STUDIES IN SOUTH AFRICAN INFANT GROWTH.

ILLUSTRATED BY COMPARATIVE ANALYSES OF GROUPS OF EUROPEAN, COLOURED, BANTU AND INDIAN BABIES FROM BIRTH TO ONE YEAR.

A Thesis Submitted For

The Degree of Doctor of Medicine,

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by

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PREFACE

There are four main ethnic groups in South Africa - European, Coloured, Bantu and Indian. Each differs widely from the other in socio-economic status and cultural background. This being so it seems to me that in South Africa one has a unique opportunity for doing comparative research.

For many years I have been interested in health rather than in disease, and growth in infancy is, I think, a good index of health. I believe that an examination of the growth pattern of infants from birth to one year gives one a good idea of the health and standard of living of a population in general and of its infants in particular.

If we are to improve the health of our people we must first know the present position so that we can have a base line against which to measure progress. For this reason standards of growth based on figures obtained in England or America, useful though they are, do not help very much in assessing improvement or deterioration of the health of our South African infants. Similarly, it is not sufficient to construct growth curves of one racial group only, nor can one use these as a standard of comparison for the other races.

I have attempted, therefore, in every investigation I carried out to take data from each of the four main ethnic groups, and to compare them with each other. This has been a difficult task, the more so since records are not easily available. I have had to limit myself to very restricted samples of the population and I realise only too well the danger of generalising from selected samples. For example, my figures of birth weight are all hospital figures, whereas the ideal would be to have the birth weight of each baby, irrespective of its place of birth. This can only be done when birth weights are recorded on birth certificates, and it is highly desirable that health authorities should aim to bring this about. The labour involved in the collection of data is considerable and could be greatly eased by the introduction of punch card techniques in municipal and hospital recording.

I have divided my work into four sections:

1) Birth weight.

2) Growth in the first ten days of life.

3) Growth in the first year.

4) Some aspects of maternal efficiency.

In the first three sections I have tried to show both the differences and the similarities which exist between the groups, and to show the influence of various factors, some biological, some socio-economic, on the results obtained. In the fourth section I chose to measure two indices - the incidence of breast feeding in the four racial groups, and the incidence of illegitimacy, in an attempt to verify some hypotheses which I put forward.

CONTENTS

SECTION II. WEIGHTS OF BABIES IN THE FIRST TEN DAYS OF LIFE

SECTION III. GROWTH DURING THE FIRST YEAR OF LIFE.

ACKNOWLEDGMENTS

My thanks are due in the first instance to the Council for Scientific and Industrial Research from whom I received a Senior Bursary for three years in Durban, and later a post-graduate bursary for one year in Cape Town. This made it possible for me to undertake these investigations. I would like to place on record how pleasant and easy it has been to work for them.

Secondly I must thank Dr S.L. Kark, Medical Officer in Charge of the Institute of Family and Community Health, who was my Research Director while I was a member of the C.S.I.R. Research Unit at the Institute, and who first suggested that I devote myself full time to this research.

I would also like to thank Professor J.F. Brock, Department of Medicine, University of Cape Town, with whom I discussed the possibility of doing an M.D. thesis, and who allowed me the facilities of his department while writing up the work in Cape Town.

It would have been impossible to do this investigation without the cooperation and assistance of the heads and staffs of the various hospitals; the Medical Officer of Health and staff of the City Health Department, Durban; the Registrar of Births and Deaths, and the Protector of Indian Immigrants, Durban, who all placed their records at my disposal. Professor J.T. Louw, Department of Obstetrics and Gynaecology, University of Cape Town, kindly allowed me to extract data from his annual reports, and Dr Sophie Kaplan, Durban, permitted me to use the records of infants in her private practice.

Dr Sybil Philips extracted the data on Coloured births from the Peninsula Maternity Hospital, Cape Town, Mrs Esther Braude the data on the births at Grey's Hospital, Pietermaritzburg, and Dr Mary Schonland helped in the collection of growth data. Miss R. Tanner, Guy's Hospital, London, carried out an investigation on my behalf, while working at McCord's Hospital, Durban. Dr P. Harrison and Miss H. Cohn gave me data on Bantu and Indian diets at Springfield. I thank them all and other friends who assisted me from time to time in the collection of data.

I found the Branch Managers and the staff of the Hollerith

Office in Durban at all times obliging and helpful.

Dr Hilda Kuper, the South African social anthropologist at present working in the C.S.I.R. Unit at the Institute of Family and Community Health, helped me greatly in discussions of Indian family life.

I received most valuable statistical advice and help from Mr S.E. Cruise, Department of Mathematics, Natal University, whose statistical note appears in Chapter V of this thesis.

I am grateful, too, to my friends Mrs L. Gilbert, Cape Town, and Mr L.V. Bradshaw, Durban, for their assistance in the drawing of the charts and diagrams.

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Lastly I must thank my husband, Dr H.T. Phillips, and my children, for their encouragement and support through this very arduous though joyful task.

PREVIOUS PUBLICATIONS

A number of preliminary reports have appeared in various journals.

A. With Mrs Bradshaw (my statistical assistant) as co-author:

1. Salber, E.J. and Bradshaw, E.S. (1951). Birth weights of South African babies. Brit. J. Soc. Med., 5, 113.

2. Ibid. (1951). Birth weights of South African babies. II. The effect of birth rank on birth weight. Brit. J. Soc. Med., 5, 247.

3. Ibid. (1952). Birth weights of South African babies. III. Seasonal variation in birth weight. Brit. J. Soc. Med., 6, 190.

4. Ibid. (1953). Birth weights of South African babies. IV. Association with maternal age. Brit. J. Prev. Soc. Med., 7, 20.

5. Ibid. (1953). Birth weights of South African babies. Observations on some of the factors affecting these weights. S. Afr. Med. J., 27, 317.

6. Ibid. (1953). Weight of Bantu babies in the first 10 days of life. Brit. J. Prev. Soc. Med., 7, 154.

7. Ibid. (1954). The effect of birth weight and time of first feed on the weight of Bantu babies in the first 10 days of life. Hum. Biol., 26, 156.

B. As co-author with Dr H.T. Phillips.

8. Phillips, H.T. and Salber, E.J. (1955). Some social aspects of paediatrics. S. Afr. Med. J., 29, 499.

C. As sole author.

9. Salber, E.J. (1955). The significance of birth weight. As illustrated by a comparative study of South African racial groups. J. Trop. Pediat., 1, 54.

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INTRODUCTION

THE SIGNIFICANCE OF BIRTH WEIGHT.

The weight of a baby at birth is not a simple figure. It is the resultant of many forces. Guttorm Toverud + (1950) states that for 20 years the working hypothesis in research and clinical activities of the late Dr K. Utheim Toverud was, "The child is nutritionally nine months old at birth". This means that in considering birth weight one must think of the health and nutrition of the expectant mother, particularly as they relate to the nutrition and health of the foetus. This emphasises the importance of the environment of the pregnant woman and includes such factors as her diet, which is influenced by, for instance, food habits, the availability of food, and standard of income.

Again it is frequently said that the infant mortality rate of a country is a sensitive index of social conditions. I believe that the mean birth weight of a country's babies is also an important and delicate measure of the health of the nation, and varies inversely with the infant mortality rate. I think it is true to say that countries with high infant mortality rates have relatively low mean birth weights, and countries with low infant mortality rates, have relatively high mean birth weights.

It is likely too, that apart from genetic factors, in a multi-racial society, the ethnic group which has good living conditions will have a lower infant mortality rate and a higher mean birth weight than the group or groups with poor living conditions.

With the above considerations in mind, I have undertaken the following investigations which are specifically meant to clarify the position in South Africa. In our country one would expect to find (if indeed the nutrition of the mother affects the birth weight of her baby) that differences in birth weight are related to socio-economic status and nutrition. Accordingly I have assembled data relating to

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(+) Toverud, G. (1950). Millbank Memorial Fund Quarterly, 28, 7.

various socio-economic conditions in different ethnic groups and have studied their effect on birth weight and the incidence of prematurity. Other factors - partly biological and partly socio-economic - have also been studied in their relationship to mean birth weight. These factors, to each of which a separate chapter is devoted, are the sex of the baby and its birth order, the age of the mother at the time of birth, and the season of birth.

It is obvious that all these factors operate within the limits of the genetic possibilities. There must be a limit (which is as yet unknown) to the weight of a baby at birth.

Data on birth weights were collected from births occurring during the period July 1946 to December 1949.

CHAPTER I.

THE EFFECT OF RACE ON BIRTH WEIGHT.

MATERIAL USED AND METHOD OF ANALYSIS.

1,757 European babies from two private nursing homes in Durban - Parklands Nursing Home, and Mothers' Hospital, Durban.

931 Coloured babies from two Provincial Hospitals - Grey's Hospital, Pietermaritzburg, and the Peninsula Maternity Hospital, Cape Town.

7,611 Bantu babies from Grey's Hospital, Pietermaritzburg, and McCord's Zulu Hospital, Durban (a Mission hospital).

1,738 Indian babies from Grey's Hospital, Pietermaritzburg, McCord's Zulu Hospital, Durban, and St. Aidan's Hospital, Durban (a Government-aided hospital).

The data extracted consist in the first instance of the birth weights and sex of the babies, and the race of the mothers. All abortions and multiple births are excluded. The information has been punched and sorted on Hollerith cards. Frequency distributions are drawn up for the different races and sexes. Means and Standard deviations are calculated in all cases, and where differences occur, their significance is determined.

RESULTS.

Birth weights are found to range from 2 lb to 13 lb (see Table 1). The Indian babies show the greatest percentage of low birth weights, while the Europeans show the greatest percentage of high birth weights. The Coloured and Bantu babies range between these two groups. All four distribution curves have much the same shape, and closely follow the normal probability curve.

Chart 1, which is the pictorial representation of Table 2, illustrates the most interesting feature of these curves, which is the shift from left to right, from Indian babies at the low end of the scale to the European babies at the high end of the scale.

The mean birth weights of the four racial groups show the same

TABLE 1.

FREQUENCY DISTRIBUTION OF BIRTH WEIGHTS

Birth Weight (lb.)	European			Coloured			Bantu			Indian		
	Male	F'male	Total	Male	F'male	Total	Male	F'male	Total	Male	F'male	Total
2 –	1	—	1	2	1	3	5	1	6	2	—	2
2½–	—	1	1	1	—	1	6	8	14	1	4	5
3 –	2	1	3	1	5	6	22	30	52	7	8	15
3½–	1	—	1	4	2	6	29	31	60	7	9	16
4 –	4	5	9	5	4	9	60	68	128	17	29	46
4½–	6	13	19	14	9	23	74	105	179	28	36	64
5 –	20	19	39	18	23	41	201	239	440	66	104	170
5½–	33	48	81	52	49	101	290	377	667	110	108	218
6 –	81	95	176	68	89	157	591	740	1,332	183	166	349
6½–	99	140	239	94	88	182	717	774	1,492	171	153	324
7 –	160	161	321	69	84	153	799	644	1,443	154	122	277
7½–	169	137	306	60	50	110	513	390	903	63	48	111
8 –	154	118	272	42	31	73	301	203	505	49	32	81
8½–	83	65	148	20	15	35	169	79	248	24	8	32
9 –	47	32	79	11	5	16	49	39	88	10	5	15
9½–	30	11	41	7	2	9	25	14	39	4	3	7
10 –	8	3	11	3	1	4	9	—	9	—	2	2
10½–	2	6	8	—	1	1	4	—	4	2	—	2
11 –	1	—	1	—	—	—	2	—	2	1	—	1
11½–	—	—	—	—	1	1	—	—	—	—	—	—
12 –	—	—	—	—	—	—	—	—	—	—	1	1
12½–	—	—	—	—	—	—	—	—	—	—	—	—
13	1	—	1	—	—	—	—	—	—	—	—	—
Total	902	855	1,757	471	460	931	3,866	3,742	7,611	899	838	1,738

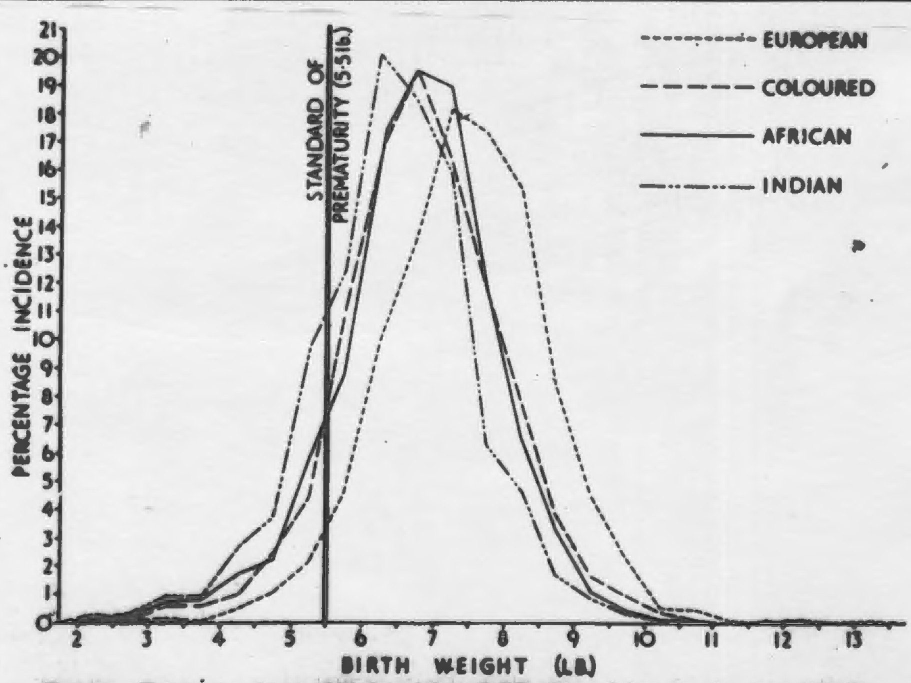

FIGURE.—Frequency curves of birth weights of different racial groups (sexes combined).

CHART 1.

TABLE 2.

PERCENTAGE INCIDENCE OF BIRTH WEIGHTS OF DIFFERENT RACIAL GROUPS (SEXES COMBINED) - see Chart 1.

BIRTH WGT. lbs	EUROPEANS		COLOUREDS		AFRICANS		INDIANS	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
2.0	1	.1	3	.3	6	.1	2	.1
2.8	1	.1	1	.1	14	.2	5	.3
3.0	3	.2	6	.6	52	.7	15	.9
3.8	1	.1	6	.6	60	.8	16	.9
4.0	9	.5	9	1.0	128	1.7	46	2.7
4.8	19	1.1	23	2.5	179	2.3	64	3.7
5.0	39	2.2	41	4.4	440	5.8	170	9.8
5.8	81	4.6	101	10.8	667	8.8	218	12.5
6.0	176	10.0	157	16.9	1332	17.5	349	20:1
6.8	239	13.6	182	19.6	1492	19.6	324	18.6
7.0	321	18.2	153	16.4	1443	19.0	277	15.9
7.8	306	17.4	110	11.8	903	11.9	111	6.4
8.0	272	15.4	73	7.8	505	6.6	81	4.7
8.8	148	8.4	35	3.8	248	3.3	32	1.8
9.0	79	4.5	16	1.7	88	1.2	15	.9
9.8	41	2.3	9	1.0	39	.5	7	.4
10.0	11	.6	4	.4	9	.1	2	.1
10.8	8	.5	1	.1	4	.1	2	.1
11.0	1	.1	-		2	.03	1	.1
11.8	-		1	.1			-	
12.0	-						1	.1
12.8	-							
13.0	1	.1						
	1757	100.0	931	99.9	7611	100.2	1738	100.1

features. The mean birth weight of European babies is 7.47 lb (7 lb 7.5 oz) - the highest of the four groups. The lowest mean birth weight of the four groups is that of the Indian babies, which is 6.46 lb (6 lb 7.4 oz) - 16 oz lower. The Coloured babies have a mean birth weight of 6.85 lb (6 lb 13.6 oz). This is slightly higher than the mean for the Bantu babies, which is 6.77 lb (6 lb 12.3 oz). The scatter around these means, as measured by the Standard deviation, does not differ to any extent between the groups. (Table 3).

TABLE 3.

MEAN BIRTH WEIGHT OF BABIES OF DIFFERENT RACIAL GROUPS +

	No. of Babies	Mean Birth Weight (lb)	Std.Deviation
European	1,757	7.47	1.14
Coloured	931	6.85	1.18
Bantu	7,611	6.77	1.12
Indian	1,738	6.46	1.15

(+) Including 3 Bantu and 1 Indian of unspecified sex.

The significance of these differences is calculated, and the limit of significance is taken at D/SE = 3. The European babies have a significantly higher birth weight than any of the others. The Indian babies have a significantly lower birth weight than the other groups. The Coloured and Bantu babies (while not differing significantly from each other), have both a significantly lower birth weight than the European babies, and a significantly higher birth weight than the Indian babies (Table 4).

It should be noted that it is commonly accepted practice for European mothers to have all their babies in hospitals or nursing homes, while among non-Europeans, more first babies tend to be delivered in hospital, and this would make the mean birth weight lighter, as first babies are generally held to be lighter than subsequent babies. On the other hand, there are more babies of higher birth order amongst the non-Europeans than amongst Europeans. (The percentages of babies of different ranks, and the effect of rank on birth weight, will be reported upon later).

TABLE 4.

DIFFERENCES IN MEAN WEIGHT BY RACE

	D.	S.E.	D/S.E.
Europeans and Coloureds	0.62	0.047	13.2
Europeans and Bantu	0.70	0.030	23.3
Europeans and Indians	1.01	0.039	25.9
Coloureds and Bantu	0.08	0.041	2.0
Coloureds and Indians	0.39	0.047	8.3
Bantu and Indians	0.31	0.031	10.0

DISCUSSION.

RACE.

There is a marked difference between the four racial groups in mean birth weights, the European babies having the highest weights, and the Indian babies the lowest, with the Coloured and Bantu babies occupying an intermediate position, Coloured babies having a slightly higher mean birth weight than Bantu babies.

Let us compare these figures with other South African findings - Le Riche (1938) working with European infants born at the Moedersbond Hospital, Pretoria, found on 942 cases, Mean : 7 lb 7.4 oz, S.D.: 16.5 oz. It should be noted that he included only infants who survived for at least two weeks after birth, which would tend to make his mean higher. The Cape Coloured Commission (1937) found the mean birth weight of babies born to European patients of the Peninsula Maternity Hospital, Cape Town, to be (on 906 cases) Mean: 7 lb 6.7 oz. In my investigation there is a difference of 9.9 oz between European and Coloured babies, whereas the Cape Coloured Commission found a difference of 6.5 oz.

Heyns and Hersch (1944) using infants of 4 lb upwards only, found the following birth weights for Bantu babies born in Johannesburg and Durban.

	No. of cases	Mean
Bridgman Memorial Hospital, Johannesburg	1216	6 lb 11.9 oz
King Edward Hospital, Durban	967	6 lb 13.1 oz
University Clinic, Alexandra, Johannesburg	440	7 lb 4.5 oz

Woodrow and Robertson (1950) found the average birth weight of babies born at Cape Town maternity hospitals to be 7 lb 11 oz for European and 7 lb 5 oz for Coloured babies. Details of data used in obtaining these figures are not given. Barrow (1952) in an analysis of 1,275 mixed births at St. Monica's Home, Cape Town, found the average birth weight of infants considered to be full-term, to be 6 lb 14 oz. My figures are in close agreement with those of Le Riche for European babies, Barrow for Coloured babies, and Heyns and Hersch for Bantu hospital figures. I could find no South African Indian figures to compare with mine.

Investigations in other parts of Africa have yielded the following figures.

Shaw (1933) examining 750 single born full-term African children born in the Lady Grigg African Maternity Home, Nairobi, found a mean birth weight of 6 lb 15 oz. For 207 Indian babies born in the Lady Grigg Indian Maternity Home, Nairobi, the corresponding figure was 6 lb 3.6 oz.

Canivet (1947) compared the birth weight and rate of growth of Sudanese infants with French white infants. The average birth weight of 17,504 Sudanese infants was 2,823 gm, more than 400 gm less than that of French white infants. He considered the difference to be due to the extreme youth of the Native mothers, and the hard physical work and poor diet.

Welbourn (1954) gives some figures for birth weights in different parts of Africa. She gives 6 lb 5 oz for Nigeria, 6 - 6¼ lb for the Belgian Congo, and for Baganda babies 6½ lb.

Jelliffe (1952) states that evidence from almost all areas of trans-Saharan Africa has shown the new born African baby to be under weight and physiologically immature, when compared with Caucasian standards. He gives average birth weights from different territories to illustrate this: Lagos, Nigeria - 6 lb 13 oz (Whitbourne, 1930); Mayombe, Belgian Congo - 6 lb 7 oz (Platel and Vandergoten, 1940); Rural Nyasaland - 6 lb 9½ oz (Platt, 1947); and Ibadan, Nigeria - 6 lb 5 oz (Walker, 1950). He thinks these low birth weights are not a racial characteristic but are primarily due to maternal malnutrition, particularly of protein.

Houghton and Fraser Ross (1953) carried out an investigation in Southern Rhodesia which was based on a publication by Salber and Bradshaw (1951). They obtained their data from institutions in Salisbury, Southern Rhodesia. The European figures were collected from the first 1,000 babies born in 1951 in a Government Maternity Hospital which admitted cases from all social classes, and which was at the same time the only maternity home available for European cases. The African figures were obtained from the first 1,000 babies born in 1951 in the maternity unit of the Government African Hospital, which admitted all cases seeking admission. Only single live births were considered, as in our own series. Their frequency curve of African and European birth weights shows the same shift to the left as our own, in other words there are more African babies in the lower weight range than Europeans and more Europeans in the higher weight range. The mean weight for Europeans was 6.9 lb and for Africans 6.3 lb.

In America many investigators have compared white and Negro birth weights. Bakwin (1932) showed that the birth weights of Negroes born in New York were definitely below those of the whites.

Bivings (1934) in comparing average birth weights for Negro and White American babies, found the following:

	No.	Mean
Negro infants	3255	6 lb 14 oz
Ward white infants	1801	7 lb 8 oz
Private white infants	955	7 lb 10 oz

Dunham and Jenss (1939) concluded that White infants weighed more on the average than the Negro infants.

Michelson (1943) corroborated the findings of other workers in obtaining a smaller birth weight for Negroes than Whites.

Anderson et al (1943) found significantly higher birth weights for White infants.

EFFECT OF SOCIO-ECONOMIC STATUS.

It seems clear enough from evidence in Africa and America that the birth weight of the European baby is greater than that of the non-European. Scott et al (1950), however, point out that the older reports on birth weights of Negro infants dealt almost exclusively with indigent dispensary material, and that in view of recent knowledge of the influence of maternal diet and adequate prenatal care, on the general well-being of the foetus and new born infant, it is worth while to re-evaluate the situation. Accordingly they analysed the birth weights of 11,818 Negro infants delivered at the Freedmen's Hospital from 1939 - 1947. 10,692 of these births were full term and the remainder premature. Economically 50 per cent of the patients were classified as indigent, but the remainder were paying patients, many of whom were delivered by private physicians.

The mean birth weight of the full term infants was 7.35 lb which was greater than any previously reported Negro series and greater than some of the American White series. In addition, these investigators compiled yearly analyses of birth weights, and found that the average weights of the full term infants from 1944 - 1947 were suggestively, although not consistently higher than the average full-term birth weights for 1939 - 1943. The per capita income showed a progressive increase during the same period. They concluded that economic status of parents has some influence on the birth weight of their offspring, and attributed the relatively high birth weight in this series of Negro infants to more favourable economic conditions prevailing during this period.

With these points in mind it is interesting to consider the economic levels of the four racial groups in South Africa. A study of the Coloured, African and Indian people served by the Springfield Health Centre (1948) showed the estimated monthly earnings to be:

	No. of domestic units	Estimated monthly earnings per worker
Coloured	417	£15. 10. 3.
African	838	£ 8. 7. 1.
Indian	506	£ 7. 1. 10.

In a study done as part of the Natal Regional Survey +, distributions of the net available weekly income were given for the four racial groups. This net available income was found by subtracting rent and transport costs from the actual weekly income. Using these figures for our purposes, we calculated the median net available income for each group. This is shown below, together with the number of households concerned, and the average number of persons per household.

	Europeans	Coloureds	Africans	Indians
No. of households	711	68	493	497
Average no. of persons	3.9	4.4	3.1	6.0
Median net available income per week	£7.19.9.	£3.18.7.	£1.7.9.	£2.13.0.

These figures are not very different from the estimated monthly earnings found by the Springfield Health Centre, and both sets of data serve to show that there are marked differences in the economic levels of the four racial groups in Durban. It is likely that this might be one of the factors affecting the differences in birth weights between the races.

Studies of groups which are not multiracial confirm the importance of socio-economic conditions on birth weight.

(+) Personal communication from Professor Burrows, Department of Economics, Natal University.

Goldstein (1947) found that Mexican neonates born in the U.S.A. were significantly heavier in body weight (males 257 gm and females 281 gm) than those born in Mexico, probably as a result of relatively better living standards of the mothers residing in the United States.

Ito (1936) compared Japanese infants born in Japan with those in America and found, too, that the average measurements of the Japanese babies born in America were definitely larger than the average measurements of the infants born in Japan.

Robertson (1915) found that South Australian infants weighed 8 - 10 oz more at birth than infants born in Great Britain and were 5 - 6 oz heavier than infants of English descent born in the Eastern United States. He inferred that the superior weight of the Australian infant at birth was attributable to the change in climatic, social and economic conditions, and stated that the mean weight of infants of the same race at birth is a very sensitive criterion of the social and economic environment in which they are born.

Gibson and McKeown (1951) presented evidence of the association of the birth weight of children born in Birmingham in 1947 with the economic circumstances of their parents. They used housing standards as indices of economic circumstances. In this way they obtained three groups and showed that the birth weight was slightly but significantly lower in the poorest group than in the other two groups.

Among socio-economic factors the diet and nutrition must rank of first importance, especially the diet and nutrition of the pregnant woman in relation to the well-being of her baby.

<u>DIET AND NUTRITION OF THE EXPECTANT MOTHER</u>.

Baird (1945) in his investigation of the influence of social and economic factors on still births and neonatal deaths, studied the association between height of mother and weight of baby. He compared the heights of four groups of expectant mothers, those attending (a) a relatively expensive nursing home, (b) a nursing home where the fees were less, (c) "booked" cases at the Aberdeen Maternity Hospital, and (d) "booked" cases at the Glasgow Maternity Hospital. He found that the percentage of women who were less than five feet in height increased from 1.6 in group (a) to 26.8 per cent in group (d). Conversely the percentage of women who were five feet six inches or more in height diminished from 24 per cent in group (a) to 3.3 per cent in group (d). When modal heights were compared it was found that in the same city, Aberdeen, there was a difference of 3 inches in the height of two groups of expectant mothers selected only on the basis of the expense of confinement. Baird says that it is reasonable to assume that the women in group (c) would have grown these extra inches if their nutrition had been better in childhood.

When the weights of the babies in groups (a) and (c) were compared it was found that in group (a) 9.2 per cent and in group (c) 18.8 per cent weighed between $5\frac{1}{2}$ lb and $6\frac{1}{2}$ lb, and in group (a) 39.2 per cent, and group (c) 40.2 per cent weighed between $6\frac{1}{2}$ lb and $7\frac{1}{2}$ lb. In group (a) 33.1 per cent and in group (c) 29.7 per cent weighed between $7\frac{1}{2}$ lb and $8\frac{1}{2}$ lb. In group (a) 18.3 per cent and in group (c) 11.1 per cent weighed over $8\frac{1}{2}$ lb. The babies in group (a) were therefore heavier on the average than those of group (c).

Analysis was then done to see the relationship, if any, between the height of the mother and the size of the baby. It was found that in groups (a) and (c) the weight of the baby increased with the height of the mother. In group (a) as the mother increased in height the proportion of large babies (over $8\frac{1}{2}$ lb) rose from 10 per cent to 29.6 per cent. In group (c) where the mother was less than 5 ft in height, 34 per cent of the children were between $5\frac{1}{2}$ and $6\frac{1}{2}$ lb in weight. The proportion fell to 9.1 per cent when the mother was 5 ft 6 in and over in height. Conversely, when the mother was 5 ft 6 in or more, 13.7 per cent of the babies weighed over $8\frac{1}{2}$ lb, whereas when she was under 5 ft in height only 5.5 per cent of the babies were over $8\frac{1}{2}$ lb. There were many more large babies in group (a), 29.6 per cent of mothers of 5 ft 6 in or more in height, had babies over $8\frac{1}{2}$ lb, compared to 13.7 per cent in group (c). Baird considered that the increase in weight in group (a) might be related to better diet during pregnancy.

Parsons (1946) maintained that "it is universally accepted that the nutritional state of the pregnant woman has an important influence on the birth weight of her baby, but this only becomes clearly obvious when the diet is severely restricted as in famine conditions. Moreover, a well balanced and more than adequate diet may not be absorbed normally and the mother and foetus may then suffer a "conditioned deficiency and not from disease due to deficiencies in the diet".

Gyllenswärd (1951), discusses nutritional deficiencies, diseases and poor social conditions during pregnancy as the cause of neonatal mortality and illness during the first year of life. He states that the average birth weight is lower for infants in lower social groups than in those better situated. He comments, too, on the increased attention which nutritional deficiencies have recently been accorded among the possible causes of foetal death and disease, (birth weight is one facet of foetal health), and gives the following reasons for this increased attention:

1. More importance is attached nowadays to the qualitative composition of the diet.
2. Investigations have shown that qualitative malnutrition can occur in all classes of society.
3. The two world wars have attracted more attention to famines.
4. Experiments on animals have also emphasised the influence of diet in pregnancy.

Since experiments on human subjects along the lines of those made on animals is impossible, he gives three other possible methods of investigation of the problem:

1. Retrospective analysis of the diet during pregnancy in cases of poor foetal development. This method is unreliable since the deficient diet is usually coupled with other unsatisfactory conditions, and moreover a control group has to be arbitrarily selected.
2. A more reliable method of investigation is that of supplementing the food of a group of people and

comparing the results with a group of similar social standards who are not given the extra foods.

3. Studying the effects of malnutrition caused by wars. Here the material is too comprehensive, since it is not possible to find groups of people in the same social circumstances who are well nourished, for comparison with those who are under-nourished. The control groups have to be taken from periods before and after the wars.

I am limited in my discussion to the effect of nutritional deficiencies on birth weight, although it is obvious that there must be broader effects on such things as fertility, the manifestation of congenital abnormalities, still births, neonatal deaths and so on.

Animal Experiments.

Huggett (1946) showed that the curve of growth of the foetus in utero is not the "normal" curve, but is steep in the last three months of intrauterine life, more than two-thirds of the birth weight being deposited in the last eight weeks. (Table 5.)

TABLE 5.

COMPOSITION OF THE HUMAN FOETUS IN GRAMS (HUGGETT, 1946)

	BODY	WATER	PROTEIN	FAT	ASH
End of 5th lunar month	300	260	22	3.5	1.5
End of 7th lunar month	1000	800	100	25.0	30
End of 10th lunar month (birth)	3200	2420	400	350.0	90
Average of daily deposition:					
1. throughout foetal life	11.4	8.6	1.4	1.25	0.32
2. in last 3 lunar months	26.2	19.3	3.57	3.87	0.71
3. in last month	35.7	23.6	6.4	6.4	2.0

This table shows the daily rate of deposition to rise steeply in the last part of pregnancy, the average daily increase being 11.4 gm a day throughout pregnancy, and 35.7 gm a day in the last month.

He then reviews some of the work on animals on this subject, and reports as follows:

Pronounced depletion of the maternal food supplies lowered the birth weight (rats: Zuntz, 1919; guinea pigs: Paton, 1903; rabbits: Reeb, 1905; sheep: Hammond, 1932).

Moderate underfeeding did not decrease the birth weight (sheep: Hammond, 1932; cow: Eckles, 1919; gilt: Hogan, 1928).

He considered that the best work had been done by Wallace (1944, 1946). Wallace fed pregnant sheep on diets which maintained weight: restricted (low-plane) diets, and high plane diets of concentrate and excess rations. A summary of the results is shown in Tables 6a and b. In this work Wallace showed that the diet in the last eight weeks of pregnancy not only raised or lowered foetal growth, but that a high plane diet also caused a high milk yield. Restricted diet depleted tissue growth and retarded physiological development, as was demonstrated by absence of temperature control, and high neonatal mortality. Quite understandably the effects of restricted diets were more pronounced with twin births.

TABLE 6a.

INFLUENCE OF HIGH-PLANE AND LOW-PLANE DIETS IN LAST 8 WEEKS OF PREGNANCY ON BIRTH WEIGHT AND POSTNATAL GROWTH.

(WALLACE, 1944, 1946)

Diet	High-plane	Low-plane
Effect on ewe weight, pounds	44 (gain)	-11 (loss)
Birth weight, pounds	10.4	6.8
Milk yield in 3rd week, pounds	50	30
Milk yield over 16 weeks, pounds	443	292
Lamb weight at 16th week, pounds	72	56
Temperature control at birth	Present	Absent
Neonatal mortality	Nil	High

T A B L E 6b.

COMPARISON OF EFFECTS OF HIGH-PLANE (H.P.) AND LOW-PLANE (L.P.) DIETS IN EARLY AND LATE PREGNANCY UPON THE FOETAL GROWTH AND UDDER DEVELOPMENT. (WALLACE, 1944, 1946)

	GROUP 1		GROUP 2	
Diet of ewe in first 4 weeks	Maintenance		Maintenance	
Diet of ewe in next 9 weeks	H.P.		L.P.	
Diet of ewe in next 8 weeks	½	½	½	½
	H.P.	L.P.	H.P.	L.P.
Average foetal weight (pounds)				
At 56th day	1.7	1.7	1.7	1.7
At 144th day	11.3	6.5	11.1	5.8
Udders - glandular growth	+++	+	+++	+
Fat in liver	+	+++	+	+++

Effects of Malnutrition Caused by Wars.

Dean (1951) summarised some of the evidence relating to maternal nutrition and size of baby, and himself investigated the size of the baby at birth and the yield of breast milk, as part of the studies of under-nutrition conducted at Wuppertal, Germany, from 1946 - 1949. He concluded that the evidence for a clear relationship between food shortage and size of baby in World War 1 was inconclusive and contradictory.

With regard to World War II he refers to the work done by Smith in Holland and Antonov in Russia, but I will discuss these investigations in more detail later. Dean states that the under-nutrition experienced in Central Europe at the end of the 1939 - 1945 war was mostly of the less acute type, but quotes Frontali who stated at the Italian Congress of Paediatricians at Pisa in 1945, that children born in Rome in 1944 were about 500 gm lighter than those born in 1936 and 1937. His figures were published later (Scapaticci and Pappalardo, 1948). Husslein (1947) found that children born in Vienna in August, 1945, weighed 600 gm less than those born in August 1944. Giese and Kayser (1947) reported that at the Landesfrauenklinik at Erfurt there was a more moderate reduction, about 230 gm in the average weight of children born in 1946, as compared with those born in 1938.

At Wuppertal in the latter half of 1946, the women theoretically were entitled to 2,400 calories a day when pregnant, and 3,500 calories during lactation. 46 per cent of the women questioned at the Landesfrauenklinik said they got less than this. It appeared too, that they started their pregnancy about 9 per cent under their normal weights.

The average birth weight of all the children born in the Landesfrauenklinik during 1937 - 1948 showed the first sign of a definite fall in 1940. They remained steady from then until 1944, but in 1945 had a further and greater fall. Afterwards there was a steady rise until 1948 when the 1940 - 1944 weight was regained. The average birth weight for all children between 1937 and 1939 was about 3,340 gm. In 1940 it fell to 3,290 gm and in 1945 to 3,155 gm. The total fall was 185 gm. The drop at the end of 1939 coincided with the outbreak of war, and that in 1945 with the period of most acute food shortage at and following the end of the war.

In England where the food rationing was very well run, especially for pregnant women and children, Huggett (1944) showed that the moderate restrictions of diet due to the war did not lower the birth weight. In fact, applying the ratio $\dfrac{\text{weight of single lambs}}{\text{weight of individual twin lambs}}$ Hammond (1932), as an indication of degree of nutritive impairment, Huggett showed that there was actually an indication of improved health and chance of survival of the London babies born in 1941 and 1942, as compared with those born in 1938 - 1939.

Peller (1940) analysed amongst other things, the influence of changes of environment upon physical growth in the prenatal and puberty periods. He took his data from the General Hospital and from the Bureau of Vocational Guidance in Vienna. He considered that the World War I blockade had more devastating results in Vienna than in other Central or West European areas, and points out that the economic crisis following 1929 was very severe. Some of his relevant conclusions applying to the neonatal period are given below.

Children born in Vienna from 1916 - 1922 were smaller and weighed less than children born in previous years. This was most manifest in the first post-war years. The children in the study were divided into: a) children whose mothers were poor and did not receive institutional care in a rest home attached to the lying-in department; b) children whose mothers were poor but received such institutional care from one to eight weeks prior to delivery because of indigency and not of illness; c) children whose mothers were poor but married; d) children of the well-to-do classes.

Indigent mothers who spent some time before delivery in the rest home, gave birth on the average, to longer and heavier children than mothers of a similar social and economic group who entered the hospital within the last week of their pregnancy. Legitimate children were better developed than illegitimate. Children of wealthy mothers were on the whole both longer and heavier than children of either one of the other groups. The more time an indigent woman spent in the rest home, the greater was the average length and weight of her child.

Smith (1947) studied the effects of maternal under-nutrition on the new born infant in Holland. He selected the cities of Rotterdam and the Hague. The majority of the pregnant women in the areas chosen suffered from severe malnutrition, because of the general transportation strike against the Nazis which began in September 1944, and continued until the liberation of Holland in May, 1945. During this winter of hunger, little or no food was transported into the big cities. In January 1945, the expectant mothers received about 1,145 calories and 34 gm of protein a day. The background, therefore, was a period of severe under-nutrition of brief duration, in people who had been fairly well fed up to that time.

From October 1st to November 15th the percentile distribution of the birth weights in Rotterdam were practically the same as in pre-war times. Then a progressive decline in weight began. The median weight declined most steeply in the first three months of under-nutrition which Smith thought indicated that maternal nutrition affected the weight of the foetus during the last half or last trimester of pregnancy only. The net change in weight was about 240 gm (8 oz) at the median, and at all percentiles there was a decline of 8 - 9 per cent of the weight in normal times, i.e. both big and small babies showed a proportionate decrease.

Smith concludes that nutrition is the sum of highly variable quantitative and chronologic factors. He believes that total maternal undernutrition may produce effects on the foetus which differ from those of specific malnutrition with adequate calories. Important too, is the duration of the dietary restriction, the period of gestation at which it occurs, and the duration of inadequate feeding before the pregnancy. These factors might account for different results found by various investigators. However, there is no doubt that Smith's studies add support to the evidence that foetal growth may be retarded by lack of proper maternal food.

Antonov (1947) investigated the effect of the siege of Leningrad on the health of the women, the course of their pregnancy and confinement, and the condition of their new born children. I am here chiefly concerned with the effect on the size of the infants. The siege of Leningrad lasted from August 1941 to January 1943, with particularly severe conditions from September 1941 to February 1942. "On a diet hardly sufficient to keep them alive, the women had to undergo physical exertions to which many of them had not been accustomed, such as standing in long lines for bread and other things, in the biting cold, and often at night, walking long distances sometimes with heavy loads, chopping wood, clearing snow and ice, cleaning back yards, and standing guard during the long cold nights at entrances to buildings or on roofs in the frequent air raids".

Table 7 shows the average weights of the babies born in 1942.

The average weight of full term boys in the first half of 1942 was 529 gm less than in the last half of 1941, and girls 542 gm less. The average birth weight increased a great deal in the second half of 1942, though it was still far below normal. This was attributed to the fact that a large proportion of the women who had babies in the second half of 1942 were getting better food than the other women in Leningrad.

TABLE 7.

AVERAGE WEIGHT AT BIRTH OF INFANTS BORN AT TERM (ANTONOV, 1947)

	Average wgt. at birth (gm)		No. included in computation of average	
	BOYS	GIRLS	BOYS	GIRLS
January - June, 1941	3,444	3,302	933	874
July - December, 1941	3,344	3,222	503	447
January - June, 1942	2,815	2,760	135	120
July - December, 1942	3,199	2,890	39	32

Antonov compared his findings with other maternity clinics in Leningrad, and there was close agreement in the decrease of birth weight. He also surveyed the work of Russian authors in the first World War where there was fairly unanimous agreement that the insufficient diet of the pregnant women resulted in a lowering of the average birth weight of their children.

Millis (1952) studied certain records of the population of Singapore to determine the effect of nutrition on fertility and the outcome of pregnancy. During the occupation of Singapore by the Japanese, and for some time after this, there was a serious shortage of food and a marked increase in food costs, which caused great hardship among the people of the low income groups. In these groups the pregnant women had insufficient food, of poor quality, during the whole gestation period. Because of unreliable records for the years 1941 - 1946 she directed her attention to the figures from 1947 onwards. Her findings on birth weight were summarised as follows:

"An investigation of the birth weights of 15,481 Indian and Chinese babies classified as full term and normal showed that the average birth weight was significantly lower in the time of food scarcity in 1947 than in 1950 for both races. The average birth weight of the Indian babies was lower than that of the Chinese babies in the same year in the lower income groups but in the higher income groups the weights were comparable. It was concluded that the average birth weight was an indication of the degree of inadequacy of maternal nutrition during pregnancy".

Nutrition Studies During Pregnancy.

Ebbs et al (1941) carried out one of the early studies on the relationship of the maternal diet to the condition of the mother and child. In Toronto, Canada, 400 women of low income were studied during the last half of pregnancy. According to their prenatal diets, the women were divided into three groups. One group of 120 women were left on their poor diet throughout pregnancy, the poor diet group. Another group of 90 women were given extra milk, eggs, cheese, fruits and vitamins daily, from the 4th or 5th month of pregnancy - the supplemented group. A third group of 170 women were given advice, and their diets improved by education - the good diet group.

The mothers in the good diet and supplemented groups had fewer complications of pregnancy and labour and there were far fewer miscarriages, premature births, and foetal and neonatal deaths than in the poor diet group. The birth weights did not seem to be influenced by the maternal diet.

Burke et al (1943) studied the influence of maternal nutrition during pregnancy upon the condition of the infant at birth in 216 women taken from the prenatal clinics of the Boston Lying-in Hospital. Detailed dietary histories were obtained at intervals during pregnancy. 94 per cent of the infants born to women whose diets were rated good or excellent, were in good or excellent physical condition at birth. 67 per cent of the infants born to women whose diets in pregnancy were poor to very poor, were in the poorest physical condition at birth, and 25 per cent were in fair physical condition, i.e. 92 per cent of infants born to mothers with very inadequate diets were in unsatisfactory condition. 89 per cent of the women whose diets were fair, had infants whose physical condition was either good or fair. There was thus an overall relationship between the physical condition of the infant at birth and the maternal diet.

The average birth weight of the babies born to mothers with good or excellent diets was 8 lb 8 oz, and only 5 lb 13 oz when the mothers diet was poor to very poor.

In another study, Burke et al (1943) correlated the protein content of the mother's diet during pregnancy with birth weight, birth length and the condition of the infant at birth. They found a significant relationship between the protein content of the mother's diet in the latter part of pregnancy, and the birth length of her infant, the correlation between length and total protein being + .80.

With regard to birth weight and protein intake during the latter months of pregnancy, they found an increase of birth weight with each additional 10 gm of protein in the prenatal diet.

One of their conclusions from this study was that: "From the standpoint of birth length, birth weight, and general physical well-being of the infant at birth, the diet should be liberally supplied with protein during pregnancy. For practical purposes this study indicates that less than 75 gm of protein daily during the latter part of pregnancy results in an infant who will tend to be short, light in weight, and most likely to receive a low pediatric rating in other respects".

Burke et al (1949) in a further study of the relationship of maternal nutrition to the condition of the infant at birth, followed some of their original cases through a later pregnancy, and stated that: "The average birth weight and birth length of the infant decreased as the maternal dietary rating became poorer. The constancy of this relationship is impressive. While a relationship exists between physical condition of infant and birth weight and length, a closer relationship is shown between maternal dietary rating for pregnancy, and birth weight and length of infant".

The Interim Report of the People's League of Health (1942) in England on "Nutrition of Expectant and Nursing Mothers" tells of an investigation on over 5,000 expectant mothers, which was planned to test whether additions of vitamins and minerals to the diet, would benefit the course of pregnancy and labour, and the new born child. Evidence was found to this effect. With regard to the effect on birth weight of the child, although the investigators thought the birth weights of treated cases in women over 30 were greater than untreated cases, the results were not statistically significant.

Toverud (1933) used material from a small municipal obstetric clinic in Oslo, consisting of 4,954 infants, full term and premature, legitimate and illegitimate, for a statistical study on the nutritional condition of new born infants. The babies born in summer were the heaviest and she concluded that the possibility of getting more fresh food in Norway at this time of the year was the most important factor.

In a home for unmarried expectant mothers in Oslo where the women were given an optimum diet, she found an increase in the birth weight of the infants whose mothers stayed two months or more in the home before delivery. These infants had an average birth weight of 3,587 gm as compared with 3,347 gm for infants whose mothers stayed 6 weeks or less before delivery, and 3,240 gm for infants of mothers who entered the home after delivery - all full term infants. The factors responsible for the increased birth weight probably had to do with nutrition, and systematic prenatal care of the mother.

Warkany (1945) as a result of his experimental work with animals, where he produced congenital deformities by giving the mothers deficient diets, emphasises an important point. "The finding of critical periods in the development of the embryo, in which there is unusual susceptibility to nutritional deficiency opens up new perspectives in the field of prenatal nutrition. It emphasises the importance of a satisfactory nutritional state of the mother in the earliest periods of pregnancy. The organogenesis of the human embryo is practically finished 10 weeks after conception, at a time when the expectant mother is not accorded any special privileges. Nutritional supplements are as a rule not given before the second half of pregnancy. Thus it may happen that an embryo is injured by nutritional deficiency in the early weeks of prenatal life while the mother appears in a perfect nutritional state at the end of pregnancy. Nutritional care and nutritional studies should include the earliest periods of pregnancy as well as the late ones".

An important study showing the benefit to the child of special food supplements during pregnancy was reported by Balfour (1944). This, however, shows the effect of the supplements on reducing still-birth and neonatal mortality rates and is not concerned with the effect on the birth weight of the child.

The Food and Nutrition Board of the National Research Council (1941) recommended an allowance of 85 gm for the average pregnant woman, in distinction to the 60 gm for the average non-pregnant woman of equal weight. Williams (1945) points out, however, that this presupposes a previously normal protein intake and nutritional status. In a group of 514 pregnant women in Philadelphia, he found that only 13 per cent of the group received the recommended allowance of 1.5 gm of protein per kilogram daily (Williams and Fralin, 1942). Burke (1941) found that 19 per cent of a group of pregnant women received a good protein diet and Ebbs 24 per cent.

All these studies underline the importance of an adequate diet, particularly one rich in protein, in pregnancy, in relation to the well-being of the mother and baby, and prove that inadequate calories and protein lowers the birth weight of the babies.

In contrast are the findings of the Vanderbilt group. "Each white woman who presented herself to the Obstetric Clinic of the Vanderbilt University Hospital for prenatal care during the period between September 1945, and February 1949, was entered in the study. A total of 2,338 pregnancies was studied".

"The patients were from families of low to moderate income status. Admission to the Clinic, within the restrictions of minimum to maximum gross annual incomes of $ 1200 to $ 3,000 was determined by the Hospitals Social Service on the basis of needs, debts and dependency." (Darby et al, 1953).

Physical examination including nutritional assessments, dietary intake, laboratory examination, and the clinical course of the mother and child were all included in the study and analysed. 25 abnormal obstetric and foetal conditions were examined for evidence of nutritional stigmata during the period of gestation, and different levels of nutrient intake were studied for any influence on the development of obstetric and foetal abnormalities.

They could find no clear indictment of nutritional lack as an important aetiological agent in the numerous conditions they studied. (McGanity et al, 1954).

It is possible, however, that these groups were better nourished than those on whom results definitely indicated a correlation between dietary insufficiency and health of mother and child. The Vanderbilt group say that "although the average nutrient intakes were somewhat below the standard widely accepted for good nutrition, they were not sufficiently low to cause concern". (Darby et al, 1953). They also found that positive correlations existed between adequacy of nutrient intake and obstetric and foetal complications in the groups who had dietary intakes during the third trimester of pregnancy of less than 1,000 calories and less than 50 gm of protein. These were associated with an increased incidence of pregnancy disease and an increased finding of pre-eclampsia and eclampsia. However, they thought that the abnormalities were responsible for the lower intake and not vice versa. (McGanity et al, 1954).

THE POSITION IN SOUTH AFRICA.

In South Africa where the non-European group is of a low socio-economic level their diets are generally unsatisfactory.

Cluver (1940/41), in a review of nutritional research in the Union of South Africa, stated: "The European as the ruling class, are the highest socio-economic section, but even among them malnutrition is prevalent among the so-called "poor whites" who probably constitute about a fifth of the European population. With isolated exceptions, the whole of the non-European population is socio-economically depressed and one may therefore assume extensive incidence of malnutrition among them".

The Report of the National Health Services Commission (1944) contains a chapter entitled "The Socio-economic Background". I quote paragraphs 2, 3 and 4 in full, and part of paragraph 7.

"One factor stands out pre-eminently in such a survey - the grinding poverty of almost all of the non-European, and a substantial part of the European population of this country. The total national income accruing to the whole population of ten million (European, Native, Coloured and Asiatic) in South Africa is about £400,000,000 per annum, or about £40 per head. This average does not, however, give a true idea of the position because the income is distributed very unequally. A small section of the community live on a high standard, while the vast majority live in great poverty. This is in fact one of the poor countries of the world, its poverty being partly the result of the country's geographical and climatic conditions, and partly the result of the economic structure which it has erected.

We have had evidence from the Secretary for Native Affairs as to the gradual economic deterioration of the Bantu from a comparatively small population based on a subsistence economy - herding cattle, growing grain, hunting, and making their own clothing and household utensils - to a much larger population which has outgrown and overstocked the territory allotted to it and become dependent to an ever-increasing extent upon employment on the farms or in urban industry. The evidence we have received strongly suggests - in the absence of precise data extending over long periods it could do no more - that in the Territories, on the farms, and in the towns, their poverty is increasing and their health deteriorating.

On the lot of the Coloured population in the Cape we have had eloquent testimony, notably from the Medical Officer of Health for Cape Town, that poverty and ignorance were the main factors in the causation of the contrast which exists between the health of the European in that city and the health of the Coloured population. Similar evidence was submitted in regard to the Indian population of Natal."

"Poverty likewise makes it impossible for its victims to purchase for themselves adequate dietaries particularly in urban areas, where they are dependent almost entirely upon purchased foodstuffs, of which the health protective varieties are nearly always the most expensive. In this connection the following is an extract taken from Paragraph 65 of Report No. 2 submitted by the Social and Economic Planning Council entitled "Social Security, Social Services and the National Income":-

'Social surveys conducted in the Union have shown that, in the cities, incomes are too low to enable the purchase of minimum low-cost diets in the case of at least -

10 per cent of European households;

45 to 50 per cent of Indian households; and

50 to 60 per cent of Coloured households.

Most urban Natives not fed in compounds or in private households are in a similar position. All the evidence suggests that in smaller towns, on many farms and in the Native Reserves the position is also unsatisfactory'. "

A milk consumption survey carried out at the Lamont Health Centre (1950 - 1951) on 526 African families in the sub-economic housing scheme at Lamontville, revealed that in 1948 an average of ½ a pint of fresh milk was purchased daily per household. An average number of persons in a household was roughly 6. By 1951 with very intensive Health Centre propaganda the figure had risen to .8 pints daily.

Again, routine diet histories are taken at the Health Centre at antenatal sessions, and the diets of the non-European pregnant women are most deficient particularly in protein. African women often obtain sufficient calories from their largely carbohydrate diet, but Indian women as a rule have diets deficient in both calories and protein. The main factor responsible for the poor diets is lack of money, but this is coupled with ignorance of food values, and food habits are also culturally determined. For example, Hunter (1936) showed that in Pondoland the final part of the marriage ceremonial is the ritual killing, after which the wife may drink the milk of her husband's umzi and must avoid the milk of her father's cattle. Sometimes this ceremony is performed very soon after the bride's arrival, but in others it may be delayed a year or more, and there are some women with grown-up children for whom the ceremony has never been performed, and who still avoid drinking milk from their husband's cows. The Pholela Health Centre is overcoming this taboo to a certain extent by the use of dried milk powder.

My personal experience in Durban and the experience of my colleagues, is that on the whole the Coloured community is the best nourished of the three non-European groups, followed by the African, and that the Indian is the worst nourished. It is common to find Indian women who weigh less than 100 lb during pregnancy, and I myself treated an Indian pregnant girl who weighed 67 lb in early pregnancy. At present Dr S. Kark and his colleagues (1954) are carrying out an experiment, to test the effect on the mother and offspring, of supplements of dried skim milk and vitamin oil, in a group of Indian and African women during pregnancy.

The poor nutrition of the pregnant non-European mothers is undoubtedly a very important factor in producing the lowered birth weights of their children, in comparison with those of the European groups studied.

In my opinion it is not race per so which is responsible for the difference in birth weights of the four racial groups, but social and economic status, with all that that implies in the nutrition of pregnant women. There may be in addition the influence of a genetic race factor, but to prove that, one would have to compare racial groups of similar socio-economic status, and in South Africa it would be extremely difficult to collect data on sufficient numbers of well-to-do Africans, Indians and Coloured peoples. This is a field of investigation which despite the difficulties, must be tackled in the future, if the factor of race is considered to be of importance.

SUMMARY.

Birth weights of infants (1,757 European, 931 Coloured, 7,611 Bantu, and 1,738 Indian) are studied in relation to the effect of race on birth weight.

1. The mean birth weights are:

European 7.47 lb.	Bantu 6.77 lb.
Coloured 6.85 lb.	Indian 6.46 lb.

2. The differences are significant except those between the Bantu and Coloured babies.

3. Work in other parts of Africa and in America confirms the findings that White infants weigh more at birth than non-White infants.

4. Evidence is presented which relates birth weight to income level and social class.

5. The nutrition of the mother appears to be of great importance in regard to the weight and health of the baby at birth. This is discussed in relation to animal and human experiments and in relation to historical events such as wars and famines.

6. The economic position of the four racial groups in South Africa is briefly discussed, and it is concluded that socio-economic status (which includes nutritional state) and not race per se is responsible for the differences in the mean birth weights found.

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CHAPTER II.

THE INFLUENCE OF SEX ON BIRTH WEIGHT.

MATERIAL USED AND METHOD OF ANALYSIS.

The same sample of babies is used for this study, as that used when assessing the influence of race on birth weight. The mean birth weight and standard deviation of the boys and girls is calculated for each racial group. The differences between the males of each racial group and the females of each racial group are noted and the significance of these differences is determined. The differences between the mean birth weight of boys and girls in each group are also calculated and their significance analysed.

RESULTS.

Analysis of birth weights of boys and girls in each of the four race groups reveals:

(1) in each group the boys have a higher mean birth weight than the girls, ranging from 0.13 to 0.27 lb (2 to 4.2 oz) higher;

(2) comparisons of the various race groups, taking the boys and girls separately, yield results similar to those found when combining the sexes. European babies have the highest mean birth weight for both boys and girls, 7.59 lb (7 lb 9.5 oz) for boys and 7.34 lb (7 lb 5.4 oz) for girls. Indian boys and girls have the lowest mean birth weights, 6.59 lb (6 lb 9.4 oz) for boys and 6.32 lb (6 lb 5.2 oz) for girls (in each case just over a pound lower than the European babies). The Coloured and Bantu again occupy an intermediate position. It will be noted that the mean birth weights of the Coloured and Bantu boys are almost identical, viz. 6.91 lb (6 lb 14.5 oz) for Coloured boys and 6.89 lb (6 lb 14.3 oz) for Bantu boys. The Coloured girls have a mean birth weight of 6.78 lb (6 lb 12.5 oz) which is slightly higher than that of the Bantu girls, whose mean weight is 6.64 lb (6 lb 10.3 oz). All these differences are found to be significant except those between the Coloured and Bantu groups. (Tables 8(a) and (b)).

In all racial groups the boys are found to have a higher mean

TABLE 8a

MEAN BIRTH WEIGHT RELATED TO SEX AND RACE

Race	European			Coloured			Bantu			Indian		
Sex	Male	F'male	Total	Male	F'male	Total	Male	F'male	Total	Male	F'male	Total
Number of Babies	902	855	1,757	471	460	931	3,866	3,742	7,611*	899	838	1,738*
Mean Birth Weight (lb)	7·59	7·34	7·47	6·91	6·78	6·85	6·89	6·64	6·77	6·59	6·32	6·46
Standard Deviation	1·16	1·12	1·14	1·22	1·13	1·18	1·14	1·08	1·12	1·14	1·14	1·15

* Including 3 Bantu and 1 Indian of unspecified sex.

TABLE 8b

DIFFERENCE IN MEAN WEIGHT BY RACE FOR EACH SEX

Sex		Male			Female			Total		
Difference Between		(a) Difference (lb.)	(b) Standard error of difference	(a) ÷ (b)	(a) Difference (lb.)	(b) Standard error of difference	(a) ÷ (b)	(a) Difference (lb.)	(b) Standard error of difference	(a) ÷ (b)
European and	Coloured	0·68	0·069	9·9	0·56	0·065	8·6	0·62	0·047	13·2
	Bantu	0·70	0·042	16·7	0·70	0·042	16·7	0·70	0·030	23·3
	Indian	1·00	0·054	18·5	1·02	0·055	18·5	1·01	0·039	25·9
Coloured and	Bantu	0·02	0·059	0·3	0·14	0·056	2·5	0·08	0·041	2·0
	Indian	0·32	0·068	4·7	0·46	0·066	7·0	0·39	0·047	8·3
Bantu and	Indian	0·30	0·042	7·1	0·32	0·043	7·4	0·31	0·031	10·0

TABLE 8c

DIFFERENCES IN MEAN WEIGHT BY SEX FOR EACH RACE

Race	(a) Difference (lb.)	(b) Standard Error of Difference	(a) ÷ (b)
European	0·25	0·054	4·6
Coloured	0·13	0·077	1·7
Bantu	0·25	0·026	9·6
Indian	0·27	0·055	4·9

birth weight than the girls, with differences ranging from 0.13 to 0.27 lb (2.0 to 4.2 oz). In the European, Bantu and Indian groups this difference is significant, but for the Coloured group, the difference of 0.13 lb (2.0 oz) is not significant. (Table 8c). Other studies have also shown that boys have a higher birth weight than girls.

DISCUSSION.

Pearson (1899) calculated the mean birth weights of 1,000 girls and 1,000 boys born at the Lambeth Lying-In Hospital, London, and found their weights to be:

Females 7.073 ± 0.021 lb.

Males 7.301 ± 0.024 lb.

He also found that the male baby was more variable than the female baby with regard to both weight and length at birth.

Murray (1924) analysed data obtained from St. Thomas' Hospital and the General Lying-In Hospital, York Road, for the years 1914, 1915, and 1918, to test the effect of maternal and social conditions and nutrition upon birth weight and length. She divided the cases into different groups, on a money basis. With regard to the influence of sex on birth weight she found that in each group, in each of the different years, the mean birth weight of the boys was higher than the mean birth weight of the girls.

Martin (1931) studied data from Queen Charlotte's Lying-In Hospital, and obtained similar results to Pearson's, except that he found greater variability in the female babies than the males.

Bakwin and Bakwin (1934) reported on the measurements of 1,653 new-born infants in New York Hospitals. Thirty-three dimensions were measured. The male children were heavier than the female, and all external dimensions were larger in the male than in the female. As far as variability in body weight was concerned he found little difference between males and females. In first born infants, females were more variable than male, but for later born children the position was reversed with the males showing greater variability than the females. They gave a table showing the results of 33 studies on birth weights

TABLE 9.

MEAN WEIGHT AT BIRTH (1753 - 1931)

(after Bakwin and Bakwin, 1934)

Mean Weight at Birth (1753-1931)

AUTHOR	YEAR	CITY OR COUNTRY	MEAN WEIGHT AT BIRTH—*grams* Males	Females
Roederer ....(45)	1753	Göttingen	2990	2854
Clarke ....(11)	1785	London	3343	3058
Siebold ....(48)	1832-1858	Göttingen	3221	3079
Hecker ....(23)	1861	Munich	3310	3230
Haacke ....(21)	1862	Leipzig	2945	2854
Winckel ....(51)	1862	Berlin	3057	2940
Quetelet ....(40)	1870	Brussels	3100	3000
Gregory ....(18)	1871	Munich	3386	3331
Kézmársky ....(31)	1873	Budapest	3383	3284
Altherr ....(3)	1874	Germany	3214	3077
Bowditch ....(9)	1877	New England	3424	3280
Fasbender ....(13)	1878	Stuttgart	3347	3250
Peterson ....(38)	1882	Sweden	3595	3455
Issmer ....(30)	1872-1883	Dresden	3320	3214
Mies ....(33)	1891	Cologne	3375	3301
Schäffer ....(46)	1896	Munich and Heidelberg	3258	3011
Recht ....(41)	1897	Bonn	3607	3149
Gundling ....(20)	1898	Erlangen	3268	3148
Pearson ....(36)	1899	London	3311	3209
Herz ....(26)	1900	Freiburg i. B.	3274	3113
Fourman ....(14)	1901	South German	3360	3221
Daffner ....(12)	1902	Leipzig	3335	3278
Fuhrmann ....(17)	1906	St. Petersburg	3490	3185
Heiberg ....(24)	1907	Denmark	3487	3280
Griffith and Gittings.(19)	1907	Philadelphia	3494	3418
Holt ....(27)	1911	New York	3400	3260
Schreiber ....(47)	1927	Göttingen	3552	3372
Kugler ....(32)	1931	Zurich	3420	3310
Authors ....(..)	1930-1931	New York	3459	3326
Miwa ....(34)	1901	Japan	2940	2780
Nagahama ....(35)	....	Japan	2900-3000	2770-2800
Authors ....(5)	1930-1931	Negro—New York ..	3100	2916
Authors ....(..)	1930-1931	Porto Rican—N. Y....	3191	3109

done in different parts of the world from 1753 - 1931 (Table 9), in which it can be seen that, without exception, the males were heavier than the females at birth.

Meredith and Brown (1939) quoted 35 studies from Anglo-American research literature dating from 1786 to 1936, all of which showed male infants to be heavier than female infants at birth (Table 10).

Later work confirms the findings of these earlier authors. Anderson, Brown and Lyon (1943) took records of over 5,000 consecutive births at the Cincinnati General Hospital from 1938 to 1941. The mean birth weights were:

White males 7 lb 6 oz (3345 gm).	Negro males 6 lb 15 oz (3147 gm).
White females 7 lb 2 oz (3232 gm).	Negro females 6 lb 11 oz (3033 gm).

The differences were of great statistical significance.

Palmer and Ciocco (1945) state that in America "the reported series of weights of new born infants reveal averages of 7.3 to 8.2 pounds (3300 to 3700 gm) for white males, 7.1 to 7.5 pounds (3200 to 3400 gm) for white females, 6.8 to 7.3 pounds (3100 to 3300 gm) for Negro males, and 6.4 to 7.1 pounds (2900 to 3200 gm) for Negro females. These averages illustrate the facts that, in general, males are heavier than females, and that white infants are heavier than Negro infants".

Recent studies on Indonesian, Chinese and European babies in Djakarta, (Njo-Tiong-Tjiat), 1951); on Europeans and Africans in Southern Rhodesia, (Houghton and Ross, 1953); and on Chinese and Southern Indian babies in Singapore, (Millis, 1953), all show boys to be heavier than girls at birth.

According to Karn and Penrose (1951), male and female weights appear to be undifferentiated before 247 days, after which the males are always heavier. Gibson and McKeown (1952) found a sex difference in weight in favour of males as early as the 29th week of gestation. Shapiro (1954) considers that the difference of weight in favour of the male, occurs at least as far back as the second trimester of pregnancy. He found small but consistent differences in average weight of live births in favour of male babies for all races in the United States from January to March, 1950. These differences were

TABLE 10 : MEAN WEIGHT OF MALES AND FEMALES AT BIRTH.
(after Meredith and Brown, 1939).

TABLE

Mean weight of males and females at birth

INVESTIGATION	MEAN WEIGHT (*grams*) Males Cases	Males Mean	Females Cases	Females Mean
Clarke (12), 1786, Ireland				
Dublin Lying-in Hospital. Full-term	60	3342	60	3056
Evetzky (16), 1881, New York				
New York Infant Asylum	57	3301	45	3197
Anthropometric Committee (1), 1883, British Isles: London and Edinburgh	451	3220	466	3130
Stockton-Hough (41), 1885, Philadelphia				
"White" infants	330	3430	382	3190
Morse (31), 1886, Virginia				
Probably private practice cases	50(?)	3300	50(?)	3200
Townsend (45), 1896, Boston				
Boston Lying-in Hospital. Nude weight	500	3428	500	3320
Holt (26), 1897, New York				
Three maternity institutions. Full-term	590	3430	568	3260
Pearson (32), 1900, England				
Lambeth Lying-in Hospital, London	1000	3312	1000	3208
Longridge (29), 1905, England				
Queen Charlotte's Lying-in Hospital				
Infants of primiparae	100	3170	100	3057
Infants of multiparae	100	3356	100	3136
Griffith and Gittings (18), 1907, Philadelphia				
Full-term infants of working mothers	111	3494	155	3418
Robertson (37), 1915, South Australia				
Healthy infants of laboring-class mothers	247	3609	264	3436
Robertson (39), 1915, England				
Maternity Hospital, Birmingham	100	3257	100	3218
Warren (46), 1917, Maine				
Private practice cases. Nude weight	1000(?)	3970	1000(?)	3740
Ramsey and Alley (34), 1918, Minnesota				
Infants born at University Hospital	150(?)	3391	150(?)	3276
Yerington (47), 1918, San Francisco				
Full-term, healthy infants studied by Faber and Murry at Lane Hospital, Stanford University	246	3500	275	3312
Taylor (43), 1919, Minnesota				
Full-term. Predominantly Scandinavian stock	125	3484	125	3377
Faber (17), 1920, San Francisco				
Lane Hospital. Full-term. Nude weight	329	3495	315	3305
Baldwin (7), 1921, Baltimore				
Negro infants	60	3408	70	3340
Brenton (10), 1922, Minneapolis				
Records of three hospitals for 1915 to 1919	952	3377	979	3254
Infants of Swedish parentage		3378		3277
Infants of German parentage		3330		3265
Infants of Jewish parentage		3240		3120
Rowe (40), 1925, Minnesota				
Infants born at Duluth Clinic	327	3374	311	3161
Martin (30), 1930-1931, England				
Queen Charlotte's Lying-in Hospital	3443	3348	3269	3211
Bakwin (4), 1932, New York				
Negro infants	99	3100	88	2916
Clements (14), 1933, Sydney, Australia				
Full-term, healthy infants. Slum, industrial, and residential areas included. Accurate data	289	3685	221	3572
Bakwin, and others (5), 1934, New York				
Parents of moderate income	205	3502	249	3372
Parents from proverty-stricken environment	470	3443	416	3339
Bakwin and Bakwin (6), 1934, New York				
First-born infants	395	3375	417	3222
Later-born infants	423	3540	418	3430
Stuart (42), 1934, Boston				
American or North European parentage	50	3459	63	3374
Bayley and Davis (8), 1935, Berkeley, California				
Parents of business and professional classes	31	3700	30	3350
Cates and Goodwin (11), 1936, Toronto, Canada				
Full-term, normal infants. Accurate weights	341	3450	327	3310
Gunstad and Treloar (19), 1936, Minneapolis				
General Hospital. All uniparous births 1930-1932	1995	3470	1933	3331

present at all gestation ages from under 28 weeks to 37 weeks or more.

However, Jeans and Marriott (1947) state that the weight of a new born infant will depend on his body size and the amount of fat. When weight is related to height, little difference exists in weights of boy and girl infants.

It seems to be universally true that boys are heavier than girls at birth, since this has been shown to be the case in every study, whatever the country, the race, and the period of time.

SUMMARY.

The effect of sex on birth weight in the four racial groups is analysed. The material used is the same as that used in the previous chapter.

1. The mean birth weights for boys and girls are as follows:

	European	Coloured	Bantu	Indian
Male	7.59 lb	6.91 lb	6.89 lb	6.59 lb.
Female	7.34 lb	6.78 lb	6.64 lb	6.32 lb.

2. The differences between boys and girls are significant, except in the Coloured group.

3. The racial differences in mean birth weight already noted are again observed when the sexes are considered separately.

4. Investigations dating from 1753 to 1953 all confirm the finding that males are heavier than females at birth.

5. Certain investigations show that the difference is exhibited long before term and possibly as early as the second trimester of pregnancy.

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CHAPTER III.

INCIDENCE AND EFFECTS OF PREMATURITY.

DEFINITIONS.

In 1919 Ylppö suggested that birth weight should be used as the basis for a definition of prematurity. He found that it was difficult to measure the length of a new born infant with accuracy, and that the information given by the mothers on the duration of pregnancy was unreliable. He defined a baby as premature if he weighed 2,500 gm (5½ lb) or less at birth.

In 1936, the American Academy of Pediatrics adopted a similar standard - "A premature infant is one who weighs 2,500 gm or less at birth, regardless of period of gestation". In 1937 this standard was also recommended by the International Committee at Geneva.

In 1938 the Royal College of Physicians of London, and the British College of Obstetricians and Gynaecologists, recommended the use of this weight standard also. The Royal College of Obstetricians and Gynaecologists and the Population Investigation Committee, in their "Survey of Maternity in Great Britain" (1948), employed a similar weight standard for the calculation of incidence of prematurity.

The expert group on prematurity, convened by the Second World Health Assembly, recognised the necessity of uniform terminology for international usage. They stated that their primary goal, to lower foetal and neonatal mortality, could best be achieved by the provision of specialised care for infants of low birth weight. Although they suggested that a premature infant be defined on a weight basis, they recognised that there were limitations in the usefulness of such a definition, since the birth weight was not always available. Other criteria, such as length of gestation period, would then have to be used.

They recommended for adoption by all countries, the international definition of the World Health Assembly (1948), which runs as follows:

"For the purpose of this classification an immature infant is a live born infant with a birth weight of 5½ lb (2,500 gm) or less, or specified as immature. In some countries, however, this criterion will not be applicable. If weight is not specified, a live born infant with a period of gestation of less than 37 weeks or specified as 'premature' may be considered as the equivalent of an immature infant for purposes of this classification".

Many investigators regard criteria other than weight as a more reliable index of prematurity.

Crosse (1952) considers the measurement of the length of the infant from vertex to sole to be the most reliable single method of estimating maturity, because it bears a very constant relationship to it, and is little affected by other factors.

Corsa et al (1952) recommended the combined use of weight and age of foetus.

Ellis (1951) using measurements of head circumference, crown - rump length and birth weight, states that the proportion of misfits will be reduced by using three or more measurements in combination, together with gestational age when this is known.

However, most people agree that at present the birth weight is the most practicable and useful measurement to be used in assessing the incidence of prematurity.

MATERIAL USED AND METHOD OF ANALYSIS.

The same sample of babies is used to determine the incidence of prematurity as was used to determine the mean birth weight of the four racial groups. All babies who weighed under 5.5 lb (5 lb 8 oz) are considered premature for the purpose of this investigation, and the incidence of prematurity is calculated in the four racial groups, for the sexes separately and combined. The difference in incidence of prematurity found between the races is analysed for the boys and girls separately and together, and the significance of the difference calculated. In addition the difference in incidence of prematurity is noted between boys and girls of each race group and the significance determined.

In this investigation all infants weighing less than 5 lb 8 oz are deemed premature, but it must be pointed out that at all hospitals some infants were not weighed at birth. These included a certain number of babies recorded as premature in the records. One of the Indian Hospitals had a very large percentage of unweighed babies (23 per cent of the infants born during 1948). It is therefore possible that the incidence of prematurity as determined by this analysis is lower than its actual occurrence in these communities.

RESULTS.

INCIDENCE OF PREMATURITY.

There is a wide variation in the incidence of prematurity found for the different racial groups. The range is 4.2 per cent for the European babies, to 18.3 per cent for the Indian babies. The Coloured and Bantu babies occupy an intermediate position, with an incidence of 9.6 per cent and 11.5 per cent respectively (Table 11a).

The incidence of prematurity follows the same pattern as found for the birth weights. As expected, the groups having the highest mean birth weights have the lowest incidence of prematurity and vice versa.

The differences in incidence of prematurity between the various race groups are found to be significant, with the exception of that between the Coloured and African groups (Table 11b).

In view of the definition of prematurity used, I expected, on investigating the sexes separately, to find a lower incidence of prematurity for boys than girls, owing to their higher mean birth weight. This is confirmed by the results found in each case, except for the Coloured group, where the incidence of prematurity is the same for the boys and girls (Table 11c).

Although the incidence of prematurity is lower for boys than for girls, it is only in the Bantu and Indian groups that this difference is significant (Table 11c).

In the Bantu group, the large number of cases studied probably accounts for this significance. It is possible that larger

TABLE 11a

PERCENTAGE OF PREMATURE BABIES (LESS THAN 5·5 LB.) BY SEX FOR EACH RACE

Race	European			Coloured			Bantu			Indian		
Sex	Male	F'male	Total	Male	F'male	Total	Male	F'male	Total	Male	F'male	Total
Number of babies weighed	902	855	1,757	471	460	931	3,866	3,742	7,611*	899	838	1,738*
Percentage less than 5·5 lb.	3·8	4·6	4·2	9·6	9·6	9·6	10·3	12·9	11·5	14·2	22·7	18·3

* Includes 3 Bantu and 1 Indian of unspecified sex.

TABLE 11b

DIFFERENCES IN PERCENTAGE OF PREMATURE BABIES BETWEEN RACES FOR EACH SEX

Sex		Male			Female			Total		
Difference Between		(a) Difference (per cent.)	(b) Standard error of difference	(a)÷(b)	(a) Difference (per cent.)	(b) Standard error of difference	(a)÷(b)	(a) Difference (per cent.)	(b) Standard error of difference	(a)÷(b)
European and	Coloured	5·8	1·50	3·9	5·0	1·55	3·2	5·4	1·08	5·0
	Bantu	6·5	0·80	8·1	8·3	0·90	9·2	7·3	0·60	12·2
	Indian	10·4	1·33	7·8	18·1	1·61	11·2	14·1	1·04	13·6
Coloured and	Bantu	0·7	1·44	0·5	3·3	1·48	2·2	1·9	1·03	1·8
	Indian	4·6	1·79	2·6	13·1	2·00	6·6	8·7	1·34	6·5
Bantu and	Indian	3·9	1·26	3·1	9·8	1·55	6·3	6·8	1·00	6·8

TABLE 11c

DIFFERENCES IN PERCENTAGE OF PREMATURE BABIES BETWEEN SEXES BY RACE

Race	(a) Difference (per cent.)	(b) Standard Error of Difference	(a)÷(b)
European	0·8	0·96	0·8
Coloured	0·0	1·93	0·0
Bantu	2·6	0·73	3·6
Indian	8·5	1·86	4·6

numbers in the other groups would confirm this finding. It will be noted that similar numbers of European and Indian, boys and girls birth weights, are studied. The difference in birth weight between European boys and girls is .25 lb (4.1 oz), and between Indian boys and girls .27 lb (4.2 oz). (Table 8c). The fact that the difference in prematurity incidence is found to be significant in the case of the Indians, and not so in the Europeans, is probably related to the comparatively low mean birth weight of Indian babies, 6.46 lb (6 lb 7 oz). (Table 3). This mean birth weight is only 15 oz more than the standard of 5 lb 8 oz used to determine prematurity. A difference of 4 oz between boys and girls would thus be likely to indicate a much greater incidence of prematurity than a similar difference in Europeans, whose mean birth weight is 31 oz above the prematurity weight criterion.

A comparison of the incidence of prematurity in girls and boys of different racial groups yields the same results as for the sexes combined (Table 11a).

DISCUSSION.

In this study 4.2 per cent of the European, 9.6 per cent of the Coloured, 11.5 per cent of the Bantu and 18.3 per cent of the Indian babies are found to be premature.

In Southern Rhodesia, Houghton and Ross (1953) found the overall incidence of prematurity to be 5.9 per cent for European and 16.6 per cent for African babies born in institutions in Salisbury. The incidence in females was higher than in males.

In England, Crosse (1946) reported an incidence of 6.3 per cent for the city of Birmingham, which corresponds closely with the figure, 6.4 per cent, found in the Maternity in Great Britain Survey. (7.7 per cent female and 5.6 per cent male).

In America there is a great deal of literature on prematurity.

Dunham, Jenss and Christie (1939) found the incidence in White and Negro American infants studied at New Haven to be as follows:

White male	6.1 per cent	Negro male	8.1 per cent
female	6.2 " "	female	13.8 " "

Baumgartner et al (1950) gave the following figures for the city of New York (1939 and 1940):

White 7.3 per cent. Non-white 12.4 per cent.

Wallace et al (1951) gave an overall figure of 8 per cent premature births among the 150,000 live births in New York city annually.

Taback (1951) gave the prematurity rate for Baltimore City in 1949 as 8.9 per cent. Negro babies had a prematurity rate of 12.0 per cent as compared with 7.4 per cent for White babies.

A comprehensive study by Bain et al (1949) analysed data from about half the hospitals in the United States caring for 50 or more premature infants a year. In these hospitals there were about 600,000 births in 1946. The incidence of prematurity was 6.1 per cent. For White infants it was 5.6 per cent, and for non-White 9.5 per cent.

Blegen (1953) gave the figure of 6.7 per cent prematures among all the babies born at public clinics in Oslo during 1930 - 1939. (5.4 per cent when only live births were considered).

Causation of Premature Births.

Crosse (1946) gives the common causes of premature birth as maternal ill health, multiple pregnancy, and foetal deformity, but says that the cause is unknown in a large number of cases. In discussing the unknown causes she draws attention to the work done on poor social conditions and diet as causative factors in prematurity.

The Ministry of Health report by the Joint Committee of the Royal College of Obstetricians and Gynaecologists and the British Paediatric Association, on "Neonatal Mortality and Morbidity" (1949), shows that a cause of prematurity can be demonstrated in only 50 per cent of cases. Toxaemia of pregnancy, antepartum haemorrhage, multiple pregnancy, and foetal malformations are mainly responsible. They state that there is reason to believe that the unknown causes will become fewer with the improvement in economic, social and educational status of the poorer classes. They cite the Report by the Department of Health for Scotland, on Infant Mortality in Scotland (1943) as illustrating that the prematurity rate is much less in the upper middle class women than in women of the "hospital" class, and the incidence of pre-eclampsia is also lower. "Upper middle class patients, corresponding to the Registrar General's classes I and II, are better developed and nourished than 'hospital patients' in the same area". They point out, with justification, that though feeding experiments suggest that the incidence of prematurity can be lowered by suitable diet, "it is unlikely, however, than even first class nutrition during pregnancy will entirely neutralise the effects of years of faulty diet dating from early childhood".

In the survey of "Maternity in Great Britain", the birth weights of 13,295 singlets were known; 6.4 per cent of these were premature. The report discusses the following factors predisposing to prematurity:

a) Order of birth and social class.

First babies were more often premature (8.0 per cent) than those resulting from subsequent pregnancies (5.3 per cent). For all birth orders premature births were more frequent among the poor than the well-to-do people. With regard to social class, it was found that 4.3 per cent of babies born to wives of professional and salaried workers were premature. This figure was significantly lower than that for black-coated wage earners (6.5 per cent), for manual workers (6.6 per cent) and for illegitimate births (9.7 per cent). It was stated that similar social class differences were reported in previous studies. (Baird, 1945; Woodbury, 1925).

It is stated too that there is some evidence available from animal and human studies that these differences may have a nutritional basis. (I will discuss some of these studies in greater detail later).

However, although there is agreement that malnutrition may lead to prematurity, there is no complete proof that prematurity frequently has a nutritional basis, and other factors such as parity, birth spacing, mothers age, work during pregnancy, and the adequacy of antenatal supervision must also be taken into account.

b) Employment during pregnancy.

Women who worked outside the home during the last five months of pregnancy more frequently had premature babies than those who had not worked or who left work in the first four months. The data was not sufficient to enable one to say how much of the increased risk was due to employment and how much to the poverty that made it necessary for the pregnant woman to work late in pregnancy.

c) Age of mother and birth spacing.

Prematurity was found to be least frequent when the mother was aged 25 - 35 years.

Both very close and very wide spacing of births were associated with a high incidence of prematurity. For spacings of less than two years the prematurity rate was 6.8 per cent as compared with 4.0 per cent for intervals of 2 - 4 years, and 4.3 per cent for intervals of 4 - 6 years. When the interval was 6 - 8 years the rate was 5.4 per cent and 7.4 per cent for still longer intervals.

d) Quality of antenatal supervision.

In this survey the criterion of adequacy of antenatal supervision was based on the duration of supervision and the total number of attendances. The classification was as follows: adequate - at least nine clinic attendances starting in the first three months of pregnancy; barely adequate - at least six clinic attendances starting in the second three months of pregnancy; and inadequate - attendances only in the last three months of pregnancy. Premature births were least frequent among those receiving adequate supervision (4.7 per cent); in the barely adequate group they were 6.7 per cent, and 9.8 per cent among those inadequately supervised.

Douglas (1950) re-analysed the material of the survey with regard to prematurity and came to the following conclusions:

1. Social class differences in premature delivery were present but a significantly low incidence was found only in the most prosperous 9 per cent of the population.

2. "Abnormally high rates of premature births are found in two well defined groups of working women, namely primiparae aged 20 years or less, and multiparae with closely spaced pregnancies. These two groups

moreover, get the least adequate antenatal and confinement care, are the least likely to be helped in the house, and frequently work until late in pregnancy. Among the well-to-do prematurity-rates are not high at these ages, and with these birth spacings; this is the explanation of the social class differences observed".

3. The incidence of prematurity was also high among births to elderly primiparae and multiparae of all classes, but the abnormal risks were well known, and to some extent offset, by greater care during pregnancy and delivery.

4. Mothers of premature babies made less use of the available antenatal services than mothers of babies born at term.

5. The incidence of premature births was abnormally high among primigravida doing paid work during the last month of pregnancy.

6. The harmful effects of work late in pregnancy were not limited to those gainfully employed outside the home; it appeared that lack of domestic help was also associated with a high risk of prematurity.

Dunham (1951) quotes the work of Horia in Roumania to show the need to protect pregnant women from heavy work during the latter months of pregnancy, as a means of lowering the incidence of premature birth there. "Among women who were 'workers by the day', 22 per cent of the infants were prematurely born; among agricultural workers, 20 per cent; among cooks, 13 per cent".

Martin (1954), on the other hand, found no evidence of any association between employment during pregnancy and risk of premature delivery. He also did not find a relationship between adequacy of antenatal supervision and prematurity, although slighly more mothers in the premature group had received minimal or no antenatal care. His enquiry was limited to primiparae only.

Illsley et al (1954) in a study of prematurity and paid work during pregnancy, on primiparae in Aberdeen, found that though women who worked till a late stage of pregnancy were more likely to have premature babies, there was no evidence that increased length of work, by itself, predisposed to prematurity. The amount of antenatal care, domestic responsibility and the nature of housing conditions, also seemed to have little direct effect on prematurity rates. Nevertheless, the social gradient in the incidence of prematurity is pronounced, and the authors consider that this is due to the fact that living conditions which produce well grown and healthy mothers, also lead to a low prematurity rate. They consider too that it is unrealistic to expect any single social factor, such as paid work in pregnancy, or housing conditions, or antenatal care, to have a predominant influence on prematurity.

Drillien (1947) showed the importance of the health of the mother in relationship to prematurity. The prematurity rate was three times as high for mothers who had complications coincident with pregnancy than for those without complications. Complications of pregnancy itself were far more important causes of high prematurity rate than chronic medical diseases coincident with pregnancy. Mothers with toxaemia had a 15.6 per cent prematurity rate.

Tompkins and Wiehl (1951) showed that the pattern of premature labour was established by an initial underweight status of a patient and/or her failure to gain at an acceptable rate during the first two trimesters.

In a review of the literature on the causes of prematurity, Anderson et al (1939) concluded that "conditions which appear to be frequently associated with the premature delivery of an infant, are multiple pregnancies, and maternal diseases such as toxaemia of pregnancy and chronic infections. Prematurity occurs somewhat more often in the births of infants of very young mothers, and with first born children. When the nutrition of mothers is impaired by frequent pregnancies in rapid succession, by insufficient food and rest, or by the overstrain of continuous work of a gainful occupation, premature births appear to occur more often than when the mothers are normal".

Bloch et al (1952) in comparing the incidence of prematurity in Negro and White mothers of different socio-economic levels, found that at the Beth-El Hospital, White private patients had a premature incidence of 8.5 per cent, compared to 11 per cent for White ward patients.

Negro ward patients had an incidence of 15 per cent, whereas Negro private patients had only 10 per cent. At the Kings County Hospital, the premature incidence for Negro mothers was 16.5 per cent compared with 12.5 per cent for White mothers. Their final conclusion was that "the occurrence of premature birth is primarily a public health problem concerned basically with the socio-economic status and nutritional condition of the pregnant mother, Inadequately prepared for the nourishment of the foetus, the pregnant mother more often delivers prematurely".

Baird (1952) studied the environmental factors that affected the outcome of pregnancy, in the City of Aberdeen. He compared primigravida who delivered in a private nursing home with those confined in hospital. The still birth and neonatal rates were both less in the private patients. The lower neonatal mortality rate was due entirely to the very small death rate in premature babies. The overall prematurity rate was 5.6 and 8.2 per cent in the private and hospital groups respectively.

The private patients were healthier than the hospital group and much taller. (There was a close correlation between height and social class). On grading the patients into five physical and functional groups, namely, very good, good, fair, poor, and very poor, he found that the prematurity rate was twice as high in the poor physical grades and that the prematurity rates were higher in small than in tall women. The evidence seemed strong that the decreased prematurity rate in the nursing home patients was due to a better state of health in pregnancy and better nutrition - not only in pregnancy, but during childhood as well.

Illsley (1953) working with Baird continued this investigation in some detail and showed the interplay between social class, age and height in relation to prematurity. There was a marked relationship between social class and prematurity, and an equally strong association with height, within each social class. The prematurity rate in primiparae was highest among those under 20 or over 30 years of age. The rate was particularly high among the very young in social classes IV and V, a group which contained a high proportion of small women of poor physical grade. Illsley attributed this high prematurity rate to poor physical grade rather than to extreme youth.

Martin (1954) discussed Douglas' results on the existence of social class differences in the incidence of prematurity. His own findings suggested that the social gradient in the incidence of prematurity was even steeper than that found by previous investigators. Douglas showed that middle class wives had significantly fewer premature deliveries than wives of manual workers. Martin divided wives of manual workers into three categories, according to the level of skill of their husband's occupations, and the incidence of prematurity rose as the occupational scale went down from the wives of skilled manual workers to those of semi-skilled and unskilled workers.

He also confirmed the results of Baird and his colleagues on the association of height of mother and incidence of prematurity, although the distribution of heights in his sample was quite different from that in the Aberdeen series.

Blegen's results indicated that the frequency of premature births increased as living conditions became poorer and that premature births were almost twice as frequent among unmarried mothers as among married ones. He states that there are relatively fewer prematures as a whole and fewer prematures with very low birth weights in Oslo than in American and English cities, and gives as a reason for this that slums are practically non-existent in Oslo. Even those mothers classified in the lowest social classes had a fairly good diet, and all had the opportunity for free medical examinations at antenatal clinics.

Certain studies stress the importance of the diet of the pregnant woman in relation to prematurity, and many report on the favourable influence improved maternal diet has on toxaemia as well. Burke (1946) reporting on the work of her co-workers and herself, found that in a group of mothers whose prenatal diet was rated as good or excellent, the birth weight of the babies ranged from 6 lb 12 oz to 11 lb 7 oz. When the dietary rating was fair, the birth weights ranged from 3 lb 6 oz to 9 lb 3 oz and in the poor to very poor rating group, the range was 3 lb 4 oz to 8 lb 15 oz, with an average of 5 lb 13 oz. In the good to excellent group there was no prematurity at all, whereas in the poor to very poor groups more than one-third of the babies were premature.

A very marked relationship was found to exist between the mothers' general dietary rating and the incidence of toxaemia during pregnancy. There was no toxaemia among the good to excellent diet group, 8 per cent in the fair diet group, and 44 per cent in the poor to very poor group.

The Peoples' League of Health (1946) studied 5,000 expectant mothers attending 10 London hospitals between March 1938 to the end of 1939. An initial survey of 1,000 of these women showed deficiencies in calcium in 70 per cent of the group and iron deficiency in 90 per cent. Half the group was given supplements of calcium, iron, iodine and vitamins A, B, C and D, from before the 24th week of pregnancy to the time of delivery. The other half formed the control group. The most significant findings were a reduced incidence of prematurity and of toxaemia of pregnancy in the treated group.

In the Toronto experiment of Ebbs, Tisdall and Scott (1941), expectant mothers were given daily supplements of protein, fats, fruit, vitamins and iron, and compared with a control group on a relatively poor diet. The supplemented group had fewer miscarriages and premature births, and were less liable to toxaemia of pregnancy. Toverud (1939) described an investigation carried out at a health station in a rural community in Norway. It was found that about a third of the women were anaemic and their diets were deficient in calcium and vitamins A and C. Their food was supplemented and corrected before delivery. In the supplemented group the incidence of prematurity was reduced from 8 per cent to 2 per cent, and the incidence of eclampsia and still births was also reduced. In a group of unmarried mothers whose diets were supplemented, the prematurity rate fell from 15 per cent to 2 per cent.

Antonov (1947) reporting on the children born during the siege of Leningrad in 1942, found that 41.2 per cent of the babies born in the first half of 1942 were premature, when prematurity was assessed on a length basis. 49.1 per cent of the children weighed less than 2,500 gm. He considered the cause of the extremely high prematurity rate to be hunger during pregnancy.

Cameron and Graham (1944) studied the effect of antenatal diet and its influence on still births and prematurity in Glasgow. They made records of the food intake of 300 women, 100 mothers of still born infants, 100 mothers of prematurely born infants, and 100 mothers of normal full term infants. Their results showed that the diets of mothers of full term infants were superior in every respect, particularly with regard to first class protein, calcium and phosphorous. To test the validity of these findings they supervised the diets of 500 expectant mothers in their last three months of pregnancy and compared them with a control series.

There were 31 premature births and 21 still births in the supervised group as compared with 50 premature births and 36 still births in the control series, and these differences were regarded as significant.

Dunham (1951) emphasises the fact that the causes of premature birth vary in different areas within a country, and in different countries of the world. She says too, that though it is commonly stated that the cause cannot be determined in a large proportion of cases, this may be due to a failure in reporting, or a lack of effort in determining the cause, and quotes reports where the causation of premature labour was determined in 69 per cent of cases in one report, and in only 35 per cent in another. "The most frequent causes of premature birth reported by these authors are multiple birth, toxaemia, premature rupture of the membranes, syphilis, and antepartum haemorrhage. In India on the other hand, malnutrition and anaemia, in Manila, beri-beri in the mothers, are said to be the most impertant factors in causing premature births".

Causation of Premature Births in South Africa.

I studied the figures of premature deliveries in 1953, at three institutions in Cape Town in an attempt to see which factors were of most importance in the causation of premature births in the White and non-White groups. The institutions are the Mowbray Maternity Home, a provincial hospital, delivering only White women who cannot afford the confinement fees demanded by private nursing homes, the St. Monica's Home, a subsidised mission hospital, which delivers only non-White - mainly Coloured women, and the Peninsula Maternity Hospital, a provincial hospital, delivering all races, but predominantly Coloured. The incidence of premature deliveries including still births in 1953 are 8.1, 13.3 and 10.1 respectively.

The proportion of the leading causes of premature live births in the three institutions are as follows:

	Mowbray Hospital	St. Monica's Home	Peninsula Maternity Hospital.
Unknown causes	28.5 %	70 %	45.5 %
Toxaemias	+ 38.7 %	9.4 %	10.2 %
Multiple pregnancies	15.4 %	7.8 %	10.6 %

(+ includes cases of essential hypertension and nephritis)

At the Peninsula Maternity Home antepartum haemorrhage is also of considerable importance, accounting for 8.5 per cent of the cases.

It is interesting to see that the proportion of "unknown" causes rises very steeply from 28.5 per cent in the European hospital, to 45.5 per cent in the hospital which admits European and non-European women, and 70.0 per cent in the home admitting only non-European women. Baird (1945) reported that the incidence of prematurity in Aberdeen was almost twice as high in social classes III, IV and V as in classes I and II, and that in the former classes over 50 per cent of the prematurity was unexplained, while in the latter very few came within this category. It is in this unexplained group that the social causation of prematurity assumes such importance.

It seems fairly clear that many of the causes of prematurity are the same as the causes of low birth weight and indeed a substantial proportion of infants classified as premature are born at or near term. (Martin, 1954). Poverty, inadequate and ill-balanced diet, ill health of the mother, early child bearing and too closely spaced pregnancies with inadequate antenatal supervision are among the most important social causes.

I have commented earlier on the fact that in South Africa the non-Europeans are in the main of a low economic level. Van der Horst (1955) gives the estimates of income per head of population as follows: African £23, Coloured £36, Asiatic £46 and European £238. It should be pointed out that the Asiatic group has a wealthy trading section which brings up the average income figure, but the majority of the Indian people are as poor as or poorer than the African.

Non-European women work hard either in or away from their homes. Their diets are poor, particularly in proteins and fats. In an investigation of the ethnic and socio-economic differentiation of protein, fat and carbohydrate content in the food of the population of Cape Town, Batson (1954) summarises his findings for the poorer European, Coloured, and African households of Cape Town:

a) "That in the European households the mean consumption of protein foods and of fats and oils does not vary much with socio-economic status;

b) that the same is true in the African household, but that they purchase proportionately less protein, and particularly less fat, than European households in the same socio-economic level;

c) that in Coloured households, whether Christian or Malay, purchases of fats and oils increase relatively to purchases of carbohydrate foods as socio-economic level increases, the proportion of these foods rising from about the 'African' to about the 'European' level".

Non-European women have larger families than European women. They begin child bearing at an earlier age and their birth spacing is closer. As will appear later, over 80 per cent of the European babies studied fall into the first two birth ranks, whereas 80 per cent covers the first 5 birth ranks for the Indian babies and 5 per cent are tenth and higher birth ranks. The Coloured and Bantu babies fall between the two extremes. 3.5 per cent of the European babies are born to mothers under 20 years whereas 20 per cent of the Coloured babies, 12 per cent of the Bantu babies, and 19 per cent of the Indian babies are born to such mothers.

Little work seems to have been done on the gain in weight during pregnancy of the four racial groups I am comparing. Kark (1954) studied the weight changes in pregnancy of 116 African women attending the Pholela Health Centre Antenatal Clinics. He found a total gain of less than 10 lb during pregnancy. During the first four months only 11 women (35.5 per cent) gained over 1 lb in weight. 13 women actually lost more than 1 lb during this period. During the last month only 31 women (52.5 per cent) gained more than 1 lb.

Most of the Indian women attending the antenatal sessions at the Merebank section of the Institute of Family and Community Health weigh under 100 lb at the beginning of pregnancy, and many weigh under 90 lb. They are also very short, usually under 5 ft. Although I do not have figures available, my impression is that the Coloured women gain more weight in pregnancy than the Indian and African women, and that the Europeans approximate to the usual standards quoted.

Non-European women certainly do not attend antenatal sessions as early and as regularly as European women do, and many have no skilled supervision either during pregnancy or delivery.

In this connection it is interesting to see the proportion of trained and untrained midwives who practise in Durban and the numbers of confinements they attend. The Medical Officer of Health for Durban reported in 1950 that there were 26 registered and 155 unregistered practising midwives on his list. The distribution was as follows:

	European	Coloured	Native	Asiatic	Total
Registered	21	4	-	1	26
Unregistered	5	2	1	147	155
	26	6	1	148	181

The number of confinements they attended was:

	European	Coloured	Native	Asiatic	Total
Registered	276	104	-	16	396
Unregistered	34	14	3	3275	3326
	310	118	3	3291	3722

The proportion of Indian women who deliver in hospital is small, and on the whole they are delivered at home either by totally untrained people, or by untrained midwives who are registered with the Municipality. The numbers of Bantu women who are confined in hospital is increasing rapidly every year, but a large number are still delivered by their mothers or other old women, or without any assistance whatever.

In the light of all the foregoing remarks it is not surprising therefore, that there is such a high incidence of prematurity among the non-European races in South Africa.

Importance of Prematurity.

MacGregor (1946) in a study of the pathology of still births and neonatal deaths makes these remarks about prematurity:

"One fact that emerges clearly from this study is the outstanding importance of prematurity as a factor in foetal, and more especially in neonatal, mortality. The figures given .... show that 54 per cent of the still births and 70.5 per cent of the neonatal deaths were in cases of premature birth. During the period covered by this series of cases, slightly over 10 per cent of all births in the hospital were premature; and it was this 10 per cent that produced almost three-quarters of the neonatal mortality. Except when it is extreme, prematurity is seldom the sole ascertainable cause of death, but its importance as a factor predisposing to death from almost every other cause cannot be exaggerated. In this series, among the live-born infants that died of asphyxia, 82.7 per cent were premature; of those that died of intracranial haemorrhage, 81.8 per cent; and of those that died of infection, 66.3 per cent. This shows how close the problem of neonatal mortality is to that of prematurity; for nothing could make a greater contribution to a reduction in the neonatal death rate than prevention of premature births".

Crosse (1946) found that although the incidence of premature births in the City of Birmingham during 1944 was only 6.3 per cent, yet 44.2 per cent of the still births and 57.3 per cent of the neonatal deaths occurred in association with these premature births. Crosse also quotes two American reports, the first of which reported prematurity as a single cause of death in 47 per cent of neonatal deaths, and the second in 60 per cent of the neonatal deaths.

The Ministry of Health report by the Joint Committee of the Royal College of Obstetricians and Gynaecologists and the British Paediatric Association (1949) states that immaturity is directly or indirectly responsible for a high proportion of neonatal deaths and disease, although it is not always certain whether the immaturity was the lethal or the predisposing factor. They quote the figures from the statistical review of the Registrar-General for England and Wales for 1938, which showed that there were 17,572 neonatal deaths of which slightly over 50 per cent were certified as due to prematurity, and it was probable that about 50 per cent of the 24,729 still births in the same year were also associated with prematurity. The mortality rate of immature babies per 1,000 live births varied from district to district; it ranged from 11.47 in Greater London in 1938 to 17.17 in Durham and Northumberland.

In the Maternity in Great Britain Survey, premature babies contributed 52 per cent of the neonatal deaths in the survey, and raised the total neonatal death rate per 1,000 from 12 for single mature births to 24 for all single births.

Blegen found that "still births were about 13 times as frequent among prematures as among full term infants, and about 33 times as many prematures died during the first 24 hours after birth. The increased mortality risk persisted during the first years of life so that after 8 years about 5 times as many prematures as full term children had died".

Corsa et al (1952) point out that as the control of communicable diseases improves, prematurity becomes increasingly important as a cause of death. In the decade 1939 to 1948, for the United States, reported infant deaths from prematurity were responsible for 25 per cent of all fatalities in the age group under 15 years, comprised 50 per cent of the neonatal deaths, and were among the 10 leading causes of death for the total population. Although in 1948 there was a considerable reduction (24 per cent) in the gross neonatal mortality rate, prematurity still maintained its dominant position.

They also point out that infants who have any appreciable degree of prematurity are disabled to varying extents and for irregular periods subsequent to birth, where disablement was defined as a "temporary human incapacity without residual structural or functional impairment in contrast to defect which involves permanent bodily change". Prematurity is also of great importance in the causation of permanent injury and the same authors draw attention to the importance of retrolental fibroplasia, which is directly related to prematurity, and which is the major cause of blindness among children in the United States to-day.

Importance of Prematurity in South Africa.

To get some idea of the wastage of life due to prematurity in Durban, I have worked out the prematurity death rates in the four racial groups. In order to do this I have taken the records of the Medical Officer of Health, Durban, over a five year period, from 1947-1951, and have calculated the deaths due to prematurity as a percentage of all the neonatal deaths, and of the total infant deaths in the first year of life. (Table 12).

TABLE 12

DEATHS FROM PREMATURITY AS A PERCENTAGE OF NEONATAL DEATHS, AND TOTAL INFANT DEATHS UNDER ONE YEAR IN DURBAN, 1947 - 1951.

	No. of Premature deaths up to 4 wks.	Total No. of Neonatal deaths	Premature deaths as percentage of Neonatal deaths	No. of Premature deaths under 1 year	Total No. of deaths	Premature deaths as percentage of total deaths under 1 year
European	163	288	56.9 %	166	382	43.5 %
Coloured	44	105	41.9 %	45	267	16.8 %
Bantu	592	1941	30.5 %	610	5338	11.4 %
Asiatic	339	841	40.3 %	361	2127	16.9 %

From this Table it can be seen that prematurity is the most important cause of death among the Europeans, both in the neonatal period

(57 per cent), and during the whole of the first year (43 per cent). The Coloured and Indian groups resemble each other, prematurity causing approximately 40 per cent of the neonatal deaths, but only 16 per cent of the total deaths under one year. Prematurity is relatively less important as a cause of death in the Bantu group, being responsible for 30 per cent of the neonatal deaths and only 11 per cent of the total deaths.

As social and economic conditions improve, one expects prematurity as a cause of death to become relatively more important, since deaths from conditions such as gastro-enteritis and pneumonia will diminish. To get a true picture of the ravages caused by prematurity, the data must be examined in other ways. Accordingly I have calculated the prematurity death rate per 1,000 live births in the neonatal period, and in the first year of life, for the four racial groups. (Table 13).

TABLE 13.

DEATH RATES OF PREMATURE BABIES PER 1,000 LIVE BIRTHS (1947-1951).

	No. of Live Births	No. of Premature deaths in Neonatal period.	Premature Death rate per 1,000 live births in neonatal period.	No. of Premature deaths in first year	Premature death rate per 1,000 live births in first year.
European	13,439	163	12.1	166	12.3
Coloured	3,129	44	14.1	45	14.3
Bantu	15,409	592	38.4	610	39.6
Asiatic	25,883	339	13.1	361	13.9

From this table it can be seen that, though prematurity is so important a cause of infant deaths in the European group, it only accounts for 12 deaths per 1,000 live births, while in the African group - the group in which prematurity is relatively the least important cause of death in the four groups, it accounts for over 39 deaths per 1,000 live births. The Coloured and Indian figures fall between the African and European extremes with a little over 14, and 13 deaths per 1,000 live births respectively.

Another point of interest is that while the incidence of prematurity is highest in the Indian group, 18 per cent, the death rate from prematurity is much lower than that of the African with a prematurity incidence of 11.5 per cent. Of course it is possible that not all the Indian babies classified as premature, are really so as regards period of gestation. The mean birth weight of the group, 6.46 lb is only 1 lb above the weight limit of prematurity, 5 lb 8 oz. Yet it is also true that the Indian infant mortality rate is, in general, far lower than that of the African, though still far above that of the European. The reason for this marked difference between the African and Indian is not known, but the answer may possibly lie in differences of cultural background, of pattern of child rearing, and of adaptation to the environment.

TABLE 14.

INFANT MORTALITY RATES IN DURBAN (1947 - 1951)

	No. of Births	No. of Deaths	Infant Mortality Rate.
European	13,439	382	28.4
Coloured	3,129	267	85.3
Bantu	15,409	5,338	346.4
Asiatic	25,883	2,127	82.2

It can be seen from Table 14 that the Coloured and Indian infant mortality rate is roughly three times the European rate, and that the African rate is over 12 times as high as that of the Europeans, and over four times as high as the Indian and Coloured rate.

Prematurity, then, leads to a great loss of infant lives in all racial groups; in the European group it is the leading cause of death in the neonatal period, and during the first year of life. In the 3 non-European groups, although a study of the annual reports of the Medical Officer of Health reveals the fact that gastro-enteritis and bronchopneumonia are more important causes of infant deaths in the first year, prematurity is still the leading cause of death in the neonatal period.

SUMMARY.

1. The definition of Prematurity is discussed. The commonly accepted criterion of prematurity is based on a weight standard - infants weighing $5\frac{1}{2}$ lb (2,500 gm) or less being classified as premature. In this investigation all babies weighing less than 5 lb 8 oz are taken to be premature.

2. The same sample of babies is used to investigate the incidence of prematurity of the four racial groups, as was used to determine their mean birth weights.

3. Results are as follows:

Europeans	4.2 per cent premature	Bantu	11.5 per cent premature.
Coloureds	9.6 " " "	Indians	18.3 " " "

4. All these differences are significant except that between the Coloured and Bantu groups.

5. Boys have a lower incidence of prematurity than girls owing to their greater birth weight. This difference is significant in the Bantu and Indian groups only.

6. A comparison of incidence of prematurity in the four racial groups yields the same results when the sexes are considered separately as when they are combined.

7. Figures for incidence of prematurity are given for England, America and Sweden. Negro infants had a higher incidence of prematurity than White infants.

8. The causation of premature births is discussed in some detail. Socio-economic factors such as health of mother, diet during pregnancy, the amount of antenatal supervision, and work during pregnancy appear to be of considerable importance in determining the incidence of prematurity. Other factors such as age of mother, order of birth and interval between births appears to be of lesser impertance. (I have not discussed the importance of multiple pregnancy as a causative factor in prematurity in my investigation, since I used only single births).

9. Where the cause of prematurity is unknown, it appears that social factors predominate.

10. The socio-economic status, diet, health and antenatal supervision of the four ethnic groups in South Africa are discussed. In all these respects the non-White races are far worse off than the White.

11. Non-European mothers have larger families than European mothers and a larger proportion of babies are born to mothers under 20 years in the non-European group.

12. The importance of prematurity is discussed in relation to infant mortality (particularly neonatal) and infant morbidity.

13. Deaths in Durban from prematurity are calculated over a five year period, and presented as a percentage of both neonatal and total infant deaths under one year, for the four racial groups. The death rate of premature babies per 1,000 live births is also worked out for the same period, and the wastage of lives brought out.

14. In the European group prematurity is the leading cause of death both in the neonatal period and in the post-neonatal period. In the non-European groups, prematurity is the chief cause of death in the neonatal period, but gastro-enteritis and broncho-pneumonia are more important in the post-neonatal period. However, more deaths per 1,000 live births from prematurity occur in the non-European races than in the European.

15. Although the incidence of prematurity is highest in the Indian group, the death rate from prematurity is higher in the Bantu than in the Indian group.

16. Infant mortality rates are calculated over a five year period in Durban for the four groups. The Europeans have the lowest infant mortality rates and the Bantu the highest. The Indian and Coloured rates are similar to each other and fall between the two extremes. The relatively low infant death rate of the Indian babies in comparison to the Bantu rate is puzzling but the explanation possibly lies in the differences of cultural background, of patterns of child rearing and adaptation to the environment.

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CHAPTER IV

THE RELATIONSHIP BETWEEN BIRTH RANK AND BIRTH WEIGHT

This chapter is concerned with the effect of birth rank (order of birth) on the birth weights of the babies of the four racial groups.

MATERIAL USED AND METHOD OF ANALYSIS.

The data extracted consist of birth weight, race of mother, sex of child, and birth rank of child. Abortions and multiple births are excluded. The number of babies used here is not identical with the number used in the previous chapters, since cases in which birth rank was not recorded had to be omitted. To make up for this, additional data were collected which included the birth rank of the child. In establishing birth rank, previous miscarriages are included.

The data were collected from the same hospitals and nursing homes in Durban, Pietermaritzburg and Cape Town as before, and the numbers used are as follows:

3,165 European babies.
1,057 Coloured babies.
2,188 Bantu babies.
1,391 Indian babies.

Frequency distributions of birth weights according to birth rank for the four racial groups are drawn up (see Appendix 1). The percentage distribution of the ranks is calculated for each group. Means and standard deviations of the birth weights for the different ranks are determined for the races and sexes separately. Where differences occur the significance of these differences is also calculated.

RESULTS.

Table 15 and Chart 2 show that over 80 per cent of the European babies fall into the first two birth ranks, whereas 80 per cent covers the first five birth ranks of the Indian babies, and over 5 per cent of the Indian babies are of tenth or higher birth rank. The

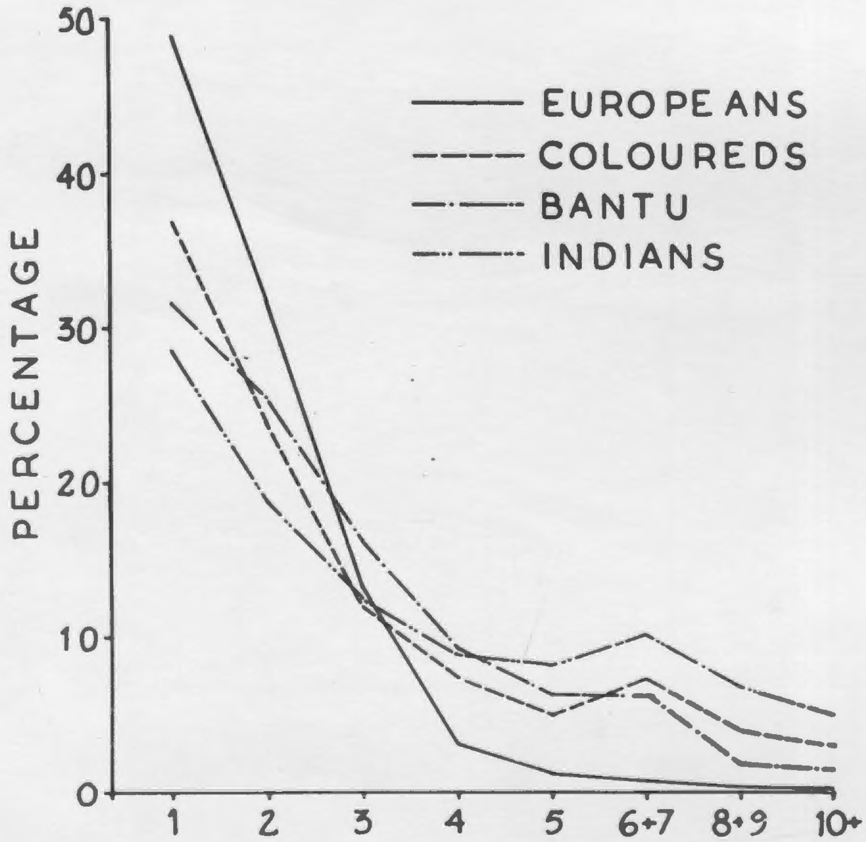
TABLE 15

PERCENTAGE DISTRIBUTION BY BIRTH RANK (BOTH SEXES)

Birth Rank	European	Coloured	Bantu	Indian
1	49·0	37·3	32·0	29·0
2	32·0	24·1	25·7	18·8
3	13·6	12·1	16·5	12·6
4	3·2	7·5	9·4	9·3
5	1·3	4·7	6·4	8·0
6 and 7	0·6	7·4	6·4	10·6
8 and 9	0·2	3·8	2·2	6·6
10+	0·1	3·1	1·4	5·1
Total	100·0	100·0	100·0	100·0

CHART 2

DISTRIBUTION OF RANKS



Coloured and Bantu babies fall between these two extremes, with the percentage of Coloured babies in the higher birth ranks slightly larger than among the Bantu.

Table 16 and Chart 3 show that the mean birth weight increases with increasing birth rank up to Rank 4 in all the racial groups, although in no group is there a steady rise in weight from Rank 1 to the highest rank. The European and Indian birth weights rise to a peak (which remains as a plateau in the Indian group) and then fall for the highest birth rank group, although remaining higher than those of Rank 1 babies. In the Coloured group, with the exception of the slight drop in mean birth weight for Ranks 6 and 7, the curve is very similar to that found in the European and Indian groups. The Bantu curve, however, does seem to be different from the other three, in that there is a drop after Rank 4, carried on to Ranks 6 and 7, after which the mean birth weights rise again to a peak at Rank 10 +. It may be that this is a question of numbers, as none of the differences between mean birth weights for the higher birth ranks is significant (see Appendix 2 and Appendix 3).

Although the mean birth weights follow the patterns previously described, the only significant differences found are between Rank 1 and the other ranks (Appendix 2), with two exceptions in which Rank 2 birth weights are also significantly lower than two of the higher ranks (see Appendix 3).

In the first chapter of this thesis it was shown that significant differences existed between the mean birth weights of the four racial groups, though not between the Coloured and Bantu babies. In the light of the very different distribution of ranks found in the four racial groups (see Table 15), this is a possible factor contributing to the differences between mean birth weights found. Accordingly, like ranks are compared with each other in the four racial groups, and as the sex ratio appears to vary in the different ranks, boys and girls are considered separately (see Table 17 and Appendix 4).

Table 17 and Appendix 4 show that for both sexes and for all ranks the same differences exist as found previously. In other words, in all

TABLE 16

MEAN BIRTH WEIGHT RELATED TO BIRTH RANK

Birth Rank	European			Coloured			Bantu			Indian		
	No. of Births	Mean (lb.)	S.D.	No. of Births	Mean (lb.)	S.D.	No. of Births	Mean (lb.)	S.D.	No. of Births	Mean (lb.)	S.D.
1	1,551	7·34	1·13	394	6·63	1·09	701	6·75	0·98	404	6·20	0·99
2	1,013	7·64	1·14	255	6·90	1·12	562	6·99	1·13	261	6·43	1·11
3	430	7·74	1·15	128	7·08	1·08	360	7·19	1·07	175	6·55	0·96
4	101	7·81	1·31	80	7·15	1·48	206	7·38	1·29	129	6·79	1·16
5	40	8·03	1·26	50	7·29	1·03	141	7·23	1·15	112	6·79	1·32
6 and 7	21	7·56	1·26	78	7·24	1·70	140	7·18	1·38	147	6·82	1·49
8 and 9	7	—	—	40	7·68	1·20	48	7·33	1·09	92	6·76	1·32
10 and over	2	—	—	32	7·33	1·63	30	7·40	1·01	71	6·58	1·54
Total	3,165	7·52	1·16	1,057	6·93	1·23	2,188	7·03	1·11	1,391	6·51	1·19

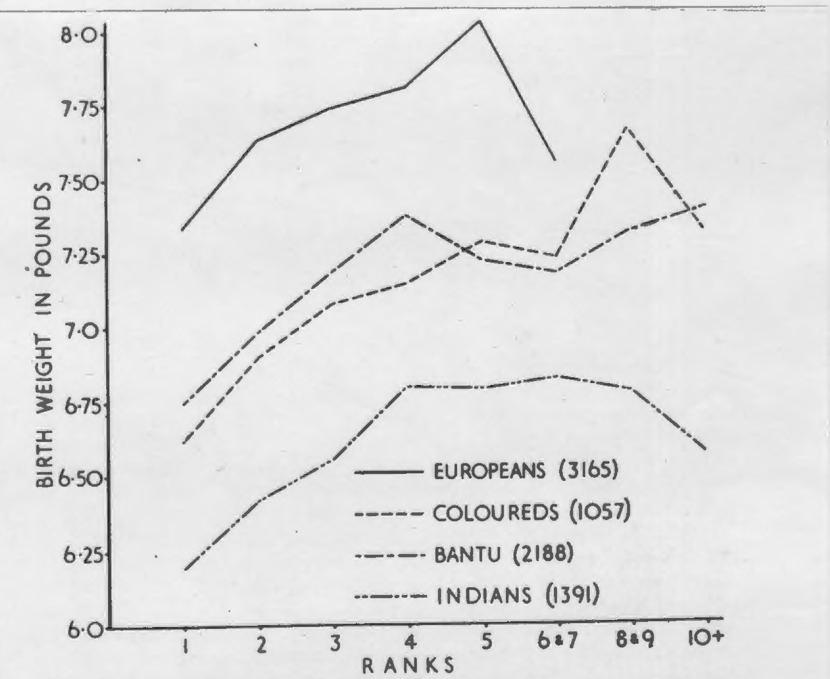


FIGURE.—Birth weight according to birth rank.

Chart 3.

ranks European babies have significantly higher mean birth weights than the others, Indians have significantly lower mean birth weights than the other groups, and there is no significant difference between the weights of the Coloured and Bantu babies.

TABLE 17

MEAN BIRTH WEIGHT FOR EACH SEX RELATED TO BIRTH RANK

Birth Rank	Mean (lb.) Male				Mean (lb.) Female			
	European	Coloured	Bantu	Indian	European	Coloured	Bantu	Indian
1	7·43	6·67	6·85	6·22	7·21	6·55	6·63	6·16
2	7·73	6·86	7·13	6·37	7·52	6·90	6·81	6·47
3	7·87	7·27	7·28	6·78	7·63	6·92	7·09	6·24
4 and over	7·92	7·48	7·44	6·88	7·79	7·10	7·12	6·65

DISCUSSION.

Meredith and Brown (1939) in a review of the literature on the relation between birth order and mean weight at birth, found that all investigators agreed that later-born babies exceeded first-born babies in mean birth weight (Table 18).

TABLE 18.

RELATION BETWEEN BIRTH ORDER AND MEAN WEIGHT AT BIRTH (after Meredith and Brown, 1939).

Investigation	First-born or primiparae		Multiparae or later-born		Excess of multiparae (grams)
	Cases	Mean	Cases	Mean	
MALES					
Stockton-Hough, 1885, Philadelphia	207	3330	123	3573	243
Longridge, 1905, England	100	3168	100	3352	184
Martin, 1930-1931, England	2041	3238	1485	3460	222
Bakwin and Bakwin, 1934 New York	395	3375	423	3540	165
Meredith and Brown, Iowa City	230	3396	303	3564	168
FEMALES					
Stockton-Hough	216	3020	166	3412	392
Longridge	100	3055	100	3133	78
Martin	1946	3139	1384	3280	141
Bakwin and Bakwin	417	3222	418	3430	208
Meredith and Brown	182	3320	323	3458	138

TABLE 19.

EFFECT OF ORDER OF BIRTH ACCORDING TO VARIOUS INVESTIGATIONS. (after Donald, 1939).

TABLE —EFFECT OF ORDER OF BIRTH ACCORDING TO VARIOUS INVESTIGATIONS.

Order of Birth.	1.	2.	3.	4.	5.	6.	7.	8.	9–10.	Total Number of Cases.
(1) Ingerslev, ♂♂ .	7·28	7·56	7·68	7·71	7·86					1833
Denmark, ♀♀ .	7·07	7·41	7·30	7·43	7·59					1617
(2) Hansen, ♂♂ .	7·74	8·10	8·34	8·32	8·49	8·47	8·45	8·43	8·49	3005
Denmark, ♀♀ .	7·49	7·80	7·94	8·14	7·95	7·98	8·16	8·07	8·05	2818
(3) Toverud, ♂♂ .	7·69				8·16					2205
Norway, ♀♀ .	7·52				7·88					2046
(4) Duncan, Scotland, ♂♂ ♀♀	7·20	7·31	7·35	7·19	7·45	7·32	7·31 (7 and over)			2087
(5) Pearson, ♂♂ .	7·01	7·36	7·41		7·70		7·91		7·59	856
England, ♀♀ .	6·76	7·08	7·33		7·36		7·32		7·65	866
(6) Donald, ♂♂ .	7·33	7·60	7·78	7·87						1571
Scotland, ♀♀ .	7·05	7·48	7·47	7·42						1465

There does not seem to be unanimity, however, as to whether the birth weight becomes progressively greater with each increasing birth rank. One of the difficulties encountered by most investigators, including myself, is the paucity of numbers in the higher birth ranks. For this reason many investigators group their birth ranks.

Meredith and Brown divided their cases into first-born, second to fourth-born, and fifth and higher ranks. They found that the second to fourth-born had a higher mean birth weight than the first-born; and that the fifth and later-born had a higher mean birth weight than the second to fourth-born.

Bakwin and Bakwin (1934) state that birth weight increases up to the sixth pregnancy, after which it declines. Martin (1931) gives results for mean birth weights for individual ranks up to 16, and finds that "the weight of the later-born exceeds that of the first-born but it seems doubtful whether weight follows a progression with the rank of birth". Donald (1939) quotes other workers in this field (Table 19), and concludes that "most investigators agree that there is an increase in weight up to the third child. What happens after that has not been satisfactorily determined owing to the inadequacy of the available numbers, but it seems likely that there is but slight change from the fourth onwards".

McKeown and Gibson (1951) found that weight increases with parity to the third birth rank, but above the third there is no consistent change (at least none is evident when "3" is compared with "4 and over").

Meredith (1950) stated that where investigators have used large samples the trend appears to be one of continuing increase. For example he quoted Perlstein and Levinson (1937) who found that birth weight increased with the parity of the mother up to the seventh parity, after which it decreased. His second example was from Peckham (1933) who used data on 26,000 Negro and white infants born at John Hopkins Hospital from 1896 - 1930. Peckham found a steady rise in weight with increasing birth order so that the mean weight of tenth children was 12 ounces more than the mean weight of first-born children.

Karn and Penrose (1951) assembled data from the University College Hospital Obstetric Hospital for the years 1935 - 1946, containing information on 7037 male and 6693 female babies and their mothers. (Table 20).

Table 20 and Chart 4 show that "the means of the first-born are the lowest in both sexes, rising to nearly 1 lb more for the high parities 8 and over".

Goldstein (1938) compared siblings born at the Sloane Maternity Hospital, New York City. He found that the later-born babies were heavier than the earlier-born, and that third-born were heavier than second-born, and second-born than first-born. In general there seemed to be a handicapping of an earlier-born child, whether he was the first, second or third-born, when compared with a later-born child. There was evidence, too, of a geometric relation between differences in birth weight and birth intervals. Birth weight differences of three birth order intervals were about twice as big as those of two birth order intervals, and the differences of birth weight of two birth order intervals

T A B L E 20.

MEAN BIRTH WEIGHT FOR GIVEN PARITY - MALES AND FEMALES (after Karn and Penrose, 1951).

Table *Mean birth weight* *for given parity—males and females*

Parity	Weight			
	Males		Females	
	No.	Mean (lb.)	No.	Mean (lb.)
0	4114	7·205	3933	6·982
1	1307	7·437	1226	7·244
2	548	7·654	466	7·384
3	257	7·599	301	7·416
4	162	7·750	156	7·606
5	103	7·829	126	7·484
6	67	7·955	71	7·773
7	48	8·026	55	7·657
8 and over	91	8·174	85	7·820
Total	6697	7·350	6419	7·132

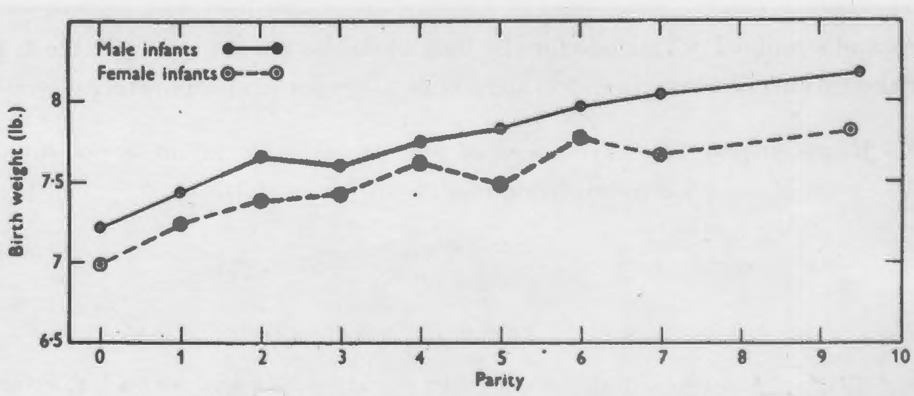


Fig. Mean birth weight for given parity.

Chart 4 : MEAN BIRTH WEIGHT FOR GIVEN PARITY.

were about twice as big as those of one birth order interval.

Karn et al (1951) also analysed material concerning repeated pregnancies in 1,714 mothers in an investigation of birth weight, gestation time and survival in sibs. With regard to birth weight and parity they found that "the first-born babies are significantly lighter than the second-born for each sex. There is a further insignificant weight increase in the third-born males which is not paralleled in the females. The males became progressively heavier by more than ½ lb (in the mean) up to the third-born; the females do not show so much difference, but seem to be heavier in the second rank of birth. The males are always heavier than the females of the same birth rank, and the difference becomes more marked as birth rank increases, at least up to the third. These facts are in general agreement with results noted by previous investigators (Matthews Duncan, 1871; Pearson, 1914; Martin, 1931).

Correlations indicating degree of likeness between sibs vary between 0.304 and 0.531; the weighted mean of all is 0.427. The highest correlations are obtained for weights of the second and third infants, that is, those in which neither member of the pair is first-born. This observation, coupled with the peculiarities of the mean weights of first-born infants, suggests that there are sources of variation affecting the first child which do not affect the later births. The correlations for like-sexed sib-pairs are slightly, but not significantly higher than those for unlike-sexed pairs. Thus the weighted mean correlation for 731 male-male and female-female pairs combined is 0.445 ± 0.030 as compared with that of 702 unlike-sexed pairs, 0.409 ± 0.031. The magnitudes of the sib-sib correlations for birth weight are thus compatible with the assumption that birth weight depends on the genetical constitution of the foetus. They might equally well be due to maternal constitution or maternal environment".

Meredith (1950) stated that "although there is a definite association between birth weight and birth order, the two variables are not highly related .... The relation of birth order to birth weight is perceptibly curvilinear, i.e. the difference in weight between

T A B L E 21.

PERCENTAGE BIRTHS IN THE VARIOUS BIRTH ORDERS (after Jain, 1951)

TABLE [ ]

Percentage births in the various birth orders.

Country.	Birth order.									
	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	8th.	9th.	10th and over.
India	21·0	19·6	16·7	13·1	9·4	6·9	4·8	3·3	2·1	3·1
Egypt	19·2	15·2	16·1	14·2	10·9	8·3	5·9	4·0	2·5	3·1
U.S.A.	39·5	28·4	14·3	7·3	3·9	2·3	1·5	1·0	0·7	1·1
England & Wales ...	42·3	30·0	13·7	6·2	3·2	1·8	1·1	0·7	0·4	0·6
Australia	38·5	28·0	15·5	7·9	4·2	2·4	1·4	0·9	0·5	0·7
New Zealand ...	34·7	26·6	18·3	9·8	4·8	2·5	1·4	0·8	0·5	0·6
Canada	32·6	23·6	14·3	8·8	5·8	4·0	2·9	2·2	1·6	4·2
Italy	27·2	21·7	15·2	10·9	7·9	5·8	4·2	2·9	1·8	2·0
France	29·2	23·2	14·9	9·4	6·1	4·0	2·7	4·4		
Germany	36·4	22·5	15·2	8·5	4·8	7·2				
Finland	36·6	23·2	14·6	8·9	5·7	3·8	2·6	1·8	1·1	1·6
Denmark	34·6	29·0	16·7	8·6	4·6	2·6	1·5	0·9	1·5	

first and second infants exceeds that between second and third, and the successive differences tend to become progressively smaller".

In my series the correlation between mean birth weight and parity is not the same in the different racial groups, except for the fact that all groups show an increase in mean birth weight up to Rank 4. The Europeans show their peak birth weight at Rank 5, with a drop thereafter. The Coloureds show an almost steady rise in weight to a peak at Ranks 8 and 9, followed by a drop. The Indian weights rise to a peak at Rank 4, remain virtually stationary to Ranks 8 and 9, and then drop. The Bantu weights rise to a peak at Rank 4, drop slightly for Ranks 5, 6 and 7, and rise again to a second peak at Rank 10+.

I have observed previously (see Table 15) that the percentage distribution of ranks is different for the racial groups. In this connection it is interesting to compare the South African figures with those of other countries. Jain (1951) gives the proportion of births by birth order for India and other countries (Table 21).

Jain points out that in every country there is a corresponding decrease in proportion with increase in the order of birth. In all the countries shown in the Table, with the exception of India and Egypt, the proportion of first births is very high. This is followed by a considerable fall in proportion for second births and a sharp decline for births of higher order. In India and Egypt the proportion of first births is not high, and the same is true of second births. This is followed by a gradual fall for births of higher order. First and second births are proportionately less than in Western countries. On the other hand, higher birth orders from fourth onwards are proportionately more. It is obvious that India and Egypt are countries with high birth rates.

In India first to fifth births account for nearly three-quarters of the total births, and with the addition of the next two birth orders, for 90 per cent of the total, whereas in the other countries, three-quarters of the births come from the first to third birth orders and 90 per cent from first to fifth.

In my series the proportion of births of low birth order is even higher for the Europeans in South Africa than for the Western World. Over 80 per cent of the European births are contained in the first two birth orders and over 90 per cent in the first three.

The South African Indian figure is similar to that of India itself in that 78 per cent of the births are contained in the first five birth orders and almost 90 per cent in the first seven.

The Coloured and Bantu figures occupy an intermediate position between these two extremes, the Coloured having a resemblance to the Finnish, and the Bantu to the Canadian in the Table drawn up by Jain. Almost three-quarters of both Coloured and Bantu births are in the first three birth orders and the Coloured have a little less than 90 per cent, and the Bantu 90 per cent, of their births in the first five birth orders.

It is obvious that since the rank distribution differs so much in the different racial groups, that the age distribution of mothers must vary too, and may be a factor in the difference in birth weight found. This will be discussed in the next chapter.

SUMMARY.

Birth weights of infants are studied with special reference to birth rank. The material comprises 3,165 European babies, 1,057 Coloured babies, 2,188 Bantu babies, and 1,391 Indian babies. Results are as follows:

1. Far more babies of higher birth rank are found in the Coloured, Bantu and Indian groups than in the European group, with 5 per cent of the Indian babies of tenth or higher birth rank.

2. These findings are compared with results obtained in other countries. This sample of Europeans in South Africa shows an even greater preponderance of low birth orders than obtains in the countries of the Western Hemisphere. The Indians in South Africa are similar in birth order pattern to the Indians of India. The Coloured and Bantu fall between the European and Indian pattern.

3. Mean birth weight increases with increasing birth rank up to Rank 4 in all racial groups. In no case is there a steady progression up to the highest rank. After Rank 4 the pattern is not consistent in the different groups. The only significant differences found are between Rank 1 and the other ranks.

4. The literature on the relation between birth order and mean weight at birth is discussed. All observers agree that later-born babies exceed first-born in mean birth weight. There is no general agreement as to whether the birth weight is progressively greater with each increase in birth rank.

5. The racial differences in mean birth weights which I discussed earlier are not due to differences in birth rank distribution of the babies. The differences are still present when like ranks are compared. That is to say, in all ranks European babies are significantly heavier, Indian babies significantly lighter, and there is no significant difference between the Coloured and Bantu groups.

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APPENDIX I.

DISTRIBUTION OF BIRTH WEIGHTS AT EACH BIRTH RANK

Birth Weight (lb.)	Birth Rank 1 M	1 F	2 M	2 F	3 M	3 F	4 and Over M	4 and Over F	All Birth Ranks M	All Birth Ranks F	All Birth Ranks Total
(a) European											
1 -	—	—	—	—	—	—	—	—	—	—	—
1½-	—	—	—	—	—	—	1	—	1	—	1
2 -	1	—	1	—	—	—	—	—	2	—	2
2½-	—	2	1	—	—	—	—	—	1	2	3
3 -	3	3	2	—	—	1	—	—	5	4	9
3½-	—	1	1	—	2	—	—	—	3	1	4
4 -	7	3	2	2	—	—	—	1	9	6	15
4½-	8	11	3	3	1	1	1	2	13	17	30
5 -	20	16	6	12	4	2	—	—	30	30	60
5½-	34	48	15	15	9	7	2	2	60	72	132
6 -	81	87	36	42	10	21	7	7	134	157	291
6½-	107	128	50	82	19	23	4	10	180	243	423
7 -	159	141	63	99	32	47	14	10	268	297	565
7½-	124	128	113	93	31	42	22	13	290	276	566
8 -	149	90	87	80	42	27	9	14	287	211	498
8½-	62	45	59	42	26	27	13	10	160	124	284
9 -	37	20	36	28	16	14	8	6	97	68	165
9½-	16	6	16	7	11	6	3	4	46	23	69
10 -	9	3	5	4	7	1	3	1	24	9	33
10½-	1	1	1	4	—	—	1	2	3	7	10
11 -	—	—	1	1	1	—	1	—	3	1	4
11½-	—	—	—	—	—	—	—	—	—	—	—
12 -	—	—	—	—	—	—	—	—	—	—	—
12½-	—	—	—	—	—	—	—	—	—	—	—
13 -	—	—	1	—	—	—	—	—	1	—	1
Total	818	733	499	514	211	219	89	82	1,617	1,548	3,165
(b) Coloured											
2 -	1	1	—	—	—	—	1	—	2	1	3
2½-	—	—	—	—	—	—	1	—	1	—	1
3 -	1	1	—	1	—	1	2	1	3	4	7
3½-	1	1	—	1	—	—	2	3	3	5	8
4 -	5	5	1	2	1	1	3	3	10	11	21
4½-	4	2	4	—	—	—	—	1	8	3	11
5 -	12	14	7	6	2	2	1	—	22	22	44
5½-	27	19	21	11	4	9	6	14	58	53	111
6 -	35	48	21	21	6	10	11	20	72	99	171
6½-	46	40	21	17	9	11	21	26	97	94	191
7 -	25	23	18	30	14	16	15	22	72	91	163
7½-	21	24	20	13	8	8	29	20	79	65	144
8 -	12	10	12	10	10	3	17	15	51	38	89
8½-	11	2	5	5	7	3	10	8	33	18	51
9 -	3	—	1	3	—	3	9	1	13	7	20
9½-	—	—	3	1	—	—	5	2	8	3	11
10 -	—	—	—	—	—	—	4	4	4	4	8
10½-	—	—	—	—	—	—	—	1	—	1	1
11 -	—	—	—	—	—	—	1	—	1	—	1
11½-	—	—	—	—	—	—	—	—	—	—	—
12 -	—	—	—	—	—	—	1	—	1	—	1
Total	204	190	134	121	61	67	139	141	538	519	1,057
(c) Bantu											
1½-	—	—	1	1	—	—	1	—	2	1	3
2 -	—	2	1	—	2	—	2	—	5	2	7
2½-	1	—	2	—	—	—	1	—	4	—	4
3 -	—	1	—	2	—	—	1	1	1	4	5
3½-	2	2	1	—	1	—	2	4	6	6	12
4 -	3	1	4	4	1	2	4	2	12	9	21
4½-	8	6	3	4	—	1	—	3	11	14	25
5 -	12	17	12	11	4	5	7	8	35	41	76
5½-	28	42	6	18	11	8	10	16	55	84	139
6 -	48	92	34	50	27	25	23	35	132	202	334
6½-	93	80	49	74	24	33	46	49	212	236	448
7 -	68	55	66	51	49	32	54	48	237	186	423
7½-	44	36	39	47	37	24	55	47	175	154	329
8 -	20	16	28	15	28	12	39	20	115	63	178
8½-	12	5	17	7	12	9	34	16	75	37	112
9 -	1	3	7	1	5	4	15	8	28	16	44
9½-	2	—	4	1	2	—	4	2	12	3	15
10 -	1	—	1	—	1	—	3	3	6	3	9
10½-	—	—	1	—	1	—	1	—	3	—	3
11 -	—	—	—	—	—	—	1	—	1	—	1
Total	343	358	276	286	205	155	303	262	1,127	1,061	2,188
(d) Indian											
1 -	—	—	—	—	—	—	1	2	1	2	3
1½-	—	—	1	—	—	—	—	—	1	—	1
2 -	—	—	—	—	—	—	2	—	2	—	2
2½-	2	1	—	—	—	—	1	1	3	2	5
3 -	1	1	4	—	—	—	2	5	7	6	13
3½-	—	1	3	1	—	—	4	3	7	5	12
4 -	3	8	4	—	1	2	1	7	9	17	26
4½-	7	13	1	1	1	6	7	9	16	29	45
5 -	34	28	11	18	7	10	15	16	67	72	139
5½-	27	36	19	19	11	9	25	20	82	84	166
6 -	46	41	30	30	17	20	38	58	131	149	280
6½-	30	38	17	19	22	12	49	38	118	107	225
7 -	31	28	24	24	20	8	48	51	123	111	234
7½-	8	7	11	5	16	3	39	34	74	49	123
8 -	4	6	7	4	6	1	18	12	35	23	58
8½-	2	—	2	4	1	1	16	6	21	11	32
9 -	—	1	1	1	—	1	6	6	7	9	16
9½-	—	—	—	—	—	—	1	2	1	2	3
10 -	—	—	—	—	—	—	2	4	2	4	6
10½-	—	—	—	—	—	—	2	—	2	—	2
Total	195	209	135	126	102	73	277	274	709	682	1,391

APPENDIX 2.

SIGNIFICANCE OF DIFFERENCES BETWEEN MEAN BIRTH WEIGHTS FOR RANK I & OTHER RANKS.

RANK	EUROPEAN.	COLOURED.	BANTU.	INDIAN.
2	D : 0.30 lb. SE : .046 lb. D/SE : 6.5	D : 0.27 lb. SE : .089 lb. D/SE : 3.0	D : 0.24 lb. SE : .060 lb. D/SE : 4.0	D : 0.23 lb. SE : .085 lb. D/SE : 2.7
3	D : 0.40 lb. SE : .063 lb. D/SE : 6.3	D : 0.45 lb. SE : .110 lb. D/SE : 4.1	D : 0.44 lb. SE : .068 lb. D/SE : 6.5	D : 0.35 lb. SE : .088 lb. D/SE : 4.0
4	D : 0.47 lb. SE : .133 lb. D/SE : 3.5	D : 0.52 lb. SE : .174 lb. D/SE : 3.0	D : 0.63 lb. SE : .074 lb. D/SE : 8.5	D : 0.59 lb. SE : .114 lb. D/SE : 5.2
5	D : 0.69 lb. SE : .202 lb. D/SE : 3.4	D : 0.66 lb. SE : .157 lb. D/SE : 4.2	D : 0.48 lb. SE : .104 lb. D/SE : 4.6	D : 0.59 lb. SE : .134 lb. D/SE : 4.4
6 & 7	D : 0.22 lb. SE : .276 lb. D/SE : <1	D : 0.61 lb. SE : .200 lb. D/SE : 3.1	D : 0.43 lb. SE : .122 lb. D/SE : 3.5	D : 0.62 lb. SE : .132 lb. D/SE : 4.7
8 & 9	D : Insuff. Cases.	D : 1.05 lb. SE : .198 lb. D/SE : 5.3	D : 0.58 lb. SE : .161 lb. D/SE : 3.6	D : 0.56 lb. SE : .146 lb. D/SE : 3.8
10 +	D : Insuff. Cases.	D : 0.70 lb. SE : .293 lb. D/SE : 2.4	D : 0.65 lb. SE : .188 lb. D/SE : 3.5	D : 0.38 lb. SE : .189 lb. D/SE : 2.0

APPENDIX 3. :

SIGNIFICANCE OF DIFFERENCES BETWEEN MEAN BIRTH WEIGHTS FOR DIFFERENT RANKS (ALL RACES).

EUROPEANS

RANK	1	2	3	4	5	6 & 7	8 & 9	10 +
1	-	D : .30 lb. SE : .046 lb D/SE : 6.5	D : .40 lb. SE : .063 lb D/SE : 6.3	D : .47 lb. SE : .133 lb D/SE : 3.5	D : .69 lb. SE : .202 lb D/SE : 3.4	D : .22 lb. SE : .276 lb D/SE : < 1	INSUFFICIENT CASES.	INSUFFICIENT CASES.
2		-	D : .10 lb. SE : .066 lb D/SE : 1.5	D : .17 lb. SE : .135 lb D/SE : 1.3	D : .39 lb. SE : .203 lb D/SE : 1.9	D : -.08 lb. SE : .277 lb D/SE : < 1	do.	do.
3			-	D : .07 lb. SE : .141 lb D/SE : < 1	D : .29 lb. SE : .208 lb D/SE : 1.4	D : -.18 lb. SE : .280 lb D/SE : < 1	do.	do.
4				-	D : .22 lb. SE : .239 lb D/SE : < 1	D : -.25 lb. SE : .304 lb D/SE : < 1	do.	do.
5					-	D : -.47 lb. SE : .340 lb D/SE : - 1.4	do.	do.
6 & 7						-	do.	do.
8 & 9							-	do.
10 +								

COLOUREDS

RANK	1	2	3	4	5	6 & 7	8 & 9	10 +
1	-	D : .27 lb. SE : .089 lb D/SE : 3.0	D : .45 lb. SE : .110 lb D/SE : 4.1	D : .52 lb. SE : .174 lb D/SE : 3.0	D : .66 lb. SE : .157 lb D/SE : 4.2	D : .61 lb. SE : .200 lb D/SE : 3.1	D : 1.05 lb. SE : .198 lb D/SE : 5.3	D : .70 lb. SE : .293 lb D/SE : 2.4
2		-	D : .18 lb. SE : .118 lb D/SE : 1.5	D : .25 lb. SE : .179 lb D/SE : 1.4	D : .39 lb. SE : .163 lb D/SE : 2.4	D : .34 lb. SE : .204 lb D/SE : 1.7	D : .78 lb. SE : .203 lb D/SE : 3.8	D : .43 lb. SE : .296 lb D/SE : 1.5
3			-	D : .07 lb. SE : .191 lb D/SE : < 1	D : .21 lb. SE : .175 lb D/SE : 1.2	D : .16 lb. SE : .214 lb D/SE : < 1	D : .60 lb. SE : .213 lb D/SE : 2.8	D : .25 lb. SE : .304 lb D/SE : < 1
4				-	D : .14 lb. SE : .221 lb D/SE : < 1	D : .09 lb. SE : .253 lb D/SE : < 1	D : .53 lb. SE : .252 lb D/SE : 2.1	D : .18 lb. SE : .332 lb D/SE : < 1
5					-	D : -.05 lb. SE : .242 lb D/SE : < 1	D : .39 lb. SE : .240 lb D/SE : 1.6	D : .04 lb. SE : .324 lb D/SE : < 1
6 & 7						-	D : .44 lb. SE : .271 lb D/SE : 1.6	D : .09 lb. SE : .346 lb D/SE : < 1
8 & 9							-	D : -.35 lb. SE : .345 lb D/SE : - 1.0
10 +								-

BANTU

RANK	1	2	3	4	5	6 & 7	8 & 9	10 +
1	-	D : .24 lb. SE : .060 lb D/SE : 4.0	D : .44 lb. SE : .068 lb D/SE : 6.5	D : .63 lb. SE : .074 lb D/SE : 8.5	D : .48 lb. SE : .104 lb D/SE : 4.6	D : .43 lb. SE : .122 lb D/SE : 3.5	D : .58 lb. SE : .161 lb D/SE : 3.6	D : .65 lb. SE : .188 lb D/SE : 3.5
2		-	D : .20 lb. SE : .074 lb D/SE : 2.7	D : .39 lb. SE : .102 lb D/SE : 3.8	D : .24 lb. SE : .108 lb D/SE : 2.2	D : .19 lb. SE : .126 lb D/SE : 1.5	D : .34 lb. SE : .164 lb D/SE : 2.1	D : .41 lb. SE : .191 lb D/SE : 2.1
3			-	D : .19 lb. SE : .106 lb D/SE : 1.8	D : .04 lb. SE : .112 lb D/SE : <1	D : -.01 lb. SE : .129 lb D/SE : <1	D : .14 lb. SE : .166 lb D/SE : <1	D : .21 lb. SE : .193 lb D/SE : 1.1
4				-	D : -.15 lb. SE : .132 lb D/SE : - 1.1	D : -.20 lb. SE : .147 lb D/SE : - 1.4	D : -.05 lb. SE : .181 lb D/SE : <1	D : .02 lb. SE : .205 lb D/SE : <1
5					-	D : -.05 lb. SE : .151 lb D/SE : < 1	D : .10 lb. SE : .184 lb D/SE : <1	D : .17 lb. SE : .208 lb D/SE : <1
6 & 7						-	D : .15 lb. SE : .195 lb D/SE : <1	D : .22 lb. SE : .218 lb D/SE : 1.0
8 & 9							-	D : .07 lb. SE : .242 lb D/SE : <1
10 +								-

INDIANS

RANK	1	2	3	4	5	6 & 7	8 & 9	10 +
1	-	D : .23 lb. SE : .085 lb D/SE : 2.7	D : .35 lb. SE : .088 lb D/SE : 4.0	D : .59 lb. SE : .114 lb D/SE : 5.2	D : .59 lb. SE : .134 lb D/SE : 4.4	D : .62 lb. SE : .132 lb D/SE : 4.7	D : .56 lb. SE : .146 lb D/SE : 3.8	D : .38 lb. SE : .189 lb D/SE : 2.0
2		-	D : .12 lb. SE : .101 lb D/SE : 1.2	D : .36 lb. SE : .124 lb D/SE : 2.9	D : .36 lb. SE : .143 lb D/SE : 2.5	D : .39 lb. SE : .141 lb D/SE : 2.8	D : .33 lb. SE : .154 lb D/SE : 2.1	D : .15 lb. SE : .195 lb D/SE : <1
3			-	D : .24 lb. SE : .126 lb D/SE : 1.9	D : .24 lb. SE : .144 lb D/SE : 1.7	D : .27 lb. SE : .143 lb D/SE : 1.9	D : .21 lb. SE : .156 lb D/SE : 1.3	D : .03 lb. SE : .197 lb D/SE : <1
4				-	D : .0 lb. SE : .162 lb D/SE : -	D : .03 lb. SE : .159 lb D/SE : <1	D : -.03 lb. SE : .172 lb D/SE : <1	D : -.21 lb. SE : .209 lb D/SE : - 1.0
5					-	D : .03 lb. SE : .175 lb D/SE : <1	D : -.03 lb. SE : .186 lb D/SE : <1	D : -.21 lb. SE : .221 lb D/SE : <1
6 & 7						-	D : -.06 lb. SE : .184 lb D/SE : <1	D : -.24 lb. SE : .220 lb D/SE : - 1.1
8 & 9							-	D : -.18 lb. SE : .229 lb D/SE : <1
10 +								-

SIGNIFICANCE OF DIFFERENCES BETWEEN MEAN BIRTH WEIGHTS OF DIFFERENT RACIAL GROUPS.

SEXES SEPARATE. RANKS 1, 2, 3 AND 4 +.

GIRLS:	RANK 1	2	3	4 +
EUROPEAN AND COLOURED.	D : .66 lb. SE : .084 lb. D/SE : 7.9	D : .62 lb. SE : .111 lb. D/SE : 5.6	D : .71 lb. SE : .153 lb. D/SE : 4.6	D : .69 lb. SE : .179 lb. D/SE : 3.9
BANTU	D : .58 lb. SE : .064 lb. D/SE : 9.1	D : .71 lb. SE : .075 lb. D/SE : 9.5	D : .54 lb. SE : .106 lb. D/SE : 5.1	D : .67 lb. SE : .158 lb. D/SE : 4.2
INDIAN	D : 1.05 lb. SE : .080 lb. D/SE : 13.1	D : 1.05 lb. SE : .097 lb. D/SE : 10.8	D : 1.39 lb. SE : .136 lb. D/SE : 10.2	D : 1.14 lb. SE : .164 lb. D/SE : 7.0
COLOURED AND BANTU	D : -.08 lb. SE : .089 lb. D/SE : < 1	D : .09 lb. SE : .117 lb. D/SE : < 1	D : -.17 lb. SE : .156 lb. D/SE : -1.1	D : -.02 lb. SE : .132 lb. D/SE : < 1
INDIAN	D : .39 lb. SE : .101 lb. D/SE : 3.9	D : .43 lb. SE : .132 lb. D/SE : 3.3	D : .68 lb. SE : .178 lb. D/SE : 3.8	D : .45 lb. SE : .138 lb. D/SE : 3.3
BANTU AND INDIAN	D : .47 lb. SE : .086 lb. D/SE : 5.5	D : .34 lb. SE : .103 lb. D/SE : 3.3	D : .85 lb. SE : .139 lb. D/SE : 6.1	D : .47 lb. SE : .109 lb. D/SE : 4.3

BOYS:	RANK 1	2	3	4 +
EUROPEAN AND COLOURED.	D : .76 lb. SE : .090 lb. D/SE : 8.4	D : .87 lb. SE : .111 lb. D/SE : 7.8	D : .60 lb. SE : .154 lb. D/SE : 3.9	D : .44 lb. SE : .195 lb. D/SE : 2.3
BANTU	D : .58 lb. SE : .067 lb. D/SE : 8.7	D : .60 lb. SE : .091 lb. D/SE : 6.6	D : .59 lb. SE : .116 lb. D/SE : 5.1	D : .48 lb. SE : .161 lb. D/SE : 3.0
INDIAN	D : 1.21 lb. SE : .081 lb. D/SE : 14.9	D : 1.36 lb. SE : .120 lb. D/SE : 11.3	D : 1.09 lb. SE : .122 lb. D/SE : 8.9	D : 1.04 lb. SE : .163 lb. D/SE : 6.4
COLOURED AND BANTU.	D : -.18 lb. SE : .096 lb. D/SE : -1.9	D : -.27 lb. SE : .122 lb. D/SE : -2.2	D : -.01 lb. SE : .151 lb. D/SE : < 1	D : .04 lb. SE : .154 lb. D/SE : < 1
INDIAN	D : .45 lb. SE : .106 lb. D/SE : 4.2	D : .49 lb. SE : .144 lb. D/SE : 3.4	D : .49 lb. SE : .156 lb. D/SE : 3.1	D : .61 lb. SE : .156 lb. D/SE : 3.9
BANTU AND INDIAN.	D : .63 lb. SE : .088 lb. D/SE : 7.2	D : .76 lb. SE : .131 lb. D/SE : 5.8	D : .51 lb. SE : .118 lb. D/SE : 4.3	D : .56 lb. SE : .111 lb. D/SE : 5.0

CHAPTER V.

RELATIONSHIP BETWEEN BIRTH WEIGHT AND MATERNAL AGE.

This chapter is a report on the birth weights of groups of South African babies with special reference to the effect of age of mother on these weights.

MATERIAL USED AND METHOD OF ANALYSIS.

The data are taken from various hospitals and nursing homes in Durban, Pietermaritzburg and Cape Town as detailed in previous chapters, the numbers considered here being 3,164 European babies, 1,059 Coloured babies, 2,188 Bantu babies and 1,391 Indian babies. The data extracted consist in all cases of race and age of mother, birth weight, sex and birth rank of child. As previously, abortions and multiple births are excluded, but in considering the birth rank of the child, previous miscarriages are included.

In view of the close relationship between age of mother and rank of child, an attempt is made to assess the association of birth weight specifically with each of these variables:

1. By determining the mean birth weight for each maternal age group within each birth rank;

2. By recourse to analysis of variance (see statistical note).

The maternal age is taken in 5-year groups from 15 to 35+. Birth ranks are classified 1, 2, 3, and 4+. All calculations are for sexes combined, as no significant differences are found between boys and girls.

The mean age of mother for each birth order is also calculated for each racial group, and the percentage of births to mothers under 20 years is compared in the groups.

RESULTS.

1. Examination of Sub-Group Means.

The mean birth weight, with standard deviation, for each birth rank in each maternal age group, is shown in Table 22 for the four ethnic

TABLE 22

MEAN BIRTH WEIGHT ACCORDING TO MATERNAL AGE AND BIRTH RANK

Racial Group	Maternal Age	Birth Rank 1			2			3			4+			All Ranks		
		No. of Births	Mean Weight (lb)	S.D.	No. of Births	Mean Weight (lb)	S.D.	No. of Births	Mean Weight (lb)	S.D.	No. of Births	Mean Weight (lb)	S.D.	No. of Births	Mean Weight (lb)	S.D.
European	15–19	103	7·52	1·01	8			1						112	7·51	1·02
	20–24	686	7·41	1·10	216	7·61	1·21	34	7·24	1·07	5			941	7·46	1·13
	25–29	479	7·32	1·18	403	7·70	1·09	140	7·80	1·26	29	7·84	1·23	1,051	7·54	1·18
	30–34	197	7·15	1·10	258	7·70	1·09	152	7·80	1·01	64	7·88	1·53	671	7·58	1·16
	35+	85	7·09	1·14	128	7·38	1·24	103	7·74	1·18	73	7·81	1·14	389	7·49	1·21
	All Ages	1,550	7·34	1·13	1,013	7·64	1·14	430	7·74	1·15	171	7·86	1·31	3,164	7·52	1·16
Coloured	15–19	168	6·53	1·06	39	6·52	0·85	7						214	6·50	1·04
	20–24	169	6·63	1·04	136	6·90	1·19	56	7·34	1·00	30	6·93	1·60	391	6·84	1·16
	25–29	43	6·88	1·33	54	6·83	1·03	44	6·99	1·05	89	7·20	1·24	230	7·01	1·19
	30–34	11			21	7·44	0·88	15			74	7·51	1·51	121	7·43	1·32
	35+	3			5			6			89	7·29	1·54	103	7·27	1·50
	All Ages	394	6·63	1·09	255	6·90	1·12	128	7·08	1·08	282	7·29	1·46	1,059	6·93	1·23
Bantu	15–19	220	6·64	1·06	46	6·65	1·30	3						269	6·65	1·10
	20–24	382	6·74	0·95	321	6·96	1·07	130	7·14	1·07	62	7·08	1·56	895	6·90	1·07
	25–29	91	6·99	0·86	156	7·12	1·13	181	7·24	1·11	219	7·40	1·24	647	7·23	1·14
	30–34	5			35	7·02	1·23	38	7·12	0·94	172	7·29	1·22	250	7·23	1·18
	35+	3			4			8			112	7·19	1·09	127	7·18	1·05
	All Ages	701	6·75	0·98	562	6·99	1·13	360	7·19	1·07	565	7·29	1·25	2,188	7·02	1·11
Indian	15–19	197	6·19	1·04	53	6·33	1·26	13			5			268	6·22	1·07
	20–24	168	6·20	0·95	153	6·44	1·07	109	6·58	0·99	100	6·78	1·15	530	6·45	1·05
	25–29	32	6·39	0·95	41	6·60	1·04	41	6·57	1·03	202	6·73	1·42	316	6·66	1·29
	30–34	6			12			11			135	6·72	1·47	164	6·65	1·41
	35+	1			2			1			109	6·91	1·33	113	6·88	1·33
	All Ages	404	6·20	0·99	261	6·43	1·11	175	6·55	0·96	551	6·77	1·36	1,391	6·51	1·19

groups. There is a steady rise in birth weight with increasing rank, when all maternal ages are grouped; and this trend is also discernible within each maternal age. When all ranks are combined, association of birth weight with age of mother is not consistent; in the Europeans virtually no difference is found from age to age; in the Coloured and Bantu groups, birth weight appears to increase until maternal age 30 - 34 years, with a slight drop in the highest age group; in the Indian group, there is a steady rise in birth weight with increasing age. When each birth rank is considered separately the following facts may be noted as age increases:

a) Among first-born Europeans, weight decreases;

b) Among first-born Coloureds, Bantu, and Indians, weight increases;

c) Among births after the first, weight shows no consistent trend in any of the four groups.

2. Analysis of Variance.

The data are first tested for homogeneity by the procedure described by Kendall (1947), by setting out the mean weights separately for each racial group, as a one-way classification with twenty classes (i.e. four birth ranks and five maternal age groups). The variance of the means of the classes and the "residual variance" (i.e. that obtained from the pooled data within the twenty classes) are obtained, giving two separate estimates of population variance in birth weight. The significance of the ratio of these is tested by Snedecor's F-test. For each ethnic group the difference is significant at the 1 per cent level, indicating that the data are not homogeneous, i.e. variations in birth rank and maternal age together account for a significant proportion of variation in birth weight. (Table 23).

The data are then arranged as a two-way classification:

i) An estimate of population variance is obtained, unbiased by birth rank, assuming homogeneity of birth weight data with respect to maternal age. The significance of the ratio between this and the independent residual variance obtained previously is tested as before. When this is significant maternal age per se is presumed to introduce a significant degree of heterogeneity into the data.

ii) This procedure is repeated with the appropriate substitutions to determine the significance of heterogeneity in birth weight data due to birth rank per se. Results of this analysis are given in Table 24.

TABLE 23.

RESULTS FOR SNEDECOR'S F-TEST WITH ONE-WAY CLASSIFICATION.

RACE	VALUE OF F	DEGREES OF FREEDOM Greater Mean Square	Lesser Mean Square	VALUE OF F FROM TABLES 1%	5%	SIGNIFICANCE OF THIS RESULT
European	6.45	18	3145	1.99	1.64	Significant at 1% level
Coloured	4.98	18	1040	2.01	1.65	Significant at 1% level
Bantu	6.01	18	2169	1.99	1.64	Significant at 1% level
Indian	3.39	19	1371	1.89	1.58	Significant at 1% level

TABLE 24.

RESULTS FOR SNEDECOR'S F-TEST WITH TWO-WAY CLASSIFICATION.

RACE	Variable	VALUE OF F	DEGREES OF FREEDOM Greater Mean Square	Lesser Mean Square	VALUE OF F FROM TABLES 1%	5%	SIGNIFICANCE OF THIS RESULT
European	Age	1.19	4	3145	3.32	2.37	Not significant
	Rank	10.67	3	3145	3.78	2.60	Significant at 1% level.
Coloured	Age	3.93	4	1040	3.34	2.38	Significant at 1% level.
	Rank	3.22	3	1040	3.80	2.61	Significant at 5% level.
Bantu	Age	2.89	4	2169	3.32	2.37	Significant at 5% level.
	Rank	2.33	3	2169	3.78	2.60	Not significant.
Indian	Age	1.31	1371	4	26.12	8.53	Not significant.
	Rank	3.45	3	1371	3.80	2.61	Significant at 5% level.

By the method of least squares, parameters are estimated (Table 25 (a) and (b)) representing the expected deviation due specifically to maternal age or to birth rank of any particular birth weight from the population mean. These parameters serve as indices summarising, on a comparative basis, the direction and degree of influence on birth weight of each of the two variables.

TABLE 25.

(a)

PARAMETERS ESTIMATING ASSOCIATION OF BIRTH RANK WITH BIRTH WEIGHT (by Method of Least Squares)

	EUROPEAN	COLOURED	BANTU	INDIAN
1	- .36	- .23	- .22	- .25
2	- .02	- .05	- .06	- .05
3	+ .11	+ .11	+ .09	+ .05
4+	+ .27	+ .17	+ .19	+ .24

(b)

PARAMETERS ESTIMATING ASSOCIATION OF MATERNAL AGE WITH BIRTH WEIGHT (by Method of Least Squares)

	EUROPEAN	COLOURED	BANTU	INDIAN
15 - 19	+ .16	- .31	- .19	- .10
20 - 24	+ .04	- .08	- .03	- .02
25 - 29	+ .02	- .03	+ .16	+ .02
30 - 34	- .04	+ .31	+ .08	- .05
35 +	- .18	+ .10	- .01	+ .14

Table 25a and Chart 5a show that birth weight rises steadily with increasing birth rank, independently of maternal age. An interesting feature of Table 25b and Chart 5b is that the European and non-European patterns are diametrically opposed up to the 25 - 29 year age group. In the European group, birth weight tends to be highest for the young mothers, and to drop steadily with increasing age. In the

CHART 5A

PARAMETERS SHOWING THE EFFECT OF RANK ON BIRTH WEIGHT

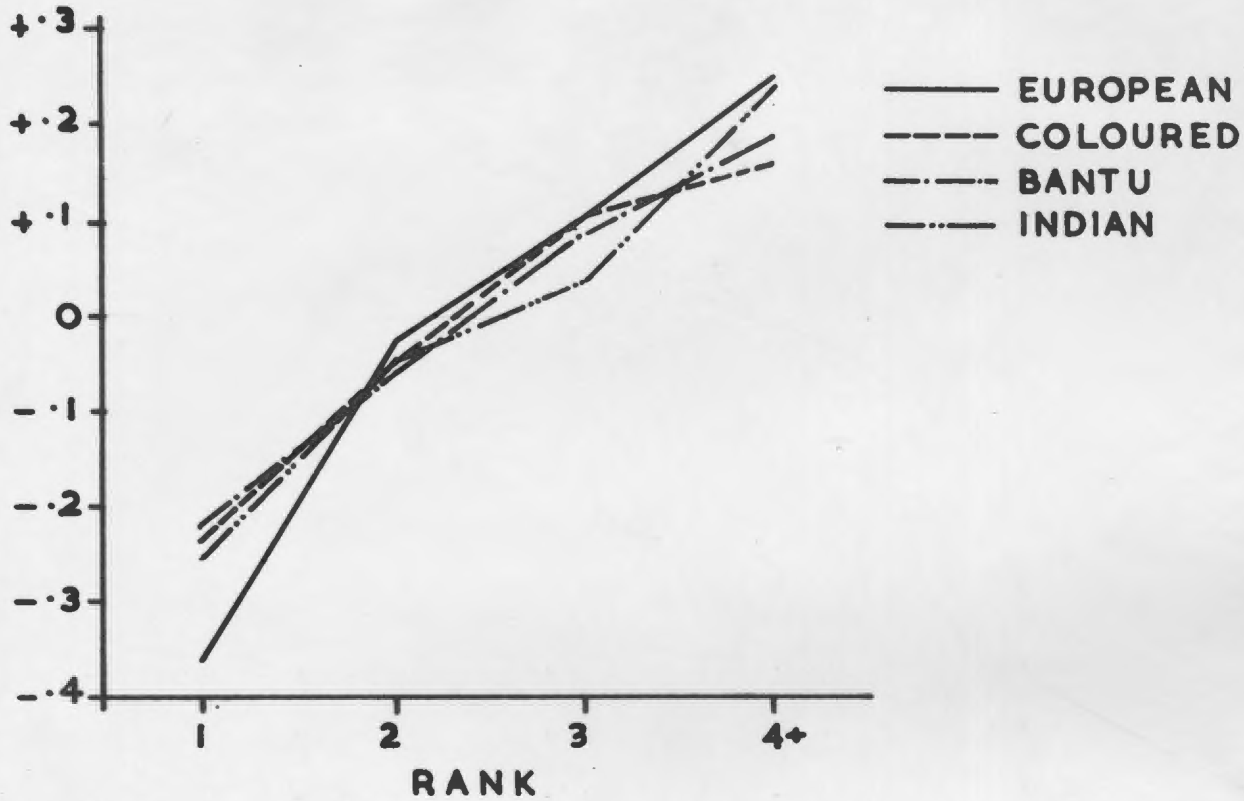
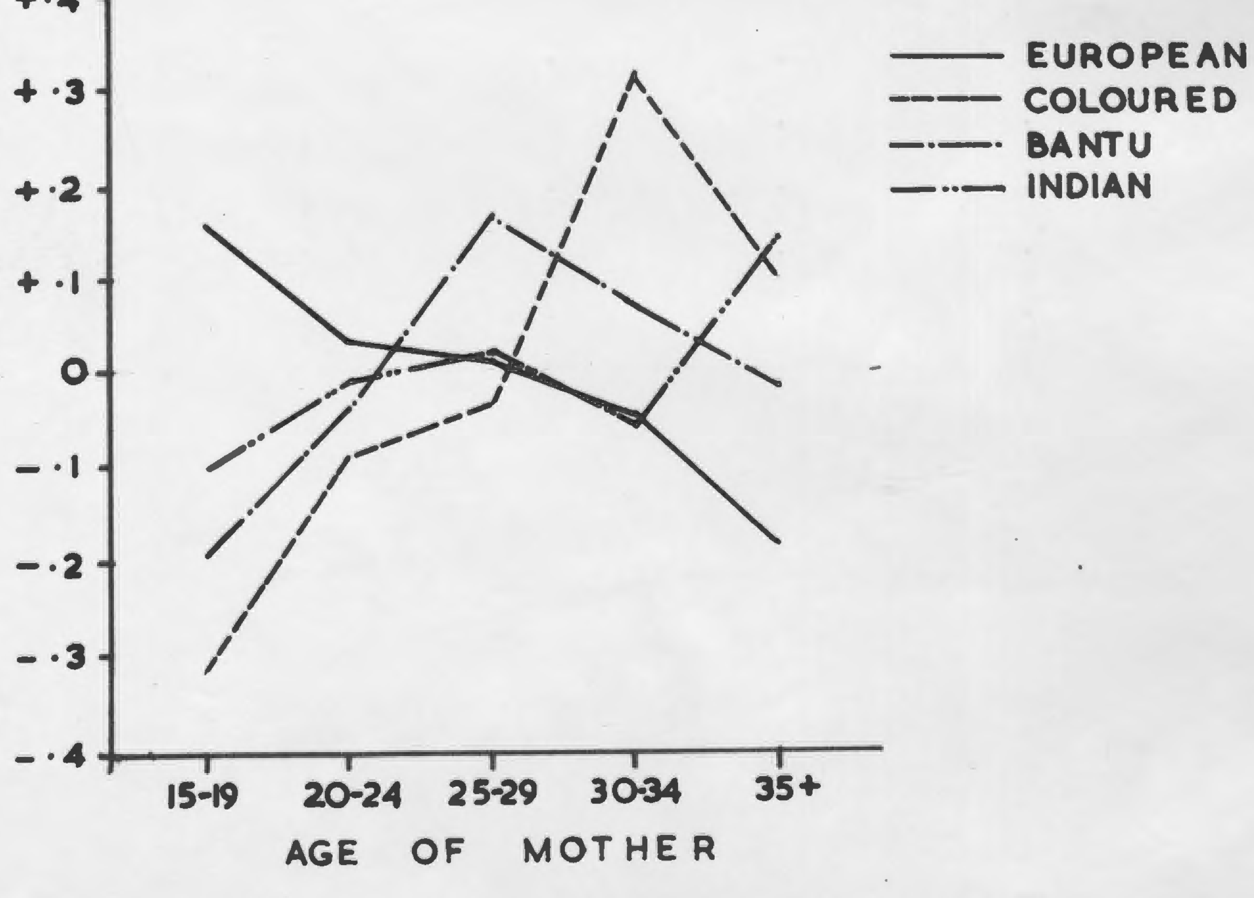


CHART 5B

PARAMETERS SHOWING THE EFFECT OF MATERNAL AGE ON BIRTH WEIGHT



non-European groups, birth weight is in general lowest for the young mothers and rises in all three groups to the 25 - 29 year age group. After this the trend is inconsistent; but it appears that among non-Europeans, mothers of 35+ years tend to have heavier babies than young mothers, whereas among Europeans, babies born to mothers of 35+ years are much lighter than those of young mothers.

DISCUSSION.

There is little published information about the association of age of mother with birth weight.

Duncan (1864) and Griffith and Gittings (1907) stated that the heaviest babies were born to mothers aged 25 - 29 years. These authors did not assess separately associations of birth weight with age of mother and birth rank.

Donald (1939) stated that "Age of mother had no apparent effect on the weight of first-born children, but may have had a slight influence on second-born children, mothers about 30 years old having the heaviest".

Uttley (1940), investigating the weights of Chinese babies, stated: "The older the mother, the heavier is the baby". But in his results ranks were combined, and no consistent relationship was apparent on examination of his data for each rank separately.

McKeown and Gibson (1951) concluded that:

" (a) Weight increases with parity.

(b) There is no consistent association between weight and maternal age when birth rank is fixed".

Solth and Abt (1951), working on a German and Swiss population over the last 50 years, found that "Mean birth weight increases with age of mother up to 35 years, and then decreases slightly. The increase is in both primiparae and multiparae. Of the three factors, age of mother, parity, and sex of child, parity has the greatest effect on birth weight".

Harris (1925 - 26 a) gave the average values of the correlation coefficients measuring the relationship between the age of mother and birth weight of child as follows:

Age of mother and weight of son r: .1563

Age of mother and weight of daughter r: .0776

Although the values were low he found the results to be consistent and concluded that there was a definite relationship between the age of the mother and the weight of her newborn infant. In a subsequent report Harris (1925 - 26 b) found the average values of the correlation coefficients measuring the relationship between pregnancy order and birth weight to be:

Birth order and weight of son r: .2179

Birth order and weight of daughter r: .1434

Again he considered that there was a relationship between birth order and birth weight. He concluded that "Considering these results in connection with those for the relationship between age and the characteristics of the infant .... we may conclude that the evidence for some relationship between age of parents and pregnancy order and birth order, on the one hand, and the length and weight of the new-born infant, on the other, is unmistakable. We cannot, however, on the basis of the present data determine which of the four variables considered is the one which should be regarded as of primary importance in determining these inter-relationships".

Karn and Penrose (1951) found parity and maternal age to have independent effects, parity having the greater influence, and mothers age very little. "Taking first birth weight with parity and with mother's age, the correlation between birth weight and parity is significant (0.166, male; 0.180, female), and that between birth weight and mother's age is very small (0.043, male; 0.062, female). The correlations between parity and mother's age are 0.482, male, and 0.507, female. With the help of these, correcting for age, the correlation between birth weight and parity is scarcely altered and is still significant (0.166, male; 0.173, female). Correcting for parity, the correlation between birth weight and mother's age is changed to a small but significant negative value (-0.043, male; -0.035, female)."

Table 26 shows the mean weight for given parity and age group of mother - first, second and third born had a definite decrease in weight as the age of the mother increased, but in the later parities the weights were high whatever the age of the mother. Weight was definitely related to birth order, and this factor was more important than the factor of maternal age.

TABLE 26.

MEAN WEIGHT (LB) FOR GIVEN PARITY AND AGE GROUP OF MOTHER
(After Karn and Penrose, 1951)

MALES

AGE GROUP OF MOTHER	PARITY					
	0	1	2	3 & 4	5 & 6	7 and over
Under 20	7.24	7.61		-	-	-
20-	7.14	7.46	7.79	7.60	7.39	-
24-	7.21	7.38	7.71			-
28-	7.15	7.37	7.69	7.58	8.08	8.18
32-	7.06	7.36	7.39	7.51	7.82	7.85
36-	7.09	7.19	7.49	7.61	7.80	7.96
40 and over	6.90	7.16	6.99	7.91	7.49	8.02

FEMALES

AGE GROUP OF MOTHER	PARITY					
	0	1	2	3 & 4	5 & 6	7 and over
Under 20	7.00	7.29	-	-	-	-
20-	6.98	7.10	7.34	7.14	-	-
24-	7.01	7.24	7.38	7.41	7.48	-
28-	6.91	7.37	7.38	7.48	7.59	7.68
32-	6.91	7.18	7.22	7.56	7.38	8.11
36-	6.83	6.94	6.97	7.37	7.59	7.70
40 and over	6.61	7.08	7.20	6.98	7.71	7.58

Millis and Seng (1954) reported on the effect of age and parity of the mother on the birth weight of offspring and concluded that "Parity has a larger positive effect on birth weight than maternal age. The effect of the latter is very small and is of a negative nature. With increasing parity there is a tendency for birth weight to decrease, but this latter tendency is much smaller numerically than the former tendency".

The relation between birth weight and parity they found was not a straight line - the increase in weight was at a decreasing rate.

For each maternal age group there was a certain stage around which the birth weight was at a maximum, after which it decreased. In the population they studied (Chinese infants born in Singapore) "For mothers younger than 30, additional births after, say, the sixth, would bring about lighter infants; for those over 30, the ninth birth marks the limiting point between increasing and decreasing weights".

The relationship between maternal age and birth weight was weaker, and less clearly defined. With parity kept constant, for the first 4 ranks, increase in age brought a decrease of birth weights. However, when all parities were considered together, the mean birth weight of the infants rose with increasing maternal age. This apparent anomaly was explained by the fact that the majority of the older mothers tended to be on a higher parity level than the younger mothers. The effect of this concentration was to make the relationship between birth weight and maternal age have the same form as that between birth weight and parity. The correlation between maternal age and parity was almost 0.7 which is very high.

I agree with most other observers, that parity is a far stronger factor affecting birth weight than is maternal age, for the birth weights increase with parity, whether maternal age is held constant or not. When rank is not held constant the effect of maternal age on birth weight is different in the different racial groups - in the European group the association is inconsistent; in the Coloured and Bantu groups, birth weight increases with maternal age until age 30 - 34 years with a slight drop in the highest age group; in the Indian group there is a steady increase in birth weight with increasing age.

Karn and Penrose found a slight increase of weight with mother's age for all births together and so did Millis and Seng. As mentioned previously Millis and Seng explain this by pointing out that young mothers have mostly early birth order lighter children, while older mothers have later born heavier children.

When the effect of maternal age is considered in each birth rank, my results vary from rank to rank and from race to race. Certain facts, however, do emerge, namely:

1. With increasing age, weight decreases among first-born Europeans, and increases among first-born Coloured, Bantu, and Indian babies.
2. For births other than first, there is no consistent trend.

When the age and rank factors are separated and rank is fixed, it will be recalled that the effect of maternal age is different in the European and non-European groups. In the Europeans, birth weight is highest in the young mothers, and drops steadily with increasing age. In the non-European groups birth weight is lowest for the young mothers, and rises with increase in age until the 25 - 29 year age group is reached. Although the pattern is not consistent for the three non-European groups after this age level, in all of them the older mothers of 35 years and over, have heavier babies than the young mothers. My results for Europeans resemble those found by Karn and Penrose, and Millis and Seng, in that birth weight decreases with increasing age of mother. However, my results in the non-European groups show maternal age to have a directly opposite effect, in that birth weight increases with increasing age of mother. This would be more in keeping with the results of Solth and Abt.

In general it can be seen that the results of investigations on the association of maternal age and birth weight are inconsistent and conflicting. The differences in the results found by various investigators, and the varying results I found between the racial groups, may be due to the following reasons:

1. The older investigators did not separate the factors of maternal age and rank, and since these factors are highly correlated with each other and rank is the stronger of the two, the effect of age of mother on birth weight may be marked.
2. The samples investigated have varying environmental, social and cultural backgrounds, and are not strictly comparable.
3. The differences between the European and non-European groups as regards association of birth weight and maternal age, may in part be due to the fact that influences of maternal age and birth rank are not strictly additive but depend on their inter-relationship.

Product moment correlations between age of mother and rank of child for the different racial groups give the following results:

European	r:	+ 0.46 ± .014
Coloured	r:	+ 0.72 ± .015
Bantu	r:	+ 0.72 ± .010
Indian	r:	+ 0.77 ± .011

It is apparent that the three non-European groups have a very high correlation between age of mother and rank of child, much higher than that shown by the European group. There would appear to be some additional factor or factors operating in the case of the Europeans which disturbs the normal rank-age relationship. This is also suggested by the fact that the European group is the only one in which the observed and expected mean birth weights differ considerably. (See statistical note.)

It is possible that this additional factor is a cultural one. There is a marked difference in the marriage and fertility habits of the Europeans as opposed to the non-Europeans in Durban. Europeans have their first babies later and far less of their total births represent births to mothers under 20 years. (Table 27a, b, c). They have much smaller families, and the rank distribution is heavily loaded towards the early birth ranks. Contraception, which obviously plays an important role in producing this picture in the European, is seldom practised by the non-European groups.

TABLE 27.

(a) AGE OF MOTHER ACCORDING TO RANK OF CHILD.

Rank	EUROPEAN	COLOURED	BANTU	INDIAN
1	25.9 yrs.	21.3 yrs.	21.7 yrs.	20.7 yrs.
2	29.0 "	23.9 "	24.2 "	22.2 "
3	31.5 "	25.9 "	26.1 "	24.0 "
4+	34.2 "	31.9 "	30.7 "	29.9 "

(b) BIRTHS TO MOTHERS UNDER 20 YEARS AS PERCENTAGE OF TOTAL BIRTHS.

European	3.5
Coloured	20.2
Bantu	12.3
Indian	19.3

(c) PERCENTAGE DISTRIBUTION OF BIRTHS IN THE 15-19 YEAR AGE GROUP

	EUROPEAN	COLOURED	BANTU	INDIAN
15	-	1.4	1.5	1.1
16	.9	6.6	7.1	4.9
17	9.8	14.6	13.0	18.0
18	28.6	34.5	31.2	32.2
19	60.7	42.9	47.2	43.8

Jain (1951) gives an interesting table of average maternal age at various birth orders for India, U.S.A., Australia, and England and Wales (Table 28). From this table it can be seen that in each birth order the average age of mother increases in the sequence India, U.S.A., Australia, England and Wales. For all birth orders together the average age of the Indian and American mothers was the same. Jain explains this result as due to the fact that in India there are more births of higher order which have an older average age of mother. The first maternities have a much younger age in India, the first births being more concentrated in the earlier years.

TABLE 28.

AVERAGE MATERNAL AGE AT THE VARIOUS BIRTH ORDERS (after Jain, 1951)

BIRTH ORDER	INDIA	U.S.A.	AUSTRALIA	ENGLAND AND WALES
All orders	27.2	27.2	28.4	29.5
1st order	21.9	24.4	25.8	26.7
2nd "	22.2	27.0	28.6	29.8
3rd "	26.2	29.1	30.7	31.8
4th "	28.3	30.3	32.3	33.4
5th "	30.5	31.6	33.4	34.7
6th "	32.0	33.0	34.5	35.8
7th "	33.7	34.3	35.6	36.9
8th "	34.6	35.6	36.8	37.9
9th "	36.3	36.8	37.9	38.8
10th "	37.2	37.9	38.6	39.6

It seems to me quite possible that investigations ofthe association of maternal age and birth weight may show different results in these four countries, and in other countries as well.

In the previous chapter, I mentioned the likelihood of finding a different age distribution of mothers in the four racial groups, and that this difference in age composition might possibly be a factor accounting for the difference in birth weights already demonstrated between the four ethnic groups. An examination of the birth weights in each maternal age group (table 22), however, reveals the familiar pattern already shown in the previous chapters. In each age group, whether ranks are combined or separated, the European babies are the heaviest, and the Indian babies the lightest, with the Coloured and Bantu babies occupying an intermediate position. The racial differences in mean birth weight found, are not due to the different age composition of the mothers in the four groups.

SUMMARY.

Birth weights of infants are studied with special reference to association specifically with age of mother. The material comprises 3,164 European, 1,059 Coloured, 2,188 Bantu and 1,391 Indian babies.

1. Parity is a far stronger factor affecting birth weight than is maternal age.

2. When age of mother is fixed, there is a steady rise in birth weight with increasing rank in all racial groups.

3. When all ranks are combined, association of birth weight with age of mother is not consistent; in the Europeans virtually no difference is found from age to age; in the Coloured and Bantu groups birth weight increases with age until maternal age 30 - 34 years with a slight drop thereafter; in the Indian group there is a steady rise in birth weight with increasing age.

4. When each birth rank is considered separately, as age of mother increases:

   a) among first born Europeans, weight decreases;
   b) among first born Coloured, Bantu and Indian, weight increases;
   c) among births after the first, weight shows no consistent trends in any of the four groups.

5. When rank is fixed, in the European group, birth weight is highest for young mothers and drops steadily with increasing age. In the non-European groups birth weight is lowest for the young mothers and rises in all cases till maternal age 25 - 29 years is reached. After this age the picture is not consistent, but the babies born to mothers of 35 years and over are heavier than those born to the youngest mothers.

6. The mean maternal age at each birth rank is different in the four racial groups. European mothers are older for each order of birth, and they have proportionately far less of their total births in the under 20 years age group, than non-European mothers.

7. The correlation between age of mother and rank of child is much higher for the three non-European groups than for the European.

8. It is suggested that cultural factors, such as difference

in age at child birth, size of family, and the use of contraception may explain the different effects which maternal age has on birth weight in the European and non-European groups.

9. The literature on the association between maternal age and birth weight yields inconsistent results. Some investigators find no association; some find an increase in birth weight with increasing maternal age until a particular age level is reached; others again find a decrease in birth weight as maternal age increases. Two possible explanations for the conflicting findings are offered:

a) It is difficult to separate the effects of age of mother and rank of child.

b) The samples investigated have varying environmental, social and cultural backgrounds and are not strictly comparable.

10. The racial difference in mean birth weight previously noted is not due to the different age composition of the mothers in the four racial groups. In each maternal age group the European babies are the heaviest, the Indian babies the lightest, and the Bantu and Coloured babies occupy an intermediate position.

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STATISTICAL NOTE.

(By Mr S.E. Cruise, M.A., Cantab., Senior Lecturer in Mathematics and Statistics, University of Natal, Durban, South Africa).

The procedure follows Kendall (Advanced Theory of Statistics), vol. II, pp. 220 - 226.

Let the means of weights in each class be denoted by $\bar{x}_{jk}$ as follows:-

Maternal Age	Rank 1	Rank 2	Rank 3	Rank 4+
15 - 19	$\bar{x}_{11}$	$\bar{x}_{12}$	$\bar{x}_{13}$	$\bar{x}_{14}$
20 - 24	$\bar{x}_{21}$	$\bar{x}_{22}$	$\bar{x}_{23}$	$\bar{x}_{24}$
25 - 29	$\bar{x}_{31}$	$\bar{x}_{32}$	$\bar{x}_{33}$	$\bar{x}_{34}$
30 - 34	$\bar{x}_{41}$	$\bar{x}_{42}$	$\bar{x}_{43}$	$\bar{x}_{44}$
35 - 39	$\bar{x}_{51}$	$\bar{x}_{52}$	$\bar{x}_{53}$	$\bar{x}_{54}$

Let the number of babies in the class whose mean is $\bar{x}_{jk}$ be n_{jk}, and let the weight of an individual baby in this class be x_{jkl}.

We first test for homogeneity by regarding the data as a one-way classification with <u>n</u> classes. (Owing to the presence of one or more empty classes which are not counted, the value of <u>n</u> will be less than 20). Then if $N = \sum\sum n_{jk}$ is the total number of observations, and $\bar{x}$ is the mean of all these observations,

$$\frac{1}{n-1} \sum\sum n_{jk} (\bar{x}_{jk} - \bar{x})^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

and

$$\frac{1}{N-n} \sum\sum\sum (x_{jkl} - \bar{x}_{jk})^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

are independent estimates of the population variance <u>v</u>, assuming homogeneity. Snedecor's F-test applies, and in each of the four cases a significant result was obtained (See Table 23).

The next step is to treat the data as a two-way classification, as follows:

Let there be $\underline{q}$ non-empty cells in the j^{th} row, and
$\underline{p}$ non-empty cells in the k^{th} column, and let the marginal <u>unweighted</u> means be

$$\bar{x}_{j.} = \frac{1}{q} \sum_k \bar{x}_{jk} \quad \text{and} \quad x_{.k} = \frac{1}{p} \sum_j \bar{x}_{jk} .$$

Then, assuming homogeneity with respect to maternal age, the variance of $\bar{x}_{j.}$ is given by

$$\frac{v}{q^2} \sum_k \frac{1}{n_{jk}} = \frac{v}{N_j} \text{, say.}$$

Then an unbiased estimator of $\underline{v}$ is

$$\frac{1}{p-1} \left\{ N_j(\bar{x}_{j.} - c)^2 \right\} \text{ where } c = \frac{\sum N_j \bar{x}_{j.}}{\sum N_j} \quad \ldots\ldots\ldots\ldots\ldots \text{(3)}$$

and this estimator is independent of the residual (2). We can again apply the F-test.

The effect of rank is tested in a similar way. The results are set out in table 24.

Having established a significant effect for both rank and maternal age in certain cases, it was decided to calculate constants a_j and b_k which would estimate these effects respectively. Accordingly it was assumed that $x_{jkl} = \bar{x} + a_j + b_k + \zeta_{jkl}$ .... (4)

It was further assumed that $\sum a_j = \sum b_k = 0$ .... (5)

and the 9 constants a_j, b_k were found (in each of the four cases) by minimising the sum of squares $\sum \zeta^2_{jkl}$, which leads to the normal equations

$$\sum_k \sum_l (x_{jkl} - \bar{x} - a_j - b_k) = 0 \quad (j = 1, 2, 3, 4)$$

$$\sum_j \sum_l (x_{jkl} - \bar{x} - a_j - b_k) = 0 \quad (k = 1, 2, 3, 4, 5)$$

The values obtained for a_j and b_k in each case are set out in Table 25 a and b. It does not seem possible to give an estimate of the accuracy of these values. They do, however, give a concise summary of the data, and it is hoped that other workers in the same field may be able to use them for comparison.

Appendix 5 shows $\bar{x} + a_j + b_k$ in the j^{th} row and k^{th} column, and may be regarded as a table of "expected weights". These "expected weights" were compared with the actual mean weights observed, and a test of goodness of fit was obtained by comparing an unbiased estimate of variance based on the differences with the residual estimate (2). In the cases of the Coloured and Indian groups the differences were not significant, indicating a reasonably good fit. In the case of the Bantu group, the differences were significantly <u>small</u> at the 5 per cent level, indicating a very good fit. In the European group, however, the differences were significantly large at the 5 per cent level, indicating a bad fit. An example of the working is shown for the Coloured group. (Appendix 6).

APPENDIX 5.

EXPECTED MEAN BIRTH WEIGHTS.
(Using constants found by Method of least Squares).

1. EUROPEANS.

Age.	Rank 1	Rank 2	Rank 3	Rank 4+
15-19	7.48	7.82	7.95	8.11
20-24	7.36	7.69	7.83	7.98
25-29	7.34	7.67	7.81	7.96
30-34	7.28	7.62	7.75	7.91
35 +	7.14	7.47	7.61	7.77

2. COLOUREDS.

Age.	Rank 1	Rank 2	Rank 3	Rank 4+
15-19	6.47	6.66	6.82	6.88
20-24	6.70	6.89	7.05	7.11
25-29	6.75	6.93	7.09	7.15
30-34	7.09	7.28	7.44	7.50
35 +	6.88	7.07	7.23	7.29

3. BANTU.

Age.	Rank 1	Rank 2	Rank 3	Rank 4+
15-19	6.61	6.78	6.93	7.02
20-24	6.77	6.94	7.08	7.18
25-29	6.97	7.13	7.28	7.37
30-34	6.88	7.05	7.19	7.29
35 +	6.79	6.96	7.10	7.20

4. INDIANS.

Age.	Rank 1	Rank 2	Rank 3	Rank 4+
15-19	6.16	6.36	6.47	6.66
20-24	6.24	6.44	6.54	6.73
25-29	6.28	6.48	6.58	6.77
30-34	6.21	6.41	6.51	6.70
35 +	6.40	6.60	6.70	6.89

APPENDIX 6.

COLOUREDS : SEXES COMBINED

SIGNIFICANCE OF DIFFERENCE BETWEEN OBSERVED AND EXPECTED MEANS

		1	2	3	4+
15-19	$(o-e)$	+.054	-.139	-.496	
	$(o-e)^2$	.002916	.019321	.246016	
	N	168	39	7	
	$N(o-e)^2$	.489888	.753519	1.722112	
20-24	$(o-e)$	-.076	+.014	+.293	-.174
	$(o-e)^2$	.005776	.000196	.085849	.030276
	N	169	136	56	30
	$N(o-e)^2$	.976144	.026656	4.807544	.908280
25-29	$(o-e)$	+.132	-.098	-.101	+.047
	$(o-e)^2$	.017424	.009604	.010201	.002209
	N	43	54	44	89
	$N(o-e)^2$	.749232	.518616	.448844	.196601
30-34	$(o-e)$	-.251	+.163	-.119	+.016
	$(o-e)^2$	.063001	.026569	.014161	.000256
	N	11	21	15	74
	$N(o-e)^2$	.693011	.557949	.212415	.018944
35+	$(o-e)$	+.367	+1.120	-1.112	.000
	$(o-e)^2$	.134689	1.254400	1.236544	.000000
	N	3	5	6	89
	$N(o-e)^2$	.404067	6.272000	7.419264	.000000

$\Sigma N(o-e)^2$: 27.175086

$\frac{\Sigma}{12}$: 2.2646

Residual estimate of v from Analysis of Variance : 1.3998

$F : \frac{2.2646}{1.3998}$: 1.62, where V_1 : 12, V_2 : 1040
(degrees of freedom)

For V_1 : 12, V_2 : 1000

1% : 2.20

5% : 1.76

This is not significant.

CHAPTER VI.

SEASONAL VARIATION IN BIRTH WEIGHT.

This chapter deals with seasonal variation in birth weight with special reference to race, sex and rank of babies. In addition the proportion of male to female births in the different ranks is noted and briefly discussed.

MATERIAL USED AND METHOD OF ANALYSIS.

Essentially the same sample of babies is used here as was used in the previous two chapters, the numbers now being 3,165 European babies, 1,058 Coloured babies; 2,190 Bantu babies and 1,403 Indian babies.

The data extracted consist in all cases of race of mother, birth weight, sex, birth rank of child, and month of birth. As before, abortions and multiple births are excluded, but in considering the birth rank of the child previous known miscarriages are included.

Frequency distributions are drawn up for birth weights in each month of birth and means and standard deviations are calculated for the races and sexes separately.

The groups are then further subdivided into ranks 1, 2-5, and 6+, and the months grouped as follows: January - March, April - June, July - September, October - December (see Appendix 7).

In this chapter the statistical significance of the results is determined by Analysis of Variance (Snedecor, 1946).

In each racial group the distribution of the sexes in the different birth ranks is analysed.

RESULTS.

Seasonal Variation in Birth Weight in relation to Race and Sex. (Table 29).

Very little monthly variation in birth weight is found, except among the Indian group. By the analysis of variance, it is found that only the Indian girls have a significant variation at the 5% level, which is the lower limit of significance.

It has been demonstrated that the distribution of ranks is markedly different for the four racial groups, with the Indians having a preponderance of high rank babies.

T A B L E 29.

SEASONAL VARIATION IN BIRTH WEIGHT IN RELATION TO RACE AND SEX.

	EUROPEAN :						COLOURED :					
	GIRLS			BOYS			GIRLS			BOYS		
	No.	Mean	SD(lb)	No.	Mean	SD(lb)	No.	Mean	SD(lb)	No.	Mean	SD(lb)
January	140	7.39 lb.	1.13	132	7.48 lb.	1.31	77	7.02 lb.	1.03	67	6.97 lb.	1.27
February	107	7.29 "	1.01	123	7.50 "	1.34	27	6.68 "	1.68	34	6.93 "	1.52
March	125	7.33 "	1.08	141	7.82 "	1.19	36	6.60 "	1.31	35	7.04 "	1.21
April	121	7.41 "	1.14	121	7.54 "	1.23	50	6.79 "	0.96	39	6.96 "	1.07
May	138	7.42 "	1.19	125	7.71 "	1.13	53	6.78 "	1.12	54	6.58 "	1.43
June	137	7.34 "	1.09	137	7.59 "	1.18	34	6.72 "	0.90	50	6.78 "	1.43
July	132	7.43 "	1.10	144	7.73 "	1.03	54	6.88 "	1.02	68	7.03 "	1.42
August	126	7.57 "	1.16	139	7.66 "	1.22	27	7.05 "	0.95	21	7.11 "	1.15
September	126	7.41 "	1.09	108	7.60 "	1.22	62	6.53 "	1.04	64	7.06 "	1.11
October	148	7.44 "	1.11	161	7.54 "	1.18	24	6.85 "	1.47	29	7.01 "	1.24
November	110	7.55 "	1.04	136	7.68 "	1.20	39	6.99 "	1.19	39	7.01 "	1.29
December	138	7.36 "	1.07	150	7.58 "	1.12	36	7.19 "	1.37	38	7.40 "	1.06

	BANTU :						INDIAN :					
	GIRLS			BOYS			GIRLS			BOYS		
	No.	Mean	SD(lb)	No.	Mean	SD(lb)	No.	Mean	SD(lb)	No.	Mean	SD(lb)
January	82	6.90 lb.	1.07	80	7.31 lb.	1.00	59	6.54 lb.	1.14	66	6.67 lb.	1.39
February	77	7.00 "	1.01	101	7.10 "	1.18	43	6.24 "	1.13	42	6.25 "	1.13
March	90	6.63 "	1.06	82	7.16 "	1.17	48	6.82 "	1.26	48	6.42 "	1.36
April	103	6.89 "	0.94	96	7.03 "	1.48	52	6.05 "	0.97	54	6.60 "	1.26
May	96	6.92 "	0.95	99	6.88 "	1.35	51	6.29 "	1.19	72	6.64 "	1.33
June	71	6.95 "	0.93	83	7.29 "	1.11	74	6.28 "	1.20	68	6.39 "	1.24
July	88	7.00 "	1.03	90	7.26 "	1.24	54	6.23 "	1.03	60	6.55 "	0.92
August	86	6.86 "	1.08	97	7.20 "	1.12	54	6.29 "	1.20	58	6.61 "	1.16
September	86	6.92 "	0.94	112	7.17 "	1.11	66	6.55 "	1.12	53	6.34 "	1.17
October	90	6.68 "	1.25	99	7.02 "	1.24	55	6.60 "	1.12	59	6.73 "	1.08
November	93	6.77 "	1.09	86	7.34 "	1.06	65	6.56 "	1.19	67	6.89 "	0.96
December	99	6.94 "	0.99	104	7.27 "	0.99	67	6.70 "	1.24	68	6.91 "	1.20

Distribution of Sex in different Ranks.

The possibility of the sex of baby as well as seasonal variation in birth weight being influenced by rank is now considered. (Table 30).

Over 20 per cent of the Indian babies are of sixth or higher rank, as compared with less than 1 per cent of the European babies. Almost 25 per cent of the Indian girls are of Rank 6+ as compared with just under 20 per cent of the Indian boys. The percentage of Rank 6+ babies does not vary greatly for the girls and boys of the other racial groups.

In the four races, the proportion of girls to boys varies in the different rank groups. In the European and Coloured groups there are less girls in Rank 1 and Rank 6+, with more girls in Rank 2-5. In the Bantu and Indian groups there are more girls in Rank 1 and Rank 6+ and less girls in Rank 2-5. However, the percentage of girls in the total group (all ranks) remains remarkably constant for all the racial groups, being slightly less than 50 per cent.

It is suggested that there may be two factors causing the differences in the sex-ratio pattern displayed by the different racial groups, and the preponderance of females in the high birth orders of the Indian group. One factor is the different age-rank distribution of the mothers in the four racial groups, and the other is the varying nutritional state of the mothers.

Seasonal Variation of Birth Weight of Babies, Rank 6 and Higher.

In order to see if there is greater seasonal variation in birth weight in higher rank babies, Rank 6+ babies are treated separately, and the months of the year are grouped into 4 seasons. It is not possible to analyse the European babies in this way, as the numbers are too small, but the results for the other three groups are shown in Table 31.

In the three racial groups examined (i.e. Coloured, Bantu and Indian) there is a seasonal variation shown by the highest birth order group which is greater than the variation found in Rank 1 or Rank 2-5 babies. (See Appendix 7).

In Rank 6+, by analysis of variance it is found that not only do the Indian girls have a significant seasonal variation in birth weight at the 1 per cent level, but that Indian boys also show significant

T A B L E 30.

DISTRIBUTION OF SEX IN DIFFERENT RANKS.

RANK:	EUROPEAN				COLOURED				BANTU				INDIAN			
	Girls	Boys	Total	% Girls	Girls	Boys	Total	% Girls	Girls	Boys	Total	% Girls	Girls	Boys	Total	% Girls:
1	733	818	1551	47.3	190	204	394	48.2	358	344	702	51.0	210	195	405	51.9
2 - 5	803	781	1584	50.7	259	256	515	50.3	590	684	1274	46.3	307	380	687	44.7
6 +	12	18	30	40.0	71	78	149	47.7	113	101	214	52.8	171	140	311	55.0
TOTAL	1548	1617	3165	48.9	520	538	1058	49.1	1061	1129	2190	48.4	688	715	1403	49.0
6+ as % of Total.	.8	1.1	.9		13.7	14.5	14.1		10.7	8.9	9.8		24.9	19.6	22.2	

T A B L E 31.

SEASONAL VARIATION OF BIRTH WEIGHT OF BABIES RANK 6 AND HIGHER.

	COLOURED:						BANTU:						INDIAN :					
	GIRLS			BOYS			GIRLS			BOYS			GIRLS			BOYS		
	No.	Mean lb.	SD(lb)	No.	Mean	SD(lb)	No.	Mean lb.	SD(lb)	No.	Mean lb.	SD(lb)	No.	Mean lb.	SD(lb)	No.	Mean lb.	SD(lb)
Jan - March	16	7.34	1.68	19	7.25lb	1.86	29	6.92	1.09	20	7.15	1.25	34	7.15	1.33	29	6.73	1.64
April - June	14	6.50	1.05	16	8.19 "	1.41	31	7.48	0.89	25	7.47	1.85	43	6.04	1.63	45	6.61	1.28
July - Sept.	18	6.64	0.95	22	7.34 "	1.66	30	7.27	0.94	33	7.34	1.36	48	6.55	1.44	31	6.61	1.25
Oct. - Dec.	23	7.49	1.64	21	7.89 "	1.18	23	6.95	1.20	23	7.38	1.35	46	7.03	1.30	35	7.45	1.24

results though at the 5 per cent level. In spite of the smallness of the numbers in the 6+ Rank group, the seasonal variation of the Indian girls has increased to the upper limit of significance. None of the other results are significant although there appears to be a seasonal difference in the Coloured and Bantu girls.

The Indian girls and boys have heavier birth weights in the summer months (October - March), and correspondingly lighter birth weights in the winter months (April - September).

Birth weights of Coloured girls are also heavier in the summer, but those of Bantu girls are found to be heavier in the winter months. As stated above, neither of these results are statistically significant. Neither the Coloured nor the Bantu boys show any consistent seasonal variation in birth weight.

DISCUSSION.

1. Indian babies show more seasonal variation in birth weights than the other racial groups. In Durban, the poor Indian groups are the worst nourished of the four racial groups. (Kark, 1951). The Indian group under review is predominantly of this category. It is suggested that a stimulus such as inadequate food, or inadequate utilisation of food, which might not be sufficiently great to manifest a seasonal variation in birth weights in slightly better or well-nourished communities, might cause a seasonal variation in a community as grossly malnourished as the Indian.

2. The second fact which emerges is that there is more seasonal variation in birth weights in girls than in boys. This is shown in Table 29, where only the Indian girls, of all those studied, show a significant seasonal variation. In Table 31 it is seen that the Bantu and Coloured girls show more seasonal variation than the boys, although the results are not statistically significant. Although both Indian boys and girls of high birth order show a significant seasonal variation, the significance is greater for girls than for boys. It is not known why girls should show a greater seasonal variation in birth weight than boys. Reference to the literature is of little assistance, except for one statement by Donald (1939) that "among first-born children males are regularly heavier than females, and less affected by seasonal fluctuations in average weight".

On the other hand Marshall (1937) in a review of American research on seasonal variation in stature and body weight, quotes Faber (1920) who found a seasonal variation in birth weight for boys only.

3. Seasonal variation of birth weight tends to increase with increasing birth rank, the Rank 6 and over babies showing more variation than those of lower ranks. Seasonal variation begins to appear in Coloured and Bantu girls of Rank 6 + (although not significantly so), becomes significant in the Indian boys and increasingly significant in the Indian girls of this birth rank. It is suggested that in malnourished communities the strain of repeated pregnancies and lactations would further undermine the nutritional state of the mother. If the nutritional state of the mother is a factor influencing the degree of seasonal variation in birth weights, it is to be expected that high ranking babies of malnourished mothers would show a more marked seasonal variation in birth weight.

4. Where seasonal variation has been found, in all cases except the Bantu girls, the babies are heavier when born in the summer months and lighter when born in the winter months. The literature on seasonal variation in birth weights does not give consistent results. Brenton (1922), and Bakwin and Bakwin (1929) found no seasonal variation.

Adersen (1899) found higher birth weights in infants born during the cold months as did Faber (1920) in the case of boys only, but the majority of workers found heavier birth weights in the summer months. (Abels, (1926), Murray (1924), Toverud (1933), Bivings (1934), Li (1936), and Donald, (1939)).

5. Donald (1939) notes the occurrence of a low proportion of males at either end of the reproductive life of women, and says "If it is true that, under good environmental conditions, the sex ratio rises, the low sex ratios must mean that the foetuses of the young and old mothers were exposed to more hazardous conditions than those of mothers of intermediate ages."

MacMahon and Pugh (1953) reporting on the influence of birth order and maternal age on the human sex ratio at birth note that for non-Whites, "(1) In live births and total births, sex ratios are lower than in Whites, but for stillbirths they are higher ..... ". "(2) As in Whites, sex ratios of live births show no consistent relationship to maternal age, but display fairly consistent trends with birth rank when the association between maternal age and birth order is separated. " "(3) The effect of birth rank differs from that noted for Whites, in that the sex ratio first increases from birth rank 1 to birth rank 2 before decreasing with increasing birth order."

Indian mothers having their sixth and higher rank babies tend to bear a high percentage of females.

Further discussion of this fact is beyond the scope of the present thesis, but it is suggested that it might be related to the nutritional state of the mothers.

SUMMARY.

Seasonal variation in birth weights of infants is studied with special reference to race, sex and rank of babies. The material comprises 3,165 European babies, 1,058 Coloured babies, 2,190 Bantu babies and 1,403 Indian babies. Results are as follows:

1. Indian babies show more seasonal variation in birth weights than do the other groups.

2. Girls show a greater seasonal variation in birth weights than boys.

3. Seasonal variation in birth weights appears to increase with increasing rank of baby.

4. Indian girls born in the summer months are heavier in all birth ranks than those born in the winter months, the difference between summer and winter birth weights being most marked in the rank 6 and over babies.

Indian boys born in summer are significantly heavier than the winter babies, in rank 6 and over only.

The other racial groups show no significant seasonal differences in birth weight in any of the birth rank groups.

5. It is possible that seasonal variation in birth weight, where it exists, may be related to gross maternal malnutrition; this may explain why significant seasonal variation occurs in the Indian community, particularly in babies of high birth order.

6. The literature on seasonal variation in birth weight gives inconsistent results. Where such variation was found, however, the majority of workers found babies born in summer to be heavier than those born in winter.

7. An interesting fact (which is outside the scope of the present investigation) emerges during the analysis of the figures : Indian mothers having their sixth and higher rank babies, tend to bear a high percentage of female babies. It is suggested that this may be related to the nutritional state of the mothers.

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APPENDIX 7.

SEASONAL VARIATION IN BIRTH WEIGHTS IN RELATION TO RACE, SEX AND RANK.

1. EUROPEAN.

	GIRLS						BOYS					
	1			2+			1			2+		
	No.	Mean	SD(lb)	No.	Mean	SD(lb)	No.	Mean	SD(lb)	No.	Mean	SD (lb)
Jan. - March	163	7.16 lb.	1.01	209	7.48 lb.	1.10	196	7.35 lb.	1.28	200	7.86 lb.	1.25
April - June	206	7.14 "	1.14	190	7.66 "	1.08	207	7.47 "	1.05	176	7.78 "	1.30
July - Sept.	170	7.27 "	1.03	214	7.62 "	1.16	187	7.55 "	1.03	204	7.77 "	1.25
Oct. - Dec.	194	7.28 "	1.12	202	7.59 "	1.01	228	7.44 "	1.20	219	7.76 "	1.11

2. COLOURED.

	GIRLS									BOYS								
	1			2 - 5			6+			1			2-5			6+		
	No.	Mean	SD (lb)	No.	Mean	SD (lb)	No.	Mean	SD (lb)	No.	Mean	SD(lb)	No.	Mean	SD(lb)	No.	Mean	SD(lb)
Jan. - March	50	6.46 lb.	1.18	74	7.00 lb.	1.14	16	7.34 lb.	1.68	51	6.85lb	1.07	66	6.98lb	1.24	19	7.25lb	1.86
April - June	56	6.60 "	0.97	68	6.93 "	1.05	14	6.50 "	1.05	56	6.41 "	1.21	71	6.93 "	1.22	16	8.19 "	1.41
July - Sept.	53	6.55 "	0.93	72	6.94 "	1.10	18	6.64 "	0.95	61	6.79 "	1.17	70	7.19 "	1.15	22	7.34 "	1.66
Oct. - Dec.	31	6.64 "	0.96	45	7.07 "	1.30	23	7.49 "	1.64	36	6.71 "	1.04	49	7.15 "	1.19	21	7.89 "	1.18

3. BANTU.

	GIRLS									BOYS								
	1			2 - 5			6+			1			2 - 5			6+		
	No.	Mean	SD(lb)	No.	Mean	SD(lb)	No.	Mean	SD(lb)	No.	Mean	SD(lb)	No.	Mean	SD(lb)	No.	Mean	SD(lb)
Jan. - March	99	6.60 lb	0.92	121	7.01 lb	1.12	29	6.92 lb	1.09	78	6.95 lb	0.89	165	7.30 lb	1.20	20	7.15lb	1.25
April - June	90	6.68 "	0.86	149	6.94 "	0.95	31	7.48 "	0.89	80	6.76 "	1.20	173	7.13 "	1.29	25	7.47 "	1.85
July - Sept.	79	6.66 "	0.97	151	7.03 "	1.02	30	7.27 "	0.94	90	6.81 "	0.94	176	7.38 "	1.17	33	7.34 "	1.36
Oct. - Dec.	90	6.61 "	1.05	169	6.89 "	1.13	23	6.95 "	1.20	96	6.94 "	0.91	170	7.33 "	1.15	23	7.38 "	1.35

4. INDIAN.

	GIRLS									BOYS								
	1			2 - 5			6+			1			2 - 5			6+		
	No.	Mean	SD(lb)	No.	Mean	SD(lb)	No.	Mean	SD(lb)	No.	Mean	SD(lb)	No.	Mean	SD(lb)	No.	Mean	SD(lb)
Jan. - March	52	6.23 lb	1.01	64	6.48 lb	1.15	34	7.15 lb	1.33	50	6.22 lb	1.09	77	6.55 lb	1.31	29	6.73 lb	1.64
April - June	54	6.20 "	0.88	80	6.32 "	0.94	43	6.04 "	1.63	41	6.27 "	0.98	108	6.62 "	1.37	45	6.61 "	1.28
July - Sept.	48	6.06 "	0.91	78	6.44 "	0.99	48	6.55 "	1.44	47	6.08 "	0.97	93	6.69 "	1.03	31	6.61 "	1.25
Oct. - Dec.	56	6.16 "	1.15	85	6.70 "	1.04	46	7.03 "	1.30	57	6.35 "	0.86	102	6.85 "	1.02	35	7.45 "	1.24

SECTION II

GROWTH IN THE FIRST 10 DAYS OF LIFE

INTRODUCTION.

Section II is also a comparative study of European, Coloured, Indian and Bantu babies, and deals with the weight progress of these babies in the first seven or the first ten days of life.

In the first section I emphasized the fact that the birth weight of the baby is dependent to a large extent on the health and nutrition of the expectant mother.

After birth the growth of the baby in its early weeks depends not only on its health at birth, but also on its care and feeding. Although I am comparing babies during their stay in hospital, even there the care varies - for example in one hospital the babies sleep in their mothers' beds, and in another hospital they are kept in nurseries.

Almost all the babies are breast fed, although it will be seen in Section IV that the incidence of breast feeding is not exactly the same in the four racial groups. Mothers vary too in the amount of milk they produce.

Certain factors have been shown to be important in the effect they have on birth weight. In this section I investigate some of these factors, such as sex of baby, birth rank and season of birth, in order to see if they affect growth in early life. In addition I attempt to measure the effect which the birth weight itself has on growth; also the effect of the mother's marital status, and the frequency and regularity of the feeds.

It should be noted that in this section I use data from two hospitals only - McCord's Zulu Hospital (a Government aided hospital) for information on Bantu and Indian babies, and Addington Hospital (a Provincial hospital) for information on European and Coloured babies.

The subject of Chapter VII deals with the weight of Bantu babies in the first ten days of life, with special reference to the effect of birth rank, sex and marital status of mother.

Chapter VIII discusses the effect of birth weight and time of first feed on the weight of these babies.

Chapter IX is a comparison of neonatal progress of the four racial groups in the first week of life, with respect to seven factors, and of the effect of birth weight on this progress. It should be noted that the data are not strictly comparable because while I myself weighed the Bantu babies daily, I used the recorded weights for the other three groups. Also there was an outbreak of epidemic diarrhoea of the new-born among my Bantu group, and I consequently excluded all sick babies from my analysis. I also excluded all abnormal deliveries, whereas for the other groups I used all baby weights recorded in the nursery books. However, I do not think the exclusion of abnormal deliveries affected the final results to any extent, for in a study which appears later on the incidence of breast feeding on discharge from hospital, I found that the method of delivery did not affect the incidence of breast feeding. Perhaps in this connection, it is significant that Cole (1939)+ in his study of the effect of operative delivery on the weight curves of the new-born, found that all but one group (high forceps) lost less weight than the average.

It should be noted also that the Bantu and Indian babies born at McCord's Zulu Hospital, slept in their mothers' beds, and were fed on an elastic three-hourly schedule, whereas the Addington Hospital European and Coloured babies were separated from their mothers and slept in nurseries, being brought to their mothers for feeds. In addition there was some difference in the time intervals adopted for the European and Coloured babies. The European babies who weighed over 6 lb 8 oz at birth, were fed four-hourly, and those under 6 lb 8 oz, three-hourly. Coloured babies over 7 lb were fed four-hourly, and under 7 lb three-hourly. The difference appeared to be due to the fact that the wards were quite separate from each other, and that there were different sisters in charge of each ward.

Chapter X analyses the results of an investigation carried out at McCord's Zulu Hospital in 1947-1948, on the effect of three-hourly, four-hourly and self demand feeding on weight progress of Bantu babies in the first week of life.

The final chapter, Chapter XI, deals with the effect of season of birth on the neonatal progress of European and Coloured babies.

+ Cole, W.C.C. (1939). Surg. Gynec. Obstet., 68, 179.

CHAPTER VII.

WEIGHT OF BANTU BABIES IN THE FIRST 10 DAYS OF LIFE WITH SPECIAL REFERENCE TO THE EFFECT OF BIRTH RANK, SEX AND MARITAL STATUS OF MOTHER ON THIS GROWTH.

MATERIAL USED AND METHOD OF ANALYSIS.

The data for this study comprise all full-term Bantu infants (excluding twins) born at McCord's Zulu Hospital, Durban, between 1st June 1950 and 31st January 1951. 598 babies, born of normal vertex delivery, who were well during their stay in hospital, were studied. All these babies were breast-fed on an elastic 3-hourly schedule with a night feed. The babies shared their mothers' beds, day and night.

The daily weighing which I carried out myself was done on a beam scale, which was checked before the start of the experiment, several times during the course of it, and again at the end. Babies were weighed naked except for the first few days when they wore a crepe binder of known weight, and weighing started at 9.30 every morning. As they were born at all times of the day and night, it was impossible for me to weigh them at birth, and this was done by the sister or staff-nurse in charge of the ward, or by a midwife under their supervision. The babies were washed before weighing.

The daily gain or loss from birth weight is calculated, and means and standard deviations of these differences are worked out for each of the first ten days. The total initial loss is recorded, showing the amount lost until the baby's weight became stationary or began to rise, irrespective of whether there was any subsequent loss. The duration of this initial loss is also recorded. Means and standard deviations of these two measures are calculated for married and unmarried mothers.

RESULTS.

1. Daily gain or loss in weight.

Table 32 shows the mean gain or loss from birth weight for each day of life for boys and girls separately and together. It will be seen that there are discrepancies in the numbers of babies weighed from day to day. A certain number of first day weights are missed because

TABLE 32
MEAN GAIN OR LOSS IN WEIGHT IN THE FIRST 10 DAYS OF LIFE BY SEX

Day	Girls			Boys			Sexes Combined		
	No.	Mean (oz.)	S.D. (oz.)	No.	Mean (oz.)	S.D. (oz.)	No.	Mean (oz.)	S.D. (oz.)
1	258	−2·55	2·48	259	−2·68	2·92	517	−2·61	2·71
2	295	−5·35	3·10	293	−5·57	3·24	589	−5·42	3·20
3	297	−5·59	4·55	298	−5·83	4·53	595	−5·71	4·55
4	294	−4·56	5·75	296	−4·80	5·99	590	−4·68	5·88
5	289	−3·42	6·64	295	−3·42	6·75	584	−3·42	6·70
6	283	−2·51	7·32	290	−2·23	7·20	573	−2·37	7·26
7	247	−1·60	7·97	250	−1·36	7·67	497	−1·48	7·82
8	158	−0·51	8·70	175	−0·25	7·69	333	−0·37	8·19
9	91	+0·56	8·60	99	+1·16	8·05	190	+0·87	8·33
10	32	+2·56	8·03	41	+2·90	8·11	73	+2·75	8·07

the time of their births coincided with the time of weighing. There is a marked decrease in numbers from the seventh day because of the departure of the mothers from hospital.

For the whole group, the maximum mean loss occurs on the third day, and amounts to 5.7 oz which is 5.0 percent of the mean birth weight (7.18 lb). The bulk of this loss is in the first two days. After the third day they start to gain weight at a rate of over an ounce a day, so that the group has regained birth weight on the ninth day.

Table 32 also shows that for boys and girls separately the maximum mean loss occurs on the third day. This is 5.6 oz for the girls and 5.8 oz for the boys, being 4.9 percent and 5.0 per cent of the respective mean birth weights (7.07 lb girls and 7.28 lb boys). The differences between the daily means for boys and girls are very slight, and none are statistically significant. Both groups regain their birth weight on the ninth day, having grown at almost exactly the same rate. Because of their superior birth weight, however, the boys remain heavier than the girls throughout this period.

The babies are divided into first babies (Rank 1) and later born (Rank 2+). Rank 1 babies lose more weight over a longer period than the Rank 2+ babies, and gain more slowly. They lose 7.2 oz in 3 days (being 6.5 per cent of the mean birth weight, which is 6.86 lb), and gain just less than an ounce a day to regain their birth weight on the tenth day. Rank 2+ babies, only lose 5.4 oz. in two days (4.6 per cent of the mean birth weight which is 7.28 lb). They then gain at a rate of nearly an ounce and a half per day, regaining their birth weight on the eighth day. (See Table 33 and Chart 6).

TABLE 33

MEAN GAIN OR LOSS IN WEIGHT IN THE FIRST 10 DAYS OF LIFE BY BIRTH RANK (SEXES COMBINED)

•	Rank 1			Rank 2+		
Day	No.	Mean (oz.)	S.D. (oz.)	No.	Mean (oz.)	S.D. (oz.)
1	135	−2·80	3·22	381	−2·55	2·50
2	150	−5·69	3·48	438	−5·39	3·07
3	152	−7·18	4·78	442	−5·22	4·34
4	151	−7·07	6·13	438	−3·88	5·54
5	149	−6·21	7·11	434	−2·48	6·26
6	145	−5·32	7·53	427	−1·38	6·89
7	133	−4·35	8·17	362	−0·43	7·43
8	101	−3·30	8·61	230	+0·90	7·67
9	72	−1·25	9·16	116	+2·14	7·51
10	27	+2·41	8·09	45	+3·00	8·14

CHART 6.

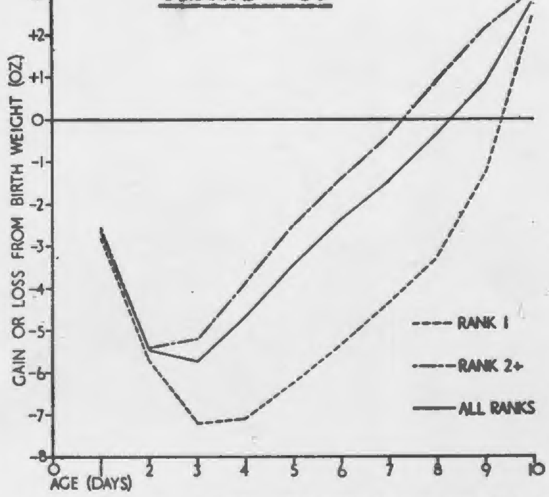

Figure.—Mean gain or loss in weight in the first 10 days of life, by birth rank (sexes combined).

The differences in mean loss between the ranks are small for the first two days and not statistically significant, but from the third to the eighth day the differences are larger, and are statistically significant. On the ninth day the difference approaches significance ($\frac{D}{S.E.}$: 2.6) and on the tenth day there is very little difference. When the boys and girls are examined separately, these rank differences are found to remain the same. (See Appendix 8).

2. Duration of loss of weight.

Although the average duration of loss of weight is three days, there is great variation among the individual babies, with seven babies not losing weight at all, and one baby losing for as long as eight days. 55.6 per cent of the babies lose for two days or less, 18.7 per cent lose for four days or more, and only 25.7 per cent actually lose for three days. There is practically no difference between the sexes with regard to this.

As there are so many unmarried mothers at this hospital (about 32 per cent) I decided to examine the effect of marital status on the duration of loss of weight. Table 34 shows the mean duration of loss for married and unmarried mothers, and also the effect of sex and rank. The mean duration of loss for the total group is 3.15 days.

In no case is a significant difference found between married and unmarried mothers, although in most cases the babies of unmarried

TABLE 34
DURATION OF LOSS OF WEIGHT, BY SEX, BIRTH RANK, AND MARITAL STATUS OF MOTHER

Sex	Marital Status of Mother	Rank 1			Rank 2+			All Ranks		
		No.	Mean (days)	S.D. (days)	No.	Mean (days)	S.D. (days)	No.	Mean (days)	S.D. (days)
Girls	Married	35	3·44	1·55	176	3·07	1·24	211	3·13	1·30
	Unmarried	38	3·82	1·58	45	3·08	1·18	83	3·42	1·42
	Total	74	3·64	1·56	222	3·07	1·22	296	3·21	1·34
Boys	Married	33	3·80	1·40	152	2·87	0·87	185	3·04	1·05
	Unmarried	44	3·41	1·18	67	3·08	1·14	111	3·21	1·17
	Total	78	3·56	1·29	221	2·93	0·96	299	3·10	1·09
Sexes Combined	Married	68	3·62	1·49	328	2·98	1·09	396	3·09	1·19
	Unmarried	82	3·60	1·39	112	3·08	1·16	194	3·30	1·29
	Total	152	3·60	1·43	443	3·00	1·10	595	3·15	1·22

mothers lose for slightly longer than those of married mothers. The difference between boys and girls is not significant, although the girls lose for slightly longer than the boys. However, the Rank 1 babies lose for a significantly longer time than the Rank 2+ babies. This shows up more in the boys than in the girls.

3. <u>Total initial loss</u>.

It is shown above that the maximum mean loss occurs on the third day, but because the duration of loss is so variable only 26 per cent of the babies reach their minimum weight on that day. It is necessary, therefore, to examine the mean amount of weight lost, regardless of when this occurs. This, again is done with reference to sex, rank, and marital status, and is shown in Table 35. The total initial loss ranges from 0 to 27 oz with a mean of 7.47 oz (6.5 per cent of body weight) and the percentage of weight loss remains constant for boys and

TABLE 35
TOTAL INITIAL LOSS OF WEIGHT, BY SEX, BIRTH RANK, AND MARITAL STATUS OF MOTHER

Sex	Marital Status of Mother	Rank 1			Rank 2+			All Ranks		
		No.	Mean (oz.)	S.D. (oz.)	No.	Mean (oz.)	S.D. (oz.)	No.	Mean (oz.)	S.D. (oz.)
Girls	Married	35	7·84	4·86	176	6·86	4·06	211	7·02	4·22
	Unmarried	38	8·79	5·41	45	7·59	5·16	83	8·14	5·31
	Total	74	8·28	5·16	222	7·03	4·32	296	7·34	4·58
Boys	Married	33	10·23	6·18	151	6·69	3·85	184	7·32	4·56
	Unmarried	44	9·52	5·61	67	7·22	4·56	111	8·13	5·13
	Total	78	9·78	5·85	220	6·83	4·08	298	7·60	4·79
Sexes Combined	Married	68	9·00	5·66	327	6·78	3·96	395	7·16	4·39
	Unmarried	82	8·18	5·53	112	7·37	4·81	194	8·13	5·21
	Total	152	9·05	5·57	442	6·93	4·20	594	7·47	4·69

girls. No significant difference is found in the weight loss of babies of married and unmarried mothers, nor is there any difference between boys and girls. However, a marked difference is again found between

Rank 1 and Rank 2+ babies, with Rank 1 babies losing significantly more weight than Rank 2+ babies (8.2 per cent of body weight as against 5.9 per cent).

4. Return to birth weight.

By the seventh day 17 per cent of the babies have already left hospital, and by the tenth day only 12 per cent of the babies still remain. Accordingly I decided to calculate the percentage of babies who regain or exceed their birth weight by the seventh day. Table 36 shows this for sexes and ranks separately and together. It can be seen that 47.7 per cent of all babies regain their birth weight by the seventh day. The figure is significantly greater for Rank 2+ babies than for Rank 1 babies (52 per cent as against 34 per cent). Although there are slight differences between boys and girls particularly in Rank 2+, these differences are not significant.

TABLE 36.

PERCENTAGE OF BABIES WHO REGAINED OR EXCEEDED THEIR BIRTH WEIGHT BY THE SEVENTH DAY, BY SEX AND BIRTH RANK

SEX	RANK 1		RANK 2+		ALL RANKS	
	No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage
Girls	74	33.8	224	49.6	298	45.6
Boys	78	34.6	220	55.0	298	49.7
Sexes combined.	152	34.2	444	52.3	596	47.7

This figure (47.7 per cent) underestimates the true position, since babies leaving hospital on the fourth, fifth and sixth days whilst still under birth weight, are included as not having regained their birth weight by the seventh day, although they might well have done so. By the method employed in survival tables, a cumulative percentage of those regaining birth weight each day is calculated for the sexes and ranks separately and combined. This is shown in Table 37, and the details of the calculations in Appendix 9. By this method it is found that

TABLE 37

CUMULATIVE PERCENTAGE OF BABIES REGAINING THEIR BIRTH WEIGHT EACH DAY, BY SEX AND BIRTH RANK

Day	Girls			Boys			Sexes Combined		
	Rank 1	Rank 2+	All Ranks	Rank 1	Rank 2+	All Ranks	Rank 1	Rank 2+	All Ranks
1	1·4	1·8	1·7	1·3	0·5	0·7	1·3	1·1	1·2
2	1·4	3·2	2·7	3·9	2·3	2·7	2·6	2·7	2·7
3	10·9	12·1	11·7	6·5	10·0	9·1	8·5	11·1	10·4
4	14·9	24·6	22·1	11·7	24·1	20·9	13·2	24·3	21·5
5	19·0	36·9	32·4	22·1	41·9	36·7	20·6	39·3	34·5
6	27·5	44·8	40·4	28·7	51·1	45·2	28·1	47·9	42·8
7	35·2	51·4	47·3	36·1	56·5	51·1	35·6	53·9	49·2
8	42·1	57·6	53·6	36·1	61·7	54·9	38·6	59·8	54·2
9	49·8	63·7	60·1	38·7	65·2	58·7	44·7	64·6	59·3
10	49·8	67·7	64·5	44·3	73·9	65·2	49·7	70·8	65·1

49.2 per cent of the babies have regained their birth weight by the seventh day, and 65.1 per cent by the tenth day. Again there is no sex difference when the ranks are combined, although the girls do slightly better than the boys in Rank 1, and the boys are a little ahead of the girls in Rank 2+. There is a marked difference between the ranks, 49.7 per cent of Rank 1 babies and 70.8 percent of Rank 2+ babies regaining their birth weight by the tenth day.

DISCUSSION OF FINDINGS.

Most observers agree that in terms of mean daily weights babies reach their minimum weight on the third day, losing from 5 per cent to 8 per cent of their birth weight (Meredith and Brown, 1939, Cole, 1939, Palmer and Ciocco, 1945, Parmelee, 1952). The present finding of a maximum mean loss of 5 per cent of birth weight on the third day compares well with the figures of other observers.

There is some difference of opinion as to the influence of sex on this loss. Martin (1931), Kugelmass, Berggren and Cummings (1933), and Shan-Yah Gin (1948) found that boys lost more weight than girls. Griffith and Gittings (1907) found that girls lost more weight, but for a shorter time. Meredith and Brown found no difference between the sexes. The results for the Bantu babies agree with those of Meredith and Brown in that girls and boys lose the same percentage of birth weight.

There is disagreement also on the effect of rank on the weight curves. Meredith and Brown found the loss to be slightly greater with increasing birth order. Longridge (1905) and Cole found no difference in the behaviour of first-born and later-born babies. Kugelmass, Berggren and Cummings found that first-born infants tended to lose more than siblings, while Griffith and Gittings state that "in children of primiparae the average loss is greater, the duration of loss is longer and day of regain of birth weight is later than in those of multiparae". The findings of the Bantu group are in exact agreement with those of Griffith and Gittings.

Griffith and Gittings, Meredith and Brown, and Parmelee all emphasize the variation found in individual babies with regard to the duration of weight loss. In this study losses vary from 0 - 8 days, with no difference between boys and girls, but with a marked difference between first-born and later-born infants. While Meredith and Brown's findings are in agreement with regard to the effect of sex, they found very little rank difference. On the other hand, the findings of Griffith and Gittings agree with regard to rank, but their girls lost for a shorter time than the boys. The marital status of the mothers appears to have no influence on the duration of loss of weight of the babies.

The mean amount of weight loss (irrespective of the day on which minimum weight was reached) is found to be 6.5 per cent of birth weight. This weight loss is lower than that reported by Meredith and Brown, Ramsey and Alley (1918), Tyson (1928) and Griffith and Gittings. Both these last-mentioned authors found the loss to be greater in girls than in boys, but Meredith and Brown found no difference. Here also no difference between boys and girls in the percentage loss of weight is found. The findings with regard to the effect of rank on this weight loss differ from those of Tyson and Meredith and Brown, who found weight loss to be greater in higher birth orders, whereas here the loss is greater for Rank 1 babies. Again the marital status of the mothers appears to have no effect on this weight loss.

It has been generally accepted by most observers that babies regain their birth weight between 10 and 14 days after birth (Parmelee). Palmer and Ciocco state that about 25 per cent of infants regain their birth weight by the seventh day, and 50 per cent by the tenth day. This is confirmed by the work of Griffith and Gittings, Ramsey and Alley, Meredith and Brown, and Chalmers (1952). Illingworth et al (1952) reported that 49 per cent of babies on "demand" feeding had regained their birth weight on the ninth day as compared to 36 per cent of babies fed on a rigid 4-hourly schedule. The figure of 59 per cent return to birth weight on the ninth day in this study compares very favourably with Illingworth's "demand" group, and, in general, is very much better than the other previously reported series.

Both Griffith and Gittings and Meredith and Brown found little difference between boys and girls in this respect and these findings are similar. On the other hand, Meredith and Brown found a tendency for first-born infants to regain birth weight earlier, while Griffith and Gittings found the opposite. In this series a significant difference is found between Rank 1 and Rank 2+ babies.

COMMENT.

I would like to emphasize both the similarities and the differences displayed by our Bantu group as compared with groups previously reported. As with all other babies, Bantu babies lose weight for the first three days after birth, and then start gaining. But their loss falls at the lower limit of the accepted range of loss, and their rate of gain is very much faster, so that a far greater percentage regain their birth weight by the seventh and tenth days than of those previously reported. There is also the undoubted superiority of the second and later born over the first born babies. I consider that the excellence of the Bantu mothers as breast feeders is the chief factor in the good progress of their babies, for a striking feature of Bantu mothers, including this group, is their abundance of breast milk, their complete acceptance of breast feeding, and the ease with which lactation is established and maintained. The accepted Bantu method of breast feeding, outside of hospitals, is self-demand feeding. Although this method could not be completely followed in hospital, owing to the 3-hourly routine, the babies shared their mothers' beds and I frequently observed that they were fed at other times. Although this group of Bantu mothers may be of a slightly higher economic level than the general Bantu population, in that they were able to afford the small hospitalisation charges, their general economic level is still very low.

SUMMARY.

598 healthy, breast fed Bantu babies were studied at McCord's Zulu Hospital in Durban for the first 10 days of life. They were all full-term, single births, of normal vertex delivery. They shared their mothers' beds, and were fed on an elastic 3-hourly schedule with a night feed.

1. The maximum mean loss of weight occurs on the third day after birth and amounts to 5.7 oz which is 5.0 per cent of the mean birth weight (7.18 lb).

2. After the third day they start to gain weight at the rate of over an ounce a day, so that the group has regained birth weight on the ninth day.

3. No difference is found between boys and girls.

4. Rank 1 babies lose for three days, and regain their birth weight by the tenth day. Rank 2+ babies lose for two days only, lose less weight, and regain their birth weight by the eighth day.

5. There is great individual variation in the duration of loss of weight (0 - 8 days), the mean being 3.15 days. There is no difference between boys and girls, but Rank 1 babies lose for a significantly longer time than Rank 2+ babies.

6. The total initial loss, irrespective of the day the minimum weight is reached, ranges from 0 - 27 ounces, with a mean of 7.47 oz. (6.5 per cent of birth weight). Again there is no sex difference, but a marked difference between the ranks, with Rank 1 babies losing 8.2 per cent of birth weight as against 5.9 per cent for the Rank 2+ babies.

7. The marital status of the mothers appears to have no effect on either the duration or the amount of loss.

8. By the method employed in survival tables it is found that 49.2 per cent of the babies regain their birth weight by the seventh day, and 65.1 per cent by the tenth day. No sex difference is found, but 70.8 per cent of Rank 2+ babies as opposed to 49.7 per cent of Rank 1 babies have regained their birth weight by the tenth day.

9. It is thought that the excellence of Bantu mothers as breast-feeders, and their method of breast feeding accounts for the good progress made by the babies.

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Appendix 8

DAILY GAIN OR LOSS OF WEIGHT IN THE FIRST 10 DAYS OF LIFE, BY SEX AND BIRTH RANK

Day	Girls						Boys					
	Rank 1			Rank 2+			Rank 1			Rank 2+		
	No.	Mean (oz.)	S.D. (oz.)	No.	Mean (oz.)	S.D. (oz.)	No.	Mean (oz.)	S.D. (oz.)	No.	Mean (oz.)	S.D. (oz.)
1	65	−2·55	2·34	193	−2·55	2·52	70	−3·01	3·84	188	−2·56	2·48
2	73	−5·14	2·70	222	−5·42	3·22	77	−6·30	3·91	216	−5·36	2·92
3	74	−6·49	4·56	223	−5·30	4·51	78	−7·85	4·89	219	−5·15	4·16
4	74	−6·43	6·01	220	−3·93	5·52	77	−7·68	6·17	218	−3·83	5·57
5	72	−5·69	6·82	217	−2·67	6·41	77	−6·69	7·34	217	−2·30	6·11
6	70	−4·86	7·54	213	−1·72	7·09	75	−5·72	7·52	204	−0·95	6·82
7	63	−4·40	8·14	183	−0·62	7·69	70	−4·31	8·20	179	−0·24	7·15
8	44	−3·27	9·33	113	+0·61	8·22	57	−3·32	8·01	117	+1·19	7·08
9	31	−1·13	10·22	59	+1·47	7·54	41	−1·34	8·27	57	+2·82	7·42
10	9	—	—	22	+0·73	8·56	18	—	—	23	+5·17	7·08

APPENDIX 9

CUMULATIVE PERCENTAGE OF BANTU BABIES REGAINING BIRTH WEIGHT EACH DAY ACCORDING TO THE NUMBER OF BABIES STILL IN HOSPITAL EACH DAY

1. RANK 1

	GIRLS							BOYS							SEXES COMBINED						
Day	No. who reg. B. Wt.	No. who did not reg. B. Wt.	TOTAL	% Reg. B. Wt.	% Exposed	No. exposed who reg. B. Wt.	Cumulative %	No. who reg. B. Wt.	No. who did not reg. B. Wt.	TOTAL	% Reg. B. Wt.	% Exposed	No. exposed who reg. B. Wt.	Cumulative %	No. who reg. B. Wt.	No. who did not reg. B. Wt.	TOTAL	% Reg B. Wt.	% exposed	No. exposed who reg B. Wt.	Cumulative %
1	1	73	74	1.4	100.0	1.4	1.4	1	77	78	1.3	100.0	1.3	1.3	2	150	152	1.3	100.0	1.3	1.3
2	0	73	73	0.0	98.6	0.0	1.4	2	75	77	2.6	98.7	2.6	3.9	2	148	150	1.3	98.7	1.3	2.6
3	7	66	73	9.6	98.6	9.5	10.9	2	73	75	2.7	96.1	2.6	6.5	9	139	148	6.1	97.4	5.9	8.5
4	3	63	66	4.5	89.1	4.0	14.9	4	68	72	5.6	93.5	5.2	11.7	7	131	138	5.1	91.5	4.7	13.2
5	3	59	62	4.8	85.1	4.1	19.0	8	60	68	11.8	88.3	10.4	22.1	11	119	130	8.5	86.8	7.4	20.6
6	6	51	57	10.5	81.0	8.5	27.5	5	54	59	8.5	77.9	6.6	28.7	11	105	116	9.5	79.4	7.5	28.1
7	5	42	47	10.6	72.5	7.7	35.2	5	43	48	10.4	71.3	7.4	36.1	10	85	95	10.5	71.9	7.5	35.6
8	3	25	28	10.7	64.8	6.9	42.1	0	36	36	0.0	63.9	0.0	36.1	3	61	64	4.7	64.4	3.0	38.6
9	2	13	15	13.3	57.9	7.7	49.8	2	23	25	4.0	63.9	2.6	38.7	4	36	40	10.0	61.4	6.1	44.7
10	-	-	-	-	50.2	-	-	1	10	11	9.1	61.3	5.6	44.3	1	10	11	9.1	55.3	5.0	49.7

2. RANK 2+

	GIRLS							BOYS							SEXES COMBINED						
1	4	220	224	1.8	100.0	1.8	1.8	1	219	220	.5	100.0	.5	.5	5	439	444	1.1	100.0	1.1	1.1
2	3	217	220	1.4	98.2	1.4	3.2	4	215	219	1.8	99.5	1.8	2.3	7	432	439	1.6	98.9	1.6	2.7
3	20	197	217	9.2	96.8	8.9	12.1	17	198	215	7.9	97.7	7.7	10.0	37	395	432	8.6	97.3	8.4	11.1
4	28	169	197	14.2	87.9	12.5	24.6	31	167	198	15.7	90.0	14.1	24.1	59	336	395	14.9	88.9	13.2	24.3
5	27	139	166	16.3	75.4	12.3	36.9	39	128	167	23.4	75.9	17.8	41.9	66	267	333	19.8	75.7	15.0	39.3
6	17	119	136	12.5	63.1	7.9	44.8	20	106	126	15.9	58.1	9.2	51.1	37	225	262	14.1	60.7	8.6	47.9
7	12	88	100	12.0	55.2	6.6	51.4	10	81	91	11.0	48.9	5.4	56.5	22	169	191	11.5	52.1	6.0	53.9
8	7	48	55	12.7	48.6	6.2	57.6	7	47	54	12.0	43.5	5.2	61.7	14	95	109	12.8	46.1	5.9	59.8
9	4	24	28	14.3	42.4	6.1	63.7	2	20	22	9.1	38.3	3.5	65.2	6	44	50	12.0	40.2	4.8	64.6
10	1	8	9	11.1	36.3	4.0	67.7	2	6	8	25.0	34.8	8.7	73.9	3	14	17	17.6	35.4	6.2	70.8

3. ALL RANKS

	GIRLS							BOYS							SEXES COMBINED						
1	5	293	298	1.7	100.0	1.7	1.7	2	296	298	.7	100.0	.7	.7	7	589	596	1.2	100.0	1.2	1.2
2	3	290	293	1.0	98.3	1.0	2.7	6	290	296	2.0	99.3	2.0	2.7	9	580	589	1.5	98.8	1.5	2.7
3	27	263	290	9.3	97.3	9.0	11.7	19	271	290	6.6	97.3	6.4	9.1	46	534	580	7.9	97.3	7.7	10.4
4	31	232	263	11.8	88.3	10.4	22.1	35	235	270	13.0	90.9	11.8	20.9	66	467	533	12.4	89.6	11.1	21.5
5	30	198	228	13.2	77.9	10.3	32.4	47	188	235	20.0	79.1	15.8	36.7	77	386	463	16.6	78.5	13.0	34.5
6	23	170	193	11.9	67.6	8.0	40.4	25	160	185	13.5	63.3	8.5	45.2	48	330	378	12.7	65.5	8.3	42.8
7	17	130	147	11.6	59.6	6.9	47.3	15	124	139	10.8	54.8	5.9	51.1	32	254	286	11.2	57.2	6.4	49.2
8	10	73	83	12.0	52.7	6.3	53.6	7	83	90	7.8	48.9	3.8	54.9	17	156	173	9.8	50.8	5.0	54.2
9	6	37	43	14.0	46.4	6.5	60.1	4	43	47	8.5	45.1	3.8	58.7	10	80	90	11.1	45.8	5.1	59.3
10	1	8	9	11.1	39.9	4.4	64.5	3	16	19	15.8	41.3	6.5	65.2	4	24	28	14.3	40.7	5.8	65.1

CHAPTER VIII.

THE EFFECT OF BIRTH WEIGHT AND TIME OF FIRST FEED ON THE WEIGHT OF BANTU BABIES IN THE FIRST 10 DAYS OF LIFE.

MATERIAL AND METHOD.

The same babies are used in this study as in the previous section, i.e. 598 full-term Bantu babies, born of normal vertex delivery, who were well during their stay in hospital. For this study it was necessary to have the birth weight of the baby, and also the time at which the baby was first put to the breast. Of this group there are 596 babies of known birth weight, and 577 babies whose time of first feed is recorded.

I divided the babies into three birth weight groups, i.e. 5 lb 8 oz to 6 lb 7 oz, 6 lb 8 oz to 7 lb 15 oz, and 8 lb and over, and compared their progress.

With regard to the time of first feed after birth, I planned to compare three groups, viz. those fed as soon after birth as possible, those fed as late after birth as possible, and those in between. However, I soon found that this interfered with the hospital routine to a large extent, and although it was possible to have babies fed soon after birth, it was extremely difficult to have the first feed delayed much longer than ten hours. As a result the three feeding groups are:

1. Those fed within the first hour (59 minutes or less).
2. Those fed between one and six hours after birth (1 hour to 5 hours 59 minutes).
3. Those fed six or more hours after birth (6 hours or more).

The distribution of the times of the first feed in single hours is shown in Appendix 10.

As in the previous chapter, daily gains or losses from birth weight are calculated, also the total initial loss and the duration of loss. This is done for the three birth weight groups and the three feeding groups, sexes and ranks separately.

RESULTS.

A. (1) The Relation Between Birth Weight And Loss Of Weight After Birth.

(a) Mean daily loss in weight.

Longridge (1905), Griffith and Gittings (1907), and Martin (1931) found that the heavier the baby, the more weight lost. Hammett (1918) and Meredith and Brown (1939) found the loss for heavy infants to be both absolutely and relatively greater than for light infants, but Ramsey and Alley (1918) and Naish and Edwards (1952) found no difference in percentage weight loss.

The babies are divided into three birth weight groups as previously stated, and will be referred to as light, average and heavy babies.

Since birth rank has a marked influence on weight loss after birth - first babies losing more weight than later born babies (see Chapter VII), Ranks 1 and 2+ are investigated separately. The results show that the heavier babies tend to lose more weight, both actual and relative, than the light babies (Appendix 11). Further, in Rank 1 the heavier babies lose for a day longer than the lighter babies. In Rank 2+, however, all the babies lose for the same time (two days) except for the light boys, who inexplicably lost for three days.

(b) Total initial loss.

As mentioned in the previous chapter, not all the babies reached their minimum weight on the third day, and it is necessary to examine the mean amount of weight lost regardless of when this occurs. A decided difference in the total initial loss is found, with the heavier babies losing more actual weight. This applies to both sexes, and to Ranks 1 and 2+ separately. The relative loss of weight, expressed as a percentage of birth weight, shows little difference between the birth weight groups, and these results are not consistent. (Appendix 12). The heavier babies lose for a slightly longer period, but the differences are very small. (Appendix 13).

A. (2) The Relationship Between Birth Weight And Regain Of Weight.

Hammett (1918) reported that "the lighter the initial weight, the earlier the recovery of weight loss". Martin (1931), however, found no difference in the weight gain of lighter or heavier babies. Meredith and Brown (1939) stated that the actual gain was more for light babies.

(a) Gain.

As some birth weight groups have no information after the seventh day, investigation into the weight gain has to be limited to the first four days after the day of minimum weight. Table 38 shows the actual amount of gain in those four days, and also the relative amount, as a percentage of birth weight. It can be seen that Rank 1 is quite consistent, and for both girls and boys average babies gain more actual and more relative weight than light babies. In Rank 2+ the picture is different - for both girls and boys the relative weight gain is greatest for the light babies and smallest for the heavy babies. In actual amount of gain, however, while the light girls gain the most, it is reversed for the boys, with the heavy babies gaining the most.

TABLE 38

GAIN IN 4 DAYS FROM MINIMUM WEIGHT.

	RANK 1				RANK 2+			
	Girls Amount	Girls %	Boys Amount	Boys %	Girls Amount	Girls %	Boys Amount	Boys %
Birth Weight Groups:	oz.		oz.		oz.		oz.	
Light	1.74	1.8	4.38	4.6	3.76	3.9	4.05	4.2
Average	3.19	2.8	5.69	5.0	3.73	3.2	4.45	3.8
Heavy	-	-	-	-	3.53	2.4	4.89	3.6

(b) Return to birth weight by seventh day.

The percentage of babies who regain birth weight by the seventh day is the resultant of

(i) the amount of weight loss;

(ii) the duration of that loss; and

(iii) the rate of gain thereafter.

In Rank 1 girls a greater percentage of the light babies regain their birth weight than the average babies, whereas for the boys there is a very slight difference in the opposite direction. In Rank 2+

the lighter girls again do very much better than the heavier girls, whereas the average boys do better than the rest. (See Appendix 14).

(c) Day on which group returns to birth weight.

This is only applicable to Rank 2+ babies. (See Appendix 11). Here again the light girls do better than the rest, for although both light and average babies regain their birth weight by the eighth day, the light babies are 1.9 oz over birth weight, whereas the average girls are only .5 oz over birth weight. The average boys again do better than the other groups, regaining birth weight by the seventh day. As the groups in Rank 1 had not regained birth weight, I compared seventh day losses as a percentage of birth weight. In both girls and boys the light babies are closer to birth weight than the average babies.

The effect of birth weight, then, on loss and gain of weight after birth shows no clear pattern. Results vary both for the ranks and the sexes. I decided, therefore, in an endeavour to obtain a clearer picture, to score the groups for the categories previously mentioned, i.e.

1. Day of maximum loss.
2. Amount of loss as a percentage of birth weight.
3. Total initial loss as a percentage of birth weight.
4. Duration of loss.
5. Gain in four days after minimum weight.
6. Percentage who regain birth weight by the seventh day.
7. Day on which group returns to birth weight.

Whichever group does best in each category is given one point, and in the event of two or three groups doing equally well, they each score one point.

It is obvious from Table 39, that the light girls do better than the others both in Rank 1 and Rank 2+. Light boys do better in Rank 1, but average boys do best in Rank 2+.

It is still a fact, however, that because of their superior birth weight, the heavy babies retain their lead (as far as actual weight is concerned) over the average and light babies on discharge from hospital.

TABLE 39.

COMPARISON OF THREE BIRTH WEIGHT GROUPS WITH RESPECT TO VARIOUS FACTORS. SEXES AND RANKS SEPARATELY.

	RANK 1														RANK 2+													
	Girls							Boys							Girls							Boys						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Light	1	1	1			1	1	1	1	1	1			1	1	1	1	1	1	1	1				1	1		
Average				1	1					1		1	1		1							1	1	1	1		1	1
Heavy															1							1						

B. <u>The Effect of Time of First Feed after Birth on the Progress of the Babies.</u>

The three feeding groups (called hereafter early, middle and late), are analysed with regard to loss and gain in weight in the same way as the birth weight groups. One of the seven categories (gain in four days after minimum weight) is omitted because of insufficient data. (See Appendices 12, 13, 14 and 15).

(a) <u>Mean daily loss in weight.</u>

In Rank 1 babies, the girls of the late feeding group lose less percentage weight than the middle group, with the same duration of loss (Appendix 15). (Insufficient data for early feeders). In the boys, the middle feeders do better - both for percentage weight loss and duration of loss than the early feeders (insufficient data for late feeders). In Rank 2+, for both boys and girls the middle feeding group are best with regard to percentage loss of weight, and the middle and late feeding girls lose for a shorter period than the early feeding girls. However, the early feeding boys lose for the shortest time.

(b) <u>Total initial loss of weight.</u>

In Rank 1 the late feeding girls and the middle feeding boys do best, whereas in Rank 2+, the middle feeding girls and the early feeding boys do best. The duration of this loss of weight follows almost exactly the same pattern as the total initial loss. (Appendices 12 and 13).

(c) <u>Return to birth weight</u>.

In Rank 1 the middle feeding girls and boys, and in Rank 2+ the middle feeding girls and the early feeding boys are superior in the percentage who regain their birth weight by the seventh day. (Appendix 14). With regard to the day on which the group returns to birth weight, there is insufficient data for Rank 1. In Rank 2+, the middle feeding girls and the early feeding boys return to birth weight soonest.

Here again the picture is not clear, and the same scoring procedure is followed, with the omission of the one criterion mentioned previously. Table 40 shows quite an interesting pattern: In Rank 1 it appears that late feeding girls and middle feeding boys progress most favourably, and the same applies to middle feeding girls and early feeding boys in Rank 2+.

TABLE 40.

COMPARISON OF THREE FEEDING GROUPS, WITH RESPECT TO VARIOUS FACTORS. SEXES AND RANKS SEPARATELY.

	RANK 1												RANK 2+											
	Girls						Boys						Girls						Boys					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
59 minutes or less																			1		1	1	1	1
1 - 5 hours	1				1		1	1	1	1	1	1	1	1	1	1	1	1		1				
6 hours or more	1	1	1	1									1									1		

<u>DISCUSSION</u>.

The birth weight of the baby and the time of first feed after birth do affect the progress of the baby in the first ten days of life, although these factors are not nearly as strong as the rank factor.

The effect of birth weight on progress after birth is slight. With regard to mean daily loss of weight the heavier babies lose more actual and relative weight than the lighter babies, and on the whole for a longer period. The total initial loss is also greater for heavier babies, although the relative loss is much the same. As far as the effect of birth weight on gain after birth is concerned, the average Rank 1 babies gain the most relative and absolute weight. In Rank 2+ the light babies gain most relative weight, but the actual amount of weight gained varies for boys and girls. On the whole the light girls and the average boys return to birth weight soonest, and a greater percentage of babies in these two groups regain birth weight by the seventh day.

When each category is scored, the total progress picture shows that for girls in Rank 1 and Rank 2+ the light babies do best. For boys this differs with the ranks - light boys being better off in Rank 1, and average boys in Rank 2+.

As mentioned previously, although the heavy babies lose more weight, and do not gain as much as the light and average babies, they are still the heaviest group on discharge from hospital owing to their superior birth weight. Various investigators have studied the effect of birth weight on subsequent growth. Illingworth et al (1949) found that throughout childhood the average child who was a small baby at birth weighed considerably less than the average child who at birth was a large baby. Lowe and Gibson (1953) stated that "the mean weight at third birthday is closely related to the birth weight". Parfit (1951), however, points out that the actual amount of weight gain is the same for the different birth weight groups after the first month, and Hammond (1952) also found that birth weight appeared to have no effect on weight gain in the first years. This means, in effect, that heavier babies at birth remain heavier subsequently, but that smaller babies gain more relative weight than larger babies, since the actual increments are the same.

The time of first feed after birth has a greater effect on subsequent progress than has birth weight. In Rank 1, for all measures of loss of weight and the duration of that loss, the late feeding girls and the middle feeding boys have the advantage. In Rank 2+, the middle feeding girls are unequivocally superior to the other groups. The differences are not as striking in the boys, although there is a tendency for the early feeding group to lead. The middle feeding girls and the early feeding boys in Rank 2+ also return to birth weight soonest, while in Rank 1 both boys and girls of the middle feeding group do best.

When the categories are scored, an interesting pattern emerges. (Table 40). Second and later born babies can advantageously be fed earlier than first born babies, and boys can be fed earlier than girls.

A very tentative explanation for these findings may be that Bantu boys recover more quickly from the stress of labour than Bantu girls, and that second and later born babies are less affected than first born babies.

There appears to be no reference in the literature to the effect of time of first feed after birth on the subsequent progress of the babies. Enquiries at the leading maternity hospitals and nursing homes in Durban reveal that the routine time of first feed after birth varies from three to twelve hours, with no definite reasons given for the time interval chosen. Various obstetric and baby-feeding textbooks in England and America give time of first feed after normal delivery to be anything between 8 and 24 hours after birth, the reasons adduced being to allow the mothers and babies to recover from the effects of labour. It would appear that investigation in this field is necessary if we are to have any scientific reason for a particular time interval between birth and first feed.

SUMMARY AND CONCLUSIONS.

Full-term babies, born of normal vertex delivery, who were well during their stay in hospital, are studied with reference to the effect of birth weight and the time of first feed on their progress in the first ten days of life. There are 596 babies of known birth weight, and 577 babies whose time of first feed is recorded.

(a) The effect of birth weight is slight.

1. In all ranks heavier babies lose more actual and relative weight than lighter babies, and on the whole for a longer period.

2. In Rank 1, the average babies gain more absolute and relative weight than the light babies.

3. In Rank 2+, the light babies gain most relative weight, although the actual weight gain varies for boys and girls.

4. In all ranks the light girls and the average boys return to birth weight soonest.

5. The total progress picture shows that light girls do best in all Ranks. Light boys are better off in Rank 1, and average boys in Rank 2+.

However, owing to their superior birth weight, heavy babies still weigh the most on discharge from hospital.

(b) Time of first feed after birth has a greater effect on subsequent progress than does birth weight.

1. In Rank 1, late feeding girls and middle feeding boys lose less weight, and for a shorter period than the other groups, while in Rank 2+, middle feeding girls and early feeding boys have the smallest loss.

2. In Rank 1, middle feeding girls and boys return to birth weight soonest, while in Rank 2+, middle feeding girls and early feeding boys are superior.

3. The total progress picture shows that second and later born babies can be fed earlier than first-born, and boys can be fed earlier than girls.

With the exception of first-born girls, babies are best off when fed within six hours of birth.

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APPENDIX 10

Distribution of times of first feed

HOURS AFTER BIRTH	BOYS		GIRLS	
	Rank 1	Rank 2+	Rank 1	Rank 2+
0	21	68	18	68
1	13	25	11	34
2	16	21	7	22
3	7	14	6	28
4	3	14	5	11
5	2	13	4	9
6	2	9	3	9
7	5	10	2	7
8	2	10	5	10
9	1	11	3	8
10	3	10	2	6
11	..	1	2	1
12	..	..	3	..
13	..	1	..	..
14	..	1	..	2
15	1	1	..	..
16	..	..	..	..
17	..	..	..	..
18	..	1	..	..
19	..	1	..	..
20	..	..	..	..
21	..	..	1	..
22	..	1	..	1
27	..	..	..	1

APPENDIX 11 a

Mean daily gain or loss in weight in ounces according to birth weight—girls

Rank 1

	6 LB 7 OZ OR LESS			6 LB 8 OZ-7 LB 15 OZ			8 LB OR MORE		
DAY	NO	MEAN	SD	NO	MEAN	SD	NO	MEAN	SD
1	26	−1.73	1.78	33	−2.89	2.26	6	..	..
2	30	−4.00	1.65	37	−5.58	2.94	6	..	..
3	30	−5.20 (5.4%)	3.48	38	−7.21	5.29	6	..	..
4	30	−5.13	5.21	38	−7.37 (6.4%)	6.77	6	..	..
5	29	−4.86	5.58	37	−6.51	7.87	6	..	..
6	28	−4.07	6.33	36	−5.78	8.70	6	..	..
7	26	−3.46 (−3.6%)	6.64	32	−5.44 (−4.7%)	9.38	5	..	..
8	17	..	..	22	−4.18	10.61	5	..	..
9	13	..	..	15	..	..	3	..	..
10	5	..	..	3	..	..	1	..	..

Rank 2+

	6 LB 7 OZ OR LESS			6 LB 8 OZ-7 LB 15 OZ			8 LB OR MORE		
DAY	NO	MEAN	SD	NO	MEAN	SD	NO	MEAN	SD
1	41	−2.26	2.03	123	−2.44	2.39	29	−3.40	3.37
2	56	−4.20 (4.3%)	2.69	132	−5.64 (4.9%)	3.27	34	−6.59 (4.8%)	3.21
3	56	−4.04	4.11	133	−5.63	4.61	34	−6.06	4.37
4	55	−2.64	5.63	131	−4.33	5.36	34	−4.47	5.62
5	54	−1.81	6.52	129	−2.84	6.23	34	−3.35	6.73
6	54	−0.44	6.95	125	−1.91	6.89	34	−3.06	7.66
7	46	−0.30	7.42	107	−0.51	7.75	30	−1.47	7.84
8	28	+1.86	8.02	68	+0.53	7.91	17	..	..
9	15	..	..	33	−0.27	7.42	11	..	..
10	7	..	..	11	..	..	4	..	..

APPENDIX 11 b

Mean daily gain or loss in weight in ounces according to birth weight—boys

Rank 1

	6 LB 7 OZ OR LESS			6 LB 8 OZ-7 LB 15 OZ			8 LB OR MORE		
DAY	NO	MEAN	SD	NO	MEAN	SD	NO	MEAN	SD
1	25	−2.62	2.39	37	−2.58	3.06	8	..	..
2	27	−5.59	2.23	41	−5.93	3.78	9	..	..
3	27	−6.56 (6.9%)	3.90	41	−8.32	5.16	10	..	..
4	27	−6.26	5.39	40	−8.45 (7.4%)	6.71	10	..	..
5	27	−5.07	5.90	40	−7.60	8.16	10	..	..
6	25	−4.84	5.90	40	−6.05	8.40	10	..	..
7	22	−2.18 (2.3%)	6.05	38	−5.05 (4.4%)	8.94	10	..	..
8	16	..	..	33	−2.76	8.54	8	..	..
9	9	..	..	25	−0.12	8.16	7	..	..
10	5	..	..	10	..	..	3	..	..

Rank 2+

	6 LB 7 OZ OR LESS			6 LB 8 OZ-7 LB 15 OZ			8 LB OR MORE		
DAY	NO	MEAN	SD	NO	MEAN	SD	NO	MEAN	SD
1	24	−2.00	2.33	116	−2.41	2.29	48	−3.19	2.87
2	28	−4.07	2.73	133	−5.10 (4.4%)	2.60	55	−6.65 (4.9%)	3.25
3	29	−4.38 (4.5%)	3.37	134	−4.70	3.95	56	−6.61	4.64
4	29	−3.69	4.50	133	−3.33	5.62	56	−5.11	5.74
5	29	−2.52	5.27	134	−1.73	6.06	54	−3.59	6.46
6	28	−1.50	5.80	131	−0.65	6.83	55	−1.76	6.65
7	24	−0.33	6.77	109	+0.03	7.55	46	−0.83	6.27
8	15	..	..	70	+1.37	7.82	32	+1.19	5.80
9	8	..	..	31	+2.29	8.45	18	..	..
10	2	..	..	12	..	..	9	..	..

APPENDIX 12

Total initial loss of weight (in ounces)

	RANK 1						RANK 2+					
	GIRLS			BOYS			GIRLS			BOYS		
	NO	MEAN	SD	NO	MEAN	SD	NO	MEAN	SD	NO	MEAN	SD
Birth Wt Groups												
6 lb 7 oz or less	30	7.00 (7.3%)	3.94	27	8.54 (8.9%)	4.45	56	5.73 (5.8%)	3.56	30	5.70 (5.8%)	3.24
6 lb 8 oz-7 lb 15 oz	38	9.11 (7.9%)	6.07	41	10.13 (8.9%)	6.35	132	7.32 (6.4%)	4.32	134	6.52 (5.6%)	3.86
8 lb or more	6	..	..	10	..	..	34	8.03 (5.9%)	4.93	56	8.16 (6.0%)	4.64
Time of First Feed after Birth												
59 minutes or less	18	..	..	21	10.98	5.47	68	7.87	4.70	68	6.62	3.50
1-5 hours	33	9.05	5.54	41	9.16	6.01	104	6.47	4.12	87	7.01	4.28
6 hours or more	21	7.17	4.31	14	..	..	45	7.23	3.97	57	6.94	4.58

APPENDIX 13

Duration of loss of weight in days

	RANK 1						RANK 2+					
	GIRLS			BOYS			GIRLS			BOYS		
	NO	MEAN	SD	NO	MEAN	SD	NO	MEAN	SD	NO	MEAN	SD
Birth Wt Groups												
6 lb 7 oz or less	30	3.70	1.49	27	3.46	1.14	56	3.00	1.13	30	2.90	1.02
6 lb 8 oz-7 lb 15 oz	38	3.63	1.70	41	3.74	1.30	132	3.09	1.23	135	2.89	1.00
8 lb or more	6	..	..	10	..	..	34	3.12	1.35	56	3.04	.82
First Feed												
59 minutes or less	18	..	..	21	3.98	1.53	68	3.18	1.25	68	2.90	.96
1-5 hours	33	3.99	1.74	41	3.38	1.09	104	2.94	1.12	87	3.02	1.04
6 hours or more	21	3.60	1.51	14	..	..	45	3.23	1.44	57	2.87	.89

APPENDIX 14

Percentage of babies who had regained birth weight by the 7th day

	RANK 1				RANK 2+			
	GIRLS		BOYS		GIRLS		BOYS	
	NO	%	NO	%	NO	%	NO	%
Birth Weight Groups								
6 lb 7 oz or less	30	43.3	27	33.3	56	55.4	30	46.7
6 lb 8 oz-7 lb 15 oz	38	26.3	41	34.1	133	48.9	135	57.8
8 lb or more	6	..	10	..	35	42.9	55	52.7
Time of First Feed After Birth								
59 minutes or less	18	..	21	23.8	68	42.6	68	66.2
1-5 hours	33	39.4	41	39.0	104	55.8	87	54.0
6 hours or more	21	23.8	14	..	45	48.9	57	42.1

APPENDIX 15 a

Mean daily gain or loss in weight in ounces according to time of first feed after birth

Girls: Rank 1

	59 MINUTES OR LESS			1-5 HOURS			6 HOURS OR MORE		
DAY	NO	MEAN	SD	NO	MEAN	SD	NO	MEAN	SD
1	17	..	..	28	−2.57	2.49	19	..	..
2	18	..	..	33	−5.29	2.68	20	−4.85	2.65
3	18	..	..	33	−6.52	4.95	21	−6.02	3.66
4	18	..	..	33	−6.70 (6.1%)	6.70	21	−6.24 (5.6%)	4.51
5	17	..	..	33	−5.55	7.62	20	−5.80	5.31
6	17	..	..	33	−4.82	8.40	18	..	..
7	14	..	..	29	−4.66	9.23	18	..	..
8	13	..	..	17	..	..	12	..	..
9	8	..	..	13	..	..	8	..	..
10	2	..	..	5	..	..	2	..	..

Girls: Rank 2+

	59 MINUTES OR LESS			1-5 HOURS			6 HOURS OR MORE		
DAY	NO	MEAN	SD	NO	MEAN	SD	NO	MEAN	SD
1	55	−3.06	2.83	90	−2.19	2.55	43	−2.57	1.82
2	67	−5.95	3.31	103	−5.02 (4.3%)	3.34	45	−5.79 (4.9%)	2.43
3	67	−6.16 (5.3%)	4.80	104	−4.67	4.54	45	−5.41	3.87
4	67	−5.00	6.00	102	−2.84	5.33	44	−4.50	4.93
5	66	−3.61	6.84	99	−1.69	6.33	45	−2.91	5.75
6	64	−2.78	7.88	99	−0.64	6.81	43	−2.12	6.37
7	56	−2.18	8.56	87	+0.56	7.47	37	−0.73	6.41
8	32	−0.44	9.18	56	+1.68	7.81	22	0.00	7.74
9	10	..	..	33	+2.52	7.88	15	..	..
10	3	..	..	11	..	..	7	..	..

APPENDIX 15 b

Boys: Rank 1

	59 MINUTES OR LESS			1-5 HOURS			6 HOURS OR MORE		
DAY	NO	MEAN	SD	NO	MEAN	SD	NO	MEAN	SD
1	16	..	..	39	−2.03	3.32	13	..	..
2	21	−6.71	4.20	40	−5.95	3.95	14	..	..
3	21	−8.14	4.39	41	−7.39 (6.6%)	5.18	14	..	..
4	21	−8.33 (7.5%)	4.71	40	−6.80	6.71	14	..	..
5	21	−7.48	5.98	40	−5.95	7.95	14	..	..
6	21	−7.00	6.82	38	−4.89	7.87	14	..	..
7	20	−6.20 (5.6%)	7.55	37	−3.11 (2.8%)	8.33	13	..	..
8	17	..	..	30	−1.73	7.91	10	..	..
9	15	..	..	18	..	..	8	..	..
10	5	..	..	8	..	..	5	..	..

Boys: Rank 2+

	59 MINUTES OR LESS			1-5 HOURS			6 HOURS OR MORE		
DAY	NO	MEAN	SD	NO	MEAN	SD	NO	MEAN	SD
1	58	−2.97	2.53	74	−2.72	2.94	48	−1.98	1.65
2	68	−5.44 (4.6%)	2.87	84	−5.19	2.95	56	−5.57	2.93
3	69	−5.14	3.58	86	−5.31 (4.4%)	4.15	56	−5.61 (4.7%)	4.60
4	69	−3.38	4.82	85	−4.11	5.82	56	−4.50	5.92
5	69	−1.81	5.35	85	−2.60	6.28	56	−2.82	6.73
6	67	−0.13	6.15	85	−1.19	6.45	55	−2.24	7.44
7	57	+0.82	6.18	71	−0.10	6.96	47	−1.77	8.42
8	37	+3.54	6.49	47	+1.04	6.26	29	−1.62	8.32
9	17	..	..	23	+3.00	6.21	15	..	..
10	9	..	..	8	..	..	5	..	..

Figures in parentheses show percentage of birth weight lost by day of maximum loss; and also, for purposes of comparison, on 7th day where no information is available as to when the group regained its birth weight.

CHAPTER IX

COMPARISON OF NEONATAL PROGRESS IN THE FIRST WEEK OF LIFE IN EUROPEAN, COLOURED, BANTU AND INDIAN BABIES.

1. WITH RESPECT TO SEVEN FACTORS.

The neonatal progress in the Bantu has been discussed in detail in the preceding chapters. Data were next collected for European, Coloured and Indian neonates, and analysed as for the Bantu babies. The records of 646 European and 344 Coloured babies born full-term at the Addington Hospital, Durban, from 1st May 1951 to 30th April, 1952, are used for this purpose, and the Indian data are collected from McCord's Zulu Hospital, Durban. Since the numbers of Indian babies delivered in this hospital is small, records over three years are used, from November, 1950 to October, 1953, giving a total of 530 full-term infants.

Results are shown for the three birth weight groups separately and together, for boys and girls, Ranks 1 and 2+.

Analyses used in these groups for comparison with the Bantu group are as follows and are shown in appendices 16 - 22:

1) The mean daily gain or loss from birth weight in the first seven days of life.
2) The total initial loss of weight.
3) The duration of that loss.
4) The gain in four days from minimal weight.
5) The percentage of babies who regain their birth weight by the seventh day.

The four racial groups are then compared with respect to seven factors, namely:

1) Day of maximum loss of weight.
2) Amount of loss as percentage of birth weight.
3) Total initial loss of weight as a percentage of birth weight.
4) The duration of that total initial loss of weight.
5) Gain in weight in four days after minimal weight.
6) The percentage of babies who regain their birth weight by the seventh day.

7) The amount and percentage of weight below birth weight on the seventh day.

This comparison is shown in Table 41 a and b, and Appendix 23 shows the significance of differences between the four groups with regard to three of the factors.

RESULTS.

In discussing the results of the comparison between the four groups, I deal first with all the girls and then with all the boys. Rank 1 and Rank 2+ are then considered separately, with the sexes in the same order. Loss of weight is treated before gain in weight.

GIRLS, ALL RANKS.

Loss in weight. With regard to mean daily loss from birth weight, the European and Coloured groups are almost identical, losing 5½ per cent of body weight, whereas the Bantu and Indian groups lose less weight - under 5 per cent. All groups lose for three days, except the Coloured, who lose for two days. A consideration of the total initial loss of weight shows that the percentage loss of weight is not very different for the four groups, but that the Bantu and Indian girls lose for a significantly longer time than the European and Coloured girls (approximately 3¼ days as against 2¾ days).

Gain in weight. In the first four days after minimal weight is reached, the Bantu babies gain the greatest percentage of weight, followed by the Coloured and then by the Indian babies, with the European infants gaining least. As a result of these losses and gains, by the seventh day of life 45 per cent of the Bantu girls have regained their birth weight. The Indian girls follow with 37 per cent and the Coloured with 32 per cent, but the Europeans are a significant last with only 20 per cent of the group back to birth weight. The average weight of the total Bantu group by the seventh day is only 1.4 per cent below birth weight, the Coloured 2.0 per cent, the Indians 2.8 per cent and the Europeans still 4.1 per cent below birth weight.

The big difference between the racial groups here appears to be in the rate of gain, with the Bantu girls easily the best gainers and the European girls the worst.

TABLE 41A

COMPARISON OF RACES WITH REGARD TO 7 FACTORS

WEIGHT OF BABIES IN THE FIRST 7 DAYS.

GIRLS

RANK 1

	EUROPEAN		COLOURED		BANTU		INDIAN	
Number	130		54		74		97	
Average amount & % of loss	6.4 oz.	5.4%	5.9 oz.	5.4%	6.5 oz.	6.0%	5.5 oz.	5.3%
Average time of loss	2 days		2 days		3 days		3 days	
Amount and % of total loss	7.49 oz.	6.4%	6.56 oz.	6.0%	8.28 oz.	7.6%	6.64 oz.	5.8%
Duration of loss	2.83 days		2.61 days		3.64 days		3.33 days	
Amount and % gained in 4 days	1.38 oz.	1.2%	3.7 oz.	3.3%	2.1 oz.	1.9%	1.84 oz.	1.8%
Amt. & % below b.wt on 7th day	4.4 oz	3.8%	2.3 oz.	2.0%	4.4 oz.	4.0%	3.7 oz.	3.5%
% Regained b. wt. by 7th day	20.0%		40.7%		33.8%		34.0%	

RANK 2+

	EUROPEAN		COLOURED		BANTU		INDIAN	
Number	297		128		222		157	
Average amount & % of loss	6.8 oz.	5.7%	6.5 oz.	5.5%	5.4 oz.	4.7%	5.1 oz.	4.7%
Average time of loss	3 days		2 days		2 days		3 days	
Amount and % of total loss	7.83 oz.	6.6%	7.10 oz.	6.1%	7.03 oz.	6.1%	6.45 oz.	6.0%
Duration of loss	2.72 days		2.63 days		3.07 days		3.07 days	
Amount and % gained in 4 days	1.7 oz.	1.5%	3.3 oz.	2.8%	3.7 oz.	3.2%	2.6 oz.	2.4%
Amt. & % below b.wt on 7th day	5.0 oz.	4.2%	2.5 oz.	2.2%	0.6 oz.	0.5%	2.4 oz.	2.3%
% Regained b. wt. by 7th day	20.9%		28.9%		49.6%		39.5%	

ALL RANKS

	EUROPEAN		COLOURED		BANTU		INDIAN	
Number	427		182		298		254	
Average amount & % of loss	6.6 oz.	5.6%	6.3 oz.	5.5%	5.6 oz.	4.9%	5.2 oz.	4.9%
Average time of loss	3 days		2 days		3 days		3 days	
Amount and % of total loss	7.7 oz.	6.5%	6.9 oz.	6.1%	7.3 oz.	6.5%	6.5 oz.	6.1%
Duration of loss	2.75 days		2.62 days		3.21 days		3.17 days	
Amount and % gained in 4 days	1.8 oz.	1.5%	3.4 oz.	3.0%	4.0 oz.	3.5 %	2.3 oz.	2.1%
Amt. & % below b.wt on 7th day	4.9 oz.	4.1%	2.3 oz.	2.0%	1.6 oz.	1.4%	3.0 oz.	2.8%
% Regained b. wt. by 7th day	20.6%		32.4%		45.6%		37.4%	

TABLE 41B

COMPARISON OF RACES WITH REGARD TO 7 FACTORS

WEIGHT OF BABIES IN THE FIRST 7 DAYS

BOYS

RANK 1

	EUROPEAN		COLOURED		BANTU		INDIAN	
Number	130		48		78		77	
Average amount & % of loss	7.0 oz.	5.8%	7.0 oz.	6.2%	7.9 oz.	7.1%	6.0 oz.	5.8%
Average time of loss	3 days		3 days		3 days		4 days	
Amount and % of total loss	7.76 oz.	6.4%	7.50 oz.	6.6%	9.78 oz.	8.8%	7.60 oz.	7.4%
Duration of loss	2.83 days		3.00 days		3.56 days		3.55 days	
Amount and % gained in 4 days	2.4 oz.	2.0%	3.7 oz.	3.2%	3.5 oz.	3.2%	4.9 oz.	4.7%
Amt. & % below b.wt on 7th day	4.6 oz.	3.8%	3.4 oz.	2.9%	4.3 oz.	3.9%	2.5 oz.	2.4%
% Regained b. wt. by 7th day	19.2%		31.3%		34.6%		36.4%	

RANK 2+

	EUROPEAN		COLOURED		BANTU		INDIAN	
Number	349		114		220		199	
Average amount & % of loss	6.8 oz.	5.4%	6.5 oz.	5.5%	5.4 oz.	4.5%	5.0 oz.	4.5%
Average time of loss	2 days		2 days		2 days		3 days	
Amount and % of total loss	7.93 oz.	6.3%	7.18 oz.	6.1%	6.83 oz.	5.8%	6.38 oz.	5.7%
Duration of loss	2.76 days		2.70 days		2.93 days		3.13 days	
Amount and % gained in 4 days	1.7 oz.	1.4%	2.6 oz.	2.2%	4.4 oz.	3.7%	3.2 oz.	2.9%
Amt. & % below b.wt on 7th day	4.7 oz.	3.7%	3.3 oz.	2.8%	0.2 oz.	0.2%	1.8 oz.	1.6%
% Regained bt. wt. by 7th day	21.2%		30.7%		55.0%		39.7%	

ALL RANKS

	EUROPEAN		COLOURED		BANTU		INDIAN	
Number	479		162		298		276	
Average amount & % of loss	6.8 oz.	5.4%	6.4 oz.	5.5%	5.8 oz.	5.0%	5.2 oz.	4.8%
Average time of loss	2 days		2 days		3 days		3 days	
Amount and % of total loss	7.9 oz.	6.3%	7.3 oz.	6.3%	7.6 oz.	6.5%	6.7 oz.	6.2%
Duration of loss	2.78 days		2.79 days		3.10 days		3.25 days	
Amount and % gained in 4 days	1.7 oz.	1.4%	2.5 oz.	2.0 %	4.5 oz.	3.8%	3.2 oz.	2.9%
Amt. & % below b.wt on 7th day	4.6 oz.	3.7%	3.3 oz.	2.9%	1.4 oz.	1.2%	2.0 oz.	1.8%
% Regained b. wt. by 7th day	20.7%		30.9%		49.7%		38.8%	

BOYS, ALL RANKS.

Loss. With boys the overall picture is the same. In daily gain or loss from birth weight, the European and Coloured groups lose 5½ per cent of body weight, as against the Bantu and Indian boys who lose around 5 per cent. The European and Coloured babies lose for two days, and the Bantu and Indian for three days. There are virtually no differences in the percentage of total initial loss of weight between the four races, but again there is a significantly longer period of loss for Bantu and Indian boys than for European and Coloured boys (approximately 3¼ days as against 2¾ days).

Gain. Bantu boys gain the most weight in four days, 3.8 per cent, followed by Indian 2.9 per cent, Coloured 2.0 per cent, and European only 1.4 per cent. By the seventh day almost half of the Bantu boys have regained or exceeded their birth weights, and this is a significantly higher percentage than that of European boys (20 per cent) and Coloured (30 per cent), and probably significantly higher than that of Indian boys among whom 38 per cent regain birth weight by this day. The Europeans score is by far the lowest of the four groups.

On the seventh day the average weight of the Bantu group as a whole is only 1.2 per cent below birth weight, with the Indian group 1.9 per cent below, the Coloured 2.9 per cent below, and the European boys still 3.7 per cent below birth weight.

As with the girls the big difference among the racial groups appears to be in the rate of gain, with the Bantu gaining the most and the Europeans the least rapidly. The chief difference between the boys and girls of the four groups is the change in position between the Coloured and Indian babies, the Indian boys doing better than the Coloured boys, and the Coloured girls doing better than the Indian girls.

GIRLS, RANK 1.

Loss. The mean daily loss from birth weight is slightly different from all ranks, in that European, Coloured and Indian girls show similar results, with an almost identical percentage loss. The Bantu girls lose rather more. The loss occurs in two days with the European and Coloured, but in three days with the Bantu and Indian groups. With regard to the total initial loss of weight, the Coloured and Indian babies lose the least weight, the Europeans slightly more, and the Bantu a great deal more. Again, the duration of loss is significantly longer for Bantu and Indian than for European and Coloured girls.

Gain. The results are again different to those found in all ranks, in that the Coloured babies gain the greatest percentage of weight in four days, followed by the Bantu and Indian babies, with the Europeans, as before, gaining the least of the four groups.

The resultant of these losses and gains brings the Coloured first-born babies into the lead, with 40 per cent having regained birth weight by the seventh day, as opposed to 34 per cent of the Bantu and Indian and only 20 per cent of the European babies.

In marked contrast to all ranks findings, by the seventh day the average weight of the Bantu group is still 4 per cent below birth weight as compared with 3.8 per cent European, 3.5 per cent Indian and 2.0 per cent Coloured.

The outstanding features of the findings for first born girls, appear to be (1) the superiority of the Coloured group who lose less and gain more weight than the other three groups, and (2) the fact that Bantu first-born babies progress far less favourably than Bantu all rank babies.

BOYS, RANK 1.

Loss. As with first girls, Bantu first-born boys have a greater mean daily loss in weight than the other three groups. They lose for the same period as European and Coloured first-born boys, three days, as against four days for the Indian group. The total initial loss is also greatest for the Bantu boys, with European and Coloured losing the least. Here again the Bantu and Indian boys lose for a significantly longer period than the European and Coloured boys.

Gain. The Indian group is interesting here, for although they lose considerably more than the European and Coloured groups, they gain the most weight in the first four days after minimal weight. They are followed by the Bantu and Coloured, with the European as usual gaining the least weight. The end result here is that by the seventh day the Indian first-born boys are in the lead, 36 per cent having regained birth weight; the Bantu 34 per cent and Coloured 31 per cent are close behind, and the Europeans a poor last with 19 per cent. The average weight of the group by the seventh day shows the Indians closest to birth weight, 2.4 per cent, with Coloured 2.9 per cent, and European and Bantu still almost 4 per cent below birth weight. It is important to note, however, that in the European group this result reflects a small gain, and in the Bantu group a greater loss.

As with the girls the Bantu first-born boys do much worse than their all ranks.

GIRLS, RANK 2+.

Loss. The mean daily loss of weight is considerably less for Bantu and Indian than for European and Coloured girls, but the grouping alters when one considers the duration of that loss - Bantu and Coloured losing for two days, and European and Indian for three days. There is almost no difference in total initial loss between Indian, Bantu and Coloured girls (approximately 6 per cent) while the Europeans lose ½ per cent more. The duration of this loss shows a consistent picture - the Bantu and Indian girls losing for a significantly longer period than the European and Coloured girls.

Gain. The Bantu girls gain the most weight in four days, 3.2 per cent, and are closely followed by Coloured girls 2.8 per cent, and by Indians 2.4 per cent. The Europeans as before gain the least, 1.5 per cent. By the seventh day almost 50 per cent of the Bantu girls have regained their birth weight, while nearly 40 per cent of Indian girls, 29 per cent of Coloured, and only 21 per cent of European girls have achieved this. The average weight of the group on the seventh day is only ½ per cent below birth weight for the Bantu girls, with the Indian and Coloured group just over 2 per cent, and the Europeans over 4 per cent below birth weight.

The Bantu girls here are undoubtedly superior to the other groups, again because of their rapid gain in weight.

BOYS, RANK 2+.

Loss. The Bantu and Indian boys show similar results to the girls, in that their mean daily loss is considerably less (1 per cent) than that of the European and Coloured babies. In this case the Indian group lose for one day longer, three days, as compared with two for the other groups.

Bantu and Indian boys lose almost the same percentage of body weight in their total initial loss, 5¾ per cent as compared with 6 per cent for European and Coloured boys. As has been the case throughout, the Indian and Bantu groups lose this weight over a longer period than the European and Coloured babies.

Gain. Bantu boys gain even more than the Bantu girls in four days after minimal weight, 3.7 per cent, followed by Indian boys with 2.9 per cent, Coloured with 2.2 per cent, and Europeans last with only 1.4 per cent. 55 per cent of the Bantu boys have regained their birthweight by the seventh day, which is very markedly better than all the others. The order is the same as for the girls, Indians come next with 40 per cent, Coloured with 31 per cent and Europeans way behind with only 21 per cent. By the seventh day, the average weight of the total Bantu group is only 0.2 per cent below birth weight; the Indian group is 1.6 per cent, the Coloured 2.8 per cent, and the European still 3.7 per cent below birth weight.

The findings in general for boys Rank 2+ are similar to girls Rank 2+, with the Bantu very much in the lead, and the Europeans very much behind, but the Bantu boys show an even greater capacity to gain weight than do the girls.

In an attempt to summarise all these findings and get as clear a picture as possible of the comparative progress of the four racial groups in the first seven days of life, each of the seven factors is scored, allotting 1 point to the race which does best in each category. In the event of a tie, each scores a point. (See Table 42). The results are commented on in the table.

DISCUSSION.

There are four general conclusions which can be drawn from the foregoing results:

1) In Rank 1 babies, Coloured girls and Indian boys do the best.

2) In Rank 2+, and therefore in all ranks, the Bantu babies

TABLE 42.

SCORING OF 7 FACTORS : COMPARISON OF RACES.

1. ALL RANKS, GIRLS.

	1	2	3	4	5	6	7
European							
Coloured	1		1	1			
Bantu		1			1	1	1
Indian		1	1				

Coloureds and Indians lose the least weight, Coloureds for the shortest time. Bantu gain the most weight and end up the best. Europeans lose the most (not markedly so) and gain least, ending up much the worst.

2. ALL RANKS, BOYS.

	1	2	3	4	5	6	7
European	1			1			
Coloured	1			1			
Bantu					1	1	1
Indian		1	1				

Indians lose the least weight. Europeans and Coloureds lose for the shortest time, but Bantu gain most and end up best. Europeans gain least and end up worst.

3. RANK 1, GIRLS.

	1	2	3	4	5	6	7
European	1						
Coloured	1			1	1	1	1
Bantu							
Indian		1	1				

Indians lose least.
Coloureds lose for shortest time and gain most, to end up best.

4. RANK 1, BOYS.

	1	2	3	4	5	6	7
European	1	1	1	1			
Coloured	1						
Bantu	1						
Indian		1			1	1	1

Europeans lose least and for the shortest time, but Indians gain most and end up best.

5. RANK 2+, GIRLS.

	1	2	3	4	5	6	7
European							
Coloured	1			1			
Bantu	1	1			1	1	1
Indian		1	1				

Indians lose least weight.
Coloureds lose for shortest time.
Bantu gain most and end up best. Europeans lose most, gain least, and end up worst.

6. RANK 2+, BOYS.

	1	2	3	4	5	6	7
European	1						
Coloured	1			1			
Bantu	1	1			1	1	1
Indian		1	1				

Results exactly same as for the girls.
Indians lose the least weight.
Coloureds lose for the shortest time.
Bantu gain the most and end up best.
Europeans lose most, gain least, and end up worst.

lose small amounts and gain very well, to end up much better than the other groups. Rank 2+ Bantu do very much better than Rank 1 Bantu.

3) The Bantu and Indian babies throughout lose for approximately half a day longer than the European and Coloured babies.

4) European babies gain the least weight throughout, and although they lose for a short time and do not lose a great deal of weight, they always end up worst.

How far these differences are racial ones I am not prepared to say. The groups are not strictly comparable, as mentioned previously. The hospitals themselves probably influence the results to a significant degree. The Bantu and Indian mothers are delivered at McCord's Zulu Hospital in two wards, one of which holds Bantu only, the other Indian and Bantu. The European and Coloured mothers are delivered at Addington Hospital, the wards being in different buildings and under different supervision, so that in some respects they might almost be two different hospitals. The biggest difference between the two hospitals is that in the former the babies remain in their mothers' beds, day and night, and in the latter they live in nurseries. This makes for rigidity on the one hand and laxity on the other.

From my clinical experience I have the impression that European mothers do not establish lactation as easily as non-European mothers. European women also seem to have far more sore breasts, cracked nipples and breast abscesses than non-Europeans. Even though they do breast feed their babies in hospital (and in the Addington the percentage of breast feeding is very high) it is not so effortless and relaxed as it appears to be among the non-Europeans in this country, although the Indians (as will appear later) do not seem to have such a high milk yield as the others.

It was interesting to me to observe the atmosphere at the two hospitals. In the Addington Hospital, the mothers and babies are not a unit, since they are separated from each other, except at certain prescribed times. At McCord's Hospital, there is a very free and easy atmosphere in the wards. Visitors wander in and out all day; mothers sit up in bed fondling their babies and laughing and chatting across the ward. This is particularly marked with the Bantu patients; the Indian mothers are not nearly so much at ease as the Bantu and do not breast feed their babies in front of strangers as do the Bantu.

These impressions are based on what I saw every day for eight months in the maternity wards of McCord's, when my weighing of the babies became a part of the daily life of the ward. The babies at McCord's are remarkably quiet and cry very little, which is in marked contrast to the crying one hears in most maternity nurseries. I think there can be no doubt that European mothers are anxious about the establishment of lactation, and that non-European mothers (particularly Bantu) exhibit in this connection a lack of tension and a natural ease.

I believe that this is an important factor in the neonatal progress of the babies, and accounts in part at least for the small gain of European babies, as compared with that of the others.

II. THE EFFECT OF BIRTH WEIGHT ON NEONATAL PROGRESS IN THE FOUR RACIAL GROUPS.

It was shown earlier that birth weight itself had some effect on the progress of Bantu babies after birth. Because of this finding, it is necessary to examine the effect of birth weight on each of the races and then to compare the races with respect to this factor.

Table 43 a and b shows the relationship between birth weight and the loss and gain after birth for European, Coloured, Bantu and Indian babies in the first week of life, for boys and girls separately and for ranks separately. Some conclusions are given in the table for each category and do not need to be repeated here.

In order to compare this relationship in the four groups, the scoring procedure is again followed and a mark given in each of the seven categories to the birth weight group that scores the best. It will be remembered that the seven categories are as follows:

1) Day of maximum loss.
2) Amount of loss as percentage of birth weight.
3) Total initial loss as percentage of birth weight.
4) Duration of total initial loss.
5) Gain in four days after minimal weight.
6) Percentage who regain birth weight by the seventh day.
7) Amount and percentage of weight below birth weight on the seventh day.

TABLE 43B

RELATIONSHIP BETWEEN BIRTH WEIGHT AND NEONATAL PROGRESS IN FIRST 7 DAYS

	EUROPEANS	COLOURED	BANTU	INDIAN
RANK 2+ - GIRLS Loss of Weight.	297 girls Lost for 3 days. Light 5.2 oz. 5.3%; Average 6.1 oz. 5.4%; Heavy 8.8 oz. 6.3% Total initial loss. Light 6.0 oz. 6.1%; Average 7.2 oz. 6.3%; Heavy 10.0 oz. 7.2% Duration. Light 2.4 days; Average 2.7 days; Heavy 3.0 days Light girls lose less weight (actual and relative) for a shorter time than average and heavy, and average lose less for shorter than heavy.	128 girls Lost for 2 days. Light 5.4 oz. 5.6%; Average 6.3 oz. 5.5%; Heavy 7.8 oz. 5.7% Total initial loss. Light 6.0 oz. 6.2%; Average 6.9 oz. 6.0%; Heavy 8.5 oz. 6.2% Duration. Light 2.5 days; Average 2.6 days; Heavy 2.8 days Average girls lose very slightly less than other two groups, but slight difference in duration - light < average < heavy.	222 girls Lost for 2 days. Light 4.2 oz. 4.3%; Average 5.4 oz. 4.9%; Heavy 6.6 oz. 4.8% Total initial loss. Light 5.7 oz. 5.8%; Average 7.3 oz. 6.4%; Heavy 8.0 oz. 5.9% Duration Light 3.0 days; Average 3.1 days; Heavy 3.1 days Light girls lose least (both actual and relative) and for a slightly shorter time than other two. Heavy girls lose slightly less than average.	157 girls Lost for 2 days. Light 4.0 oz. 4.[illegible]% " " 3 days. Average 5.4 oz. 4.[illegible]%; Heavy Insufficient data. Total initial loss. Light 5.4 oz. 5.7%; Average 6.9 oz. 6.[illegible]%; Heavy - - Duration. Light 2.8 days; Average 3.2 days; Heavy - Light girls lose less (actual and relative) and for shorter time than average babies.
RANK 2+ - BOYS Loss of Weight.	349 boys Lost for 3 days. Light 5.9 oz. 6.1% " " 2 days. Average 6.1 oz. 5.2% " " " " Heavy 7.9 oz. 5.6% Total initial loss. Light 6.7 oz. 6.9%; Average 7.0 oz. 6.0%; Heavy 9.2 oz. 6.5% Duration. Light 2.7 days; Average 2.7 days; Heavy 2.9 days Light boys lose least actual weight, but relatively lost most, average losing least. Duration inconsistent.	114 boys. Lost for 2 days. Light 5.5 oz. 5.7%; Average 6.9 oz. 6.0%; Heavy 6.3 oz. 4.5% Total initial loss. Light 6.1 oz. 6.2%; Average 7.7 oz. 6.7%; Heavy 6.9 oz. 5.0% Duration. Light 2.7 days; Average 2.8 days; Heavy 2.6 days Heavy boys lose least relatively, with light losing least actually, heavy lost for shortest time. Average do worst.	220 boys. Lost for 3 days. Light 4.4 oz. 4.5% " " 2 days. Average 5.1 oz. 4.4% " " " " Heavy 6.7 oz. 4.9% Total initial loss. Light 5.7 oz. 5.8%; Average 6.5 oz. 5.6%; Heavy 8.2 oz. 6.0% Duration Light 2.9 days; Average 2.9 days; Heavy 3.0 days Average boys lose lease relatively, with light losing least actually. Average do better than light do better than heavy.	199 boys Lost for 3 days. Light 4.2 oz. 4.3%; Average 5.2 oz. 4.5%; Heavy - - Total initial loss. Light 5.5 oz. 5.6%; Average 6.5 oz. 5.7%; Heavy 8.2 oz. 6.0% Duration. Light 3.0 days; Average 3.1 days; Heavy 3.7 days Light boys lose least actually and relatively and for shorter time than average. Heavy boys do the worst.
RANK 2+ - GIRLS Gain in Weight.	297 girls. Gain in 4 days. Light 2.8 oz. 2.9%; Average 1.5 oz. 1.3%; Heavy 1.6 oz. 1.2% % below B. Wt on 7th day Light 2.4 oz. 2.4%; Average 4.6 oz. 4.0%; Heavy 7.1 oz. 5.1% % regained B. Wt by 7th day Light 35.4%; Average 20.1%; Heavy 14.4% Light girls gain most, are nearer birth weight by 7th day and greater percentage have regained birth weight, followed by average, followed by heavy.	128 girls. Gain in 4 days. Light 3.3 oz. 3.4%; Average 3.3 oz. 2.9%; Heavy 3.3 oz. 2.4% % below B. Wt on 7th day Light 0.8 oz. 0.9%; Average 2.6 oz. 2.2%; Heavy 4.0 oz. 2.9% % regained B. Wt by 7th day Light 37.5%; Average 28.0%; Heavy 24.1% Light girls gain most, are nearest birth weight by 7th day and greater percentage have regained birth weight, followed by average, followed by heavy.	222 girls. Gain in 4 days. Light 3.8 oz. 3.9%; Average 3.7 oz. 3.2%; Heavy 3.5 oz. 2.4% % below B. Wt on 7th day Light 0.3 oz. 0.3%; Average 0.5 oz. 0.4%; Heavy 1.5 oz. 1.1% % regained B. Wt by 7th day Light 55.4%; Average 48.9%; Heavy 42.9% Light girls gain most, are nearest birth weight by 7th day and greater pe rcentage have regained birth weight, followed by average, followed by heavy.	157 girls. Gain in 4 days. Light 1.8 oz. 1.9%; Average 2.8 oz. 2.5%; Heavy - - % below B. Wt on 7th day Light 2.5 oz. 2.6%; Average 2.6 oz. 2.3%; Heavy Insufficient data. % regained B. Wt by 7th day Light 47.5%; Average 37.3%; Heavy 20.0% (15 cases) Average babies gain more and are nearest their birth weight by 7th day, but a greater percentage of light girls have regained birth weight by 7th day, followed by average, followed by heavy.
RANK 2+ - BOYS Gain in Weight.	349 boys Gain in 4 days. Light 2.9 oz. 3.0%; Average 2.2 oz. 1.9%; Heavy 1.4 oz. 1.0% % below B. Wt on 7th day Light 3.0 oz. 3.1%; Average 3.5 oz. 3.0%; Heavy 6.3 oz. 4.5% % regained B. Wt by 7th day Light 21.2%; Average 24.4%; Heavy 17.8% Light boys gain most, but by 7th day average boys are nearer birth weight and greater percentage of average boys have regained birth weight. Heavy boys do worst.	114 boys Gain in 4 days. Light 3.1 oz. 3.2%; Average 2.3 oz. 2.0%; Heavy 2.8 oz. 2.0% % below B. Wt on 7th day Light 1.9 oz. 1.9%; Average 3.8 oz. 3.3%; Heavy 3.2 oz. 2.3% % regained B. Wt by 7th day Light 39.1%; Average 23.1%; Heavy 41.5% Light boys gain most and are nearest birth weight by 7th day, but the greatest percentage of heavy boys regained birth weight by 7th day. Average boys do worst.	220 boys. Gain in 4 days. Light 4.1 oz. 4.2%; Average 4.5 oz. 3.8%; Heavy 4.9 oz. 3.6% % below B. Wt on 7th day Light 0.3 oz. 0.3%; Average 0.0 oz. 0.0%; Heavy 0.8 oz. 0.6% % regained B. Wt by 7th day Light 46.7%; Average 57.8%; Heavy 52.7% Light boys gain most, but by 7th day average boys are nearer birth weight and greater percentage of average boys have regained birth weight, greater % of heavy boys have regained birth weight by 7th day than light.	199 boys. Gain in 4 days. Light 3.0 oz. 3.1%; Average 3.2 oz. 2.7%; Heavy Insufficient data. % below B. Wt on 7th day Light 1.2 oz. 1.2%; Average 2.0 oz. 1.8%; Heavy Insufficient data. % regained B. Wt by 7th day Light 48.4%; Average 40.0%; Heavy 13.6% Light boys gain most and are nearer birth weight by 7th day and greater pe rcentage have regained birth weight by 7th day than average boys and than heavy boys.

TABLE 43A

RELATIONSHIP BETWEEN BIRTH WEIGHT AND NEONATAL PROGRESS IN FIRST 7 DAYS

	EUROPEAN (ADDINGTON)	COLOURED	BANTU (McCORDS)	INDIAN
RANK 1 - GIRLS Loss of Weight	646 full-term babies 130 girls - only average and heavy groups. Lost for 2 days. Average 6.4 oz. 5.6% Heavy 7.3 oz. 5.3% Total Initial Loss Average 7.3 oz. 6.4% Heavy 8.2 oz. 6.0% Duration. Average 2.9 days Heavy 2.6 days Average girls lose slightly more weight relatively for slightly longer time than heavy babies.	344 full-term babies 54 girls - only light and average groups. Lost for 2 days. Light 5.5 oz. 5.68% Average 5.97 oz. 5.23% Total Initial Loss. Light 6.3 oz. 6.5% Average 6.4 oz. 5.6% Duration. Light 2.7 days Average 2.5 days Average girls lose less weight relatively for slightly shorter time than light babies.	598 full-term, well babies (normal delivery) fully breast fed. 74 girls - only light and average groups. Lost for 3 days. Light 5.2 oz. 5.4% " " 4 days. Average 7.4 oz. 6.4% Total initial loss. Light 7.0 oz. 7.3% Average 9.1 oz. 7.9% Duration. Light 3.7 days Average 3.6 days Average girls lose more weight (actual and relative) for a slightly longer time than light girls.	530 full-term babies 97 girls - only light and average groups. Lost for 3 days. Light 5.0 oz. 5.2% " " 4 days. Average 6.9 oz. 6.1% Total initial loss. Light 6.0 oz. 6.3% Average 7.4 oz. 6.5% Duration Light 3.3 days Average 3.3 days Light girls lose less weight for slightly shorter period than average girls.
RANK 1 - BOYS Loss of Weight	130 boys - only average and heavy groups. Lost for 3 days. Average 6.7 oz. 5.8% Heavy 8.3 oz. 6.0% Total Initial Loss. Average 7.3 oz. 6.4% Heavy 9.1 oz. 6.6% Duration. Average 2.8 days Heavy 2.8 days Average boys lose less weight (actual and relative) for same length of time as heavy babies.	48 boys - only average group. Lost for 3 days. 7.0 oz. 6.1% Total Initial Loss. 7.8 oz. 6.8% Duration. 3.1 days	78 boys - only light and average groups. Lost for 3 days. Light 6.6 oz. 6.9% " " 4 days. Average 8.5 oz. 7.4% Total initial loss. Light 8.5 oz. 8.9% Average 10.1 oz. 8.9% Duration. Light 3.5 days Average 3.7 days Average boys lose more weight (actual) for a longer time than light boys.	77 boys - only light and average groups. Lost for 4 days Light 5.8 oz. 6.1% Average 6.5 oz. 5.9% Total initial loss Light 6.9 oz. 7.2% Average 8.4 oz. 7.5% Duration. Light 3.5 days Average 3.6 days Very slight difference between light and average. Light boys lose less weight actual and relative than average boys for the same length of time.
RANK 1 - GIRLS Gain in Weight.	Gain in 4 days. Light - Average 1.4 oz. 1.2% Heavy 1.2 oz. .9% % below B.Wt on 7th day. Light - - Average 4.5 oz. 4.0% Heavy 5.4 oz. 4.0% % regained B. Wt by 7th day. Light 44.4% (18 cases) Average 17.7% Heavy 12.1% Average girls gain slightly more than heavy girls, but on 18 cases more light girls regained birth weight by 7th day.	Gain in 4 days. Light 4.4 oz. 4.6% Average 3.4 oz. 2.5% Heavy - % below B. Wt on 7th day, Light .6 oz. .6% Average 2.1 oz. 1.9% Heavy - - % regained B. Wt by 7th day. Light 45.0% Average 40.0% Heavy - Light girls gain more and are closer to birth weight on 7th day than average girls, and more have regained birth weight by 7th day.	Gain in 4 days. Light 1.7 oz. 1.8% Average 3.2 oz. 2.8% Heavy - - % below B. Wt on 7th day. Light 3.5 oz. 3.6% Average 5.4 oz. 4.7% Heavy - - % regained B. Wt by 7th day. Light 43.3% Average 26.3% Heavy - Average girls gain more, but light girls are closer to birth weight on 7th day, and more of them have returned to birth weight.	Gain in 4 days Light 2.1 oz. 2.2% Average - insufficient data % below B. Wt on 7th day. Light 2.9 oz. 3.0% Average 4.6 oz. 4.0% % regained B. Wt by 7th day. Light 39.3% Average 26.5% Insufficient data for gain, but light girls are nearer birth weight by 7th day and a greater percentage have regained birth weight by 7th day.
RANK 1 - BOYS Gain in Weight.	Gain in 4 days. Light - Average 2.7 oz. 2.4% Heavy 1.9 oz. 1.4% % below B. Wt.on 7th day. Light - Average 3.9 oz. 3.4% Heavy 6.5 oz. 4.7% % regained B. Wt by 7th day. Light 50.0% (16 cases) Average 21.7% Heavy 4.4% No information on light boys. Average boys gain more in 4 days, and are closer to birth weight at 7th day, and greater percentage have regained birth weight by 7th day than heavy boys.	Gain in 4 days. Light - Average 3.3 oz. 2.9% Heavy - - % below B. Wt on 7th day. Light - Average 3.7 oz. 3.2% Heavy - - % regained B. Wt by 7th day. Light 44.4% (18 cases) Average 25.0% Heavy - Insufficient data for comparison.	Gain in 4 days Light 4.4 oz. 4.6% Average 5.7 oz. 5.0% Heavy - - % below B. Wt on 7th day. Light 2.2 oz. 2.3% Average 5.1 oz. 4.4% Heavy - - % regained B. Wt by 7th day. Light 33.3% Average 34.1% Heavy - No information on heavy boys. Average boys gain more and a slightly greater percentage have regained birth weight by 7th day, but on 7th day light boys are nearer to birth weight.	Gain in 4 days Light - insufficient data % below B. Wt on 7th day. Light 0.8 oz. 0.8% Average 4.2 oz. 3.7% % regained B. Wt by 7th day. Light 37.5% Average 32.4% No information on heavy boys, and no information on gain. Greater percentage of light boys have regained birth weight by 7th day and light boys are nearer birth weight on 7th day than average boys.

Table 44 shows the results of the scoring in each race, sexes and ranks separately.

<u>T A B L E 44.</u>

**EFFECT OF BIRTH WEIGHT ON NEONATAL PROGRESS.
SCORING OF 7 FACTORS : COMPARISON OF RACES.**

	EUROPEAN							COLOURED							BANTU							INDIAN						
RANK 1	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
GIRLS:																												
Light								1				1	1	1	1	1	1			1	1	1	1	1			1	1
Average	1				1	1	1	1	1	1	1							1	1						1			
Heavy	1	1	1	1			1																					
BOYS:																												
Light															1	1	1	1			1	1		1	1		1	1
Average	1	1	1	1	1	1	1										1		1	1		1	1					
Heavy	1			1																								
RANK 2+	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
GIRLS:																												
Light	1	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	
Average	1							1	1	1					1											1		1
Heavy	1							1							1													
BOYS:																												
Light				1	1			1				1		1				1	1			1	1	1	1	1	1	1
Average	1	1	1	1		1	1	1							1	1	1	1		1	1	1						
Heavy	1							1	1	1	1		1		1													

<u>DISCUSSION.</u>

<u>Rank 1 Girls.</u>

The numbers of Coloured, Bantu and Indian first-born girls are large enough for analysis in the light and average groups, but not in the heavy group. The Europeans, however, have only average and heavy groups in sufficient numbers. The Indian and Bantu groups behave in almost the same fashion, with light babies losing the least weight, and returning to birth weight soonest. Light babies of the Coloured group gain better too, and end up closer to birth weight than the average babies, but they do this despite a greater and longer loss. Although the heavy European babies lose less weight and for a shorter time, their average babies gain more, and a greater percentage have regained birth weight by the seventh day.

Rank 1 Boys.

Since there are only sufficient numbers for analysis in the average group of Coloured boys, first-born Coloured boys can not be compared with the others. Only light and average babies are sufficient for analysis among Bantu and Indian first-born boys, and for European boys only average and heavy babies.

In the Bantu group the light boys lose less weight for a shorter time, and end up closest to birth weight, although the average babies gain more and a greater percentage have regained their birth weight by the seventh day. Light Indian boys on the whole lose less weight and for a shorter period than average boys, and they return to birth weight faster. European average babies have the advantage over heavy babies with regard to both loss and gain.

Rank 2+ Girls.

The Indians have insufficient heavy babies for analysis but the other groups are all complete. In general, for all the races the light babies lose least and gain most, although in the Coloured group the average section lose less, and in the Indian group the average section gain more than the others.

Rank 2+ Boys.

Again the Indians have too few heavy babies for study. Here the European and Bantu boys behave exactly the same way with the average babies losing least weight and for the shortest time, returning to birth weight soonest, although light babies gain most in the first four days. In the Indian group the light babies do consistently better.

The Coloured boys behave differently to the other three, in that the heavy boys lose least for the shortest time, and a greater percentage regain their birth weight by the seventh day. However, their light boys gain more and are nearer birth weight by the seventh day.

COMMENT.

The relationship between birth weight and loss and gain in the first seven days is not exactly the same in all the races, the main differences showing in Rank 2+ babies in the boys.

The overall conclusions are:

1) In Rank 1 in general, for both boys and girls, lighter babies do better than heavier ones.

2) In Rank 2+ the same conclusion applies to all the girls and to the Indian boys. Average boys are better off in the European and Bantu and heavy boys in the Coloured groups.

SUMMARY OF NEONATAL PROGRESS IN THE FIRST WEEK OF LIFE : COMPARISON OF RACES.

European, Coloured, Bantu and Indian babies are compared in their first week of life with regard to seven factors covering loss and gain in weight. The effect of birth weight itself is then compared in these groups.

The overall conclusions are as follows:

1. In Rank 1 babies, Coloured girls and Indian boys make the best progress.

2. In Rank 2+, and therefore in all ranks, the Bantu babies lose small amounts and gain very well, to end up much ahead of the other three groups.

3. Rank 2+ Bantu babies are markedly superior to Bantu rank 1 babies.

4. Bantu and Indian babies throughout lose for approximately half a day longer than European and Coloured babies.

5. European babies gain the least weight throughout, and although they lose for a short time and do not lose a great deal of weight, they always end up the worst of the four racial groups by the seventh day.

6. Birth weight has some effect on neonatal progress in all the racial groups, but the effect is not consistent throughout.

7. In general, first-born babies, both girls and boys, of lighter birth weight, progress more satisfactorily than heavier first-born babies in all the races.

8. For second and later born babies there is a sex difference in this respect. Lighter birth weight girls are better than heavier girls in all the groups. Indian boys behave the same way, but average boys

are superior in the European and Bantu races, and heavy boys in the Coloured.

9. In comparing the progress of babies of different racial groups I suggest that the hospitals themselves may be partly responsible for the differential results, particularly through their application of feeding schedules.

10. Apart from this factor, however, there is probably a real difference in the ease with which European and non-European mothers accept and establish lactation.

APPENDIX 16a

ADDINGTON EUROPEANS

MEAN DAILY GAIN OR LOSS FROM BIRTH WEIGHT - GIRLS. ALL RANKS

DAY	B. Wt. 6.10 lbs. → 6 lb. 7 oz. No.	Mean (oz.)	S.D. (oz.)	7.14 lbs. 6 lb. 8oz.- 7 lb. 15oz. No.	Mean (oz.)	S.D. (oz.)	8.67 lbs. 8 lb. + No.	Mean (oz.)	S.D. (oz.)	7.413 lbs. TOTAL No.	Mean (oz.)	S.D. (oz.)
1	65	-3.87	2.48	234	-4.05	2.49	119	-5.34	3.26	418	-4.39	2.[illegible]
2	66	-4.91	3.20	235	-6.17 (-5.40%)	2.74	120	-8.20	3.54	421	-6.55	3.26
3	66	-5.21 (-5.34%)	3.52	239	-6.14	3.31	120	-8.33 (-6.00%)	3.94	425	-6.61 (-5.57%)	3.71
4	66	-4.39	4.13	240	-5.75	3.61	120	-8.13	4.37	426	-6.21	4.13
5	66	-3.64	4.45	239	-5.15	3.77	119	-7.54	4.56	424	-5.58	4.33
6	65	-2.75	4.13	240	-4.92	4.10	120	-7.10	5.00	425	-5.21	4.60
7	60	-2.27 (-2.33%)	4.52	227	-4.59 (-4.02%)	4.06	114	-6.70 (-4.83%)	5.06	401	-4.85 (-4.09%)	4.65

RANK 1

DAY	B. Wt. → 6 lb. 7 oz. No	Mean (oz.)	S.D. (oz.)	7.14 lbs. 6 lb. 8oz.- 7lb. 15oz. No.	Mean (oz.)	S.D. (oz.)	8.57 lbs. 8 lb. + No.	Mean (oz.)	S.D. (oz.)	7.334 lbs. TOTAL No.	Mean (oz.)	S.D. (oz.)
1	18			81	-3.96	2.66	31	-4.69	2.83	130	-4.15	2.75
2	18			80	-6.37 (-5.58%)	2.56	31	-7.26 (-5.29%)	3.79	129	-6.38 (-5.44%)	3.28
3	18			80	-6.17	3.44	30	-7.00	4.16	128	-6.25	3.82
4	18			81	-5.74	3.74	30	-7.27	4.52	129	-6.07	4.23
5	18			80	-5.08	3.80	30	-7.13	4.35	128	-5.41	4.35
6	18			81	-5.02	3.96	31	-6.03	4.42	130	-5.00	4.34
7	16			78	-4.54 (-3.97%)	4.01	29	-5.41 (-3.95%)	4.44	123	-4.41 (-3.76%)	4.40

RANK 2+

DAY	B. Wt. 6.10 lb. → 6 lb. 7 oz. No	Mean (oz.)	S.D. (oz.)	7.14 lbs. 6 lb. 8oz.- 7lb. 15oz. No.	Mean (oz.)	S.D. (oz.)	8.70 lbs. 8 lb. + No.	Mean (oz.)	S.D. (oz.)	7.448 lbs. TOTAL No.	Mean (oz.)	S.D. (oz.)
1	47	-3.78	2.33	153	-4.10	2.39	88	-5.57	3.37	288	-4.49	2.81
2	48	-4.92	2.58	155	-6.06	2.82	89	-8.53	3.39	292	-6.62	3.25
3	48	-5.17 (-5.30%)	3.08	159	-6.12 (-5.36%)	3.25	90	-8.78 (-6.31%)	3.76	297	-6.77 (-5.68%)	3.65
4	48	-3.96	3.51	159	-5.75	3.54	90	-8.42	4.28	297	-6.27	4.08
5	48	-3.50	3.91	159	-5.19	3.76	89	-7.67	4.63	296	-5.66	4.31
6	47	-2.62	3.66	159	-4.87	4.17	89	-7.47	5.13	295	-5.30	4.70
7	44	-2.36 (-2.42%)	4.24	149	-4.62 (-4.04%)	4.08	85	-7.14 (-5.13%)	5.18	278	-5.04 (-4.23%)	4.75

APPENDIX 16b

ADDINGTON EUROPEANS

MEAN DAILY GAIN OR LOSS FROM BIRTH WEIGHT - BOYS. ALL RANKS

	B. Wt. 6.08 lbs.			7.27 lbs.			8.80 lbs.			7.776 lbs.		
	→ 6 lb. 7 oz.			6 lb. 8oz.- 7 lb.15oz.			8 lb.+			TOTAL		
DAY	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)
1	45	-3.68	2.42	230	-4.13	2.55	192	-5.19	2.96	467	-4.52	2.77
2	49	-4.96	2.84	230	-6.24 (-5.36%)	2.75	196	-7.82 (-5.55%)	3.24	475	-6.76 (-6.43%)	3.12
3	47	-5.55 (-5.70%)	3.42	230	-6.07	3.11	194	-7.79	3.95	471	-6.73	3.63
4	49	-5.12	3.53	233	-5.40	3.55	194	-7.47	4.36	476	-6.22	4.04
5	49	-4.63	3.87	232	-4.58	3.80	197	-6.94	4.55	478	-5.56	4.29
6	49	-3.69	4.23	231	-4.13	4.19	197	-6.46	4.74	477	-5.05	4.59
7	41	-2.66 (-2.73%)	5.19	219	-3.62 (-3.11%)	4.43	178	-6.36 (-4.52%)	5.13	438	-4.64 (-3.73%)	5.01

RANK 1

	B. Wt.			7.20 lbs.			8.62 lbs.			7.57 lbs.		
	→ 6 lbs. 7 oz.			6 lb. 8oz.- 7 lb.15oz.			8 lb.+			TOTAL		
DAY	No	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)
1	13			67	-4.28 oz	2.61	45	-5.17	2.26	125	-4.47	2.60
2	16			68	-6.56	3.03	45	-7.58	3.06	129	-6.57	3.24
3	15			69	-6.65 (-5.77%)	3.16	44	-8.32 (-6.03%)	3.79	128	-7.01 (-5.79%)	3.71
4	16			69	-5.93	3.65	44	-8.32	3.81	129	-6.55	4.08
5	16			68	-4.88	4.14	45	-7.04	4.03	129	-5.53	4.32
6	16			69	-4.57	4.48	45	-6.42	3.17	130	-4.94	4.35
7	15			66	-3.94 (-3.42%)	4.89	44	-6.45 (-4.68%)	3.58	125	-4.60 (-3.80%)	4.84

RANK 2+

	B. Wt. 6.03 lbs.			7.29 lbs.			8.86 lbs.			7.853 lbs.		
	→ 6 lbs. 7 oz.			6 lb. 8oz.- 7lb.15oz.			8 lb.+			TOTAL		
DAY	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)
1	32	-4.09	2.19	163	-4.04	2.52	147	-5.19	3.14	342	-4.54	2.84
2	33	-5.55	2.62	162	-6.11 (-5.24%)	2.62	151	-7.89 (-5.57%)	3.28	346	-6.83 (-5.43%)	3.08
3	32	-5.87 (-6.08%)	2.78	161	-5.82	3.06	150	-7.64	3.98	343	-6.62	3.59
4	33	-5.48	2.74	164	-5.18	3.49	150	-7.23	4.48	347	-6.10	4.01
5	33	-4.94	3.39	164	-4.45	3.64	152	-6.91	4.69	349	-5.57	4.28
6	33	-4.33	3.61	162	-3.95	4.05	152	-6.47	5.11	347	-5.09	4.67
7	26	-3.00 (-3.11%)	4.74	153	-3.48 (-2.98%)	4.21	134	-6.33 (-4.47%)	5.54	313	-4.66 (-3.71%)	5.08

APPENDIX 17a

ADDINGTON COLOURED.

MEAN DAILY GAIN OR LOSS FROM BIRTH WEIGHT - GIRLS.

ALL RANKS

B. Wt.	6.03 lb.			7.18 lb.			8.54 lb.			7.146 lb.		
	> 6 lb. 7 oz.			6 lb. 8oz.- 7lb. 15 oz.			8 lb.+			TOTAL		
DAY	No	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)
1	44	-3.46	2.11	105	-4.34	2.43	33	-4.68	2.78	182	-4.19	2.47
2	44	-5.43 (-5.63%)	2.28	105	-6.20 (-5.40%)	2.59	32	-7.72 (-5.65%)	2.65	181	-6.28 (-5.49%)	2.64
3	44	-4.75	2.65	105	-5.76	2.83	33	-7.14	3.35	182	-5.76	2.99
4	44	-3.71	3.01	105	-4.43	3.24	33	-5.92	4.57	182	-4.53	3.55
5	44	-2.66	3.31	105	-3.55	3.52	33	-5.11	4.91	182	-3.62	3.85
6	43	-1.64	3.65	102	-2.85	4.09	32	-4.66	5.42	177	-2.88	4.38
7	41	-0.74 (-.77%)	3.86	87	-2.43 (-2.12%)	4.50	28	-4.18 (-3.06%)	6.07	156	-2.30 (-2.01%)	4.81

RANK 1

B. Wt.	6.05 lb.			7.13 lb.			-			6.83 lb.		
	> 6 lb. 7 oz.			6 lb. 8 oz.- 7lb.15 oz.			8 lb.+			TOTAL		
DAY	No	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)
1	20	-3.20	2.24	30	-4.30	2.33	4			54	-3.78	2.34
2	20	-5.50 (-5.68%)	2.12	30	-5.97 (-5.23%)	2.59	4			54	-5.91 (-5.41%)	2.52
3	20	-4.75	2.47	30	-5.67	2.94	4			54	-5.50	3.04
4	20	-3.75	2.62	30	-4.10	3.63	4			54	-4.28	3.71
5	20	-2.55	3.06	30	-3.07	3.59	4			54	-3.17	3.74
6	20	-1.10	3.38	30	-2.53	4.10	4			54	-2.26	4.16
7	19	-0.55 (-.57%)	3.37	26	-2.12 (-1.86%)	4.39	4			49	-1.83 (-1.67%)	4.39

RANK 2+

B. Wt.	6.01 lb.			7.20 lb.			8.54 lb.			7.28 lb.		
	> 6 lb. 7 oz.			6 lb. 8 oz.- 7lb.15 oz.			8 lb.+			TOTAL		
DAY	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)
1	24	- 3.67	1.97	75	-4.35	2.48	29	-4.95	2.77	128	-4.36	2.50
2	24	-5.42 (-5.64%)	2.31	75	-6.29 (-5.46%)	2.59	28	-7.75 (-5.67%)	2.59	127	-6.45 (-5.54%)	2.65
3	24	-4.75	2.79	75	-5.79	2.78	29	-7.02	3.14	128	-5.88	2.96
4	24	-3.67	3.30	75	-4.57	3.07	29	-5.60	4.25	128	-4.63	3.47
5	24	-2.75	3.50	75	-3.74	3.47	29	-4.85	4.77	128	-3.81	3.87
6	23	-2.11	3.81	72	-2.99	4.08	28	-4.46	5.40	123	-3.16	4.44
7	22	-0.82 (-.85%)	4.20	61	-2.57 (-2.23%)	4.54	24	-3.96 (-2.90%)	6.07	107	-2.52 (-2.16%)	4.97

APPENDIX 17b

ADDINGTON COLOURED.

MEAN DAILY GAIN OR LOSS FROM BIRTH WEIGHT - BOYS.

ALL RANKS

B. Wt.	6.13 lb.			7.19 lb.			8.713 lb.			7.262 lb.		
	→ 6 lb. 7 oz.			6 lb. 8oz.- 7lb.15oz.			8lb.+			TOTAL		
DAY	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)
1	41	-3.38	1.77	84	-4.68	1.89	36	-4.22	2.68	161	-4.25	2.14
2	41	-5.40	1.92	85	-6.71 (-5.83%)	2.33	35	-6.81 (-4.89%)	3.23	161	-6.40 (-5.51%)	2.52
3	40	-5.60 (-5.71%)	3.17	85	-6.67	3.10	36	-6.19	3.93	161	-6.30	3.35
4	41	-4.67	3.27	85	-5.82	3.51	36	-5.94	4.29	162	-5.56	3.68
5	41	-3.57	3.46	84	-5.06	3.91	36	-4.69	4.50	161	-4.60	3.99
6	41	-2.65	3.90	81	-4.49	4.15	36	-4.00	4.72	158	-3.90	4.30
7	38	-2.18 (-2.22%)	4.23	77	-3.76 (-3.27%)	4.37	34	-3.65 (-2.62%)	4.45	149	-3.33 (-2.87%)	4.42

RANK 1

B. Wt.	6.20 lb.			7.15 lb.			8.66 lb.			7.11 lb.		
	→ 6 lb. 7 oz.			6 lb. 8oz.- 7lb.15oz.			8 lb.+			TOTAL		
DAY	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)
1	18			19			10			47	-3.67	1.80
2	18			20	-6.10	1.72	10			48	-6.17	2.24
3	17			20	-6.95 (-6.08%)	3.23	10			47	-7.01 (-6.16%)	3.36
4	18			20	-6.40	3.70	10			48	-6.29	3.92
5	18			19	-5.40	3.71	10			47	-5.05	3.81
6	18			20	-4.05	4.20	10			48	-3.88	4.23
7	17			20	-3.65 (-3.19%)	4.49	10			47	-3.35 (-2.94%)	4.75

RANK 2+

B. Wt.	6.08 lb.			7.20 lb.			8.73 lb.			7.326 lb.		
	→ 6 lb. 7 oz.			6 lb. 8oz.- 7lb.15 oz.			8 lb.+			TOTAL		
DAY	No	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)
1	23	-3.41	2.10	65	-4.98	1.80	26	-4.19	2.80	114	-4.48	2.22
2	23	-5.54 (-5.69%)	2.22	65	-6.90 (-5.99%)	2.46	25	-6.34 (-4.54%)	3.08	113	-6.50 (-5.54%)	2.62
3	23	-5.20	3.18	65	-6.58	3.06	26	-5.27	3.66	114	-6.00	3.30
4	23	-4.28	2.80	65	-5.64	3.43	26	-5.12	4.12	114	-5.25	3.53
5	23	-3.20	3.24	65	-4.90	3.96	26	-4.12	4.61	114	-4.41	4.05
6	23	-2.41	3.61	61	-4.63	4.17	26	-3.54	4.92	110	-3.91	4.34
7	21	-1.88 (-1.93%)	3.26	57	-3.80 (-3.30%)	4.33	25	-3.22 (-2.31%)	4.61	103	-3.27 (-2.79%)	4.27

APPENDIX 18a'

McCORDS - INDIAN GIRLS

MEAN DAILY GAIN OR LOSS FROM BIRTH WEIGHT.

ALL RANKS

B. Wt.	5.94 lb.			7.08 lb.						6.516 lb.		
	> 6 lb. 7 oz.			6 lb. 8oz.- 7 lb. 15oz.			8 lb.+			TOTAL		
DAY	No	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)
1	22	-2.46	2.53	10			4			36	-3.08	2.55
2	52	-3.83	3.27	32	-5.03	3.03	6			90	-4.33	3.26
3	52	- 4.98 (-5.24%)	3.48	32	-6.16	3.56	6			90	-5.52 (-5.29%)	3.52
4	53	-4.41	4.07	33	-6.89 (-6.08%)	3.74	7			93	-5.40	4.09
5	49	-3.62	4.30	33	-5.99	4.70	7			89	-4.65	4.62
6	42	-3.45	4.47	30	-5.33	4.80	4			76	-4.36	4.79
7	37	-2.89 (-3.04%)	4.60	23	-4.57 (-4.03%)	5.62	4			65	-3.68 (-3.53%)	5.17

RANK 1

B. Wt.	5.94 lb.			7.08 lb.						6.516 lb.		
	> 6 lb. 7 oz.			6 lb. 8oz.- 7 lb. 15oz.			8 lb.+			TOTAL		
DAY	No	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No	Mean (oz.)	S.D.(oz.)
1	22	-2.46	2.53	10			4			36	-3.08	2.55
2	52	-3.83	3.27	32	-5.03	3.03	6			90	-4.33	3.26
3	52	-4.98 (-5.24%)	3.48	32	-6.16	3.56	6			90	-5.52 (-5.29%)	3.52
4	53	-4.41	4.07	33	-6.89 (-6.08%)	3.74	7			93	-5.40	4.09
5	49	-3.62	4.30	33	-5.99	4.70	7			89	-4.65	4.62
6	42	-3.45	4.47	30	-5.33	4.80	4			76	-4.36	4.79
7	37	-2.89 (-3.04%)	4.60	23	-4.57 (-4.03%)	5.62	4			65	-3.68 (-3.53%)	5.17

RANK 2+

B. Wt.	5.98 lb.			7.03 lb.						6.759 lb.		
	> 6 lb. 7 oz.			6 lb. 8oz.- 7 lb. 15oz.			8 lb.+			TOTAL		
DAY	No	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)
1	26	-2.54	2.19	27	-3.43	2.32	3			56	-3.09	2.37
2	53	-4.01 (-4.19%)	3.06	69	-5.01	3.32	13			135	-4.68	3.31
3	54	-4.00	3.92	78	-5.41 (-4.81%)	4.19	14			146	-5.07 (-4.69%)	4.29
4	56	-3.71	4.59	75	-4.68	4.94	13			144	-4.47	4.82
5	53	-2.89	5.90	75	-4.68	5.82	11			139	-4.08	5.91
6	46	-2.22 (-2.32%)	6.26	62	-2.65	6.56	8			116	-2.59	6.53
7	31	-2.48	6.44	52	-2.62 (-2.33%)	7.27	7			90	-2.44 (-2.26%)	6.84

APPENDIX 18b

McCORDS - INDIAN BOYS

MEAN DAILY GAIN OR LOSS FROM BIRTH WEIGHT.

ALL RANKS

B. Wt.	5.99 lb.			7.12 lb.			8.41 lb.			6.823 lb.		
	→ 6 lb. 7 oz.			6 lb. 8 oz.- 7 lb. 15oz.			8 lb.+			TOTAL		
DAY	No	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)
1	39	-1.83	2.21	57	-3.97	3.02	8			104	-3.03	2.92
2	92	-3.63	3.03	135	-4.72	3.34	22	-4.14	2.90	249	-4.27	3.23
3	97	-4.98 (-5.2%)	3.95	142	-5.38 (-4.7%)	4.28	22	-6.09	3.40	261	-5.21 (-4.77%)	4.11
4	92	-4.48	4.70	135	-5.36	5.86	23	-6.39 (-4.7%)	4.66	250	-5.13	5.39
5	89	-3.16	5.19	136	-4.12	5.91	22	-5.82	6.26	247	-3.92	5.75
6	78	-2.18	5.84	111	-3.16	6.48	19			208	-3.02	6.32
7	63	-1.03 (-1.1%)	6.41	86	-2.67 (-2.3%)	7.18	14			163	-2.03 (-1.86%)	7.02

RANK 1

B. Wt.	5.94 lb.			6.94 lb.						6.463 lb.		
	→ 6 lb. 7 oz.			6 lb. 8oz.- 7 lb. 15oz.			8 lb.+			TOTAL		
DAY	No	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)
1	13			12			1			26	-3.69	2.87
2	36	-3.94	3.37	31	-5.44	3.68	3			70	-4.58	3.59
3	40	-5.38	3.78	31	-5.92	4.88	3			74	-5.58	4.25
4	32	--5.75 (-6.05%)	4.82	31	-6.50 (-5.85%)	6.07	3			66	-6.02 (-5.82%)	5.50
5	31	-4.03	5.44	34	-5.82	6.31	3			68	-4.99	6.21
6	28	-2.86	6.46	28	-5.57	6.84	2			58	-4.34	7.01
7	25	-0.84 (-0.76%)	6.69	26	-4.15 (-3.74%)	7.63	3			54	-2.52 (-2.44%)	7.58

RANK 2+

B. Wt.	6.03 lb.			7.18 lb.			8.46 lb.			6.962 lb.		
	→ 6 lb. 7oz.			6 lb. 8oz.- 7lb. 15oz.			8 lb.+			TOTAL		
DAY	No	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)
1	26	-1.15	1.78	45	-3.79	3.03	7			78	-2.81	2.90
2	56	-3.43	2.76	104	-4.51	3.20	19	-4.34	2.82	179	-4.15	3.07
3	57	-4.18 (-4.33%)	3.87	111	-5.19 (-4.52%)	4.05	19	-6.29	3.41	187	-4.99 (-4.48%)	3.98
4	60	-3.77	4.46	104	-5.00	5.75	20	-6.80 (-5.02%)	4.42	184	-4.79	5.30
5	58	-2.69	4.99	102	-3.55	5.66	19	-5.95	5.44	179	-3.53	5.51
6	50	-1.80	5.43	83	-2.35	6.14	17	-5.35	5.75	150	-2.51	5.96
7	38	-1.16 (-1.20%)	6.21	60	-2.03 (-1.78%)	6.88	11			109	-1.79 (-1.61%)	6.71

APPENDIX 19

TOTAL INITIAL LOSS OF WEIGHT (IN OUNCES)

1. EUROPEAN

	→ 6 lb. 7 oz.			6 lb. 7 oz.- 7lb.15 oz.			8 lb.+			TOTAL		
	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)
Boys												
Rank 1	16	6.00	3.64	69	7.31 (6.4%)	3.14	45	9.08 (6.6%)	3.42	130	7.76 (6.4%)	3.46
Rank 2+	33	6.65 (6.9%)	2.65	164	7.01 (6.0%)	2.68	152	9.20 (6.5%)	3.74	349	7.93 (6.3%)	3.37
ALL RANKS	49	6.44 (6.62%)	3.03	233	7.10 (6.10%)	2.83	197	9.17 (6.51%)	3.67	479	7.88 (6.33%)	3.40
Girls												
Rank 1	18	6.94	3.78	81	7.32 (6.4%)	2.95	31	8.24 (6.0%)	4.18	130	7.49 (6.4%)	3.43
Rank 2+	48	5.96 (6.1%)	2.45	159	7.16 (6.3%)	2.87	90	10.01 (7.2%)	3.93	297	7.83 (6.6%)	3.51
ALL RANKS	66	6.28 (6.43%)	2.91	240	7.21 (6.31%)	2.90	121	9.56 (6.89%)	4.07	427	7.73 (6.52%)	3.49

2. COLOURED

	→ 6 lb. 7 oz.			6 lb. 7 oz.- 7lb.15 oz.			8 lb.+			TOTAL		
	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)
Boys												
Rank 1	18			20	7.80 (6.8%)	3.04	10			48	7.50 (6.59%)	3.07
Rank 2+	23	6.07 (6.2%)	2.73	65	7.67 (6.7%)	2.52	26	6.92 (4.95%)	3.18	114	7.18 (6.12%)	2.80
ALL RANKS	41	6.28 (6.4%)	2.75	85	7.70 (6.69%)	2.65	36	7.39 (5.30%)	3.27	162	7.27 (6.26%)	2.89
Girls												
Rank 1	20	6.30 (6.51%)	2.09	30	6.43 (5.64%)	2.73	4			54	6.56 (6.00%)	2.75
Rank 2+	24	6.00 (6.24%)	2.38	75	6.91 (6.00%)	2.60	29	8.50 (6.22%)	2.91	128	7.10 (6.10%)	2.76
ALL RANKS	44	6.14 (6.36%)	2.26	105	6.78 (5.90%)	2.65	33	8.53 (6.24%)	3.13	182	6.94 (6.07%)	2.77

3. INDIAN

	→ 6 lb. 7 oz.			6 lb. 7 oz.- 7lb.15oz.			8 lb.+			TOTAL		
	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)	No.	Mean (oz.)	S.D.(oz.)
Boys												
Rank 1	40	6.85 (7.2%)	4.40	34	8.38 (7.5%)	4.61	3			77	7.60 (7.36%)	4.68
Rank 2+	62	5.45 (5.6%)	3.74	115	6.54 (5.7%)	4.75	22	8.18 (6.0%)	3.64	199	6.38 (5.73%)	4.42
ALL RANKS	102	6.00 (6.26%)	4.06	149	6.96 (6.11%)	4.78	25	8.26 (6.14%)	4.18	276	6.72 (6.17%)	4.53
Girls												
Rank 1	56	5.98 (6.3%)	3.59	34	7.40 (6.5%)	3.40	7			97	6.64 (6.37%)	3.60
Rank 2+	59	5.42 (5.7%)	3.81	83	6.93 (6.2%)	4.57	15			157	6.45 (5.96%)	4.36
ALL RANKS	115	5.69 (5.97%)	3.71	117	7.07 (6.27%)	4.27	22	7.95 (5.98%)	4.03	254	6.52 (6.11%)	4.08

APPENDIX 20

DURATION OF TOTAL INITIAL LOSS OF WEIGHT IN DAYS

1. EUROPEAN

	→ 6 lb. 7 oz.			6 lb. 8 oz.- 7lb.15oz.			8 lb.+			TOTAL		
	No.	Mean (Days)	S.D.(Days)	No.	Mean (Days)	S.D.(Days)	No.	Mean (Days)	S.D.(Days)	No.	Mean (Days).	S.D.(Days)
Boys												
Rank 1	16			69	2.82	.96	45	2.81	.89	130	2.83	.95
Rank 2+	33	2.65	.96	164	2.67	1.02	152	2.89	1.12	349	2.76	1.06
ALL RANKS	49	2.75	1.00	233	2.72	1.00	197	2.87	1.08	479	2.78	1.03
Girls												
Rank 1	18			81	2.88	.92	31	2.63	1.04	130	2.83	1.03
Rank 2+	48	2.42	.86	159	2.67	.98	90	2.96	1.12	297	2.72	1.02
ALL RANKS	66	2.56	1.04	240	2.74	.97	121	2.87	1.11	427	2.75	1.02

2. COLOURED

	→ 6 lb. 7 oz.			6 lb. 8 oz.- 7lb.15oz.			8 lb.+			TOTAL		
	No.	Mean (Days)	S.D.(Days)	No.	Mean (Days)	S.D.(Days)	No.	Mean (Days)	S.D.(Days)	No.	Mean (Days)	S.D.(Days)
Boys												
Rank 1	18			20	3.05	1.02	10			48	3.00	.89
Rank 2+	23	2.67	.76	65	2.76	.95	26	2.58	1.07	114	2.70	.95
ALL RANKS	41	2.82	.78	85	2.83	.97	36	2.67	1.01	162	2.79	.94
Girls												
Rank 1	20	2.70	1.03	30	2.50	.77	4			54	2.61	.90
Rank 2+	24	2.50	.76	75	2.59	.80	29	2.81	1.12	128	2.63	.88
ALL RANKS	44	2.59	.90	105	2.57	.80	33	2.83	1.09	182	2.62	.89

3. INDIAN

	→ 6 lb. 7 oz.			6 lb. 8 oz.- 7lb.15oz.			8 lb.+			TOTAL		
	No.	Mean (Days)	S.D.(Days)	No.	Mean (Days)	S.D.(Days)	No.	Mean (Days)	S.D.(Days)	No.	Mean (Days)	S.D.(Days)
Boys												
Rank 1	40	3.48	1.31	34	3.62	1.47	3			77	3.55	1.39
Rank 2+	62	2.98	1.29	115	3.09	1.22	22	3.73	1.24	199	3.13	1.27
ALL RANKS	102	3.18	1.32	149	3.21	1.30	25	3.74	1.24	276	3.25	1.31
Girls												
Rank 1	56	3.27	1.38	34	3.32	1.01	7			97	3.33	1.28
Rank 2+	59	2.81	1.39	83	3.21	1.29	15			157	3.07	1.32
ALL RANKS	115	3.03	1.40	117	3.24	1.21	22	3.46	1.19	254	3.17	1.31

APPENDIX 22

PERCENTAGE OF BABIES WHO HAD REGAINED BIRTH WEIGHT BY THE 7TH DAY.

1. ADDINGTON EUROPEAN

Birth Weight Groups	RANK 1				RANK 2+			
	Girls		Boys		Girls		Boys	
	No.	%	No.	%	No.	%	No.	%
→ 6 lb. 7 oz.	8	44.4	8	50.0	17	35.4	7	21.2
6 lb. 8 oz. - 7 lb. 15 oz.	14	17.7	15	21.7	32	20.1	40	24.4
8 lb.+	4	12.1	2	4.4	13	14.4	27	17.8
TOTAL	26	20.0	25	19.2	62	20.9	74	21.2

2. COLOURED

Birth Weight Groups	RANK 1				RANK 2+			
	Girls		Boys		Girls		Boys	
	No.	%	No.	%	No.	%	No.	%
→ 6 lb. 7 oz.	9	45.0	8	44.4	9	37.5	9	39.13
6 lb. 8 oz. - 7 lb. 15 oz.	12	40.0	5	25.0	21	28.0	15	23.08
8 lb.+	1	25.0	2	20.0	7	24.14	11	41.54
TOTAL	22	40.74	15	31.25	37	28.91	35	30.70

3. INDIAN

Birth Weight Groups	RANK 1				RANK 2+			
	Girls		Boys		Girls		Boys	
	No.	%	No.	%	No.	%	No.	%
→ 6 lb. 7 oz.	22	39.3	15	37.5	28	47.5	30	48.4
6 lb. 8 oz. - 7 lb. 15 oz.	9	26.5	11	32.4	31	37.3	46	40.0
8 lb.+	2	28.6	2	66.7	3	20.0	3	13.6
TOTAL	33	34.02	28	36.36	62	39.49	79	39.7

APPENDIX 21

GAIN IN FIRST 4 DAYS AFTER MINIMAL WEIGHTS

1. EUROPEAN

Birth Weight Groups	RANK 1				RANK 2+			
	Girls		Boys		Girls		Boys	
	Amount	% of B. Wt.	Amount	% of B. Wt.	Amount	% of B. Wt.	Amount	% of B. Wt.
Light					2.81 oz	2.88	2.87 oz	2.97
Average	1.35 oz	1.18	2.71 oz	2.35	1.50 "	1.32	2.16 "	1.85
Heavy	1.23 "	.90	1.87 "	1.35	1.64 "	1.18	1.42 "	1.00
TOTAL	1.38 "	1.2	2.41 "	1.99	1.73 "	1.45	1.74 "	1.4

2. COLOURED

Birth Weight Groups	RANK 1				RANK 2+			
	Girls		Boys		Girls		Boys	
	Amount	% of B. Wt.	Amount	% of B. Wt.	Amount	% of B. Wt.	Amount	% of B. Wt.
Light	4.40 oz	4.55	-	-	3.31 oz	3.44	3.13 oz	3.22
Average	3.44 "	2.45	3.30 oz	2.89	3.30 "	2.86	2.27 "	1.97
Heavy	-	-	-	-	3.29 "	2.41	2.80 "	2.00
TOTAL	3.65 "	3.34	3.66 "	3.22	3.29 "	2.82	2.59 "	2.2

3. INDIAN

Birth Weight Groups	RANK 1				RANK 2+			
	Girls		Boys		Girls		Boys	
	Amount	% of B. Wt.	Amount	% of B. Wt.	Amount	% of B. Wt.	Amount	% of B. Wt.
Light	2.09 oz	2.20	-	-	1.79 oz	1.87	3.02 oz	3.13
Average	-	-	-	-	2.79 "	2.48	3.16 "	2.74
Heavy	-	-	-	-	-	-	-	-
TOTAL	1.84 "	1.80	-	-	2.6 "	2.4	3.2 "	2.9

APPENDIX 23

SIGNIFICANCE OF DIFFERENCES - BOYS

COMPARISON OF NEONATAL PROGRESS OF THE FOUR RACIAL GROUPS

RANK 1

	% Regained B.Wt by 7th Day			Duration of Loss			Total Initial Loss		
	D	SE	D/SE	D	SE	D/SE	D	SE	D/SE
European and Coloured	12.1%	7.5	1.6	.17 days	.15	1.1	.26 oz	.54	<1
European and Bantu	15.4%	6.4	2.4	.73 days	.17	4.3	2.02 oz	.73	2.8
European and Indian	17.2%	6.5	2.6	.72 days	.18	4.0	.16 oz	.61	<1
Coloured and Bantu	3.3%	8.6	<1	.56 days	.19	2.9	2.28 oz	.80	2.8
Coloured and Indian	5.1%	8.6	<1	.55 days	.20	2.8	.10 oz	.69	<1
Bantu and Indian	1.8%	7.7	<1	.01 days	.22	<1	2.18 oz	.85	2.6

RANK 2+

	% Regained B.Wt by 7th Day			Duration of Loss			Total Initial Loss		
	D	SE	D/SE	D	SE	D/SE	D	SE	D/SE
European and Coloured	9.5%	4.8	2.0	.06 days	.11	<1	.75 oz	.32	2.3
European and Bantu	33.8%	4.0	8.5	.17 days	.09	1.9	1.10 oz	.33	3.3
European and Indian	18.5%	4.1	4.5	.37 days	.11	3.4	1.55 oz	.36	4.3
Coloured and Bantu	24.3%	5.5	4.4	.23 days	.11	2.1	.35 oz	.38	<1
Coloured and Indian	9.0%	5.5	1.6	.43 days	.13	3.3	.80 oz	.41	2.0
Bantu and Indian	15.3%	4.8	3.2	.20 days	.11	1.8	.45 oz	.42	1.1

ALL RANKS

	% Regained B.Wt by 7th Day			Duration of Loss			Total Initial Loss		
	D	SE	D/SE	D	SE	D/SE	D	SE	D/SE
European and Coloured	10.2%	4.1	2.5	.01 days	.09	<1	.61 oz	.27	2.3
European and Bantu	29.0%	3.4	8.5	.32 days	.08	4.0	.28 oz	.32	<1
European and Indian	18.1%	3.5	5.2	.47 days	.09	5.2	1.16 oz	.31	3.7
Coloured and Bantu	18.8%	4.6	4.1	.31 days	.10	3.1	.33 oz	.36	<1
Coloured and Indian	7.9%	4.7	1.7	.46 days	.11	4.2	.55 oz	.35	1.6
Bantu and Indian	10.9%	4.1	2.7	.15 days	.10	1.5	.88 oz	.39	2.3

SIGNIFICANCE OF DIFFERENCES - GIRLS

RANK 1

	% Regained B.Wt by 7th Day			Duration of Loss			Total Initial Loss		
	D	SE	D/SE	D	SE	D/SE	D	SE	D/SE
European and Coloured	20.7%	7.6	2.7	.22 days	.15	1.5	.93 oz	.48	1.9
European and Bantu	18.6%	6.5	2.1	.81 days	.20	4.0	.79 oz	.67	1.2
European and Indian	14.0%	6.0	2.3	.50 days	.16	3.1	.85 oz	.47	1.8
Coloured and Bantu	6.9%	8.7	<1	1.03 days	.22	4.7	1.72 oz	.71	2.4
Coloured and Indian	6.7%	8.2	<1	.72 days	.18	4.0	.08 oz	.52	<1
Bantu and Indian	.2%	7.3	<1	.31 days	.22	1.4	1.64 oz	.70	2.3

Rank 2+

	% Regained B.Wt by 7th Day			Duration of Loss			Total Initial Loss		
	D	SE	D/SE	D	SE	D/SE	D	SE	D/SE
European and Coloured	8.0%	4.65	1.7	.09 days	.10	<1	.73 oz	.32	2.3
European and Bantu	28.7%	4.1	7.0	.35 days	.10	3.5	.80 oz	.35	2.3
European and Indian	18.6%	4.6	4.0	.35 days	.12	2.9	1.38 oz	.40	3.5
Coloured and Bantu	20.7%	5.2	4.0	.44 days	.11	4.0	.07 oz	.38	<1
Coloured and Indian	10.6%	5.6	1.9	.44 days	.13	3.4	.65 oz	.42	1.5
Bantu and Indian	10.1%	5.1	2.0	0	.13	<1	.58 oz	.45	1.3

ALL RANKS

	% Regained B.Wt by 7th Day			Duration of Loss			Total Initial Loss		
	D	SE	D/SE	D	SE	D/SE	D	SE	D/SE
European and Coloured	11.8%	3.98	3.0	.13 days	.08	1.6	.79 oz	.27	2.9
European and Bantu	25.0%	3.5	7.1	.46 days	.09	5.1	.39 oz	.31	1.3
European and Indian	16.8%	3.6	4.7	.42 days	.10	4.2	1.21 oz	.31	3.9
Coloured and Bantu	13.2%	4.5	2.9	.59 days	.10	5.9	.40 oz	.34	1.2
Coloured and Indian	5.0%	4.6	1.1	.55 days	.11	5.0	.42 oz	.33	1.3
Bantu and Indian	8.2%	4.2	2.0	.04 days	.11	<1	.82 oz	.37	2.2

CHAPTER X

THE EFFECT OF DIFFERENT FEEDING SCHEDULES ON THE GROWTH OF BANTU BABIES IN THE FIRST WEEK OF LIFE.

In an earlier chapter I have discussed the effect of birth weight and the time of first feed on the growth of Bantu babies after birth. I will now examine the effect on their progress of different feeding schedules during the first week of life.

MATERIAL USED AND METHOD OF ANALYSIS.

My results are based on an experiment conducted at McCord's Zulu Hospital where from November, 1947 to May, 1948, all the Bantu newborn babies were fed on a regular four-hourly schedule; from June, 1948 to August, 1948 on an irregular self-demand schedule; and from August, 1948 to December, 1948, on a regular three-hourly feeding schedule. The first group consists of 458 babies, the second of 185, and the third of 414, making a grand total of 1,057 babies.

In my analysis I have not attempted to assess the effects according to sex or rank, but according to birth weight groups. All babies who weighed 5 lb and over are included in the data, the mean birth weight being 7 lb 2.28 oz with a standard deviation of 15.08 oz. The mean birth weights in the three feeding groups are almost identical, 7 lb 2.31 oz for the four-hourly group, 7 lb 2.39 for the self-demand babies, and 7 lb 2.18 oz for the three-hourly group.

A further division is made between those babies who weigh less than the mean birth weight, and those who weigh more than the mean birth weight, in each of the three feeding groups.

In addition there is a finer division into:

Babies weighing 5 lb 0 oz - 6 lb 15 oz at birth.

Babies weighing 7 lb 0 oz - 7 lb 15 oz at birth.

Babies weighing 8 lb and over at birth.

The effects of the different feeding schedules are examined in these five birth weight groups. Since it has been shown in Chapter VII that the maximum mean loss of weight of Bantu babies occurs on the third day of life, the weight on the third day of life is subtracted from the birth weight to assess the effect of differing feeding routines on weight loss. The effect on the gain of weight is measured by subtracting the seventh day weight from birth weight, and the third day weight from the seventh day weight.

RESULTS.

Table 45 a and b show the effect of the feeding schedules on the babies who weigh less and more than the mean (7 lb 2.28 oz) at birth. It is obvious from the table that the babies who weigh more than the mean, lose more weight and gain less than the babies who weigh less than the mean. This result is to be expected in the light of earlier discussions on the effect of birth weight on growth, and has been reported on in detail in Chapter VIII.

In both the small and the bigger b abies, those fed on a regular three-hourly regime lose less actual and relative weight than the other two feeding categories. In both cases the next best group with regard to losses is the four-hourly feeding group. The differences are more marked in the heavier babies than the lighter ones.

However, when the gain in weight is considered there is a marked contrast. Here both groups show a greater rate of growth both absolute and relative for the self-demand babies, despite their heavier losses. The three-hourly feeders give the second best results and the four-hourly feeders the worst.

Tables 45 c, d and e demonstrate the effect of the three feeding schedules on the babies weighing 5 lb 0 oz to 6 lb 15 oz at birth, 7 lb 0 oz to 7 lb 15 oz and 8 lb and over. It will be convenient to call them small, medium and heavy babies. The results with regard to loss of weight are not quite as consistent as before. On the whole the self-demand babies lose more than the other two groups, while the three-hourly and four-hourly groups have almost the same losses for the small babies; the three-hourly lose less for the medium babies, and the four-hourly less for the large babies. The rate of gain is unquestionably greatest with the self-demand babies, particularly so with the heavy ones. The three-hourly group are nearer to birth weight on the seventh day than the four-hourly, but the medium four-hourly babies gain more than

TABLE 45

GROWTH OF AFRICAN BABIES IN FIRST WEEK OF LIFE ACCORDING TO BIRTH WEIGHT AND FEEDING.

(a) Infants weighing less than mean birth weight (7 lb 2.28 oz)

	Birth Wgt.			3 Day Wgt. - Birth Wgt.			7 Day Wgt. - Birth Wgt.			7 Day Wgt. - 3 Day Wgt.		
	No.	Mean		No.	Mean	S.D.	No.	Mean	S.D.	No.	Mean	S.D.
		lb	oz		oz	oz		oz	oz		oz	oz
Regular 4-hourly Feeding	247	6	6.8	247	-4.24 -4.1%	5.6	190	-2.57 -2.5%	8.2	187	+1.86 +1.8%	7.3
Regular 3-hourly Feeding	225	6	7.2	225	-4.09 -4.0%	6.0	183	-1.04 -1.0%	9.5	178	+3.48 +3.4%	7.2
Irregular Self-demand Feeding	91	6	5.5	91	-4.66 -4.6%	5.1	79	-0.35 -0.3%	9.3	78	+4.15 +4.1%	7.2

(b) Infants weighing more than Mean Birth Weight (7 lb 2.28 oz)

	Birth Wgt.			3 Day Wgt. - Birth Wgt.			7 Day Wgt. - Birth Wgt.			7 Day Wgt. - 3 Day Wgt.		
	No.	Mean		No.	Mean	S.D.	No.	Mean	S.D.	No.	Mean	S.D.
		lb	oz		oz	oz		oz	oz		oz	oz
Regular 4-hourly Feeding	203	7	14.9	203	-7.03 -5.5%	7.1	158	-5.7 -4.5%	10.2	154	+1.53 +1.2%	7.9
Regular 3-hourly Feeding	180	7	14.5	180	-5.53 -4.4%	8.1	139	-4.79 -3.7%	10.7	134	+1.64 +1.3%	7.6
Irregular Self-demand Feeding	92	7	14.3	92	-7.43 -5.9%	7.0	74	-3.35 -2.6%	9.2	73	+3.80 +3.0%	7.4

(c) Infants weighing 5 lb 0 oz - 6 lb 15 oz at Birth.

	Birth Wgt.			3 Day Wgt. - Birth Wgt.			7 Day Wgt. - Birth Wgt.			7 Day Wgt. - 3 Day Wgt.		
	No.	Mean		No.	Mean	S.D.	No.	Mean	S.D.	No.	Mean	S.D.
		lb	oz		oz	oz		oz	oz		oz	oz
Regular 4-hourly Feeding	208	6	5.3	205	-4.03	5.66	161	-2.33	8.17	158	+1.77	7.35
Regular 3-hourly Feeding	199	6	6.1	194	-4.11	6.10	159	-0.74	9.66	154	+3.82	6.89
Irregular Self-demand Feeding	77	6	3.7	76	-4.97	5.06	65	-1.17	8.44	64	+3.52	7.04

(d) Infants weighing 7 lb 0 oz - 7 lb 15 oz at birth.

	Birth Wgt.			3 Day Wgt. - Birth Wgt.			7 Day Wgt. - Birth Wgt.			7 Day Wgt - 3 Day Wgt.		
	No.	Mean		No.	Mean	S.D.	No.	Mean	S.D.	No.	Mean	S.D.
		lb	oz		oz	oz		oz	oz		oz	oz
Regular 4-hourly Feeding	165	7	6.8	161	-6.59	7.13	120	-4.67	9.41	115	+2.57	7.30
Regular 3-hourly Feeding	149	7	7.6	146	-4.34	6.95	113	-3.38	8.55	110	+1.45	6.62
Irregular Self-demand Feeding	78	7	7.8	78	-6.04	6.58	64	-1.69	10.0	64	+3.98	7.34

(e) Infants weighing 8 lb and over at Birth.

	Birth Wgt.			3 Day Wgt. - Birth Wgt.			7 Day Wgt. - Birth Wgt.			7 Day Wgt. - 3 Day Wgt.		
	No.	Mean		No.	Mean	S.D.	No.	Mean	S.D.	No.	Mean	S.D.
		lb	oz		oz	oz		oz	oz		oz	oz
Regular 4-hourly Feeding	85	8	9.5	84	-6.96	6.13	60	-7.2	11.04	59	0.0	8.59
Regular 3-hourly Feeding	66	8	10.3	65	-7.45	9.09	50	-7.2	13.40	48	+1.92	10.31
Irregular Self-demand Feeding	30	8	10.1	29	-9.05	7.29	24	-3.83	9.69	23	+5.28	7.57

the three-hourly from the third to the seventh day. In general, looking at all five subdivisions of birth weight grouping, babies on self-demand feeds lose most weight, gain best, and are nearest to birth weight on the seventh day.

Babies fed three-hourly are slightly better off with regard to loss of weight than those fed four-hourly, they also gain faster, and are nearer to birth weight by the seventh day.

DISCUSSION.

Several interesting facts emerge from the experiment. The babies fed on self-demand lose more weight than the babies fed on a regular schedule. On the other hand, their rate of gain is so rapid that despite their heavier losses, they are nearer birth weight on the seventh day than the "clock fed" babies.

Illingworth et al (1952) compared the progress of two groups of babies born at the Jessop Hospital for women, Sheffield, one group being fed four-hourly in the day and once at night, and the other (the "demand" group), whenever they wanted it, day or night. Both groups were fed six-hourly for the first two days. It was found that the gain in weight in relation to birth weight on the ninth day, was greater for the demand babies by 2 oz for the lighter, and 3½ oz for the heavy babies. 49.1 per cent of the demand babies had recovered their birth weight on the ninth day as compared with 36.1 per cent of the rigid group. There was a strong positive correlation between the weight gain and the amount of milk taken from the mothers' breasts, as shown by test feeds. There was also a positive correlation between the number of feeds taken in the day, and the quantity of milk consumed. It is easy to see why a baby fed on a demand schedule will gain more weight than a baby fed on a rigid schedule. A demand baby takes more frequent feeds. A baby fed by the clock may be exhausted from crying excessively before the next feed is due, and so take a poor feed, or it may be woken for a feed when not hungry, and again not take much milk. There is no second chance for the clock fed baby - he has to wait another three or four hours for his next feed.

It is interesting to speculate on why our demand baby loses more weight than the clock fed baby. Perhaps it is due to the well-known fact that babies sleep the greater part of the time for the first few days, and a demand baby will therefore probably get less food than a clock fed baby for the first two days of life. Simsarian and McLendon (1942), who recorded in detail the behaviour of an infant during the first 12 weeks of life on a self-demand schedule, reported that on the first day the baby took only three feeds, as compared with 11 on the fifth day. Meredith and Brown (1939) in reviewing the literature on the effect of prelacteal feeds on initial weight loss and gain in the first few weeks of life, refer to the following studies. Griffith and Gittings (1907) showed that the initial weight loss of infants could be materially lessened by giving them milk of wet nurses until the mothers' lactation was established.

Bachman (1923) also found a lower initial weight loss when prelacteal feeds were given. Randall (1930), Kugelmass et al (1933), Halpern (1934) and Crawford (1935) all found a lessening of initial weight loss with early complemental feeding.

Illingworth (1953) warns against the use of prelacteal feeds in that they have an adverse effect on the establishment of lactation.

Platt (1954) feels that giving prelacteal artificial feeds may, by satisfying the baby's hunger, reduce the amount of milk he sucks from the mother, and so retard the establishment of lactation.

It does seem that though abundant prelacteal feeding does not materially affect later weight gain, it can reduce the amount of weight originally lost. The smaller intake of the demand babies in the first two days may possibly explain the greater loss of weight they show as compared with the clock fed babies. However, as previously stated, this greater initial weight loss in no way affects their later gain in weight.

With regard to the frequency of feeds after birth, nursing homes and hospitals appear to have set rules. Babies are fed three-hourly in some, and four-hourly in others. In some institutions a decision is made according to the birth weight of the baby. Babies who are over 7 lb at birth are fed four-hourly, under 7 lb three-hourly.

Standard paediatric textbooks on the whole also advocate either three-hourly feeding or four-hourly feeding, usually the latter, without giving any convincing reason for their choice of a particular time interval.

Few studies have been done on the frequency of feeds in early life, but those that have, show that very often a schedule of either three hours or four hours does not fit in with the individual baby's needs in the early weeks.

Aldrich and Hewitt (1947) studied a group of 100 infants, after discharge from hospital, to ascertain the intervals of feeding during each month of the first year. At 1 month of age, two of the infants were on schedules too irregular to grade, 10 were being fed every two hours, 61 were fed three-hourly, and only 26 chose the four-hourly feeds which are generally recommended by doctors. One infant was on four meals a day. The trend during the first year was an orderly progression from a short interval to a longer interval between feedings. Aldrich and Hewitt's conclusions were, therefore, that though the averages at various months agreed fairly closely with the intervals usually prescribed by physicians, a large majority of babies desired an interval of less than four hours in the first two months of life. They showed that "a rigid routine, even if regulated to fit the average baby at each age, will leave a large group of infants poorly adjusted as far as timing is concerned".

Illingworth et al in the experiment mentioned previously, noted the number of feeds a day taken by the demand fed babies. The overall mean number of feeds in 24 hours was 6.4 and there was no difference between the mean number of feeds taken by his A, B and C babies. (A babies were full-term babies with a birth weight of less than 6 lb 13¼ oz, the Bs weighed between 6 lb 13¼ oz and 7 lb 13 oz, and the Cs had a birth weight greater than 7 lb 13 oz).

A considerable number of babies demanded more than seven feeds a day. On the fifth day 28.6 per cent and on the seventh day 15.5 per cent of the babies demanded eight feeds or more. 9.5 per cent demanded nine feeds or more on the fifth day. Demands were most frequent between the fourth and seventh days.

Simsarian and McLendon (1942) in their study previously mentioned, found a total of 54 feedings in the first week of life. The number of feeds ascended from three feedings on the first day to 11 feedings on the fifth day, and then gradually decreased from nine to six feeds daily in the next week.

A further study on self-demand feeding was carried out by Simsarian and McLendon (1945) when they found the number of feeds in the first week ranged from none on the first day to eleven on the fourth, fifth and sixth days.

Olmsted and Jackson (1950) found evidence of a definite patterning of feeding behaviour even within the first week of life. The third to the sixth day postpartum were the days of most frequent feedings, for breast fed babies on a self-demand regime.

It is interesting to note in passing that Nyhan (1952) in a study of stool frequency of normal infants in the first week of life, found the third to the sixth days were quite strikingly the peak days with regard to numbers of stools.

Aldrich et al (1945) in their studies of the crying of newly born babies also found the fourth to the sixth days to be the maximum in relation to the amount of crying.

All the workers seem to point to the same conclusions:

1) There are great individual variations between babies with regard to frequency of feeds required.

2) Babies need very frequent feeds in the first two weeks of life with the peak usually from the third to the seventh days.

3) Babies will settle down to a regular schedule themselves, with the time between feeds gradually getting longer.

It is unfortunate that there are no records of the number of feeds taken by the McCord's infants during the self-demand period. My experience, however, with African mothers in their homes and at the Health Centre, is that far more frequent feeds are given than the five or six a day necessitated by clock feeding. It used to be customary not to feed the babies on colostrum and to use this period for massage of the breasts in preparation for breast feeding, but gradually this custom has broken down. There is no doubt, however, that feeds are far more frequent once the milk has come in than before. It has long been a puzzle to me why babies of heavier birth weight should be presumed to manage with less frequent feeds than babies of lighter birth weights during their hospital stay. It is true that the breasts respond to the demands made by the suckling, but it would seem to be more logical for the heavier baby to suck more frequently rather than less frequently, to get the amount of food he needs before lactation is freely established. If babies must be fed at regular times in their early life in hospital, it appears that a three-hourly schedule would suit more babies than a four-hourly one.

It is obvious that we have a lot to learn about the needs of the neonate, and that much of our teaching is dogmatic and not founded on experiment and observation. Self-demand feeding has been the pattern for mankind from time immemorial, and the following quotation is rather apt in this connection:

"The hours of suckling it I do not fix
Nature in that must guide the nursing sex,
When by its cries it calls you, do not spare
your labour, nor be loath your breasts to bare". +

SUMMARY.

The effect of differing schedules of feeding is studied in 1,057 babies born at McCord's Zulu Hospital, Durban. 458 babies born between November, 1947 and May, 1948, were fed every four hours from birth; 185 babies born between June and August, 1948, were fed on self-demand, and 414 babies born from August, 1948 to December, 1948, were fed three-hourly.

All babies weighing 5 lb and over are included in this experiment. In the analysis, weight progress is measured by taking the birth weight minus the third day weight and birth weight minus the seventh day weight. The difference between seventh day weight and third day weight is also calculated. The babies are divided into five birth weight groups for comparison - those below and above the mean birth weight of all the babies, and again babies weighing between 5 lb to 6 lb 15 oz at birth, 7 lb to 7 lb 15 oz at birth, and those weighing 8 lb and over. No attempt is made to assess the effect on boys and girls separately, or in the different birth orders.

Results are as follows:

1. Babies fed on a self-demand regime lose more weight from birth to the third day than babies fed at regular intervals.

2. Despite this greater loss, the rate of gain of the babies on a self-demand schedule is so great that they overtake the babies fed at regular intervals, and are closer to birth weight at the seventh day.

3. Babies fed every three hours make more satisfactory progress than babies fed every four hours.

4. The results are discussed in the light of experimental work done elsewhere, and add to the evidence in favour of a self-demand feeding regime in early life. If such a regime is not or cannot be accepted in institutions, it appears that an interval of three hours is nearer the requirements of most young infants than a four-hour interval.

+ St. Marthe (1584). "Pediatrophia".

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CHAPTER XI

THE EFFECT OF SEASON OF BIRTH ON NEONATAL GROWTH IN EUROPEAN AND COLOURED BABIES.

MATERIAL USED AND METHOD OF ANALYSIS.

In assessing the effect of season of birth on neonatal growth, I have used 906 European and 344 Coloured babies born in the Addington Hospital from 1st May 1951 to 30th April 1952.

The effect of season of birth is assessed against two measures:

1) the total initial loss of weight of these babies, and
2) the duration of that loss.

Means and standard deviations of these measures are worked out for each month of the year for boys and girls separately and combined, and for Rank 1 and 2+, separately and combined. The babies were also divided into the three birth weight groups previously mentioned but, because the numbers became too small, the analysis is done irrespective of the birth weight groups. In the Coloured group the numbers are too small to measure the sexes separately, and I use only the figures for the sexes combined. Statistical significance is measured by the method of analysis of variance.

RESULTS.

1. SEASONAL VARIATION IN TOTAL INITIAL LOSS OF WEIGHT.

A) EUROPEAN.

Table 46 a, b and c shows the seasonal variation in total initial loss for European girls, boys and sexes combined for Rank 1, 2+, and all ranks together. The numbers of first-born babies in each month are too small for analysis, and discussion is confined to second and later-born babies (Rank 2+), and all ranks.

GIRLS.

Rank 2+. It will be seen that the total initial loss is greatest in June, July and August, the winter months, with the least loss occurring in December, January and February, the summer months. These variations are significant at the 5 per cent level, i.e. five times in 100 could variations as large as these be caused by chance.

TABLE 46

SEASONAL VARIATION IN TOTAL INITIAL LOSS OF WEIGHT.

(a) EUROPEAN GIRLS.

MONTHS	RANK 1 No.	RANK 1 Mean (oz)	RANK 1 S.D. (oz)	RANK 2+ No.	RANK 2+ Mean (oz)	RANK 2+ S.D. (oz)	ALL RANKS No.	ALL RANKS Mean (oz)	ALL RANKS S.D. (oz)
January	8			26	7.54	3.24	34	7.59	3.58
February	3			27	6.28	2.42	30	6.53	2.64
March	13			21	7.98	3.06	34	7.68	2.85
April	10			22	7.96	3.67	32	7.47	3.81
May	13			23	7.02	3.51	36	7.69	3.21
June	18			25	9.86	4.44	43	9.08	3.95
July	13			24	9.21	3.65	37	8.64	3.41
August	7			22	8.73	3.64	29	8.64	3.53
September	9			27	7.76	3.12	36	7.31	3.18
October	13			25	6.54	2.01	38	7.40	3.55
November	15			22	7.96	3.29	37	7.28	3.29
December	8			33	7.53	3.68	41	7.16	3.57
TOTAL	130	7.49	3.43	297	7.83	3.51	427	7.73	3.49
				Significant at 5 per cent level.			Not significant.		

(b) EUROPEAN BOYS.

MONTHS	RANK 1 No.	RANK 1 Mean (oz)	RANK 1 S.D. (oz)	RANK 2+ No.	RANK 2+ Mean (oz)	RANK 2+ S.D. (oz)	ALL RANKS No.	ALL RANKS Mean (oz)	ALL RANKS S.D. (oz)
January	9			29	7.29	2.61	38	6.79	2.59
February	17			27	7.06	2.77	44	6.86	3.03
March	10			33	8.44	2.70	43	8.31	2.76
April	3			34	8.38	3.76	37	8.26	3.81
May	11			34	7.97	3.80	45	8.01	3.54
June	11			29	8.19	3.49	40	8.55	3.92
July	9			26	7.92	2.95	35	8.44	2.89
August	12			23	8.72	3.31	35	8.70	4.18
September	8			39	7.78	3.43	47	7.76	3.31
October	12			22	8.50	3.15	34	8.21	2.73
November	17			32	7.75	3.81	49	8.01	3.49
December	11			21	7.07	3.76	32	6.72	3.33
TOTAL	130	7.76	3.46	349	7.93	3.37	479	7.88	3.40
				Not significant			Not significant		

(c) EUROPEANS : SEXES COMBINED

MONTHS	RANK 1 No.	RANK 1 Mean (oz)	RANK 1 S.D. (oz)	RANK 2+ No.	RANK 2+ Mean (oz)	RANK 2+ S.D. (oz)	ALL RANKS No.	ALL RANKS Mean (oz)	ALL RANKS S.D. (oz)
January	17			55	7.41	2.93	72	7.17	3.12
February	20			54	6.67	2.63	74	6.73	2.88
March	23			54	8.26	2.85	77	8.03	2.82
April	13			56	8.21	3.73	69	7.89	3.83
May	24			57	7.59	3.72	81	7.87	3.40
June	29			54	8.96	4.04	83	8.83	3.94
July	22			50	8.54	3.37	72	8.54	3.17
August	19			45	8.72	3.48	64	8.67	3.90
September	17			66	7.77	3.31	83	7.56	3.26
October	25			47	7.46	2.78	72	7.78	3.22
November	32			54	7.83	3.61	86	7.70	3.43
December	19			54	7.35	3.72	73	6.88	3.73
TOTAL	260	7.62	3.45	646	7.88	3.44	906	7.81	3.44
				Significant at 5 per cent level			Significant at 1 per cent level		

All Ranks. Again, June, July and August show the greatest total initial loss of weight, with November, December, January and February showing the least loss. Although these differences are not statistically significant, they are obviously of importance since the trend is exactly the same as for Rank 2+.

BOYS.

Rank 2+. The boys do not show as great variations as the girls, but they do show slightly greater losses from March to October than from November to February. The losses, therefore, are slightly greater in the winter than in the summer months. The differences are not large enough to be statistically significant.

All Ranks. Again, the variation shown is too small to be of statistical significance, but there are smaller losses of weight in December, January and February, than in the rest of the year.

SEXES COMBINED.

Even with the sexes combined, there are too few Rank 1 babies to work out means for each month.

Rank 2+. The results for the sexes combined is exactly the same as for the girls alone. The loss is greatest in June, July and August, and least in December, January and February, and this is significant at the 5 per cent level.

All Ranks. Again, June, July and August show the heaviest losses and December, January and February the lightest, but the differences are now significant at the 1 per cent level, i.e. there is only 1 chance in 100 that the variation is due to chance.

B) COLOURED.

In the Coloured group there are too few babies to work out separate means for boys and girls monthly, and the analysis is done with the sexes combined only. Table 47 shows the effect of seasonal variation on total initial loss for Coloured infants, sexes combined, ranks separately and combined.

Rank 1 still has insufficient numbers for analysis.

TABLE 47.

SEASONAL VARIATION IN TOTAL INITIAL LOSS OF WEIGHT. COLOURED SEXES COMBINED.

MONTHS	RANK 1 No.	Mean (oz)	S.D. (oz)	RANK 2+ No.	Mean (oz)	S.D. (oz)	ALL RANKS No.	Mean (oz)	S.D. (oz)
January	6			20	6.65	2.52	26	6.77	3.02
February	8			13	8.04	3.30	21	7.21	3.09
March	4			22	6.23	3.26	26	6.31	3.14
April	7			28	5.39	2.26	35	5.64	2.43
May	9			23	6.76	2.72	32	6.38	2.44
June	14			21	7.69	1.97	35	7.87	3.05
July	8			22	8.36	2.58	30	7.93	2.62
August	12			21	8.26	2.56	33	8.08	2.88
September	4			19	7.87	2.70	23	7.98	2.55
October	11			24	7.79	2.19	35	7.79	2.04
November	9			15	6.83	2.65	24	6.46	2.54
December	10			14	6.29	2.81	24	6.54	2.53
TOTAL	102	7.00	2.94	242	7.14	2.78	344	7.10	2.83
				Significant at 1 per cent level			Significant at 1 per cent level		

Rank 2+. The babies definitely lose more weight in June, July, August, September and October, and less from November to May. The effect on Coloured babies is more marked than on European babies since the results are significant at the 1 per cent level.

All Ranks. Exactly the same result is obtained for all ranks as for Rank 2+ alone with the significance again at the 1 per cent level.

2. SEASONAL VARIATION IN THE DURATION OF LOSS OF WEIGHT.

A) EUROPEAN.

Table 48 a, b and c shows the seasonal variation in duration of loss of weight for European girls and boys, separately and combined, for ranks separately and combined, irrespective of birth weight groups. As with the total initial loss there are insufficient numbers of first-born babies for analysis.

TABLE 48

SEASONAL VARIATION IN DURATION OF LOSS OF WEIGHT

(a) EUROPEAN GIRLS.

MONTHS	RANK 1 No.	RANK 1 Mean (days)	RANK 1 S.D. (days)	RANK 2+ No.	RANK 2+ Mean (days)	RANK 2+ S.D. (days)	ALL RANKS No.	ALL RANKS Mean (days)	ALL RANKS S.D. (days)
January	8			26	2.62	.97	34	2.62	1.02
February	3			27	2.46	1.14	30	2.57	1.15
March	13			21	3.02	1.22	34	3.06	1.14
April	10			22	2.64	.55	32	2.66	.75
May	13			23	2.41	.78	36	2.61	.81
June	18			25	3.06	1.50	43	3.01	1.37
July	13			24	3.00	.82	37	2.91	.88
August	7			22	2.82	.92	29	2.81	.88
September	9			27	2.94	1.13	36	2.86	1.11
October	13			25	2.50	.75	38	2.66	.90
November	15			22	2.64	.82	37	2.64	.87
December	8			33	2.56	.95	41	2.57	.97
TOTAL	130	2.83	1.03	297	2.72	1.02	427	2.75	1.02
				Not significant			Not significant		

(b) EUROPEAN BOYS.

MONTHS	RANK 1 No.	RANK 1 Mean (days)	RANK 1 S.D. (days)	RANK 2+ No.	RANK 2+ Mean (days)	RANK 2+ S.D. (days)	ALL RANKS No.	ALL RANKS Mean (days)	ALL RANKS S.D. (days)
January	9			29	2.53	.81	38	2.45	.79
February	17			27	2.54	.74	44	2.61	.78
March	10			33	2.92	1.39	43	2.92	1.30
April	3			34	2.65	.69	37	2.69	.77
May	11			34	2.56	.97	45	2.63	1.00
June	11			29	2.91	1.16	40	2.83	1.10
July	9			26	2.85	.83	35	2.87	.80
August	12			23	3.11	1.17	35	3.10	1.25
September	8			39	2.78	.88	47	2.82	.85
October	12			22	2.73	1.04	34	2.65	1.03
November	17			32	2.75	1.23	49	2.79	1.05
December	11			21	2.98	1.53	32	3.13	1.34
TOTAL	130	2.83	.95	349	2.76	1.06	479	2.78	1.03
				Not significant			Not significant		

(c) EUROPEANS : SEXES COMBINED

MONTHS	RANK 1 No.	RANK 1 Mean (days)	RANK 1 S.D. (days)	RANK 2+ No.	RANK 2+ Mean (days)	RANK 2+ S.D. (days)	ALL RANKS No.	ALL RANKS Mean (days)	ALL RANKS S.D. (days)
January	17			55	2.57	.89	72	2.53	.91
February	20			54	2.50	.96	74	2.59	.95
March	23			54	2.96	1.33	77	2.98	1.23
April	13			56	2.64	.64	69	2.67	.76
May	24			57	2.50	.90	81	2.62	.92
June	29			54	2.98	1.33	83	2.92	1.25
July	22			50	2.92	.83	72	2.89	.84
August	19			45	2.97	1.07	64	2.97	1.10
September	17			66	2.85	.99	83	2.84	.97
October	25			47	2.61	.90	72	2.65	.97
November	32			54	2.70	1.08	86	2.72	.98
December	19			54	2.72	1.23	73	2.82	1.18
TOTAL	260	2.83	.99	646	2.74	1.05	906	2.77	1.03
				Not significant			Not significant		

GIRLS.

Rank 2+. These babies lose weight for a longer period in June, July, August and September, and for a shorter period in December, January and February. The differences, however, are not very great and are not significant.

All Ranks. Exactly the same remarks pertain to all ranks as to Rank 2+ above.

BOYS.

Rank 2+. As with the girls, the loss is slightly longer in June, July, August and slightly shorter in January and February. The differences are small and insignificant statistically.

All Ranks. The boys again agree with the girls, in that the same results apply to all ranks as to Rank 2+ above.

SEXES COMBINED.

Rank 2+. As before, losses last longer in June, July, August and September, and shorter in January and February. The differences are rather greater than those for boys and girls separately, but are still not significant.

All Ranks. The results here are less consistent than for Rank 2+ but they are in the same direction with longer losses from June to September, and shorter in January and February. The differences are too slight for statistical significance.

B) COLOURED.

As with total initial loss the numbers of babies are too small to separate the sexes and Table 49 shows the effect of season on duration of loss of weight for the sexes combined, Rank 1, 2+ and combined.

As with the European infants, the effect of season on duration of loss is not marked, though the trends remain the same.

Rank 2+. Results from month to month are rather inconsistent here, but the loss is shorter in January, February and March.

All Ranks. Exactly the same statement applies to all ranks as to Rank 2+ above. In neither case are the results of statistical significance.

TABLE 49.

SEASONAL VARIATION IN DURATION OF LOSS OF WEIGHT

COLOURED SEXES COMBINED.

MONTHS	RANK 1 No.	RANK 1 Mean (days)	RANK 1 S.D. (days)	RANK 2+ No.	RANK 2+ Mean (days)	RANK 2+ S.D. (days)	ALL RANKS No.	ALL RANKS Mean (days)	ALL RANKS S.D. (days)
January	6			20	2.45	.97	26	2.54	1.02
February	8			13	2.58	.83	21	2.41	.81
March	4			22	2.41	1.20	26	2.42	1.21
April	7			28	2.57	1.07	35	2.67	1.13
May	9			23	2.59	.72	32	2.53	.68
June	14			21	2.83	.84	35	2.87	.93
July	8			22	2.77	.69	30	2.70	.75
August	12			21	2.64	.64	33	2.83	.80
September	4			19	2.34	.74	23	2.50	.78
October	11			24	3.13	.70	35	3.01	.65
November	9			15	2.77	1.00	24	2.83	.94
December	10			14	2.86	1.11	24	2.88	.90
TOTAL	102	2.79	.91	242	2.66	.92	344	2.70	.92
				Not significant.			Not significant.		

DISCUSSION.

The effect of season of birth on weight loss in the first few days of life is essentially the same in European and Coloured babies. Both races show the heaviest losses in June, July and August (winter months) and the least losses in December, January and February (summer months).

The trend is quite consistent even where the differences are not large enough to be of statistical significance.

The variation is more marked in girls than in boys, and slightly more marked in Coloured babies than in Europeans when the sexes are combined.

The duration of the loss of weight is very little affected in both races, but the summer babies tend to have a shorter period of loss than the winter babies.

Seasonal variation in birth weights of South African babies has been discussed earlier (Chapter VI). Where differences prevailed the heavier babies were on the whole born in the summer months. The female babies showed greater variation than the males and the non-Europeans than the European babies.

Although there is virtually no racial difference in weight loss and its duration the females again show more variation than the males. Bakwin and Bakwin (1929) investigated seasonal variation in the weight loss of several thousand infants born at the Bellevue Hospital, New York, over two years, and found that the weight loss was considerably less for both boys and girls during the summer than during the winter months. The weight loss during the summer months was about 15 per cent less than during the winter months and averaged about 7.5 per cent of birth weight, as compared with a loss of 8.78 per cent during the winter months. Meredith and Brown (1939) studied seasonal variation in growth in weight during the first ten post-natal days in 533 male and 505 female babies born at the University Hospitals, Iowa City, during a three year period. They found that between birth and the third post-natal day, males born in the winter and spring showed a greater absolute and relative loss of weight than those born in the summer and autumn. No trend of loss was found for females from season to season.

From three to ten days of age both male and female babies born in the summer and autumn showed greater gains in weight than those born in winter and spring. The female gain for summer and autumn was 20 per cent more than the winter and spring gain, and thus exceeded the male difference of 12 per cent. They found also that the weights of male and female babies born in the summer and autumn more nearly approximated the birth means by ten days of age than those of the babies born in the winter and spring.

It seems, then, that season of birth has an influence on both loss and gain in weight for the first ten days after birth, with the babies born in the summer months losing less and gaining more weight than the winter babies. Duration of weight loss is less affected by season but the overall picture is the same.

The reason for seasonal differences has not been established, but it would seem logical to look for it in the prenatal environment. There appears to be some difference in the effect of season on boys and girls. Bakwin and Bakwin found no difference, but this study shows a greater variation in girls. Meredith and Brown found more seasonal effect in boys with regard to loss of weight, but more effect in girls when gain in weight was considered.

Since the numbers are too small for analysis I cannot state the effect of season of birth on the weight of first-born babies. As has been shown the results for second and later born babies and for babies of all ranks are essentially the same.

SUMMARY.

The effect of season of birth on neonatal growth is studied on 906 European and 344 Coloured babies born in the Addington Hospital from 1st May 1951 to 30th April 1952. The measures used are the total initial loss of weight of the babies and the duration of that loss. In the European group the effect of season of birth is assessed for boys and girls separately and together, but in the Coloured group only for the sexes combined. In neither group are there sufficient first-born babies for separate analysis, but second and later born babies are analysed apart from all ranks taken together.

Results are as follows:

1. In both European and Coloured groups, sexes combined, babies born in the summer months lose significantly less weight than babies born in the winter months.

2. The effect is essentially the same for second and later born babies as for all babies taken together.

3. European girls show a greater variation in weight loss than European boys.

4. The duration of the loss of weight is less affected by season of birth and is not of statistical significance, but the babies lose for a longer period in the winter months and a shorter period in the summer months.

R E F E R E N C E S.

Bakwin, H. and Bakwin, R.M. (1929). Amer. J. Obstet. and Gynec., 18, 863.

Meredith, H.V. and Brown, A.W. (1939). Hum. Biol., 11, 24.

S E C T I O N   I I I

G R O W T H   D U R I N G   T H E   F I R S T   Y E A R   O F   L I F E

INTRODUCTION

The previous two sections dealt with birth weight and weight growth in the first ten days of life. This section deals with the weight of babies during the whole of the first year of life. As before, this is a comparative study of European, Coloured, Bantu and Indian babies.

When dealing with birth weights it was hardly possible to separate the baby from its mother and her uterus formed the external environment of the baby. In the second section (Growth in the first ten days of life) although the baby was now a separate being and the umbilical cord had been severed, the cord of attachment between mother and child was still very strong and the baby almost completely dependent on its mother for its life. The effect of the pre-natal environment was still very powerful although the breast had replaced the uterus as the most important maternal organ.

In the present section the child gradually develops an independent existence, precarious though it may be. It is possible for the child to survive without its mother's constant presence. However, its health depends, to a very great extent, on the mother's love and care and on her efficiency in bringing up the child. After the first few months the breast alone is not sufficient for the child - he needs other food, other stimulation, and other interests. Infections too, play an increasing role, particularly after the first six months, in determining the health and growth of the baby.

The growth curve in the first year then is a resultant of the child's vitality at birth and the food, care and handling it receives thereafter, with the mother playing an indispensable role.

I started the investigation of growth in the first year of life by studying a group of Coloured, Bantu and Indian babies who attended the Springfield Health Centre in 1947. I analysed their diets in the first two years of life and their gain and loss of weight during that period. In addition I analysed their weight at different age levels during the first year of life and compared their growth with each other and with a group of European babies attending a municipal clinic in Durban.

This study I regarded as a pilot survey for a later and far bigger study of growth in the first year of life of the four racial groups, for which I used the records of the Durban Municipal Child Welfare clinics.

Accordingly Chapter XII deals with the diet and growth of Coloured, Bantu and Indian babies attending the Springfield Health Centre.

Chapter XIII is an analysis of the weights (observed and calculated), and of the rate of gain in weight from 2 - 52 weeks of European, Coloured, Bantu and Indian babies attending the Durban Municipal Child Welfare clinics.

Chapter XIV discusses the effects of sex, rank and birth weight on that growth.

CHAPTER XII

DIET AND GROWTH OF COLOURED, BANTU AND INDIAN BABIES ATTENDING THE SPRINGFIELD HEALTH CENTRE.

This chapter discusses the diets from birth to two years, and the growth (particularly in the first year of life) of Coloured, Bantu and Indian babies attending the mother and baby sessions at the Springfield Health Centre. I was a medical officer in the Coloured section of the Health Centre at that time and analysed the Coloured diet myself. Information on Bantu and Indian diets was supplied to me by the medical officer in charge of the African section of the Health Centre, and the sister in charge of the Indian section.

The Coloured section of the Health Centre served a group of Coloured people with a considerable range of income, and an educational standard and economic level far above that of the Bantu and Indian sections. The Bantu seen at Springfield were a shifting population who lived in shacks and back yards, and who had none of the advantages of the Bantu living in the Lamont Subeconomic Housing Scheme. The Indian population were very poor, but lived in a municipal subeconomic housing scheme and had small plots of ground on which they grew vegetables.

MATERIAL USED AND METHOD OF ANALYSIS.

A. Data used are:

1. Coloured babies from Sydenham, Durban, who attended the Health Centre from April to June, 1947, and from April to June, 1948.

2. Bantu babies from a defined area attending the Health Centre from July to December, 1947.

3. Indian babies from the Springfield Village (a subeconomic municipal housing scheme) who attended the Health Centre from March to June, 1947.

The foods are divided into milks - breast, cow's, full cream, dried skim, and sweetened condensed - fruit, vitamin oil, vegetables, cereals, meat, fish, eggs, butter, and miscellaneous, and the numbers and percentages of babies having these foods from birth to 52 weeks is shown, grouped into three age levels in the first year, namely 0 - 16 weeks, 17 - 32 weeks, and 33 - 52 weeks, and in the second year of life into one section. Unfortunately the data for Bantu and Indian babies were not arranged in exactly the same way as for Coloured babies. The percentage of babies having particular foods is based on attendances, so that one baby may appear several times during the year at different age levels.

Although this thesis deals with growth only in the first year, I have included a certain amount of data on diet in the second year of life, since, in the first place, information was available and is on the whole not easy to get, and secondly because it helps to give a general picture of infant feeding practice. All data given are qualitative not quantitative.

Using Paterson and Smith (1946) standards for satisfactory gain in weight and applying the same standards for the three racial groups, analysis of weight gain is shown as gain in weight, relative failure to gain weight, stationary weight and actual loss of weight.

I have compared the diets of the Coloured babies attending in 1948 with those attending in 1947, and also their gains and losses in the two years.

B. As additional material I analyse the weights at different age levels of 141 Coloured, 92 Bantu and 180 Indian babies attending the Health Centre and compare them with 127 European babies attending a Municipal clinic in Durban.

RESULTS AND DISCUSSION.

A. DIETS AND GAIN IN WEIGHT IN FIRST TWO YEARS OF LIFE.

Table 50a shows number and percentage of Coloured babies who consume various foods in 1947.

The following facts emerge from a study of this table:-

Breast milk. The percentage of babies on breast milk in the first year of life is very high, ranging from 95 per cent in the 0 - 16 weeks age group to 85 per cent in the 33 - 52 weeks age group. Even in the second year of life the figure is quite high at 28 per cent. Coloured babies are put to the breast within the first 24 hours after birth.

T A B L E 50 a.

DIET OF COLOURED BABIES FROM BIRTH TO TWO YEARS. (APRIL - JUNE 1947).

		M I L K						F R U I T			VEGETABLES		C E R E A L S								
		B.M.	C.M.	F.C.M.	D.S.M.	S.C.M.	Vit. Oil.	Juice	Banana	Other	Pot-ato.	Other	Oats or M. Meal	Patent	Bread	Egg	Meat	Fish	But-ter.	Misc.	Total Attend.
0 - 16 Weeks.	No.	53	4	3	0	2	11	17	0	0	0	0	0	1	0	0	0	0	0	0	56
	%	95	7	5	0	4	20	30	0	0	0	0	0	2	0	0	0	0	0	0	
17 - 32 Weeks.	No.	48	25	2	5	5	41	33	1	1	27	12	20	3	1	4	0	0	1	2	54
	%	89	46	4	9	9	76	61	2	2	50	22	37	6	2	8	0	0	2	4	
33 - 52 Weeks.	No.	86	72	3	27	5	55	58	27	8	82	74	78	13	25	31	10	12	23	33	101
	%	85	71	3	27	5	54	57	27	8	81	73	77	13	25	31	10	12	23	33	
12 - 24 Months	No.	19	49	7	28	3	35	38	18	19	63	52	60	20	48	16	32	11	21	30	67
	%	28	73	10	42	4	52	57	27	28	94	78	90	30	72	24	48	16	31	45	

T A B L E 50 b.

DIET OF COLOURED BABIES FROM BIRTH TO TWO YEARS. (APRIL - JUNE 1948).

		M I L K						F R U I T			VEGETABLES			C E R E A L S								
		B.M.	C.M.	F.C.M.	D.S.M.	S.C.M.	Vit. Oil.	Juice	Ban-ana.	Other	Pot-ato.	Green Veg.	Yellow Veg.	Oats or M. Meal	Patent	Bread	Egg	Meat	Fish	But-ter.	Misc.	Total Attend.
0 - 16 Weeks.	No.	66	11	14	0	1	30	31	0	0	2	0	0	0	2	0	0	0	0	0	0	78
	%	85	14	18	0	1	38	40	0	0	3	0	0	0	3	0	0	0	0	0	0	
17 - 32 Weeks.	No.	80	57	26	0	1	31	74	15	0	49	5	33	18	7	8	13	3	1	13	3	93
	%	86	61	28	0	1	33	80	16	0	53	5	35	19	8	9	14	3	1	14	3	
33 - 52 Weeks.	No.	35	52	5	5	0	35	48	35	12	51	42	48	48	11	45	25	28	9	46	8	55
	%	64	95	9	9	0	64	87	64	22	93	76	87	87	20	82	45	51	16	84	15	
12 - 24 Months	No.	22	55	3	8	0	46	58	52	7	61	55	61	62	1	59	30	50	14	57	6	65
	%	34	85	5	12	0	71	89	80	11	94	85	94	95	2	91	46	77	22	88	9	

Abbreviations: B.M. = Breast Milk; C.M. = Cow's Milk; F.C.M. = Full Cream Milk; D.S.M. = Dried Skim Milk; S.C.M. = Sweetened Condensed Milk; M. Meal = Mealie Meal; Misc. = Miscellaneous.

My impression is that the majority of Coloured mothers do not feed their babies on a regular time schedule, but those who are most Europeanised do tend to follow the European pattern of feeding, and this applies particularly to bottle-fed babies.

Cow's milk. Increases as we would expect from a low figure of 7 per cent in the first age group to 71 per cent in the last group under one year. Only 73 per cent of babies have cow's milk in the second year of life: it must be remembered that since this is not a quantitative survey the amounts taken may not be adequate.

Full cream milk is drunk by a negligible number of babies, because of the very limited quantity available at the Centre, and the high incidence of breast feeding.

Condensed milk is also not much used, partly because of the availability of fresh cow's milk and partly because we did not encourage its use.

Dried skim milk figures rise appreciably at the end of the first year and reach 42 per cent in the second year. If it were not for this addition many babies would have very little milk, particularly in the second year.

Vitamin oil at the time of this survey had not yet been introduced routinely for all babies.

Potatoes. Consumption is good and is introduced early on Health Centre advice.

Other vegetables. Includes all vegetables except potatoes, and the figures of 70 - 80 per cent towards the end of the first year and during the second year is therefore not satisfactory.

Bananas. Since we had not yet established the banana as an important infant food in this community the 1947 figures are low.

Fruit juice is taken by about 50 per cent of babies over the whole period. This figure is fairly high in view of the expense of oranges and tomatoes.

Other fruit includes all fruits except fruit juice and bananas. Being expensive it is given to few infants.

Cereals, such as oatmeal and mealie meal, are introduced from

17 - 32 weeks but are not eaten by 100 per cent of babies by the end of the first year, because many mothers prefer the more expensive patent prepared cereals - whose use we discouraged.

Bread. The figures, 25 per cent in the third period of the first year, and 72 per cent in the second year, I consider low, and suspect they are not properly reported in our diet histories.

Meat figures are very low and even in the second year less than 50 per cent of the babies eat meat. This is due not only to the expense, but to the meat shortage at the time of the survey.

Fish is eaten by still fewer children. The reason for this, apart from the expense, is the lack of a fish shop in the area.

Eggs. All the figures are obviously inadequate, but since eggs were very expensive during the survey period, I discouraged their use at the time.

Butter. Less than one-third of our babies are having butter by the time they reach two years. Expense and short supply are the likely reasons for this position.

Miscellaneous. Represents a collection of foodstuffs such as biscuits, custard, gravies, soups and so on, and I cannot draw any conclusions from my rather inadequate information.

On the whole the position with regard to the diet of Coloured infants in 1947 can be summarised as follows:

This community does not have sufficient cow's milk, vegetables, fruit, eggs, meat, fish and butter, and therefore lacks protein, fat, mineral salts and the vitamins contained in these foods. The deficiencies become more marked in the older babies, the younger ones being protected by the fact that they are almost 100 per cent breast fed. The position of the older child is alleviated to some extent by the dried skim milk and vitamin oil supplied by the Health Centre.

COMPARISON OF 1947 AND 1948 DIET SURVEYS (1948 diet survey is shown in Table 50b).

The food groups are slightly different in 1948 and 1947, the group "other vegetables" having been divided into yellow and green vegetables. It appears from comparing the tables that there has been an increased consumption of most of the foods listed. Certain foodstuffs such as full cream milk are consumed by too few babies to warrant statistical analysis, though they appear to be used more in 1948.

Dried skim milk and vitamin oil figures are not compared since they are supplied by the Health Centre, and increased consumption can not really be attributed to a change in the food habits of the community.

Sweetened condensed milk. The numbers here are too small for comparison but its use seems to have fallen off in favour of other milks. This is probably a result of Health Centre teaching.

Potato and porridge. There does not seem to be much difference in use of these two items from 1947 to 1948, but it is pleasing to note the marked decrease in use of patent cereals (such as nutrine, cream of wheat, etc) in the older age groups, after we discouraged the buying of expensive and refined cereals.

Vegetables. Because of the different grouping employed in 1948 I cannot do a direct comparison of vegetable consumption. Assuming however, that children who eat green vegetables probably also eat yellow vegetables, I compare yellow vegetable consumption in 1948 with that of "other vegetables" (which includes yellow and green vegetables) in 1947.

The miscellaneous group is too vague in definition to warrant comparison.

The significance of differences in consumption of 10 foods in 1947 and 1948 is shown in Table 50c.

From this table it can be seen that the figures for cow's milk, fruit juice, bananas, bread, meat and butter or margarine are all significantly increased in 1948 as compared with 1947. Fish is unchanged but vegetables and egg levels are higher, and this is probably significant. In the 33 - 52 week group, oddly enough, breast milk consumption has dropped though this is compensated for by an increase in cow's milk intake at the same age level. The babies who benefit most are those aged 33 - 52 weeks and 1 - 2 years, which are the ages at which the diet is most deficient.

T A B L E 50c

COMPARISON OF FOODS CONSUMED BY COLOURED BABIES SIGNIFICANCE OF DIFFERENCES (1948 - 1947)

		D %	S.E.	$\frac{D}{S.E.}$
1.	Breast milk			
	0-16 weeks	- 10	5	2.0
	17-32 "	- 3		
	33-52 "	- 21	6	3.5
	12-24 mths.	+ 6	8	.75
2.	Cow's milk			
	17-32 weeks	+ 15	8.5	1.8
	33-52 "	+ 23	5.3	4.3
	12-24 mths.	+ 12	7.0	1.7
3.	Fruit juice			
	0-16 weeks	+ 10	8.2	1.2
	17-32 "	+ 19	7.8	2.4
	33-52 "	+ 30	6.7	4.5
	12-24 mths.	+ 32	7.2	4.4
4.	Banana			
	17-32 weeks	+ 14	4.3	3.3
	33-52 "	+ 37	6.6	5.6
	12-24 mths.	+ 53	7.3	7.3
5.	Vegetables			
	17-32 weeks	+ 13	7.5	1.7
	33-52 "	+ 14	6.3	2.2
	12-24 mths.	+ 16	5.9	2.7
6.	Eggs			
	17-32 weeks	+ 6	5.1	1.2
	33-52 "	+ 14	8.1	1.7
	12-24 mths.	+ 22	8.1	2.7
7.	Bread			
	17-32 weeks	+ 7	3.5	2.0
	33-52 "	+ 57	6.7	8.5
	12-24 mths.	+ 19	6.5	2.9
8.	Meat			
	33-52 weeks	+ 41	7.4	5.5
	12-24 mths.	+ 29	8.0	3.6
9.	Fish			
	33-52 weeks	+ 4	5.9	.7
	12-24 mths.	+ 6	6.8	.9
10.	Butter or margarine			
	17-32 weeks	+ 12	4.1	2.9
	33-52 "	+ 61	6.5	9.4
	12-24 mths.	+ 57	6.9	8.3

(Significant levels are underlined. Levels of significance taken as

$\frac{D}{S.E.} = 3.$)

COMPARISON OF GAIN OF WEIGHT OF COLOURED INFANTS 0 - 2 YEARS, 1947 and 1948.

Tables 51 a, b and c show the gains in weight in April to June, 1947 and 1948, and the significance of difference between the two periods. (The numbers used differ very slightly from those used in the diet survey).

TABLE 51a

RELATIVE WEIGHT GAINS OF COLOURED BABIES IN 1947.

Age	Gain		+Relative Failure		Stationary Weight		Loss of Weight		Total no. of cases
	No.	%	No.	%	No.	%	No.	%	
0-16 wks.	42	87.5	4	8	0	0	2	4	48
17-32 "	29	56	15	28	0	0	8	15	52
33-52 "	43	45	30	31	5	5	18	19	96
12-24 mths.	37	51	10	14	5	7	20	28	72

TABLE 51b

RELATIVE WEIGHT GAINS OF COLOURED BABIES IN 1948.

Age	Gain		+Relative failure		Stationary Weight		Loss of Weight		Total no. of cases
	No.	%	No.	%	No.	%	No.	%	
0-16 wks.	59	83	11	16	0	0	1	1	71
17-32 "	54	58	30	32	1	1	8	9	93
33-52 "	15	28	30	55	2	4	7	13	54
12-24 mths.	30	46	24	37	2	3	9	14	65

(+ Relative failure to gain weight represents an actual gain of weight but this gain is insufficient).

Tables 51 a and b show that the young breast fed babies who require no other foods at this age except vitamin oil and fruit juice do well, but as they get older they do less well, particularly at the 33-52 weeks stage, and during the second year of life.

TABLE 51c

SIGNIFICANCE OF DIFFERENCES OF RELATIVE WEIGHT GAINS, 1948-1947

	Gain		Rel.failure		Stationary		Loss	
0-16 wks.	D.	-4.5%	D.	+8%	D.	0	D.	-3%
	S.E.	6.5	S.E.	5.8			S.E.	3.1
	$\frac{D}{S.E.}$	0.7	$\frac{D}{S.E.}$	1.8		-	$\frac{D}{S.E.}$	1.0
17-32 wks.	D.	+2%	D.	+4%	D.	+1%	D.	-6%
	S.E.	8.6	S.E.	7.9			S.E.	5.8
	$\frac{D}{S.E.}$	0.2	$\frac{D}{S.E.}$	0.5		-	$\frac{D}{S.E.}$	1.0
33-52 wks.	D.	-17%	D.	+24%	D.	-1%	D.	-6%
	S.E.	7.9	S.E.	8.3	S.E.	3.5	S.E.	6.1
	$\frac{D}{S.E.}$	2.2	$\frac{D}{S.E.}$	2.9	$\frac{D}{S.E.}$	0.3	$\frac{D}{S.E.}$	1.0
12-24 mths.	D.	-5%	D.	+23%	D.	-4%	D.	-14%
	S.E.	8.5	S.E.	7.3	S.E.	3.7	S.E.	6.8
	$\frac{D}{S.E.}$	0.6	$\frac{D}{S.E.}$	3.2	$\frac{D}{S.E.}$	1.1	$\frac{D}{S.E.}$	2.1

(Level of significance taken as $\frac{D}{S.E.} = 3$).

From this analysis it appears that the only statistically significant difference in the relative weights of the babies of 1948 and 1947 is the definite increase in the "relative failure to gain weight" class, in the 12 - 24 month age group and a probable decrease in the "loss of weight" class in the same age group. On the other hand, although the difference is not statistically significant, the 1948 33 - 52 week babies have a lower percentage gain than the 1947 babies of that age.

This result is disappointing, but it must be remembered that the diet survey is qualitative not quantitative, so that an increase in the numbers of babies taking certain foods does not show the actual amounts of the foods eaten or how often they are eaten. Perhaps this result is as much as one can expect to achieve in one year by diet advice only, since we cannot influence the actual purchasing power of the population we serve. It is obviously important to repeat such surveys and to try and assess the results by objective statistical measures.

INDIAN INFANT DIET SURVEY.

Table 52a is an analysis of the diets of the Indian infants attending the Health Centre from March to June, 1947. I have adapted the table to conform with that of the Coloured infants, and used the same age levels.

TABLE 52a

DIET OF INDIAN BABIES AGED 0 - 2 YEARS (MARCH - JUNE 1947).

	MILKS						FRUIT		VEGETABLES				
	Breast	Cows	Full Cream	Dried Skim.	Sweetened Condensed	Vit. Oil	Juice	Banana	Potato	Green Veg.	Cereal	Miscellaneous.	Total Attendances :
0 - 16 Weeks. No.	39	2	4	8	15	21	9	1	0	0	0	0	52
%	75	4	8	15	29	40	17	2	0	0	0	0	
17 - 32 Weeks. No.	68	10	15	37	25	71	29	8	18	4	24	1	93
%	73	11	16	40	27	76	31	9	19	4	26	1	
33 - 52 Weeks. No.	78	30	2	62	37	81	47	17	84	16	88	10	114
%	68	26	2	54	32	71	41	15	74	14	77	9	
12 - 24 Months No.	61	37	0	70	39	96	50	38	102	39	110	14	122
%	50	30	0	57	32	79	41	31	84	32	90	11	

TABLE 52b

DIET OF BANTU BABIES AGED 0 - 2 YEARS (JULY - DECEMBER 1947).

	MILKS					FRUIT			VEGETABLES		CEREALS.								
	B.M.	C.M.	F.C.M.	D.S.M.	S.C.M.	Orange	Banana.	Other	Potato.	Other	M. Meal or Oats	Patent	Bread	Other	Egg	Meat	Fish	Butter	Total Attendances :
0 - 16 Weeks. No.	147	7	4	0	0	64	0	0	1	0	0	0	0	1	2	0	0	0	147
%	100	5	3	0	0	44	0	0	1	0	0	0	.0	1	1	0	0	0	
17 - 32 Weeks. No.	104	51	9	28	0	80	7	1	31	7	20	1	2	8	1	0	0	0	125
%	84	41	7	22	0	64	6	1	25	6	16	1	2	6	1	0	0	0	
33 - 52 Weeks. No.	78	68	8	46	0	50	9	2	58	31	72	5	19	10	2	7	2	3	114
%	70	61	7	41	0	45	8	2	52	28	65	4	17	9	2	6	2	3	
12 - 24 Months. No.	39	71	3	53	3	47	16	7	81	52	85	9	51	11	8	23	1	10	99
%	39	72	3	54	3	47	16	7	82	53	86	9	52	11	8	23	1	10	

Abbreviations: B.M. = Breast Milk; C.M. = Cows Milk; F.C.M. = Full Cream Milk; D.S.M. = Dried Skim Milk; S.C.M. = Sweetened Condensed Milk; M. Meal = Mealie Meal.

The list of foods analysed is not as complete as for the Coloured infants, fish, meat, butter and eggs not appearing on the list at all. Bread is included in cereals for this group. Green vegetables include all vegetables and dholl. However, when the analysis of the diet of infants attending sessions in the following three months is studied, fish and meat are included as a composite item and 11 per cent of babies under 1 year and 67 per cent of babies 1 - 2 years are recorded as partaking of fish or meat.

The percentage of breast feeding is high, decreasing in amount as well as incidence towards the termination of lactation. Breast feeding is given at irregular intervals and continued for a long time. Between 12 - 24 months 50 per cent of the babies are still breast fed. A few hours after birth a mixture of castor oil and honey is prepared and the mother dips her finger into this at intervals and lets the baby suck it. The child is not given colostrum but usually put to the breast on the third day or 48 hours after birth. Under 1 year consumption of cow's milk is low and that of sweetened condensed milk more frequent. Only three babies were artificially fed from the ages of 2 to 3 weeks (two having lactogen and one sweetened condensed milk before attending the Health Centre). Several babies were weaned from the breast between 10 and 16 weeks, and these again were fed either on lactogen or sweetened condensed milk.

From about 5 - 6 months, the mother teaches the baby to eat solids, by holding him on her lap and giving him morsels from the family dishes. Since the family dishes are curried the baby starts getting curry from an early age, starting usually with potato and going on to other vegetables, and later to meat, though at first the mother makes the curry milder by washing the portions.

Comparing the diet of Indian and Coloured babies over the same period of time, we see that except for sweetened condensed milk, dried skim milk and vitamin oil (the two last mentioned items being supplied by the Health Centre), consumption figures for Indians are lower than those for Coloureds.

GAIN IN WEIGHT OF INDIAN BABIES.

The percentage gain is highest in the youngest age group and decreases increasingly in the older age groups. (See Table 53).

TABLE 53.

RELATIVE WEIGHT GAINS OF INDIAN INFANTS (1947).

Age	Gain		Relative failure		Stationary		Loss		Total cases	Total known wgts.
	No.	%	No.	%	No.	%	No.	%		
0-16 wks.	41	79	4	8	0	0	7	13	52	52
17-32 "	67	76	5	6	3	3	13	15	93	88
33-52 "	57	54	17	16	2	2	30	28	114	106
12-24 mths.	58	51	13	11	4	4	39	34	122	114

Comparison with Coloured babies reveals that in the first year of life Coloured babies have a greater percentage gaining weight from 0-16 weeks but a lower percentage the rest of the year. In the second year percentage gain is the same in both groups. With regard to loss of weight, however, Indian babies are at a disadvantage, a greater percentage of Indian babies losing weight at every age period.

The advantage shown by Indian babies from 17 - 52 weeks in percentage of weight gain is surprising in view of the superiority of the Coloured diet at those ages. The fact that they do less well from 0 - 16 weeks is readily related to their lower percentage of breast feeding at this age as compared with Coloured babies. The greater percentage of losses shown by Indian babies at all ages is to be expected.

It should be pointed out that these gains and losses are relative to the arbitrary standard chosen, and do not indicate the actual amount of weight gained or lost. For example at a particular age period a baby may be recorded as a gain if it has gained 4 oz or 10 oz, and similarly a loss is recorded as such whether it is 1 oz or 1 lb.

On the whole, I think it can be fairly said that in the first two years of life, Indian babies do less well than Coloured.

DIETS OF BANTU BABIES.

This is shown in Table 52b. Again the foods are not listed in exactly the same way as for Coloured babies but they are similar enough for comparative purposes.

Bantu babies are fed irregularly, the time of first feed varying considerably from within the first 24 hours after birth to several days after birth. According to the Medical Officer in charge of the African Section at the Springfield Health Centre, the small number of babies under 9 months who are not breast fed are adopted children or children who have been weened on the advice of an inyanga. The greatest incidence of weaning appears to be between 15 and 18 months. Patent, tinned and full cream milks are used by few mothers and although sweetened condensed milk in tea is certainly given later, it is probably omitted from the diet histories.

In the younger age groups it is probable that more babies are having cereal than is recorded, since it is a common practice to give a child small lumps of food from the common pot if it is willing to eat them. This is usually not reported in a routine diet history, unless special enquiries are made. For the same reason, the figures for meat are probably also too low. Also, unless the eating of bread is especially enquired about, it is often not mentioned by the mothers. A mixture of bread and mealie meal is common, and the patent cereals used are almost invariably nutrine and cream of wheat. Potato is a common food, probably because of Health Centre advice. "Other vegetables" are mainly cabbage, pumpkin and pumpkin tops. The eating of biscuits and sweets is practically never recorded, but judging from answers to specific questions, seems to be common.

As with Coloured and Indian babies deficiencies are most marked in the 33 - 52 week age period and in the second year of life.

With the exception of breast milk and dried skim milk, the percentage figures for Bantu foods are lower than those for Coloured.

GAIN IN WEIGHT OF AFRICAN BABIES.

Although food percentages are lower in the Bantu, their percentage weight gain appears to be better than that of the Coloured. 96 per cent of Bantu babies (87.5 per cent Coloured) gain weight satisfactorily in the 0 - 16 week age period, and 88 per cent (56 per cent Coloured) gain well in the 17 - 32 week period. From 33 - 52 weeks the percentage gain is 58 per cent (45 per cent Coloured) and in the second year of life the Bantu children still appear to have the advantage in weight gain - 63 per cent Bantu as against 51 per cent Coloured. (See Table 54).

TABLE 54.

RELATIVE WEIGHT GAINS OF BANTU INFANTS (1947).

Age	Gain		Relative failure		Loss		Total Attendances	Total with known wgt.
	No.	%	No.	%	No.	%		
0-16 wks.	119	96	2	2	3	2	147	124
17-32 "	106	88	3	2.5	11	9	125	120
33-52 "	64	58	14	13	33	30	114	111
12-24 mths.	61	63	5	5	31	32	99	97

On the other hand, though Bantu percentage loss is lower than that of Coloured babies up to 32 weeks, it is greater than Coloured loss thereafter. In both Bantu and Coloured babies the group which appears to do the worst is the 33 - 52 week age group. This is interesting and understandable since at that age children cannot walk around and help themselves or ask for food, as they can later on, and mothers probably depend too much on a failing milk supply. At this age too, many mothers may be working away from home with the baby inadequately cared for.
On the other hand, the Indian baby seems to have a progressive decrease in percentage weight gain from age period to age period, although the sharpest decrease is from the 17 - 32 weeks to the 33 - 52 weeks age period.

I can only speculate on the reason for the fact that the Bantu weight gain is better than the Coloured, despite their less varied diet. In the first place the percentage of breast feeding is higher at all ages, and secondly Bantu mothers tend to stuff their infants with food (even though it may only be porridge) until their bellies are full and hard, so that calorie intake is likely to be higher. It is interesting that the advantage is most marked up to 32 weeks (after this age percentage losses are greater than for Coloured) in the light of the evidence, which appears later in this chapter, and again in the next chapter, that until 30 - 32 weeks, Bantu growth is remarkably good.

B. COMPARISON OF WEIGHTS AT DIFFERENT AGE LEVELS OF COLOURED, BANTU AND INDIAN BABIES ATTENDING SPRINGFIELD HEALTH CENTRE, AND EUROPEAN BABIES ATTENDING A MUNICIPAL CHILD WELFARE CLINIC.

The data were taken from cards showing date of attendance, age and weight. Age was taken to the nearest week. Only single infants weighing 5 lb and over were used (where birth weight was known) and since we knew these communities well we could exclude all definite premature babies even if no birth weight was recorded. Average weights at each weekly age level were calculated but because the numbers were small, boys and girls were not separated.

Numbers used are as follows:

	No. of infants	No. of weights
European	127	1803
Coloured	141	1082
Bantu	92	1000
Indian	180	1610

I am not reproducing the graphs here, since in the next two chapters I give graphs based on far larger numbers of babies, but I will discuss the findings.

In order to compare the racial groups I used Paterson and Smith's expected weight curve. (According to Paterson and Smith, a baby gains 1 oz a day for the first 100 days, excluding the first 10 days, and thereafter 4 oz a week till 1 year). I personally do not entirely agree with Paterson and Smith's rule, since I don't think the growth rate from 110 to 365 days is the same, but it is convenient to measure groups against a yardstick and this is quite a simple one to use.

The following table shows the weights at 2 weeks and 52 weeks and the difference between these and their expected weights at these levels. Since I had birth weights only for the European and Coloured groups, I have taken the birth weights for Indian and Bantu babies from birth weights obtained at McCord's Zulu Hospital.

From this table it can be seen that the babies of all the racial groups are above their expected weights at two weeks, the difference being most marked in the Bantu and Indian groups. It must be remembered, however, that the birth weights of these two races is taken from babies born at

TABLE 55.

WEIGHTS AT 2 WEEKS AND 52 WEEKS OF THE FOUR RACIAL GROUPS

	WEIGHT AT 2 WEEKS	EXPECTED WEIGHT AT 2 WKS. (from own birth weight)	DIFFERENCE BETWEEN ACTUAL AND EXPECTED WEIGHT	WEIGHT AT 52 WEEKS	EXPECTED WEIGHT AT 52 WEEKS	DIFFERENCE BETWEEN ACTUAL AND EXPECTED WEIGHT
EUROPEAN	8 lb 4 oz	7 lb 14 oz	+ 6 oz	22 lb 2 oz	22 lb 11 oz	- 9 oz
COLOURED	7 " 14 "	7 " 13 "	+ 1 "	18 " 11 "	22 " 10 "	-3 lb 15 "
BANTU	7 " 15 "	7 " 6 "	+ 9 "	19 " 6 "	22 " 3 "	-2 " 13 "
INDIAN	7 " 6 "	6 " 12 "	+10 "	17 " 6 "	21 " 9 "	-4 " 3 "

McCord's Hospital. Looking at the actual weights at 2 weeks, one sees that European babies are heaviest, followed closely by Coloured, then by Bantu and lastly by Indian babies. At 52 weeks none of the groups has reached expected weights. Europeans are closest, about ½ lb below, Bantu come next, 2 lb 13 oz below, and Coloured and Indian are 3 lb 15 oz and 4 lb 3 oz below respectively. Actual weights at 52 weeks are in the same order as at 2 weeks except that Bantu and Coloured babies have reversed their positions, Bantu babies being heavier than Coloured. All non-European groups are well below the European, and this is particularly marked in the Coloured and Indian babies.

GROWTH BETWEEN 2 AND 52 WEEKS.

The European growth pattern follows Paterson and Smith's expected weight curve quite well. Up to 16 weeks they are slightly below, from 16 - 44 weeks above, and from 44 - 52 weeks below their own expected weights.

Coloured babies up to 24 weeks follow expected weights closely, being very slightly below, but from 24 weeks onwards there is a progressive fall below expected weights.

Bantu babies up to 32 weeks are well above expected weights, from 32 - 48 weeks they are below, and from 48 - 52 weeks they appear to lose rather than gain weight.

Indian infants are a little above their expected weights in the early period, but from 10 weeks they fall progressively below expected weights.

This is an interesting pattern. It shows that non-Europeans grow satisfactorily in early life but this growth is not maintained and indeed is seriously retarded by the end of the first postnatal year. This retardation starts early in the Indian baby - from 10 weeks, in the Coloured from 24 weeks, and in the African from 32 weeks. To me the most interesting feature of these curves is the remarkable growth of the Bantu babies in the first 6 months of life who starting below the Europeans at birth, maintain a weight above that of the European until 32 weeks.

I have not discussed the feeding of European babies but it is much the same as that of clinic supervised babies in England and America - a progressive rapid decrease in incidence of breast feeding - early introduction of solids and a good mixed diet by the end of the year.

Among non-Europeans growth is satisfactory in early life because of the high incidence of breast feeding, but as is seen from the diet surveys, they do not have the good mixed diets they need when breast milk alone is insufficient. The splendid growth of the Bantu baby is a tribute to the lactating ability of the Bantu mother.

SUMMARY.

This chapter is a report of the diet and growth of Bantu and Indian babies attending the Springfield Health Centre in 1947 and of Coloured infants attending in 1947 and 1948. Part A gives the diets and gains and losses in weight of babies from birth to 2 years. Part B is a comparison of weights at different age levels in the first year of life of Coloured, Bantu and Indian babies from Springfield, with a sample of European babies from a municipal clinic in Durban.

Data for part A are based on 278 Coloured attendances at mother and baby sessions from April to June, 1947, 381 Indian attendances from March to June, 1947, and 485 Bantu attendances from July to December, 1947.

In addition the Coloured data of 1947 are compared with data from 291 Coloured attendances in 1948.

The foods are divided into milks, cereals, fruit, vegetables, eggs, fish, meat, butter and miscellaneous, and the babies are grouped into three age levels in the first year, 0 - 16 weeks, 17 - 32 weeks, and 33 - 52 weeks; and one group 12 - 24 months, in the second year of life.

Gain and loss in weight is based on Paterson and Smith's standards and is divided into gain, relative failure to gain (i.e. unsatisfactory gain), stationary weight, and loss of weight.

Data for part B comprises

127 European babies (1,803 weights) from a municipal clinic in Durban.

141 Coloured babies (1,082 weights).

92 Bantu babies (1,000 weights).

180 Indian babies (1,610 weights)

The last three groups were babies attending the mother and baby sessions at the Springfield Health Centre in 1947.

RESULTS ARE AS FOLLOWS:

1. The percentage of breast fed Coloured babies is high, ranging from 95 per cent in the 0 - 16 week age group to 85 per cent in the 33 - 52 week group. Even in the second year of life 28 per cent of babies are breast fed. Method of feeding is mainly on demand, though a certain number are fed by the clock.

2. In general, Coloured babies have too little cow's milk, vegetables, fruit, eggs, meat, fish and butter, and the deficiencies are most marked in the 33 - 52 week age period and in the second year of life.

3. In 1948 a repeat diet survey shows a significant increase in percentage consumption of cow's milk, fruit, bread, meat and butter or margarine. Most other items have also increased although not significantly so, but breast milk has dropped in the 33 - 52 week age group. On the whole the babies from 33 weeks to the end of the second year of life have benefited most by food increases in 1948.

4. With regard to gain and loss of weight it is seen that the young breast fed baby who requires no other food except fruit juice and vitamin oil does well but as he gets older he does less well particularly at the 33 - 52 week age level, and in the second year of life.

5. A comparison of the gains in 1948 with those of 1947 shows that the only significant difference is a definite increase in the relative failure to gain weight class in the 12 - 24 month age group and a probable decrease in the loss of weight class.

6. In the first year the percentage of breast fed Indian infants,

though high, is not as high as for Coloured infants but 50 per cent of Indian babies are still breast fed in the second year of life. Feeding is on demand. A mixture of honey and castor oil is given to Indian babies soon after birth, but solids are usually introduced from about 5 - 6 months, the baby being given morsels from the family meal. Babies are introduced to curries from this early age but the curry is made milder by washing the baby's portion.

7. Foods are deficient at the same age levels as for Coloured babies but compared with Coloured figures it is seen that except for sweetened condensed milk, dried skim milk and vitamin oil (the two last mentioned items being supplied by the Health Centre) the percentage consumption of all food items is lower for Indians than for Coloureds.

8. Gain in weight is most unsatisfactory in Indian babies in the 33 - 52 weeks age group and especially in the second year of life. Comparison with Coloured figures reveals that although the advantage in percentage gains appears to lie with the Indians the percentage loss of weight is undoubtedly greater in the Indian group.

9. Bantu babies have the highest percentage of breast fed babies in the first year of life but in the second year more Indian babies are still breast fed than in the other groups. Babies are fed on demand and on the whole babies who are weaned before the age of nine months are either adopted babies or children weaned on the advice of an inyanga.

10. Foods are given from the common pot when the child appears willing to take them and hence some of the food items are probably recorded less frequently than they should be. Cereals (mostly mealie meal) are the first foods introduced into the diet.

11. As with Coloured and Indian babies, food deficiencies are most marked at ages 33 - 52 weeks, and in the second year of life. With the exception of breast milk and dried skim milk, the figures for Bantu food consumption are lower than those for Coloured.

12. Gain in weight up to 32 weeks is good, and is worst in the 33 - 52 weeks period as it is with the Coloured babies. The percentage gain for Bantu babies is greater than that for Coloured babies at all ages, but the percentage loss is also greater from 33 weeks to the end of the second year.

13. Comparison of weights at different age levels in the first year of life are made between European, Coloured, Bantu and Indian babies.

14. At 2 weeks European babies are the heaviest, followed by Coloured, Bantu and Indian babies, but the differences between actual and expected weights at this age are greatest for Bantu and Indian babies. At 52 weeks European babies are still the heaviest, but Bantu babies are now heavier than Coloured, and Indian babies are still the lightest - over 4 lb lighter than their expected weights.

15. Growth between 2 and 52 weeks shows that the European babies follow the expected curve quite closely.

Coloured babies grow quite well until 24 weeks and then progressively fall below expected weight.

Indian infants show retardation of growth, which is progressive, from 10 weeks of age.

Bantu babies on the other hand have a remarkable early growth and are well above expected weights until 32 weeks of age. From 32 to 48 weeks their weights fall and are below expected weights, and from 48 to 52 weeks they appear to lose rather than gain weight.

16. In general, non-European growth is satisfactory, in early life, because of the high incidence of breast feeding, but they do not have the good mixed diets they need when breast milk alone is insufficient for their needs. The remarkable growth of the Bantu baby until 6 or 7 months of age is a tribute to the lactating ability of the Bantu mother.

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CHAPTER XIII

GROWTH FROM TWO TO FIFTY-TWO WEEKS

This chapter is a report of growth in the first year of life as measured by weight from two to fifty-two weeks.

MATERIAL USED AND METHOD OF ANALYSIS.

This is a mixed longitudinal and cross-sectional study, since although the same babies are followed over a year not all the babies attended every week and the sample and number of babies at each week therefore varies.

I have extracted data from the records of:

2,096 European infants	1,116 boys	980 girls
1,303 Bantu infants	628 boys	675 girls
579 Coloured infants	284 boys	295 girls
509 Indian infants	259 boys	250 girls

I used all available records from the Durban Municipal Child Welfare Clinics from 1948 - 1951, but excluded multiple births and also records of infants who had attended less than six times in their first year. The data extracted consist of race, sex, birth rank, birth weight where available, dates of attendance and weights at those attendances from 2 - 52 weeks. Since in the non-European groups the birth weight is often not recorded and I must inadvertently have included records of premature babies, I have included premature babies in the European group so as to make the records comparable.

In the first instance, the growth curves and rates of growth are compared in the 4 racial groups for boys and girls separately. Mean weights and standard deviations are worked out for each week from 2 - 52 weeks. The figures are then smoothed by taking a running average over five weeks, e.g. the eight week figure is an average of the mean weights at 6, 7, 8, 9 and 10 weeks. At each end of the scale (2 - 3 and 51 - 52 weeks) this is not possible so the third week weight and the 51st week weight are calculated on an average of three weeks only (2, 3, 4 and 50, 51, 52) while the second week and 52nd week show the actual weights for that week only. The smoothed curves are used for the graphs and also for calculating increments of growth.

In addition I collected data from the records of a private practitioner in Durban who held a routine weekly baby clinic for her private patients - parents of middle and upper income level - and I compared their babies' growth curves with those of the European babies who attended the Municipal clinic. (Appendix 28 a and b).

INCREMENTS.

I have calculated the rate of growth of the babies of the four racial groups at four-weekly intervals during the first year by successive subtraction of mean weights at those age levels, and express this also as the number of ounces gained per week. In addition I have shown increments of growth in three-monthly periods and these are shown for boys and girls separately.

RESULTS.

Tables 56, 57, 58 and 59 show the smoothed weights from 2 - 52 weeks for each racial group, boys and girls seperately, Ranks 1, 2+ and combined. Charts 7 a and b are a comparison of the growth curves of European, Coloured, Bantu and Indian babies during the first year of life, for boys and girls separately, all ranks combined and irrespective of birth weights. The actual weights are shown in appendices 24 to 27. Graphs are also presented of growth in the first year of life for each racial group, boys and girls separately, giving mean weight ± 1 standard deviation. (Appendices 28 a and b - 31 a and b).

BOYS.

It can be seen that:

1. At the beginning of the year European babies are the heaviest, Indian babies are the lightest, and the Coloured and Bantu babies occupy an intermediate position, with the Coloured slightly higher than the Bantu. At the end of the year, the European babies are still the heaviest and the Indian the lightest, but the Coloured and Bantu, although still occupying an intermediate position have reversed their places, the Bantu now being heavier than the Coloured.

2. At three weeks the European and Coloured weights are the same 8.40 lb and 8.42 lb, while the Bantu are slightly less at 8.22 lb and the Indian about a pound lower at 7.33 lb. At 51 weeks the gap has

MUNICIPAL CLINIC, 2-52 WEEKS

TABLE 56

EUROPEAN GROWTH CURVES - SMOOTHED

Week	Rank 1		Rank 2+		All Ranks	
	Boys	Girls	Boys	Girls	Boys	Girls
2	7.85	7.25	8.06	7.74	7.98	7.55
3	8.23	7.77	8.51	8.17	8.40	8.01
4	8.66	8.22	8.96	8.58	8.83	8.43
5	9.08	8.65	9.39	8.99	9.26	8.84
6	9.50	9.08	9.81	9.40	9.68	9.26
	9.92	9.49	10.24	9.76	10.10	9.64
8	10.34	9.88	10.63	10.11	10.50	10.01
9	10.74	10.26	11.05	10.47	10.91	10.37
10	11.12	10.65	11.45	10.85	11.30	10.76
11	11.53	10.99	11.82	11.18	11.69	11.09
12	11.94	11.36	12.22	11.55	12.09	11.46
13	12.36	11.71	12.59	11.92	12.49	11.83
14	12.75	12.05	12.97	12.28	12.87	12.17
15	13.16	12.40	13.36	12.60	13.27	12.51
16	13.56	12.77	13.75	12.94	13.66	12.86
17	13.92	13.11	14.12	13.26	14.02	13.19
18	14.26	13.46	14.48	13.56	14.38	13.51
19	14.62	13.81	14.83	13.86	14.73	13.84
20	14.97	14.13	15.18	14.15	15.08	14.14
21	15.26	14.45	15.51	14.45	15.39	14.45
22	15.61	14.78	15.79	14.69	15.70	14.73
23	15.90	15.07	16.10	14.98	16.00	15.02
24	16.22	15.38	16.40	15.26	16.31	15.32
25	16.49	15.66	16.69	15.50	16.59	15.58
26	16.79	15.94	16.97	15.76	16.88	15.85
27	17.03	16.17	17.29	16.10	17.17	16.14
28	17.33	16.47	17.55	16.35	17.45	16.41
29	17.59	16.73	17.80	16.57	17.70	16.65
30	17.88	17.00	18.07	16.82	17.99	16.91
31	18.14	17.25	18.31	17.07	18.24	17.16
32	18.43	17.51	18.52	17.25	18.48	17.38
33	18.65	17.70	18.80	17.46	18.73	17.58
34	18.86	17.93	19.02	17.72	18.95	17.82
35	19.09	18.21	19.25	17.97	19.17	18.08
36	19.32	18.46	19.48	18.21	19.40	18.33
37	19.54	18.70	19.74	18.44	19.65	18.57
38	19.77	18.95	19.92	18.72	19.85	18.84
39	20.05	19.19	20.20	18.94	20.13	19.07
40	20.27	19.40	20.37	19.07	20.32	19.24
41	20.51	19.59	20.56	19.30	20.54	19.44
42	20.73	19.76	20.68	19.44	20.70	19.60
43	20.99	19.97	20.93	19.58	20.96	19.78
44	21.19	20.14	21.05	19.66	21.12	19.90
45	21.44	20.32	21.16	19.90	21.29	20.10
46	21.61	20.45	21.35	19.98	21.47	20.21
47	21.89	20.66	21.53	20.19	21.70	20.41
48	22.12	20.82	21.65	20.30	21.86	20.55
49	22.37	21.03	21.86	20.50	22.09	20.76
50	22.56	21.22	22.09	20.71	22.30	20.96
51	22.80	21.48	22.31	20.88	22.53	21.17
52	22.94	21.72	22.47	21.34	22.67	21.52

TABLE 57

COLOURED GROWTH CURVES - SMOOTHED

Week	Rank 1		Rank 2+		All Ranks	
	Boys	Girls	Boys	Girls	Boys	Girls
2			7.99	7.96	7.89	7.76
3	7.90	7.56	8.58	8.19	8.42	8.02
4	8.42	8.10	9.10	8.57	8.90	8.43
5	8.85	8.56	9.60	8.93	9.38	8.81
6	9.32	9.01	10.07	9.33	9.84	9.22
7	9.75	9.40	10.52	9.76	10.29	9.64
8	10.22	9.78	10.94	10.15	10.72	10.03
9	10.70	10.16	11.31	10.56	11.13	10.43
10	11.11	10.64	11.75	10.91	11.56	10.79
11	11.45	10.90	12.11	11.22	11.92	11.12
12	11.79	11.29	12.46	11.51	12.28	11.44
13	12.13	11.56	12.83	11.80	12.63	11.72
14	12.48	11.93	13.05	12.13	12.88	12.06
15	12.84	12.21	13.24	12.34	13.12	12.30
16	13.26	12.51	13.53	12.62	13.44	12.58
17	13.64	12.89	13.81	12.88	13.74	12.89
18	14.07	13.35	14.05	13.14	14.03	13.22
19	14.37	13.59	14.52	13.42	14.46	13.47
20	14.70	13.89	14.82	13.76	14.78	13.80
21	16.00	14.37	15.14	14.13	15.09	14.16
22	15.24	14.49	15.43	14.35	15.35	14.34
23	15.36	14.63	15.74	14.52	15.61	14.49
24	15.54	14.89	15.89	14.69	15.77	14.70
25	15.69	15.19	16.18	14.92	16.03	14.96
26	15.76	15.14	16.47	15.08	16.33	15.09
27	16.00	15.42	16.68	15.28	16.54	15.37
28		15.25	16.89	15.66	16.73	15.73
29			17.16	15.79	17.03	15.90
30			17.50	16.02	17.31	16.09
31			17.63	16.00	17.41	16.20
32			17.86	16.16	17.67	16.35
33			18.05	16.32	17.93	16.44
34			18.04	16.61	18.02	16.70
35			18.16	16.63	18.17	16.80
36			18.30	16.82	18.34	16.98
37			18.51	17.04	18.51	17.20
38			18.59	17.10	18.62	17.39
39			18.88	17.04	18.81	17.47
40			18.88	17.28	18.86	17.80
41			19.07	17.69	18.99	18.10
42			19.21	17.72	19.15	18.17
43			19.20	17.90	19.12	18.20
44			19.27	18.10	19.24	18.43
45			19.26	18.01	19.28	18.31
46			19.23	17.92	19.39	18.33
47			19.29	18.14	19.47	18.50
48			19.55	18.11	19.74	18.50
49			19.72	18.34	19.86	18.80
50			20.17	18.60	20.23	19.02
51			20.41	18.77	20.36	19.21
52			21.05	18.81	20.94	19.22

MUNICIPAL CLINIC, 2-52 WEEKS

TABLE 58

AFRICAN GROWTH CURVES - SMOOTHED

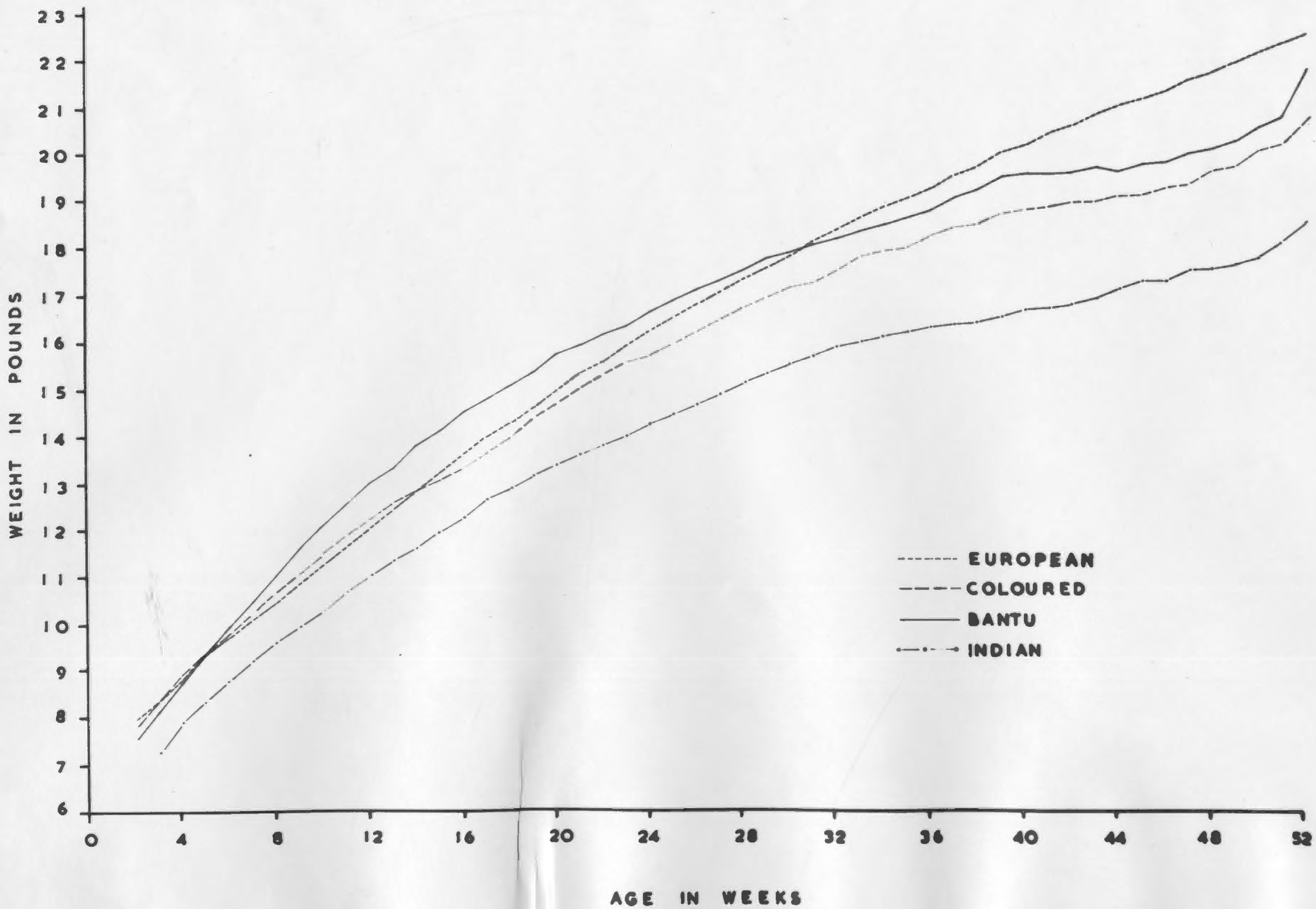
Week	Rank 1		Rank 2+		All Ranks	
	Boys	Girls	Boys	Girls	Boys	Girls
2	7.28	6.75	7.71	7.44	7.60	7.29
3	7.83	7.44	8.34	8.05	8.22	7.90
4	8.36	8.02	8.97	8.60	8.80	8.46
5	8.93	8.58	9.56	9.14	9.38	9.01
6	9.58	9.13	10.14	9.65	9.98	9.54
7	10.18	9.67	10.71	10.12	10.55	10.03
8	10.83	10.21	11.26	10.58	11.13	10.51
9	11.48	10.68	11.76	11.02	11.67	10.96
10	12.01	11.21	12.21	11.48	12.15	11.43
11	12.46	11.58	12.67	11.88	12.60	11.82
12	12.86	12.05	13.09	12.30	13.05	12.24
13	13.20	12.46	13.46	12.68	13.42	12.63
14	13.64	12.82	13.86	13.08	13.84	13.02
15	14.03	13.08	14.17	13.38	14.17	13.31
16	14.44	13.49	14.53	13.75	14.54	13.69
17	14.87	13.74	14.81	14.03	14.83	13.97
18	15.32	14.07	15.09	14.30	15.15	14.25
19	15.63	14.27	15.34	14.50	15.42	14.46
20	15.98	14.57	15.68	14.79	15.77	14.74
21	16.19	14.86	15.86	15.03	15.96	15.00
22	16.47	15.10	16.12	15.34	16.22	15.29
23	16.58	15.33	16.37	15.61	16.43	15.55
24	16.83	15.68	16.66	15.85	16.71	15.81
25	17.06	15.84	16.92	16.08	16.97	16.02
26	17.23	16.10	17.16	16.23	17.19	16.20
27	17.39	16.25	17.41	16.37	17.42	16.34
28	17.70	16.45	17.58	16.54	17.64	16.52
29	17.79	16.77	17.81	16.74	17.82	16.76
30	17.90	17.12	17.97	16.88	17.95	16.93
31	18.31	17.26	18.14	17.05	18.19	17.10
32	18.52	17.50	18.20	17.31	18.30	17.35
33	18.74	17.61	18.36	17.43	18.48	17.47
34	18.92	17.67	18.44	17.61	18.59	17.61
35	19.10	17.78	18.59	17.66	18.75	17.69
36	19.14	17.82	18.86	17.86	18.93	17.85
37	19.15	17.96	19.18	17.97	19.21	17.92
38		17.82	19.35	18.18	19.36	18.11
39			19.62	18.35	19.60	18.27
40			19.67	18.56	19.67	18.45
41			19.69	18.60	19.68	18.57
42			19.70	18.56	19.71	18.62
43			19.82	18.50	19.79	18.57
44			19.68	18.51	19.71	18.65
45			19.87	18.61	19.90	18.72
46			19.91	18.89	19.95	18.92
47			20.08	19.14	20.16	19.17
48			20.24	19.43	20.25	19.49
49			20.37	19.59	20.40	19.63
50			20.65	19.72	20.70	19.83
51			20.88	19.68	20.94	19.87
52			21.60	19.63	21.90	19.93

TABLE 59

INDIAN GROWTH CURVES - SMOOTHED

Week	Rank 1		Rank 2+		All Ranks	
	Boys	Girls	Boys	Girls	Boys	Girls
2						
3			7.55	6.63	7.33	6.70
4			8.14	7.45	7.94	7.35
5	8.18		8.56	7.87	8.39	7.77
6	8.44		9.00	8.37	8.81	8.23
7	8.78	7.99	9.43	8.67	9.27	8.53
8	9.15	8.27	9.81	8.99	9.64	8.78
9	9.56	8.71	10.14	9.32	10.00	9.11
10	9.96	9.07	10.52	9.65	10.36	9.44
11	10.42	9.44	10.90	9.89	10.76	9.69
12	10.73	9.87	11.22	10.21	11.07	10.04
13	11.04	10.23	11.48	10.55	11.35	10.38
14	11.34	10.45	11.78	10.82	11.65	10.64
15	11.60	10.69	12.18	11.02	12.02	10.85
16	11.85	11.03	12.51	11.27	12.35	11.12
17	12.32	11.12	12.82	11.45	12.69	11.27
18	12.67	11.36	13.06	11.56	12.95	11.41
19	13.03	11.58	13.33	11.70	13.24	11.57
20	13.32	11.82	13.52	11.93	13.45	11.82
21	13.55	11.96	13.73	12.19	13.67	12.05
22	13.70	12.31	13.91	12.47	13.84	12.35
23	13.78	12.59	14.19	12.64	14.06	12.56
24	13.90	12.86	14.50	12.85	14.32	12.79
25	14.23	13.04	14.65	12.98	14.52	12.91
26	14.43	13.26	14.89	13.13	14.75	13.11
27	14.64		15.13	13.36	14.97	13.35
28	14.94		15.39	13.54	15.25	13.55
29	15.26		15.48	13.79	15.40	13.77
30	15.34		15.76	14.03	15.62	14.04
31	15.55		15.94	14.21	15.80	14.24
32	15.84		16.11	14.27	15.99	14.29
33	16.06		16.13	14.51	16.08	14.52
34			16.23	14.68	16.20	14.68
35			16.18	14.76	16.27	14.80
36			16.23	14.78	16.35	14.84
37			16.21	15.06	16.44	15.14
38			16.28	15.17	16.50	15.25
39			16.43	15.39	16.64	15.47
40			16.65	15.48	16.76	15.59
41			16.63	15.60	16.79	15.71
42			16.85	15.65	16.88	15.80
43			17.09	15.75	17.04	15.90
44			17.26	15.72	17.23	15.98
45			17.45	16.01	17.41	16.20
46			17.51	16.20	17.46	16.45
47			17.58	16.12	17.56	16.41
48			17.61	16.22	17.68	16.60
49			17.41	16.40	17.75	16.70
50			17.61	16.62	17.90	17.06
51				17.02	18.25	17.55
52				17.66	18.71	18.54

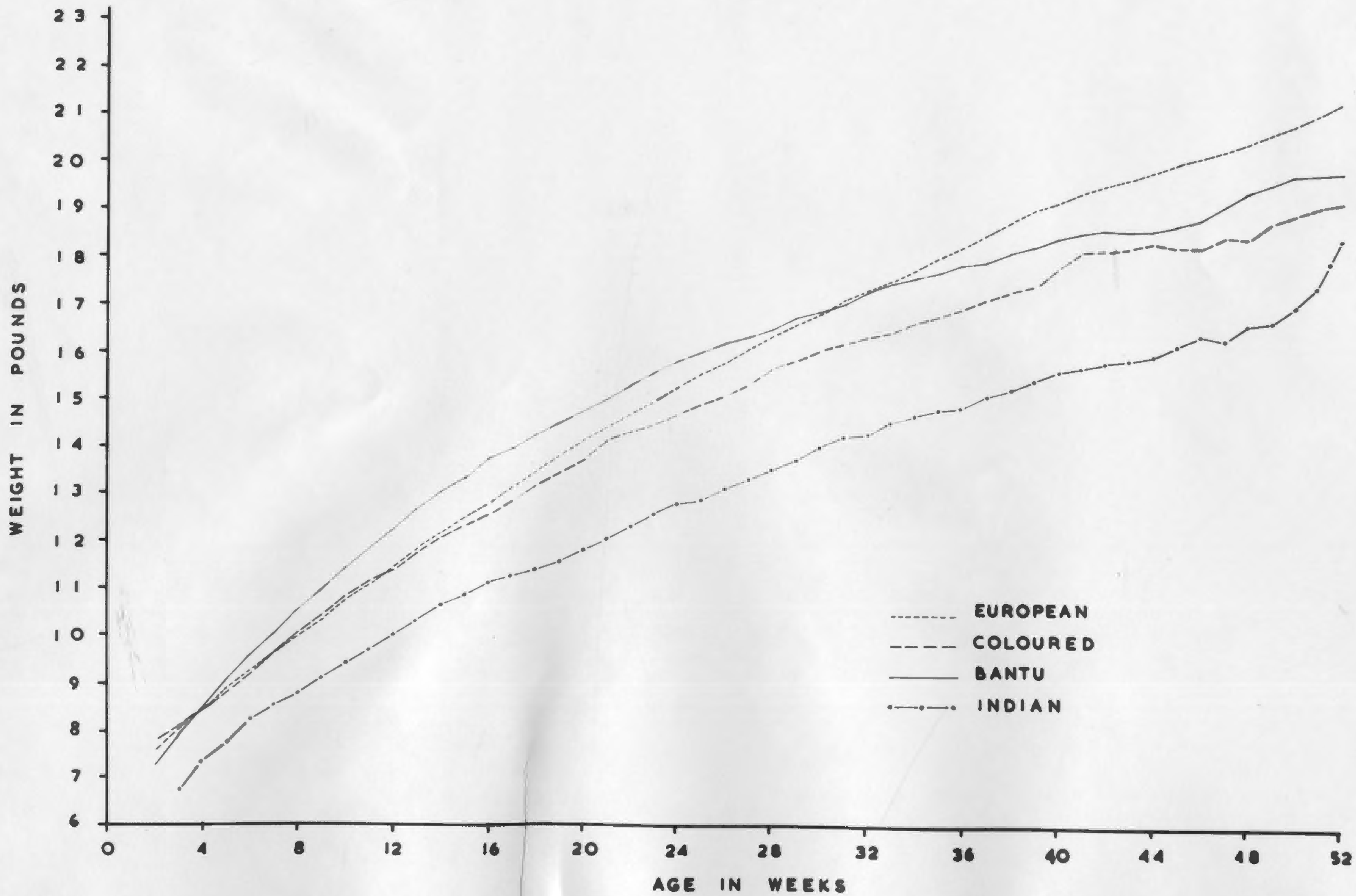
CHART 7a
COMPARISON OF GROWTH CURVES IN THE FIRST YEAR OF LIFE OF FOUR RACIAL GROUPS.



BOYS: ALL RANKS (CURVES SMOOTHED)

CHART 7b

COMPARISON OF GROWTH CURVES IN FIRST YEAR OF LIFE OF FOUR RACIAL GROUPS



GIRLS: ALL RANKS (CURVES SMOOTHED)

widened considerably with Europeans 22.53 lb and the difference between European and Bantu being 1.59 lb, European and Coloured 2.17 lb, and European and Indian 4.28 lb. 51 weeks has been chosen rather than 52 weeks because of a peculiar spurt shown by the Bantu and Coloured during the last week of the year, which may be a true picture, but is probably due to the smallness of the numbers and the lack of smoothing at this point of the graph.

3. The Coloured boys, although they start below the European, and as we know have a lower birth weight than the European, at three weeks have reached the European level and then actually rise above the European weights, although not by very much, until 14 weeks, when once again their weights drop below the European level. Thereafter there is a gradually increasing difference between these two groups for the rest of the year.

4. In the first eight weeks, although the Indian boys are below the European because of their lower birth weight, the European and Indian curves run parallel to each other showing the same amount of increase. The gap widens gradually from 8 - 32 weeks, with considerable disparity thereafter.

5. The Bantu pattern is quite different from the European. They start below the European because of their lower birth weight, but by 5 weeks they have overtaken the European boys and remain above their level until 30 weeks. From 30 weeks there is a marked flattening of the Bantu curve and at 51 weeks the difference between European and Bantu babies is 1.59 lb.

GIRLS.

1. As with boys, at the beginning of the year European girls are the heaviest, Indians the lightest and Coloured and Bantu occupy an intermediate position with the Coloured slightly higher than the Bantu. At the end of the year, again, the Europeans are still the heaviest and the Indians the lightest but the Bantu are heavier than the Coloured.

2. At 3 weeks of age European and Coloured weights are the same, 8.01 lb and 8.02 lb, Bantu slightly less at 7.96 lb and Indians considerably less at 6.70 lb. At 51 weeks the European weight has reached 21.17 lb and the difference between European and Bantu is 1.3 lb, between European and Coloured 1.96 lb and between European and Indian 3.62 lb.

3. Coloured girls start off slightly heavier than European girls at two weeks of age, but from three to twelve weeks there is very little difference between them. After that the pattern is the same as that shown by the boys.

4. The curve of the Indian girls runs parallel to that of the European girls for the first six weeks only (boys eight weeks) and after that the pattern is similar to that displayed by the boys.

5. Bantu girls overtake European girls by four weeks and follow the same pattern as the boys, but the curve does not flatten as much and the difference at 51 weeks is 1.3 lb (not as great a difference as the boys).

COMPARISON OF RATE OF GAIN (INCREMENTS).

BOYS (ALL RANKS). (See Table 60 a and Chart 8).

1. Europeans. From two to twenty weeks rate of growth is most rapid varying between almost 7 oz. to almost 6 oz. per week. From 20 - 32 weeks growth is not as rapid - 4 to 5 oz. per week. After that until the end of the year it is between 3 and 4 oz. per week with a total gain of 14.32 lb from 2 - 50 weeks (2 - 52 weeks, 14.69 lb)

2. Coloureds. From 2 to 12 weeks Coloured babies show their most rapid period of growth - 6 to 8 oz. per week, and during the first six weeks their rate of growth is even greater than that of Europeans. From 12 to 32 weeks rate of growth decreases and varies between 5 and 3 oz per week. After that there is a fairly sharp decrease to between 3 and 1½ oz per week. The last four-weekly period shows an average increase of 4.8 oz per week, but owing to the smallness of the numbers at this end of the scale and the fact that the curve could not be smoothed here, I do not consider this a reliable figure. The total gain from 2 to 50 weeks is 12.35 lb (2 - 52 weeks 13.05 lb).

3. Bantu. From two to eight weeks Bantu rate of growth is the most rapid of all the racial groups being over 9 oz per week. From 8 to 16 weeks growth is still very rapid, between 6 and 8 oz per week. From 16 to 28 weeks rate of gain is 3½ to 5 oz per week, and from 28 to 52 weeks it is only about 2½ oz per week. Again the figure for the last four-weekly period is probably not reliable. The total gain from 2 to 50 weeks is 13.10 lb (2 to 52 weeks 14.30 lb).

4. Indians. As I have no weight at two weeks for Indian babies,

TABLE 60a

4-WEEKLY INCREMENTS OF WEIGHT (SMOOTHED)
BOYS - ALL RANKS

	EUROPEAN		COLOURED		BANTU		INDIAN	
	Incr. (lbs)	oz per week	Incr. (lbs)	oz per week	Incr. (lbs)	oz per week	Incr. (lbs)	oz per week
Birth wgt.	7.48		-		-		-	
weeks								
0 - 2	.50	.25	-		-		-	
2 - 4	.85	6.8	1.01	8.1	1.20	9.6	.85+	6.8
4 - 8	1.67	6.7	1.82	7.3	2.33	9.3	1.70	6.8
8 -12	1.59	6.4	1.56	6.2	1.92	7.7	1.43	5.7
12 -16	1.57	6.3	1.16	4.6	1.49	6.0	1.28	5.1
16 -20	1.42	5.7	1.34	5.4	1.23	4.9	1.10	4.4
20 -24	1.23	4.9	.99	4.0	.94	3.8	.87	3.5
24 -28	1.14	4.6	.96	3.8	.93	3.7	.93	3.7
28 -32	1.03	4.1	.94	3.8	.66	2.6	.74	3.0
32 -36	.92	3.7	.67	2.7	.63	2.5	.36	1.4
36 -40	.92	3.7	.52	2.1	.74	3.0	.41	1.6
40 -44	.80	3.2	.38	1.5	.04	.2	.47	1.9
44 -48	.74	3.0	.50	2.0	.54	2.2	.45	1.8
48 -52	.81	3.2	1.20	4.8	1.65	6.6	1.03	4.1
48 -50	.44	3.5	.49	3.9	.45	3.6	.22	1.7
Total 2-52	14.69		13.05		14.30		11.62	
" 2-50	14.32		12.35		13.10		10.81	

\+ Assuming the gain per weekfrom 2 - 4 weeks to be at least as great as thatfrom 4 - 8 weeks.

TABLE 60b

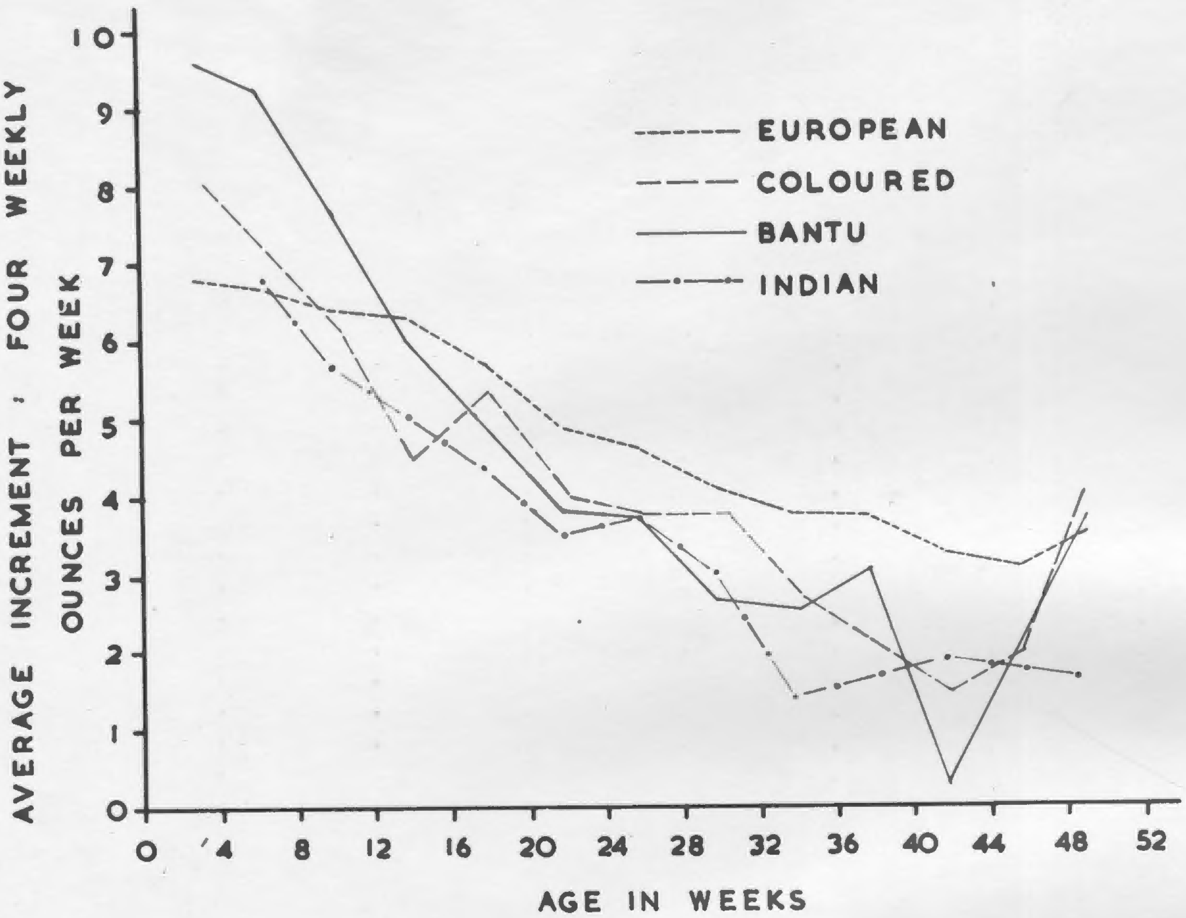
4-WEEKLY INCREMENTS OF WEIGHT (SMOOTHED)
GIRLS - ALL RANKS

	EUROPEAN		COLOURED		BANTU		INDIAN	
	Incr. (lbs)	oz per week	Incr. (lbs)	oz per week	Incr. (lbs)	oz per week	Incr. (lbs)	oz per week
Birth wgt.	7.20		-		-		-	
weeks								
0 - 2	.35	2.6	-		-		-	
2 - 4	.88	7.0	.67	5.4	1.17	9.4	.72+	5.7
4 - 8	1.58	6.3	1.60	6.4	2.05	8.2	1.43	5.7
8 - 12	1.45	5.8	1.41	5.6	1.73	6.9	1.26	5.0
12 - 16	1.40	5.6	1.14	4.6	1.45	5.8	1.08	4.3
16 - 20	1.28	5.1	1.22	4.9	1.05	4.2	.70	2.8
20 - 24	1.18	4.7	.90	3.6	1.07	4.3	.97	3.9
24 - 28	1.09	4.4	1.03	4.1	.71	2.8	.76	3.0
28 - 32	.97	3.9	.62	2.5	.83	3.3	.74	3.0
32 - 36	.95	3.8	.63	2.5	.50	2.0	.55	2.2
36 - 40	.91	3.6	.82	3.3	.60	2.4	.75	3.0
40 - 44	.66	2.6	.63	2.5	.20	.8	.39	1.6
44 - 48	.65	2.6	.07	.3	.84	3.4	.62	2.5
48 - 52	.97	3.9	.72	2.9	.44	1.8	1.94	7.8
48 - 50	.41	3.3	.49	3.9	.34	2.7	.46	3.7
Total 2-52	13.97		11.46		12.64		11.91	
" 2-50	13.41		11.23		12.54		10.43	

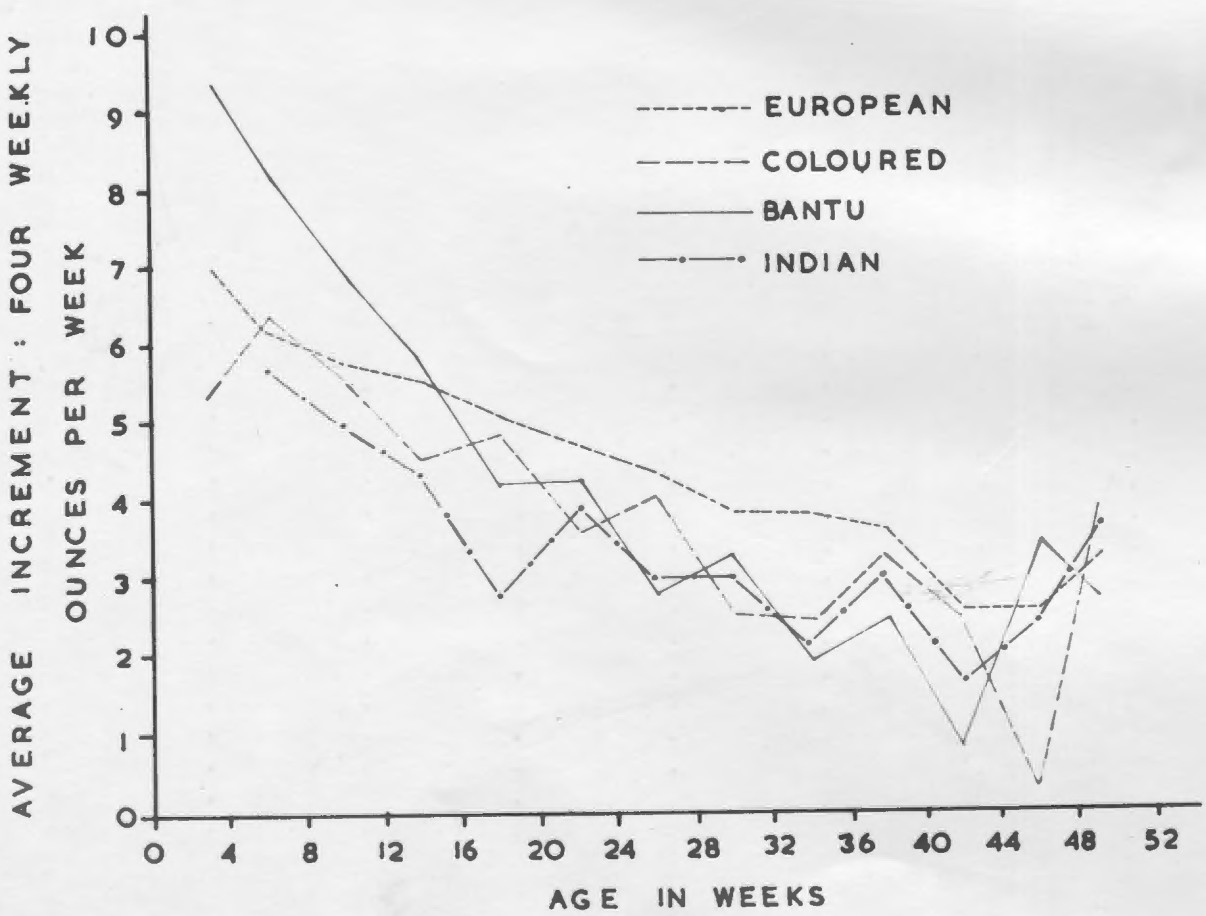
\+ Assuming the gain per week from 2 - 4 weeks to be at lëast as great as that from 4 - 8 weeks.

CHART 8

AVERAGE FOUR WEEKLY INCREMENTS IN FIRST YEAR OF LIFE FOR FOUR RACIAL GROUPS



BOYS : ALL RANKS



GIRLS : ALL RANKS

owing to insufficient data, the information only starts from 4 weeks of age. From 4 to 16 weeks Indian babies grow most rapidly and gain from 5 to 7 oz per week. From 16 to 30 weeks rate of gain has slowed and is 3 to 4½ oz per week. Thereafter their growth is very slow - from 1½ to 2 oz per week. Again the last four-weekly figure is probably unreliable. Assuming the gain per week from 2 to 4 weeks to be not less than the weekly gain from 4 to 8 weeks, total gain from 2 to 50 weeks would be 10.81 lb approximately (2 to 52 weeks 11.62 lb approximately).

From the foregoing we see that from 2 to 8 weeks European boys gain the least weight of the four racial groups, with the Bantu gaining the most weight, followed by the Coloured, and then by the Indian. From 8 to 12 weeks the Bantu are still gaining more than the European boys, but from 12 weeks onwards the European boys gain more than any other group. In the non-European groups the Bantu gain most weight from 2 to 16 weeks, more than either the Coloured or the Indian. After 16 weeks, however, in spite of certain slight irregularities, Coloured boys gain more than either Bantu or Indian boys. But because of the tremendous amount of weight that Bantu boys have gained in the first 16 weeks (6.94 lb as against 5.68 lb for European, 5.55 lb for Coloured, 5.26 lb for Indian) by the end of the year the Bantu weights are still above the Coloured and Indian groups in spite of the greater birth weight and the greater gain from 16 weeks shown by the Coloured boys.

TABLE 61a

COMPARISON OF GAIN FROM 2-16 WEEKS WITH GAIN FROM 16-50 WEEKS
BOYS - ALL RACIAL GROUPS

weeks	EUROPEAN Gain (lb)	COLOURED Gain (lb)	BANTU Gain (lb)	INDIAN Gain (lb)
2 - 16	5.68	5.55	6.94	5.26
16 - 50	8.64	6.80	6.16	5.55
16 - 52	9.01	7.50	7.36	6.36
2 - 50	14.32	12.35	13.10	10.81
2 - 52	14.69	13.05	14.30	11.62
Gain from 16-50 weeks as % of gain from 2-16 weeks	152 %	122 %	89 %	106 %

Table 61a shows that in the first 14 weeks (from 2 weeks) Bantu boys have gained 6.94 lb as against only 6.16 lb in 34 weeks (16 to 50 weeks). They are the only group who have actually gained more in this first period (2 to 16 weeks) than during the rest of the year. This is due both to the largeness of the gain during the first period and the smallness of the gain during the second period.

Expressing the gain from 16 to 50 weeks as a percentage of the gain from 2 to 16 weeks, we find the following result:

European 152 % Coloured 122 % Bantu 89 % Indian 106 %

GIRLS (ALL RANKS). (See Table 60 b and Chart 8)

1. Europeans. Growth rate is again most rapid from 2 to 20 weeks - between 5 to 7 oz per week. From 20 to 40 weeks rate of gain is less rapid - between 3½ to 5 oz per week. From 40 weeks onwards the gain is just over 2½ oz per week. Total gain from 2 to 50 weeks is 13.41 lb (2 to 52 weeks 13.97 lb).

2. Coloureds. Coloured girls have their most rapid period of growth between 2 and 12 weeks - 5½ to 6½ oz per week. From 12 to 28 weeks the gain is 3½ to 5 oz per week and from 28 weeks onwards average gain is about 2½ oz a week. Total gain from 2 to 50 weeks is 11.23 lb (2 to 52 weeks 11.46 lb).

3. Bantu. Rate of gain for Bantu girls is very rapid from 2 to 8 weeks - 8 to 9½ oz a week. From 8 to 16 weeks gain is still rapid at 5¾ to 7 oz a week. From 16 to 24 weeks weight gain is a little over 4 oz a week but from 24 weeks to the end of the year the gain is rather irregular and only between 1 to 3 oz a week. Total gain from 2 to 50 weeks is 12.54 lb (2 to 52 weeks 12.64 lb).

4. Indians. The most rapid period of growth here is from 4 to 16 weeks at 4 to 6 oz a week. From 16 to 32 weeks it has become 2¾ to 4 oz a week. From 32 weeks onwards (disregarding the 48 to 52 week figure) the gain has slowed to 1½ to 3 oz a week. Again a two-week weight has been assumed giving a total gain from 2 to 50 weeks of 10.43 lb approximately (2 to 52 weeks 11.91 lb approximately).

Summarising the above we see that the Bantu rate of gain from 2 to 16 weeks is greater than that shown by the other racial groups. In the 4 to 8 weeks period the Coloured gain is also very slightly higher than that of the European, but Indian girls always gain the least of the four groups. Bantu girls have gained the greatest amount of weight as compared with the other three groups from 2 to 16 weeks of age, but unlike the boys, European girls from 2 weeks onwards gain more weight than either Coloured or Indian girls. The picture is not as clear for the girls as for the boys, but from 16 weeks Coloured girls gain more than either Bantu or Indian girls.

Comparing the pattern of weight gain in the four racial groups the picture is very similar in girls and boys - the Bantu gaining most in the first period and the European most in the second period. But in the second period although the Coloured girls have still gained more than the Indian girls, the relative percentage gain is greater for the Indian girls. (See Table 61 b).

T A B L E 61 b

COMPARISON OF GAIN FROM 2-16 WEEKS WITH GAIN FROM 16-50 WEEKS
GIRLS - ALL RACIAL GROUPS

Weeks	EUROPEAN Gain (lb)	COLOURED Gain (lb)	BANTU Gain (lb)	INDIAN Gain (lb)
2 - 16	5.31	5.12	6.40	4.49
16 - 50	8.10	6.11	6.14	5.94
16 - 52	8.66	6.34	6.24	7.42
2 - 50	13.41	11.23	12.54	10.43
2 - 52	13.97	11.46	12.64	11.91
Gain from 16 - 50 weeks as % of gain from 2 - 16 weeks	152 %	119 %	96 %	132 %

THREE-MONTHLY INCREMENTS. (Tables 62 a and b).

Boys. When increments are combined into three-monthly periods, many irregularities become smoothed, but the picture is similar. Outstanding features here are:

1. Europeans show a steady decline of gain in weight in each successive three-monthly period. In the non-European groups the decline in weight gain is far more marked from the first to the second three-monthly period, with the Bantu almost halving their rate of gain.

2. In the first three-monthly period there is very little difference between European, Coloured and Indian rate of growth, while the Bantu show a far higher rate of growth than the other three. In the second three-monthly period the Europeans lead the others in rate of growth, but there is no very great difference between them. In the second half of the first post-natal year, however, particularly if the weights are considered only up to 50 weeks, there is no doubt about the superiority of the European baby's weight gain over the other three groups.

Girls. Girls show a similar pattern to boys although their rate of growth is not as great as that of the boys.

TABLE 62 a

3-MONTHLY INCREMENTS OF WEIGHT (SMOOTHED).
BOYS - ALL RANKS

weeks	EUROPEAN Total gain (lb)	EUROPEAN oz. per week	COLOURED Total gain (lb)	COLOURED oz. per week	BANTU Total gain (lb)	BANTU oz. per week	INDIAN Total gain (lb)	INDIAN oz. per week
4 - 13	3.66	6.5	3.73	6.6	4.62	8.2	3.41	6.1
13 - 26	4.39	5.4	3.70	4.6	3.77	4.6	3.40	4.2
26 - 39	3.25	4.0	2.48	3.0	2.41	3.0	1.89	2.3
39 - 52	2.54	3.1	2.13	2.6	2.30	2.8	2.07	2.5
39 - 50	2.17	3.2	1.42	2.1	1.10	1.6	1.26	1.8

TABLE 62 b

3-MONTHLY INCREMENTS OF WEIGHT (SMOOTHED)
GIRLS - ALL RANKS

weeks	EUROPEAN Total gain (lb)	EUROPEAN oz. per week	COLOURED Total gain (lb)	COLOURED oz. per week	BANTU Total gain (lb)	BANTU oz. per week	INDIAN Total gain (lb)	INDIAN oz. per week
4 - 13	3.40	6.0	3.29	5.8	4.17	7.4	3.03	5.4
13 - 26	4.02	4.9	3.37	4.1	3.57	4.4	2.73	3.4
26 - 39	3.22	4.0	2.38	2.9	2.07	2.5	2.36	2.9
39 - 52	2.45	3.0	1.75	2.2	1.66	2.0	3.07	3.8
39 - 50	1.89	2.8	1.55	1.8	1.56	1.8	1.59	2.3

DISCUSSION.

A fair number of growth studies in infancy (mainly cross-sectional or mixed cross-sectional longitudinal) have been done. A few investigators show weekly weights during the first year, others monthly weights; some give figures at 4-weekly intervals, and yet others give results at 3-monthly intervals. Weights are sometimes shown in kilograms, sometimes in pounds and ounces, or in pounds and fractions of pounds. It is difficult, therefore, to compare all these studies with the results of my own investigation in which I have shown the weights at weekly levels in pounds and decimals of a pound. I have chosen ten American and British studies to compare with my own results for white babies, (Table 63) and where results have been given in kilograms or in pounds and ounces, I have converted the figures to pounds and decimals of a pound. Where percentiles have been used, I have taken the 50th percentile, i.e. the median value, to compare with the means. I have not used the results of studies given at 4-weekly intervals, since they could not be converted to monthly figures, and where weekly figures were given I took the weights at 13, 26, 39 and 52 weeks and expressed them as 3, 6, 9 and 12 monthly weights. Figures for boys and girls are shown separately in each investigation. Most of the data are derived from local authority child welfare clinic records, but some are selected samples of babies of good economic level receiving optimal paediatric and home care.

It can be seen that all the growth curves of the boys and girls in America and England are very similar, and my South African European figures do not differ to any extent from those of the other investigators.

The growth curves of the Coloured, Bantu and Indian boys and girls, however, do not follow the European pattern and deserve some detailed comment. From 2 - 8 weeks European boys gain the least weight of the four racial groups, but from 12 weeks onwards they gain the most, and their total gain from 2 - 50 weeks is 14.32 lb as compared to 12.35 lb for Coloured, 13.10 lb for Bantu and 10.81 lb for Indian boys.

This picture is not as clearly seen in the girls, for European girls after 2 weeks of age gain more weight than either Coloured or Indian girls though the Bantu girls gain more than the European for the first 16 weeks. The total gain in weight from 2 - 50 weeks in European girls is

TABLE 63.

COMPARISON OF WEIGHTS IN FIRST YEAR OF LIFE : AMERICAN, BRITISH AND SOUTH AFRICAN

(Mean weight in lbs)

MALES

AGE (mths)	1	2	3	4	5	6	7	8	9	10	11
Birth								7.5	7.6	7.63	7.48
1	8.58	9.61	9.3						8.5		
2	11.00	11.62	11.4						9.9		
3	12.76	13.31	13.4	11.89	12.16	14.34	13.05	12.6	12.1	13.06	12.49
4	14.52	14.81	15.2				14.74		13.9		
5	16.28	16.48	16.8				16.20		15.4		
6	17.60	17.86	18.0	16.10	16.77	18.67	17.46	16.7	16.8	17.5	16.88
7	18.04	19.27	19.0				18.56		18.0		
8	19.58	20.46	19.9				19.55		19.2		
9	20.46	21.45	20.7	19.35	20.34	21.70	20.47	20.0	20.2	20.75	20.13
10	20.68	22.62	21.5				21.22		20.9		
11	21.56	23.39	22.1				21.95		21.7		
12	22.00	24.11	22.8	21.46	23.13	23.82	22.59	22.2	22.4	23.13	22.67

FEMALES

AGE (mths)	1	2	3	4	5	6	7	8	9	10	11
Birth								7.4	7.3	7.38	7.20
1	8.14	8.76	8.9						8.2		
2	9.68	10.63	10.9						9.4		
3	12.54	12.12	12.7	11.24	11.25	13.02	12.16	12.4	11.2	12.06	11.83
4	12.98	13.73	14.2				13.69		12.8		
5	15.62	15.22	15.6				15.09		14.2		
6	15.84	16.24	16.8	15.13	15.44	17.04	16.36	16.0	15.6	16.25	15.85
7	16.94	17.58	17.8				17.49		16.7		
8	18.04	18.55	18.8				18.49		17.6		
9	18.92	19.29	19.7	18.12	18.70	19.73	19.34	19.2	18.6	19.13	19.07
10	19.58	20.17	20.5				19.97		19.3		
11	20.68	20.97	21.2				20.53		20.0		
12	20.46	21.56	21.8	20.09	20.56	21.88	21.03	21.5	20.8	21.50	21.51

INVESTIGATIONS:

1. Iowa Child Welfare Research Station (1931).
2. Bayley and Davis (1935).
3. Peatman and Higgons (1938).
4. Hill and Magee (1938).
5. Lewis-Faning and Milligan (1944).
6. Simmons (1944).
7. Gore and Palmer (1949).
8. Children's Medical Center, Boston (1949).
9. Norval et al (1951).
10. Parfit (1951).
11. Present investigation (White South African).

13.41 lb as compared with 11.23 lb for Coloured, 12.54 lb for Bantu and 10.43 lb for Indian girls.

Why do the European babies gain relatively little weight in the first 2 - 3 months of life when there is no doubt of their greater gain thereafter?

I believe that European babies on the whole are underfed in early life when they are on the breast or given a bottle. Time and again I have seen the remark "baby overfed" when the child has gained 8 oz in a week. The mother is told to give four-hourly feeds instead of three-hourly, or to feed for a shorter time, or to give less in the bottle. The non-European mother, on the whole ignores this advice, since in any case she usually does not have a clock and anyhow feeds "on demand". In most cases her baby is breast fed and she worries far more about whether he gets enough milk rather than too much milk. Even the Coloured mother who is to all intents and purposes a "poor European" still tends to breast feed her baby and ignore the clock, although many Coloured mothers wean their babies very early, and go to work, and non-European babies on the bottle almost invariably get too dilute a milk mixture in an attempt to make the tin of powdered milk last a little longer. It is my experience, and I have had this impression confirmed by many medical officers working with Indians, that Indian mothers complain of insufficient breast milk very early on. They do not wean their babies but supplement the feeds, though often inadequately. The Bantu mother, on the other hand, is a magnificent lactator, and it is the exception for her to wean the baby because of insufficient breast milk. Early weaning is far more often due to belief that her milk has been poisoned, and unless she can be persuaded to the contrary, the outlook for those babies is very bad.

Wickes (1952) quotes figures of average weight gain in the first few months of life taken from standard paediatric textbooks as 4 - 6 oz a week. Spock (1946) gives the most liberal figure (7 - 8 oz a week). My own figures for weight gain from 4 - 13 weeks are 6.5 oz per week for European boys and 6.0 oz for European girls. Wickes followed up 503 babies born at St. Bartholomew's Hospital and then singled out all infants who had temporary setbacks due to illness and feeding difficulties. This left a residual group of infants who had a "smooth passage since birth". These infants were then classified according to whether they were satisfied or not when first seen, and the 214 babies in the satisfied group were taken to be a normal collection of healthy, well-fed babies. Their rate of gain was compared with the remainder of the series. The median rate of gain of the normal infants approached 1.3 oz per day (9 oz per week). Wickes, however, considered that there was good evidence that the group still contained unrecognised underfed infants. He selected three infants whose early rate of gain exemplified the ideal to be aimed at. These babies were male breast fed babies who gained 16 oz per week from the second to the seventh week. Their weights at 6 months fell between 19½ and 20½ lb and at one year they were between 25 and 26 lb, which represented a steady gain of 3 oz per week, i.e. less than one-fifth of that in the first three months. Wickes gained the impression that babies with the potentiality to gain at this optimal rate were commonly found amongst infants with feeding problems at this age. "These babies, when restricted, commonly cry and vomit. If the gain is above average, overfeeding is often suspected, if gaining normally, wind is usually diagnosed, whereas only if the gain is low is the true nature of the difficulty appreciated. Presumably many of the unsatisfied infants would have been contented if the feeds in the early weeks had been adequate to allow for some degree of 'stoking up' ".

Wickes concludes that infant feeding practice to-day underestimates the requirements of the young baby. Underfeeding he considers to be extremely prevalent due to inadequate lactation, inappropriate formulas, ignorance of the optimal rate and curve of growth, and "a morbid fear of overfeeding in the early weeks".

Wood (1952) showed that many babies admitted to hospital for vomiting of unknown origin were underfed babies. Vining (1952) found overfeeding at the breast to be exceptionally rare, but underfeeding only too common. "Babies are not like penny-in-the-slot machines, and I feel sure that we have done harm in insisting on exact quantities, exact times, and feeding by the clock".

It is interesting, in this connection, to compare the mean weights of the boys and girls attending the "private clinic" with those attending the Municipal clinic. Until 14 weeks of age the private clinic children grow, if anything, less well than the Municipal clinic children, showing that the same pattern of underfeeding prevails in a better off section of the community. The effect of increased income is seen at the period of introduction of foods into the baby's diet, and is most marked towards the end of the year. (Appendix 28 a and b).

As a point of interest too, I am including here the growth curves of three of my children. (Chart 9). Unfortunately I did not keep a record of the weights of my first child, but his pattern was very much the same. All the children were breast fed. M.P. (male) on an elastic four-hourly schedule with night feeds, R.P. (female) and P.P. (male) on "self-demand". All three show a great potentiality for growth and all were "colicky" babies, M.P. and R.P. for six weeks, and P.P. for three months. Looking back at their records I am inclined to think that though their early rate of gain was satisfactory according to the standards taught, and although I had sufficient milk (by test feeds) it is quite likely that they required still more milk than I gave them and once solids were introduced (at about 15 lb weight) their rate of growth was very rapid indeed. (See Table 64).

TABLE 64.

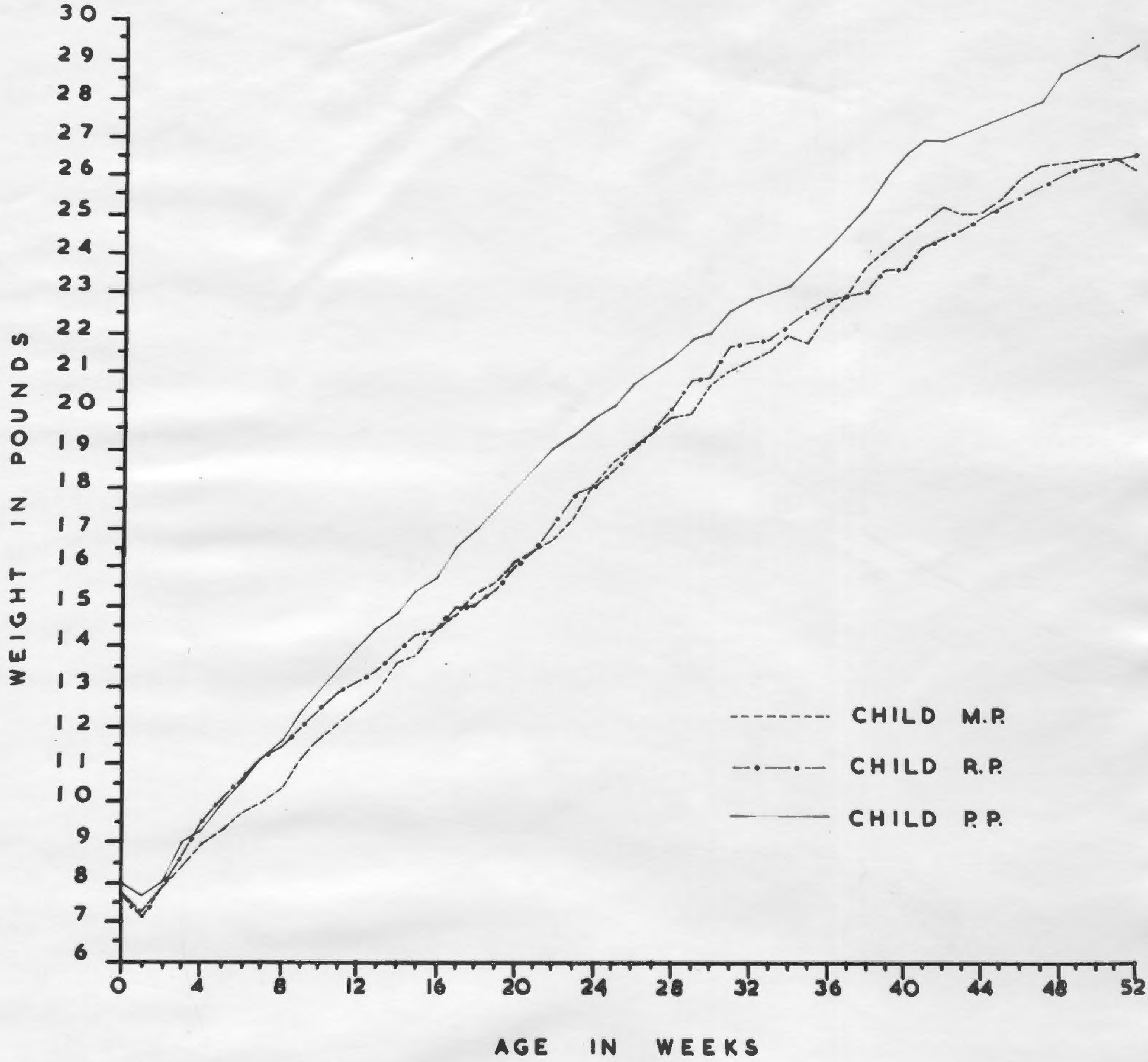
GAIN IN WEIGHT DURING FIRST POSTNATAL YEAR OF THREE SELECTED INFANTS.

weeks	M.P.		R.P.		P.P.	
	Total gain	oz/wk.	Total gain	oz/wk.	Total gain	oz/wk.
4 - 13	4 lb 0½ oz	7.1	4 lb 1 oz	7.2	5 lb 2½ oz	9.2
13 - 26	5 " 3½ "	6.4	5 " 10½ "	7.0	6 " 5 "	7.8
26 - 39	5 " 3 "	6.4	4 " 10½ "	5.7	5 " 6½ "	6.7
39 - 50	2 " 7½ "	3.6	2 " 12½ "	4.0	3 " 2 "	4.5

I have commented earlier on the fact that European boys for the first 8 weeks gain the least weight of all the racial groups, but from 12 weeks onwards they gain the most weight of all the groups, and I have suggested that this is due to their method of feeding - usually a regular four-hourly time interval and a fear of over feeding. After 3 months, however, European boys rapidly increase the difference in rate of growth

CHART 9

GROWTH CURVES OF THREE SELECTED CHILDREN



between themselves and non-European boys and the disparity becomes increasingly obvious till the end of the year.

Coloured boys starting with a birth weight below that of Europeans, reach the European level at 3 weeks, and then actually rise slightly above them, but at 14 weeks their weights have dropped below those of the Europeans and by 51 weeks they are 2.17 lb below the European weight.

Coloured girls actually overtake European girls at 2 weeks of age and there is practically no difference in their weights until 12 weeks. After that the picture is similar to that shown by boys with Coloured girls 1.96 lb lighter than European girls at the end of the year.

Indian boys also start below European boys from birth but for the first 8 weeks the rate of increase is the same. After that the gap between them widens consistently with a difference of 4.28 lb by the end of the year. Indian girls show a very similar pattern, though the rate of increase is similar to that of European girls for 6 weeks only, and the difference at the end of the year is slightly less than that shown by the boys, namely 3.62 lb.

The Bantu growth pattern is the most interesting of all. Starting below the Europeans at birth, by 5 weeks Bantu boys have overtaken European boys and remain above the European weight level until 30 weeks of age. Their growth curve then flattens considerably and by the end of the year they are 1.59 lb below the European boys.

Bantu girls overtake European girls even earlier (at 4 weeks) and also keep their lead until 30 weeks but their curve does not flatten out quite as much as does that of the boys - the difference at one year being 1.3 lb.

To appreciate the true position one must examine the growth curves in conjunction with the growth increments. From 2 - 8 weeks the European boys gain the least of all the groups, and, although they then grow faster than Coloured and Indian boys, Bantu boys maintain the lead until 12 weeks. After 16 weeks Coloured boys grow faster than Bantu and Indian boys, though slower than European boys. But because of the tremendous amount of weight Bantu boys have gained in the first 16 weeks, 6.94 lb as against 5.68 lb for European, 5.55 lb for Coloured and 5.26 lb for Indian, the Bantu weight is still above that of the Coloured and Indian at the end of the year, in spite of the greater birth weight and greater gain from 16 weeks onwards shown by the Coloured boys. Because of their rapid gain in this first period Bantu weights are above those of Europeans up to 30 weeks of age.

In girls the Bantu gain in weight is greatest of all groups for the first 16 weeks, but European girls gain more weight than Coloured and Indian girls from 2 weeks onwards. Again, although Coloured girls gain more than Bantu from 16 weeks onwards, because of the very rapid growth displayed by Bantu girls in the early period they are above the level of the Coloured girls at the end of the year, and are above the European weight level until 30 weeks of age.

GROWTH STUDIES IN AFRICA.

Trowell (1946) stated that he had never seen anything but good results in African babies from their excessive feeding. Although the African baby started the race at a disadvantage, liberal breast feeding often allowed him to catch up with the European child. However, after the age of 5 or 6 months the weight of many African babies fell far below that of the Europeans and became almost stationary. This was due to the fact that the breast milk was no longer sufficient for the baby's needs, and supplementation with cow's milk and solids was inadequate for the African baby, though adequate for the European baby.

In another study Trowell (1954) stated that during the first few months of life the rate of growth was almost the same among breast fed infants of all races, and that no difference should be accepted on the basis of race or climate until the common causes of unsatisfactory growth had been excluded. He gave three reasons for an infant's failure to thrive:

1. Infection.

2. Undernutrition, i.e. the infant received a diet which was correct in its proportions but reduced in amount so that it did not satisfy requirements. In Uganda this occurred in the first few months of life when breast milk had failed and diluted cow's milk had been substituted.

3. The baby is fed a diet which, though adequate to satisfy hunger, contained too low a proportion of proteins. (Trowell considered that protein should constitute 14 per cent of the calories).

This last cause was the explanation of most cases of failure to thrive, and was the cause of all the cases of severe kwashiorkor.

Welbourn (1954) compared the growth figures of Baganda children with those of Stuart and Stevenson (1950). The birth weights of the Baganda babies fell close to the 10th percentile of the American figures. From one to three months, however, the mean weights were close to the 50th percentile of the standard figures. At about the fifth month there was a definite falling off in weight increase and from the ninth month onwards the mean weights were below the 10th percentile of the standard American figures. Welbourn says that "African babies start life as great eaters. For four or five months they stuff themselves with mothers' milk. But this does not prevent the inevitable hunger which follows when mothers' milk is no longer sufficient for their needs". She attributes their rapid early growth to their plentiful consumption of breast milk but during the second six months of life there is a marked decline in weight gain. During this time the American babies (whose weights she used for comparison) were having mixed feeding with a large variety of good foods, but the African children were having poor diets from the time their mothers' milk was insufficient for their needs.

Brock and Autret (1952) had the general impression that throughout Central Africa there is general retardation of growth similar to that recorded at Kampala by Welbourn.

Canivet (1947) compared the rate of growth of African babies in French Sudan with white French babies in France. The average birth weight of Sudanese infants was 400 gm (.88 lb) less than that of French white infants, but at first the rate of growth of the Sudanese infants is more rapid, and their birth weight is doubled at $3\frac{1}{2}$ months, whereas the French babies doubled their birth weight at 5 months. After 4 months the rate of growth of the black infants became less rapid and they did not treble their birth weight until the 14th month. This pattern was displayed by both male and female babies, first and later born. He explained the difference as partly physiological and partly due to the mode of life and feeding. Instead of well regulated methods of breast feeding with introduction of fruit juices and mixed feeding with broth and vegetables between 3 and 6 months as was the French custom, the black infant was suckled by an undernourished mother in completely irregular fashion, and the only complementary food given was adult food, which the mother had previously masticated.

Meyers (1951) studied the graph of the gain in weight of African children in Ituri, and ascertained that a decline in increase of weight was evident after 6 months.

MacKay and Martin (1952) investigated the dentition and physique of Bantu children of the Digo tribe at Mnsambweni in Kenya. They give the following weights for children under 1 year of age:

AGE	BOYS		GIRLS	
	Mean (lbs)	S.D. (lbs)	Mean (lbs)	S.D. (lbs)
Under 3 months	10.8	3.42	9.8	2.71
3 months	14.6	1.89	12.7	2.06
6 months	16.0	1.67	14.2	2.33
9 months	16.3	1.48	15.3	1.83
12 months	19.3	2.62	18.1	2.29

It can be seen that the weights at 3 months compare favourably with overseas figures, at 6 months growth has slowed down but is still quite good, but in the second 6 months growth is slow and well below white standards.

Woodrow and Robertson (1950) analysed the heights and weights of Coloured children attending the municipal welfare centres. The sexes were not separated. Mean birth weight was 7 lb 5 oz and weight at one year 19 lb. Their graph shows the familiar pattern of retardation of growth in the second half of the year.

Matthews (1955) on a group of 374 Yoruba infants found the rate of growth to be comparable to that of British infants, during the first six months. From about the sixth month onwards, however, the weight increase fell below British standards, especially during the second year of life.

STUDIES OF GROWTH IN INFANCY AMONG NON-WHITE CHILDREN OTHER THAN AFRICAN.

Other investigations have also shown the rapid growth in early infancy and the marked retardation of growth in the second 6 months of the year.

Gounelle and Demarchi (1953) found that up to two months the Bagdad baby had the same weight as the European. This initial advantage was lost at the third month and up to the seventh month there was a small but marked difference of about 400 gram (.88 lb) between the European and the Bagdad infant at the same age. From then on the position became worse until at 12 months the difference was 1.41 Kg (3.1 lb). They found the same results too when comparing the curves for French and Iraqi babies.

During 1948 - 49 the Medical Research Council of New Zealand sent a team to Western Samoa to make a survey of certain health problems (Marples, 1950). The main object of the investigation was to determine the incidence of skin diseases, but in a large number of children heights and weights were also recorded. The weights of Samoan infants up to 6 months were above, but the weights in the second 6 months of life were considerably below the New Zealand figures. The weights at 12 months were in the lowest 20 per cent of the New Zealand figures.

Su and Liang (1940) studied the normal development of Chinese infants in Hunan, by measuring infants from two well-baby clinics, and compared the data with that collected by the Iowa child welfare research station. They found that the Chinese infants in Hunan, Peiping and Tsinan were not smaller in early infancy than American babies, but their growth slowed down gradually a few months later. They considered that the slow growth in the latter part of the first year could probably be explained on a nutritional basis. The babies depended too much on breast feeding and were not given supplementary feedings in most cases.

Millis (1953) investigated the gain in weight and length in the first year of life of Chinese infants born in Singapore, in order to establish their growth curves for the first year of life. She found that the curves for Chinese infants in Singapore were similar to those for Chinese infants in China. The weight increased at a similar rate to that of white infants for about 20 weeks, but the Chinese infant made slower progress in the second six months of the year. At 1 year the average Chinese male infant was 47 to 54 oz lighter than the white infant, and the female was 54 to 60 oz lighter. The standards for white children were taken from Vickers and Stuart (1943).

In a further study Millis (1954) investigated the growth curves in the first year of life of Southern Indian infants born in Singapore. The Indian infant was lighter at birth than the Chinese infant and tended to gain weight more slowly and like the Chinese infant showed the retardation in growth in the second six months of the year. The Indian infants were on an average over 4 lb lighter than white infants at the age of one year.

Rao and Bhattacharjee (1952) analysed the growth curves of Indian infants in the first month of life. Their families belonged to the middle class economic group, and they were normal full-term infants born to healthy mothers. They stated that the range of birth weights reported by various authors seemed to be a very wide one - the lowest they quote as 5 lb 5 oz and the highest their own figure of 6 lb 8.5 oz which is very similar to my own figures for South African Indian birth weights (6.46 lb). The new-born baby lost 8.6 to 10 oz in weight (9 per cent of birth weight) up to the third or fourth day, and thereafter steadily increased in weight, putting on 1.1 to 1.3 oz per day until at the end of four weeks the weight reached was a little over 8 lb. At 4 weeks the weight level of my Indian boys is 7.94 lb and of my Indian girls 7.35 lb. This study confirms the occurrence of the early rapid gain in weight previously mentioned.

NEGRO INFANT GROWTH STUDIES.

Dodge (1927) analysed data of American Coloured (i.e. Negro) infants attending the University District Prophylactic Dispensary in Cleveland from 1914 - 1920. Converting his figures from grams to pounds I get the following results for weights at 3, 6, 9 and 12 months:

Boys	11,82 lb,	14.46 lb,	17.13 lb,	18.90 lb.
Girls	10.78 lb,	13.93 lb,	16.26 lb,	18.87 lb.

He states that the growth in weight of Cleveland Coloured infants is definitely slower than the growth of white infants. It seems to me, though, that the pattern of growth is not quite the same as that found in African children in Africa or in South Africa. Although the weights at 3 months are closer to the white weights than are the weights later in the year, even at 3 months they are well below European weights.

Bakwin and Patrick (1944) pointed out that though according to reports in the literature, the Negro infant was smaller at birth than the white infant and his growth during the first year was slower, it was not clear from the data whether these differences were due to innate or to environmental influences, since observations on Negro children had been limited to dispensary material.

Accordingly, they made a study on a group of Negro infants seen in private practice who were supervised from early life and given a good diet. They compared these babies with a group of white infants supervised from early life at the Fifth Avenue Hospital. There was no significant difference in the weight gain of white and Negro infants during the first year of life, and they concluded that "the slower growth observed in earlier studies was due to difference in socioeconomic status rather than to differences in the nature of the germ plasm. Given the opportunity of proper medical supervision, Negro infants from moderate income families grow as well as white infants".

Scott et al (1950) analysed the growth records of 654 Negro infants observed in private paediatric practice. These infants were from lower middle class families. I quote some of their conclusions:

"The mean birth weight for the male and female infants was 7.66 pounds and 7.20 pounds respectively .... "

"At 12 months of age the weights attained were 22.59 pounds for male infants and 21.33 pounds for female infants .... "

"We compared our results with data on Negro infants from various economic levels (general population, indigent, low middle class) reported in the literature. The infants in our study and those reported by Bakwin and Patrick surpassed those of other series in growth throughout the first year of life. A significant difference in growth was observed when indigent infants were compared with infants from middle class levels".

"We also compared our data with similar reports on the growth of white infants. There was no significant difference between the growth curves of Negro and white infants from comparable economic levels".

Meredith (1952) reviewed the literature on the size at birth and growth during the first postnatal year of North American Negro infants, and compared them with North American white babies. (See Table 65). Meredith gives his figures in kilograms but I have converted them to pounds in order to make comparison with my own figures easier.

For each Negro white comparison within the period 1930-1950 there was approximate comparability in economic status and health care. The

Negro group overall was of slightly lower economic level than the whites but all groups had reasonably adequate diets and sustained medical supervision.

In summary Meredith's findings as far as weight is concerned are:

1. Mean weight of viable Negro infants at birth is 3.23 Kg (7.11 lb) and mean weight of Negro infants weighing more than 2.2 Kg at birth is 3.28 Kg. (7.2 lb). The mean weights of white infants were higher by 0.12 Kg (.26 lb) and 0.13 Kg (.29 lb) respectively. The average North American Negro baby is over ¼ lb, nearly 4 per cent lighter at birth than the average North American white baby.

2. The mean weight of Negro infants receiving adequate dietary and medical care from birth is 7.44 Kg (16.37 lb) at 6 months and 9.87 Kg (21.71 lb) at 1 year. Comparable means for white babies are higher by 0.20 Kg (.44 lb) and 0.14 Kg (.29 lb). At end of the first postnatal year the average well cared for North American Negro infant is not lighter than the average well cared for North American white infant by more than 2 per cent.

TABLE 65.

WEIGHT MEANS (LBS) AT SELECTED POSTNATAL AGES FOR NORTH AMERICAN NEGRO AND WHITE INFANTS
(Adapted from Meredith, 1952)

INVESTIGATION	3 MONTHS		6 MONTHS		9 MONTHS		1 YEAR	
	No.	Mean	No.	Mean	No.	Mean	No.	Mean
1. Baldwin +	90	11.15	82	14.45	73	16.50	63	18.48
	118	11.35	109	14.63	87	17.47	53	19.89
2. Woodbury	301	12.21	279	15.47	245	17.18	182	18.92
	7046	12.89	7238	16.41	7152	18.59	6476	20.24
3. Dodge, Rude	208	11.48	155	14.56	145	16.70	119	18.79
	85	12.45	96	15.27	78	17.71	101	19.12
4. Michelson	1714	11.79	981	15.91	589	18.77	338	20.92
	180	12.91	219	17.07	167	20.33	100	22.77
5. Bakwin and Patrick	102	12.50	97	16.79	99	20.11	95	22.57
Bakwin and Bakwin	218	12.58	164	16.79	115	20.02	90	22.77
6. Pasamanick;	53	14.08	53	17.93	53	20.86	53	23.21
Norval et al	2518	12.50	1943	16.76	1508	19.73	1076	21.87
7. Kelly and Rey-	108	12.10	100	16.46	84	19.49	46	21.45
nolds	289	12.14	269	16.59	220	19.51	124	21.63
8. Scott et al	613	12.45	600	16.90	580	20.11	553	21.91
Vickers and Stuart	254	12.56	252	17.20	241	19.93	244	22.18
9. 1930 - 1950	2590	12.03	1831	16.37	1405	19.54	1085	21.71
Composite	4538	12.50	3937	16.81	3245	19.82	2640	22.00
							MALES ONLY	
10. Rhoads et al							99	21.96
							134	22.13

+ In each comparison the upper figures are for American Negro infants and the lower figures for American white infants.

From these studies of American Negroes it would appear that their growth pattern in infancy is different from that of our South African Bantu and of Africans in Africa. When they are economically depressed their growth curve is generally lower than that of white infants and when they are better off economically and have good medical supervision and adequate diet their growth is the same as that of whites of comparable circumstances.

Although I do not have figures of incidence of breast feeding among Negro mothers in the United States, my impression is that the incidence is far lower than amongst our non-European population in South Africa and in Africa as a whole. This impression is borne out by the study done by Bakwin and Patrick, previously cited. Of the 114 infants in private paediatric practice that they studied, only 40 per cent were breast fed for the first three to four months of life, the remainder being bottle fed. Our Bantu babies are breast fed whenever they cry and get adequate milk in early infancy, but they suffer when mothers' milk alone is insufficient for their needs, particularly after the second 6 months of life.

To improve the growth curve of European babies I think one must concentrate on more liberal breast feeding (or even bottle feeding) in early life, but to improve the growth curve of our non-European babies, on the whole, the emphasis must be placed on earlier introduction of suitable solids in adequate amount, and the maintenance of satisfactory mixed feeding.

We have demonstrated at health centres in Durban that this can be done. At the Springfield Health Centre in 1948, Indian weights at 1 year had risen to 17 lb 9 oz (17 lb 6 oz in 1947) and Coloured weights to 19 lb 2 oz (18 lb 11 oz in 1947). I do not have data on Bantu weights at Springfield for 1948. (These figures appear in the Training Scheme for Health Personnel Annual Report (1948).) When the Lamont Health Centre commenced its work in the Lamontville Native Location in 1948, there was a Municipal child welfare clinic functioning in the area, which later closed down when the Health Centre ran its own mother and baby sessions for the same clientele. I analysed the weight growth of the infants attending the Lamont Municipal child welfare clinics in 1947 and 1948 in order to have a base line for comparison later on. The mean weights of the infants attending the Health Centre mother and baby sessions in 1950 - 51 were compared with those of the Municipal clinic, and we found that up to about the 30th week growth was about the same in the two periods. After 30 weeks, however, the 1947 - 48 curve flattened out considerably and the average infant gained only 1½ lb before the end of the 52nd week. The growth curve of the 1950 - 51 group of infants flattened out less than the previous curve and they gained 2½ lb in the same period, with a mean weight of 21.5 lb at 52 weeks. (See Annual Report Lamont Health Centre, 1950 - 51).

SUMMARY.

Weights in the first year of life are studied on 2,096 European, 1,303 Bantu, 579 Coloured, and 509 Indian infants who attended the Durban Municipal Child Welfare clinics from 1948 - 1951. Multiple births are excluded and also babies who attended less than six times during the year. Boys and girls are treated separately.

Tables of mean weight for each week from 2 - 52 weeks are drawn up, and graphs plotted in order to compare the growth curves of the four racial groups.

Rate of growth (4-weekly and 3-monthly) is also analysed.

In addition the growth curve of European babies attending a private practitioner in Durban is compared with the European babies from the Municipal clinic. Results are as follows:-

1. Comparison of growth curves show that at the beginning of the year European babies are heaviest, Indian babies lightest, and that Coloured and Bantu occupy an intermediate position with Coloured babies slightly heavier than Bantu babies.

2. By the end of the year European babies are still heaviest and Indians lightest, but Bantu babies are heavier than Coloured.

3. Coloured babies weights are about the same as Europeans for about 3 months, and then fall progressively below them.

4. Indian babies grow as well as Europeans for about 2 months though their actual weights are always well below those of Europeans because of their difference in birth weight. After that they deviate increasingly from Europeans till the end of the year.

5. Bantu babies overtake Europeans by about 1 month and their weights are above those of Europeans until 30 weeks of age, from which time they are below. All these remarks apply to both boys and girls.

6. Comparison of rate of gain shows that from 2 to 12 weeks Bantu boys gain more weight than all the other groups and from 2 to 8 weeks European boys gain the least of the four groups. European boys, however, gain more than the rest from 12 weeks onwards. From 16 weeks Coloured boys gain more than Bantu and Indian.

7. Rate of gain of Bantu girls is greater than all the rest from 2 - 16 weeks, but European girls from 2 weeks onwards gain more weight than Coloured and Indian girls. From 16 weeks Coloured girls gain more than Bantu and Indian girls.

8. European babies show a steady decline in weight gain in each successive three-monthly period over the first year. In the non-European groups the decline in weight gain is far more marked from the first to the second three-monthly period, with the Bantu almost halving their rate of gain. In the second half of the first postnatal year there is no doubt about the superiority of the European baby's weight gain over the other three groups.

9. The literature on weight in the first year of life is discussed. The curve for South African European babies is similar to that of comparable babies overseas. I suggest that European infants are, on the whole, underfed in early life, due to the method of feeding on regular schedules and a fear of overfeeding.

10. Non-European babies in South Africa, on the other hand, particularly the Bantu, grow well in early life, due to the high incidence of breast feeding which is given "on demand". When these babies need foods other than breast milk, growth becomes retarded because for reasons of poverty and ignorance the mothers do not supply a good and sufficient mixed diet.

11. Rapid early growth with marked slowing down in the second six months of life has been noted by investigators in Africa and elsewhere.

12. In America, on the other hand, where the Negro is very much a "poor white", growth of Negro babies is similar to that of white American babies, though on a lower level. When the economic groups are comparable and the infants have good medical supervision there is no difference in the pattern of growth between Negro and white American infants in the first year of life.

13. Graphs are presented of growth in the first postnatal year for each racial group, boys and girls separately, giving mean weight $\pm$ 1 standard deviation. It is suggested that they may be of use in child welfare clinics in South Africa providing it is remembered that these are curves of average growth and not of optimal growth.

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APPENDIX 24

ACTUAL WEIGHTS 2-52 WEEKS - EUROPEAN BOYS AND GIRLS - MUNICIPAL CLINICS, DURBAN (1948-51)

WEEK	RANK 1						RANK 2+						ALL RANKS					
	Boys			Girls			Boys			Girls			Boys			Girls		
	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)
2	122	7.85	1.10	113	7.25	.77	176	8.06	1.18	163	7.74	1.04	298	7.98	1.15	276	7.55	.97
3	230	8.22	1.05	232	7.81	.93	334	8.53	1.22	294	8.11	1.08	564	8.40	1.17	526	7.98	1.03
4	291	8.63	1.08	269	8.26	.95	382	8.95	1.28	348	8.66	1.05	673	8.81	1.21	617	8.49	1.03
5	323	9.06	1.13	298	8.67	1.04	415	9.49	1.37	378	9.01	1.14	738	9.30	1.29	676	8.86	1.11
6	324	9.53	1.21	306	9.10	1.11	399	9.77	1.39	367	9.40	1.23	723	9.66	1.32	673	9.26	1.19
7	322	9.96	1.25	300	9.40	1.13	407	10.22	1.48	401	9.76	1.30	729	10.11	1.39	701	9.60	1.24
8	344	10.32	1.33	314	9.95	1.17	411	10.64	1.52	383	10.17	1.31	755	10.50	1.45	697	10.07	1.25
9	337	10.73	1.37	320	10.31	1.28	412	11.07	1.51	368	10.46	1.36	749	10.92	1.46	688	10.39	1.32
10	339	11.15	1.47	330	10.66	1.24	399	11.47	1.62	376	10.76	1.43	738	11.32	1.56	706	10.71	1.35
11	333	11.52	1.54	337	11.00	1.27	416	11.84	1.67	343	11.18	1.40	749	11.69	1.62	680	11.09	1.34
12	351	11.89	1.50	325	11.32	1.30	391	12.21	1.69	371	11.68	1.43	742	12.06	1.61	696	11.52	1.39
13	335	12.37	1.58	320	11.67	1.39	392	12.51	1.78	374	11.81	1.51	727	12.45	1.69	694	11.75	1.46
14	331	12.79	1.59	337	12.15	1.40	379	13.07	1.82	381	12.32	1.61	710	12.94	1.72	718	12.24	1.52
15	324	13.25	1.56	320	12.43	1.44	390	13.34	1.71	360	12.62	1.67	714	13.30	1.64	680	12.53	1.57
16	324	13.43	1.71	321	12.67	1.43	382	13.72	1.78	364	12.96	1.57	706	13.59	1.75	685	12.82	1.51
17	311	13.95	1.77	298	13.09	1.52	372	14.16	2.11	351	13.29	1.71	683	14.06	1.85	649	13.20	1.63
18	317	14.39	1.69	311	13.49	1.50	367	14.46	1.92	343	13.49	1.69	684	14.42	1.81	654	13.49	1.60
19	298	14.57	1.73	296	13.86	1.52	354	14.90	1.98	335	13.94	1.80	652	14.75	1.88	631	13.90	1.67
20	318	14.96	1.63	312	14.19	1.55	365	15.15	1.79	331	14.10	1.81	683	15.06	1.72	643	14.14	1.69
21	290	15.25	1.74	266	14.41	1.58	321	15.46	1.89	317	14.48	1.83	611	15.36	1.82	583	14.45	1.72
22	285	15.66	1.85	309	14.68	1.59	327	15.92	1.91	324	14.73	1.85	612	15.80	1.88	633	14.70	1.73
23	276	15.88	1.78	275	15.13	1.46	312	16.10	1.94	306	14.99	1.84	588	15.99	1.87	581	15.06	1.67
24	273	16.29	1.83	269	15.51	1.68	304	16.30	2.00	299	15.14	1.99	577	16.30	1.92	568	15.31	1.86
25	262	16.40	1.88	272	15.60	1.58	283	16.72	2.07	275	15.56	2.03	545	16.56	1.99	547	15.58	1.82
26	264	16.86	1.83	273	15.98	1.53	303	16.96	1.99	306	15.89	1.97	567	16.91	1.92	579	15.93	1.78
27	241	17.02	1.93	248	16.08	1.74	297	17.36	1.97	263	15.94	1.87	538	17.20	1.96	511	16.01	1.82
28	243	17.37	2.04	246	16.55	1.76	278	17.52	2.13	263	16.27	2.08	521	17.45	2.09	509	16.41	1.94
29	205	17.50	1.89	238	16.63	1.61	279	17.89	2.10	239	16.86	1.92	484	17.73	2.03	477	16.75	1.78
30	235	17.91	2.00	230	17.11	1.71	261	18.00	2.13	247	16.79	1.97	496	17.96	2.07	477	16.94	1.85
31	200	18.15	1.99	224	17.28	1.78	254	18.21	2.16	228	16.98	2.09	454	18.18	2.09	452	17.13	1.95
32	215	18.47	2.03	210	17.43	1.78	223	18.74	2.27	227	17.21	2.06	438	18.61	2.17	437	17.32	1.93
33	207	18.69	2.01	212	17.80	1.67	230	18.73	2.16	223	17.49	2.05	437	18.71	2.09	435	17.64	1.88
34	198	18.92	2.02	200	17.93	1.81	231	18.93	2.14	229	17.79	2.17	429	18.93	2.08	429	17.85	2.01
35	187	19.04	2.14	191	18.08	1.80	216	19.38	2.28	207	17.82	1.97	403	19.22	2.22	398	17.94	1.90
36	177	19.18	2.07	194	18.42	1.75	218	19.33	2.12	209	18.28	2.12	395	19.26	2.11	403	18.35	1.86
37	183	19.61	2.05	160	18.82	1.91	192	19.88	2.20	180	18.48	2.10	375	19.75	2.13	340	18.64	2.02
38	165	19.84	2.11	188	19.06	1.80	205	19.87	2.20	185	18.68	2.32	370	19.85	2.16	373	18.88	2.09
39	181	20.03	2.13	169	19.13	1.81	204	20.25	2.20	198	18.93	2.11	385	20.15	2.17	367	19.02	1.98
40	163	20.17	2.15	173	19.34	1.86	201	20.26	2.12	181	19.23	2.32	364	20.22	2.13	354	19.29	2.11
41	175	20.59	2.21	156	19.61	1.79	187	20.72	2.37	170	19.39	1.95	362	20.66	2.29	326	19.50	1.88
42	147	20.73	2.23	163	19.84	2.02	164	20.74	2.12	151	19.12	2.41	311	20.74	2.17	314	19.49	2.25
43	151	21.05	2.21	159	20.02	1.95	160	20.84	2.35	169	19.83	2.21	311	20.94	2.28	328	19.92	2.09
44	151	21.09	2.43	149	19.98	2.12	181	20.82	2.23	137	19.64	2.15	332	20.96	2.33	286	19.82	2.14
45	147	21.51	2.39	148	20.40	2.06	138	21.53	2.37	155	19.92	2.31	285	21.52	2.38	303	20.16	2.20
46	120	21.57	2.48	126	20.44	2.09	165	21.32	2.56	127	19.80	2.29	285	21.42	2.53	253	20.12	2.22
47	131	21.97	2.20	114	20.75	1.87	129	21.28	2.46	145	20.31	2.33	260	21.63	2.36	259	20.50	2.15
48	117	21.92	2.47	127	20.68	1.94	137	21.78	2.30	130	20.21	2.34	254	21.84	2.38	257	20.44	2.25
49	117	22.48	2.32	121	21.01	1.95	136	21.74	2.62	120	20.70	2.16	253	22.08	2.51	241	20.85	2.07
50	100	22.65	2.45	124	21.24	2.18	146	22.15	2.38	129	20.46	2.37	246	22.35	2.42	253	20.85	2.30
51	116	22.81	2.59	97	21.47	2.16	112	22.30	2.46	104	20.83	2.22	228	22.56	2.54	201	21.14	2.21
52	117	22.94	2.46	141	21.72	2.27	150	22.47	2.44	141	21.34	2.35	267	22.67	2.45	282	21.52	2.32

APPENDIX 25

ACTUAL WEIGHTS 2-52 WEEKS - COLOURED BOYS AND GIRLS - MUNICIPAL CLINICS, DURBAN (1948-1951)

WEEK	RANK 1						RANK 2+						ALL RANKS					
	Boys			Girls			Boys			Girls			Boys			Girls		
	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)
2	9	-	-	12	-	-	39	7.99	1.15	31	7.96	1.26	48	7.89	1.17	43	7.76	1.20
3	27	7.90	1.26	26	7.56	1.09	73	8.53	1.23	62	8.13	1.34	100	8.36	1.26	88	7.96	1.30
4	39	8.60	1.12	42	8.04	1.03	82	9.21	1.29	82	8.49	1.52	121	9.01	1.29	124	8.33	1.39
5	37	8.76	1.46	47	8.7	1.27	97	9.65	1.47	90	8.95	1.47	134	9.41	1.52	137	8.86	1.41
6	41	9.20	1.34	41	9.03	1.25	88	10.11	1.43	82	9.33	1.51	129	9.82	1.47	123	9.23	1.39
7	37	9.80	1.57	35	9.48	1.34	81	10.52	1.44	83	9.77	1.52	118	10.28	1.53	118	9.68	1.49
8	37	10.24	1.66	40	9.78	1.52	96	10.88	1.67	81	10.13	1.56	133	10.70	1.69	121	10.01	1.55
9	31	10.77	1.62	40	10.01	1.43	76	11.46	1.91	76	10.61	1.72	107	11.26	1.86	116	10.40	1.65
10	30	11.07	1.80	28	10.61	1.59	82	11.71	1.93	74	10.93	1.60	112	11.54	1.92	102	10.84	1.61
11	36	11.64	1.52	39	10.90	1.46	77	12.00	1.86	81	11.38	1.68	113	11.88	1.78	120	11.22	1.63
12	32	11.81	1.90	31	11.38	1.78	76	12.71	2.09	69	11.52	1.74	108	12.43	2.07	100	11.48	1.74
13	30	11.98	1.86	35	11.62	1.81	73	12.68	1.92	76	11.65	1.91	103	12.48	1.93	111	11.64	1.90
14	29	12.47	2.02	38	11.92	1.48	83	13.22	2.13	79	12.07	1.73	112	13.05	2.12	117	12.02	1.66
15	39	12.76	2.21	32	11.98	1.81	82	13.55	2.22	69	12.39	1.70	121	13.30	2.26	101	12.26	1.74
16	29	13.37	2.13	41	12.75	1.90	65	13.07	2.17	69	13.00	1.83	94	13.15	2.15	110	12.90	1.86
17	29	13.63	2.12	34	12.78	1.65	64	13.66	2.37	74	12.61	1.92	93	13.60	2.31	108	12.67	1.81
18	24	14.08	2.26	36	13.10	1.96	72	14.14	2.25	61	13.04	2.05	96	14.10	2.33	97	13.07	2.03
19	24	14.38	2.51	29	13.85	1.83	69	14.62	2.17	59	13.38	2.11	93	14.55	2.27	88	13.57	1.96
20	27	14.90	2.21	38	14.26	2.02	65	14.75	2.27	62	13.66	2.18	92	14.77	2.26	100	13.87	2.13
21	24	14.88	2.61	28	13.95	3.97	62	15.45	2.32	73	14.41	2.53	86	15.30	2.39	101	14.19	2.25
22	23	15.25	2.13	21	14.30	1.36	60	15.15	2.18	68	14.31	2.21	83	15.17	2.12	89	14.28	2.01
23	23	15.58	2.08	26	15.50	2.16	61	15.73	2.45	54	14.91	2.41	84	15.67	2.34	80	14.89	2.35
24	33	15.58	2.78	27	14.44	1.62	57	16.06	2.14	62	14.47	2.19	90	15.86	2.36	89	14.45	1.98
25	23	15.51	2.28	20	14.98	2.25	56	16.29	2.43	44	14.50	2.27	79	16.07	2.40	64	14.66	2.26
26	25	15.77	2.56	21	15.23	1.76	46	16.20	2.77	52	15.25	2.26	71	16.06	2.72	73	15.24	2.13
27	20	16.00	2.47	18	-	1.62	56	16.64	2.45	54	15.48	2.43	76	16.47	2.48	72	15.57	2.26
28	14	-	-	22	15.25	1.93	48	17.17	2.77	49	15.68	2.14	62	17.21	2.86	71	15.54	2.08
29	17	-	-	19	-	-	49	17.11	2.73	46	15.50	2.48	66	16.91	2.94	64	15.86	2.44
30	19	-	-	19	-	-	48	17.31	2.89	48	16.37	2.20	67	17.02	3.04	67	16.45	2.04
31	21	17.45	3.0	14	-	-	41	17.59	1.77	39	15.94	2.55	62	17.53	2.27	53	16.08	2.34
32	24	16.98	2.81	20	16.3	2.31	46	18.30	2.83	46	16.63	2.50	70	17.86	2.92	66	16.53	2.44
33	16	-	-	19	-	-	33	17.84	2.27	40	15.55	2.50	49	17.74	2.25	59	16.09	2.73
34	18	-	-	16	-	-	34	18.24	2.50	39	16.29	2.64	53	18.22	2.57	55	16.69	2.68
35	20	18.33	2.37	15	-	-	36	18.28	2.71	39	17.17	1.83	56	18.29	2.58	54	16.90	1.80
36	17	-	-	13	-	-	36	17.56	2.21	33	17.41	2.25	53	17.97	2.26	46	17.39	2.32
37	18	-	-	13	-	-	33	18.87	2.13	40	16.75	2.63	51	18.64	2.32	53	17.03	2.60
38	20	18.58	2.01	22	17.77	1.93	32	18.56	2.74	35	16.47	2.69	52	18.60	2.47	57	17.01	2.54
39	17	-	-	14	-	-	42	19.26	2.58	34	17.38	3.10	59	19.06	2.51	48	17.67	2.85
40	16	-	-	13	-	-	29	18.70	2.35	33	17.48	1.84	45	18.85	2.19	46	17.87	2.06
41	18	-	-	11	-	-	35	19.01	2.56	29	17.11	2.32	53	18.89	2.54	40	17.75	2.71
42	18	-	-	17	-	-	39	18.86	2.63	26	17.96	2.87	57	18.89	2.54	43	18.69	2.76
43	11	-	-	10	-	-	27	19.54	2.78	29	18.53	3.17	38	19.26	2.78	39	18.50	2.82
44	14	-	-	12	-	-	27	19.95	2.66	31	17.53	2.66	41	19.57	2.60	43	18.04	2.77
45	10	-	-	11	-	-	25	18.63	1.87	36	18.36	2.35	35	18.71	1.94	47	18.48	2.56
46	7	-	-	10	-	-	25	19.37	2.44	35	18.11	2.50	32	19.48	2.35	45	18.43	2.51
47	16	-	-	14	-	-	22	18.82	2.34	27	17.53	2.37	41	19.10	2.34	41	18.11	2.63
48	11	-	-	15	-	-	27	19.40	2.34	31	18.05	2.45	38	19.79	2.41	46	18.57	2.53
49	15	-	-	4	-	-	32	20.22	2.94	24	18.63	2.94	47	20.27	2.69	28	18.89	2.96
50	10	-	-	5	-	-	33	19.93	2.43	22	18.23	2.65	43	20.08	2.42	27	18.50	2.57
51	9	-	-	11	-	-	21	20.25	1.92	23	19.28	2.19	30	20.05	2.08	34	19.91	2.56
52	8	-	-	8	-	-	23	21.05	2.76	24	18.81	2.61	31	20.94	2.50	32	19.22	2.72

APPENDIX 26

ACTUAL WEIGHTS 2-52 WEEKS - BANTU BOYS AND GIRLS - MUNICIPAL CLINICS, DURBAN (1948-1951)

WEEK	RANK 1						RANK 2+						ALL RANKS					
	Boys			Girls			Boys			Girls			Boys			Girls		
	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)
2	47	7.28	1.38	43	6.75	0.85	132	7.71	1.08	153	7.44	1.10	179	7.60	1.21	196	7.29	1.09
3	57	7.72	1.29	52	7.50	0.97	169	8.33	1.16	192	8.09	1.17	226	8.19	1.26	244	7.91	1.17
4	70	8.50	1.49	64	8.06	1.13	193	8.99	1.38	237	8.62	1.29	263	8.86	1.43	301	8.50	1.29
5	88	8.92	1.64	70	8.60	1.16	186	9.65	1.51	256	9.21	1.29	274	9.42	1.62	326	9.08	1.29
6	73	9.38	1.43	81	9.19	1.38	174	10.19	1.67	243	9.63	1.52	247	9.94	1.66	324	9.52	1.49
7	78	10.15	1.71	69	9.55	1.76	203	10.61	1.72	265	10.14	1.58	281	10.49	1.75	334	10.02	1.63
8	88	10.96	1.62	75	10.25	1.56	208	11.27	1.77	250	10.63	1.49	296	11.18	1.73	325	10.56	1.57
9	89	11.48	1.83	76	10.74	1.82	200	11.84	1.99	246	11.01	1.66	289	11.72	1.94	322	10.97	1.75
10	79	12.18	1.83	68	11.32	1.72	202	12.38	1.90	241	11.50	1.75	281	12.32	1.90	309	11.46	1.74
11	78	12.62	2.12	62	11.52	2.02	187	12.70	2.08	249	11.84	1.78	265	12.66	2.11	311	11.78	1.81
12	71	12.80	2.26	56	12.21	1.51	172	12.88	2.10	228	12.43	1.78	243	12.87	2.19	284	12.39	1.73
13	68	13.22	2.21	66	12.11	2.15	172	13.54	2.12	218	12.64	1.85	240	13.45	2.15	284	12.51	2.01
14	56	13.48	2.28	59	13.09	1.92	172	13.93	2.22	212	13.07	1.88	228	13.95	2.29	271	13.07	1.93
15	69	13.90	2.12	54	13.39	1.96	177	14.26	2.39	185	13.42	2.13	246	14.19	2.27	239	13.42	2.18
16	69	14.79	2.50	59	13.29	1.89	151	14.69	2.28	186	13.84	1.99	220	14.72	2.36	245	13.70	1.98
17	46	14.78	2.29	45	13.54	2.40	141	14.45	2.45	177	13.95	2.13	187	14.54	2.41	222	13.87	2.19
18	64	15.26	2.47	56	14.12	2.35	155	15.31	2.38	158	14.46	2.21	219	15.28	2.41	214	14.37	2.25
19	58	15.60	2.44	38	14.37	2.48	134	15.36	2.62	164	14.50	2.15	192	15.43	2.58	202	14.48	2.14
20	66	16.17	2.48	46	15.01	2.34	123	15.63	2.57	155	14.75	2.33	189	15.79	2.55	201	14.82	2.34
21	57	16.32	2.50	38	14.32	2.67	127	15.94	2.70	154	14.83	2.35	184	16.06	2.67	192	14.74	2.43
22	57	16.55	2.51	44	15.02	2.37	111	16.18	2.67	133	15.40	2.35	168	16.30	2.59	177	15.31	2.36
23	52	16.33	2.75	38	15.57	2.20	121	16.18	2.57	126	15.66	2.35	173	16.24	2.62	164	15.63	2.32
24	42	16.96	2.75	38	15.57	2.49	108	16.66	2.71	113	16.06	2.37	150	16.71	2.73	151	15.94	2.41
25	42	16.74	2.49	47	16.17	2.67	101	16.91	2.91	119	16.10	2.45	143	16.86	2.80	166	16.11	2.51
26	49	17.57	2.57	42	16.05	2.51	98	17.38	2.77	106	16.05	2.67	147	17.45	2.65	148	16.05	2.63
27	48	17.68	2.45	31	15.83	3.01	93	17.47	2.71	122	16.51	2.65	141	17.59	2.61	153	16.37	2.74
28	34	17.18	2.77	30	16.90	2.91	88	17.40	3.04	99	16.45	2.42	122	17.35	2.95	129	16.55	2.55
29	28	17.80	2.64	32	16.31	2.36	91	17.87	2.62	94	16.74	2.86	119	17.86	2.63	126	16.64	2.74
30	30	18.25	2.69	28	17.14	2.66	69	17.80	2.65	92	16.94	2.47	99	17.95	2.65	120	16.99	2.51
31	38	18.04	2.71	30	17.65	2.44	80	18.49	2.78	82	17.07	2.74	118	18.34	2.76	112	17.23	2.68
32	34	18.21	1.97	24	17.58	3.00	50	18.28	2.84	78	17.21	2.56	84	18.25	2.53	102	17.25	2.72
33	28	19.23	2.34	29	17.60	2.97	67	18.28	2.95	74	17.28	2.64	95	18.56	[illegible]	103	17.38	2.77
34	27	18.86	2.21	30	17.52	2.72	59	18.14	2.68	75	18.04	2.51	86	18.39	2.59	105	17.89	2.58
35	33	19.34	2.66	24	17.71	3.09	62	18.62	2.74	89	17.56	2.88	95	18.87	2.73	113	17.59	2.91
36	27	18.94	2.73	24	17.92	2.89	64	18.87	3.12	66	17.95	2.60	91	18.88	3.01	90	17.94	2.68
37	24	19.15	2.60	22	18.14	2.76	67	19.03	2.26	59	17.46	2.10	91	19.06	2.35	81	17.65	2.32
38	18	-	-	23	17.82	2.45	45	19.65	2.13	70	18.28	2.83	63	19.47	2.64	93	18.16	2.75
39	17	-	-	18	-	-	50	19.75	2.32	64	18.61	2.63	67	19.77	2.43	82	18.27	2.57
40	27	19.94	2.60	20	18.48	1.94	52	19.43	2.58	77	18.59	2.89	79	19.60	2.60	97	18.53	2.82
41	18	-	-	10	-	-	50	20.24	2.42	51	18.80	2.33	68	20.08	2.81	61	18.72	2.35
42	15	-	-	16	-	-	58	19.28	2.86	37	18.51	2.98	73	19.43	2.75	53	18.56	2.86
43	10	-	-	15	-	-	46	19.74	2.66	38	18.49	2.84	56	19.53	2.64	53	18.78	2.70
44	13	-	-	8	-	-	45	19.79	2.22	40	18.40	2.56	58	19.89	2.27	48	18.51	2.46
45	16	-	-	12	-	-	37	20.06	3.63	49	18.31	2.56	53	20.01	3.39	61	18.30	2.41
46	12	-	-	12	-	-	41	19.54	3.15	45	18.85	2.53	53	19.69	3.07	57	19.11	2.53
47	15	-	-	10	-	-	42	20.21	3.40	36	18.99	2.59	57	20.40	3.39	46	18.92	2.55
48	7	-	-	7	-	-	26	19.94	2.50	35	19.91	2.53	33	19.75	2.56	42	19.74	2.56
49	10	-	-	5	-	-	34	20.66	3.15	35	19.64	2.82	44	20.93	3.20	40	19.80	2.80
50	9	-	-	14	-	-	29	20.85	2.52	26	19.77	2.96	38	20.49	2.51	40	19.86	2.60
51	11	-	-	9	-	-	25	20.19	1.90	22	19.64	3.13	36	20.44	2.12	31	19.82	2.85
52	6	-	-	11	-	-	20	21.60	2.36	28	19.63	2.74	26	21.90	2.21	39	19.93	2.88

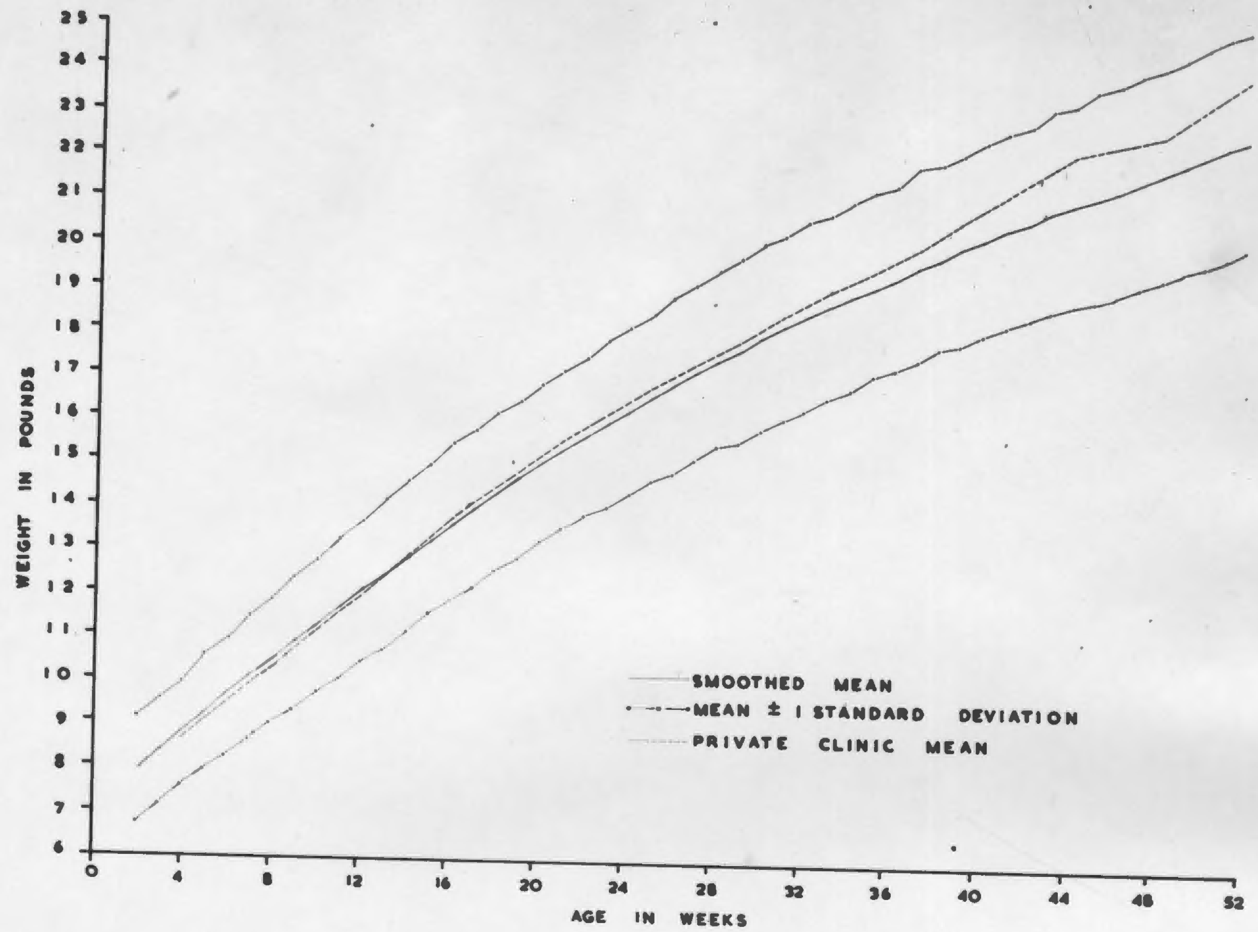
APPENDIX 27

ACTUAL WEIGHTS 2-52 WEEKS - INDIAN BOYS AND GIRLS - MUNICIPAL CLINICS, DURBAN (1948-51)

WEEK	RANK 1						RANK 2+						ALL RANKS					
	Boys			Girls			Boys			Girls			Boys			Girls		
	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)
2	6	-	-	4	-	-	7	-	-	7	-	-	13	-	-	11	-	-
3	13	-	-	7	-	-	35	7.55	1.36	26	6.63	1.30	48	7.33	1.31	33	6.70	1.41
4	18	-	-	14	-	-	44	8.10	1.37	40	7.67	1.29	62	7.86	1.30	54	7.56	1.32
5	28	8.18	1.14	15	-	-	68	8.76	1.52	56	8.04	1.40	96	8.64	1.43	71	7.80	1.44
6	29	8.37	1.41	13	-	-	90	9.08	1.56	75	8.35	1.28	119	8.91	1.55	88	8.31	1.25
7	29	8.78	1.71	25	7.99	1.66	93	9.33	1.58	86	8.65	1.62	122	9.20	1.63	111	8.50	1.65
8	33	8.87	1.74	24	8.15	1.63	92	9.67	1.53	93	9.15	1.73	125	9.46	1.62	117	8.99	1.77
9	34	9.68	1.81	29	8.66	1.70	81	10.30	1.65	85	9.17	1.54	115	10.12	1.72	114	9.04	1.60
10	34	10.06	1.98	28	8.89	1.52	100	10.69	1.64	99	9.65	1.75	134	10.53	1.75	127	9.48	1.73
11	37	10.41	2.15	35	9.84	1.94	81	10.72	1.73	99	10.00	1.76	118	10.62	1.88	134	9.96	1.81
12	38	10.76	2.05	27	9.81	1.95	86	11.22	1.92	79	10.27	1.73	124	11.08	1.97	106	10.15	1.80
13	34	11.18	2.04	25	10.01	1.86	87	11.55	2.23	84	10.36	1.86	121	11.44	2.18	109	10.27	1.87
14	43	11.24	2.14	27	10.82	1.76	78	11.80	2.00	92	10.79	2.10	121	11.67	2.07	118	10.80	2.03
15	30	11.63	1.96	27	10.69	2.18	81	12.01	2.17	80	11.34	1.69	111	11.93	2.13	107	11.18	1.85
16	26	11.87	1.64	27	10.92	1.93	78	12.24	2.19	76	11.34	1.94	104	12.15	2.07	103	11.23	1.94
17	29	12.10	2.05	31	11.01	2.13	75	13.19	2.33	66	11.28	2.06	104	12.89	2.31	97	11.19	2.08
18	33	12.92	2.08	30	11.70	1.68	70	13.23	2.15	83	11.62	2.15	103	13.13	2.13	113	11.63	2.07
19	39	13.10	2.10	22	11.27	1.99	73	13.45	2.26	64	11.66	2.39	112	13.33	2.21	86	11.56	2.30
20	22	13.36	2.29	23	11.88	1.84	72	13.19	2.46	84	11.91	2.26	94	13.23	2.42	107	11.90	2.18
21	32	13.67	2.31	24	12.06	2.77	63	13.58	2.39	70	12.02	2.43	95	13.61	2.39	94	11.99	2.52
22	34	13.57	2.33	31	12.17	2.49	76	14.13	2.21	71	12.43	2.56	110	13.96	2.30	102	12.46	2.54
23	30	14.03	2.06	27	12.44	2.50	64	14.30	2.31	50	12.93	2.32	94	14.21	2.24	77	12.80	2.39
24	28	13.88	2.68	21	12.98	2.54	65	14.36	2.36	63	13.04	2.47	93	14.21	2.47	84	13.02	2.49
25	31	13.77	2.50	27	13.31	2.75	62	14.57	2.55	50	12.78	2.52	93	14.30	2.55	77	12.95	2.63
26	23	14.27	2.79	22	13.39	2.13	60	15.14	2.26	52	13.05	2.36	83	14.90	2.45	74	13.15	2.30
27	30	15.20	2.14	20	13.07	2.21	56	14.80	2.49	43	13.09	2.35	86	15.00	2.38	63	13.07	2.31
28	25	15.03	2.85	13	-	-	47	15.50	2.14	55	13.67	2.39	72	15.33	2.42	68	13.79	2.55
29	27	14.95	1.94	21	14.32	2.50	50	15.54	2.46	49	14.20	2.70	77	15.33	2.30	70	14.21	2.63
30	24	15.27	1.81	13	-	-	51	15.86	2.30	39	13.71	2.51	75	15.67	2.17	52	13.96	2.53
31	24	15.85	2.47	17	-	-	44	15.60	2.37	46	14.29	2.51	68	15.69	2.41	63	14.26	2.67
32	22	15.61	2.37	15	-	-	38	16.32	2.45	40	14.27	2.46	60	16.06	2.45	55	14.43	2.49
33	24	16.06	1.86	15	-	-	36	16.38	2.32	48	14.56	2.45	60	16.25	2.16	63	14.76	2.63
34	19	-	-	16	-	-	31	16.40	2.28	40	14.52	2.44	50	16.29	2.08	56	14.50	2.42
35	19	-	-	19	-	-	39	15.94	2.60	37	14.93	2.65	58	16.13	2.35	56	15.11	2.67
36	18	-	-	11	-	-	38	16.13	2.76	47	15.10	2.27	56	16.25	2.46	58	15.05	2.30
37	19	-	-	15	-	-	28	16.05	2.73	29	14.70	2.57	47	16.42	2.40	44	15.02	2.61
38	16	-	-	16	-	-	35	16.62	2.76	33	14.63	2.20	51	16.64	2.58	49	14.98	2.39
39	20	17.65	1.55	9	-	-	40	16.30	2.67	38	15.96	2.24	60	16.75	2.45	47	15.99	2.47
40	24	16.65	2.38	10	-	-	26	16.29	2.72	36	15.44	2.65	50	16.46	2.57	46	15.65	2.85
41	18	-	-	9	-	-	31	16.91	2.76	34	16.24	2.52	49	16.92	2.67	43	16.13	2.53
42	9	-	-	10	-	-	40	17.13	3.02	25	15.13	2.63	49	17.03	2.92	35	15.64	2.82
43	14	-	-	9	-	-	28	16.52	2.48	34	15.24	2.34	42	16.80	2.40	43	15.58	2.46
44	10	-	-	11	-	-	29	17.42	2.50	36	16.22	3.11	39	17.20	2.63	47	16.44	3.06
45	19	-	-	11	-	-	26	17.46	2.60	30	15.93	2.80	45	17.26	2.42	41	16.13	2.71
46	4	-	-	7	-	-	28	17.79	2.45	25	16.10	3.09	32	17.86	2.37	32	16.53	3.27
47	10	-	-	10	-	-	28	18.04	2.54	28	16.54	3.08	38	17.92	2.63	38	16.76	3.07
48	10	-	-	8	-	-	23	16.86	2.44	29	16.19	3.33	33	17.08	2.61	37	16.82	3.38
49	7	-	-	7	-	-	20	17.75	3.01	28	15.86	2.83	27	17.68	3.03	35	16.24	2.80
50	8	-	-	7	-	-	22	17.61	2.41	18	-	-	30	17.87	2.83	25	17.10	3.46
51	4	-	-	3	-	-	18	-	-	22	17.02	2.93	22	18.18	2.51	25	17.02	2.83
52	6	-	-	9	-	-	19	-	-	17	-	-	25	18.71	2.37	26	18.54	3.14

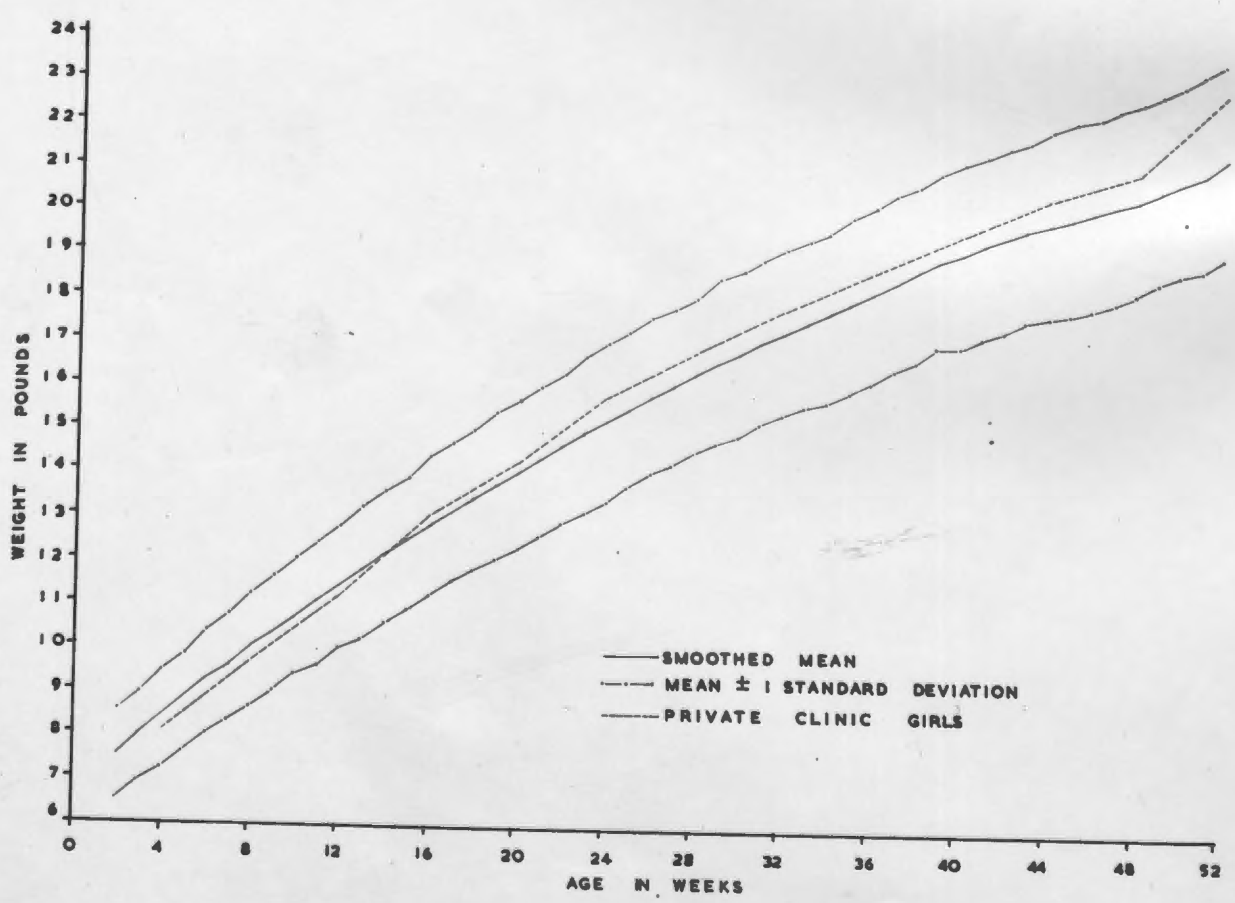
APPENDIX 28a

GRAPH OF MEAN WEIGHTS ± 1.S.D FROM 2-52 WEEKS : EUROPEAN BOYS ALL RANKS
(ALSO MEAN WEEKLY WEIGHTS EUROPEAN BOYS FROM PRIVATE CLINIC)



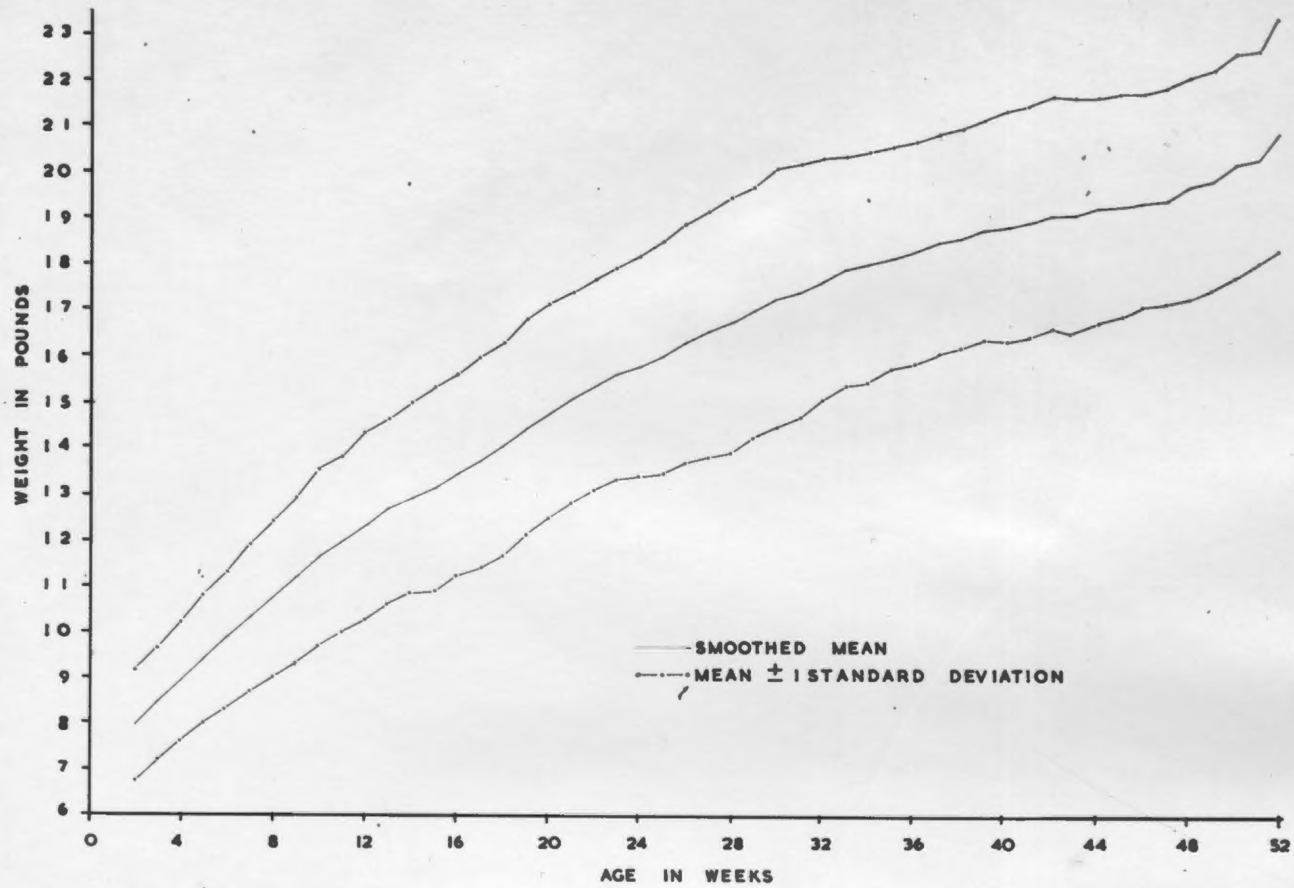
APPENDIX 28b

GRAPH OF MEAN WEIGHTS ± 1.S.D. FROM 2 52 WEEKS : EUROPEAN GIRLS ALL RANKS
(ALSO MEAN WEEKLY WEIGHTS EUROPEAN GIRLS FROM PRIVATE CLINIC)



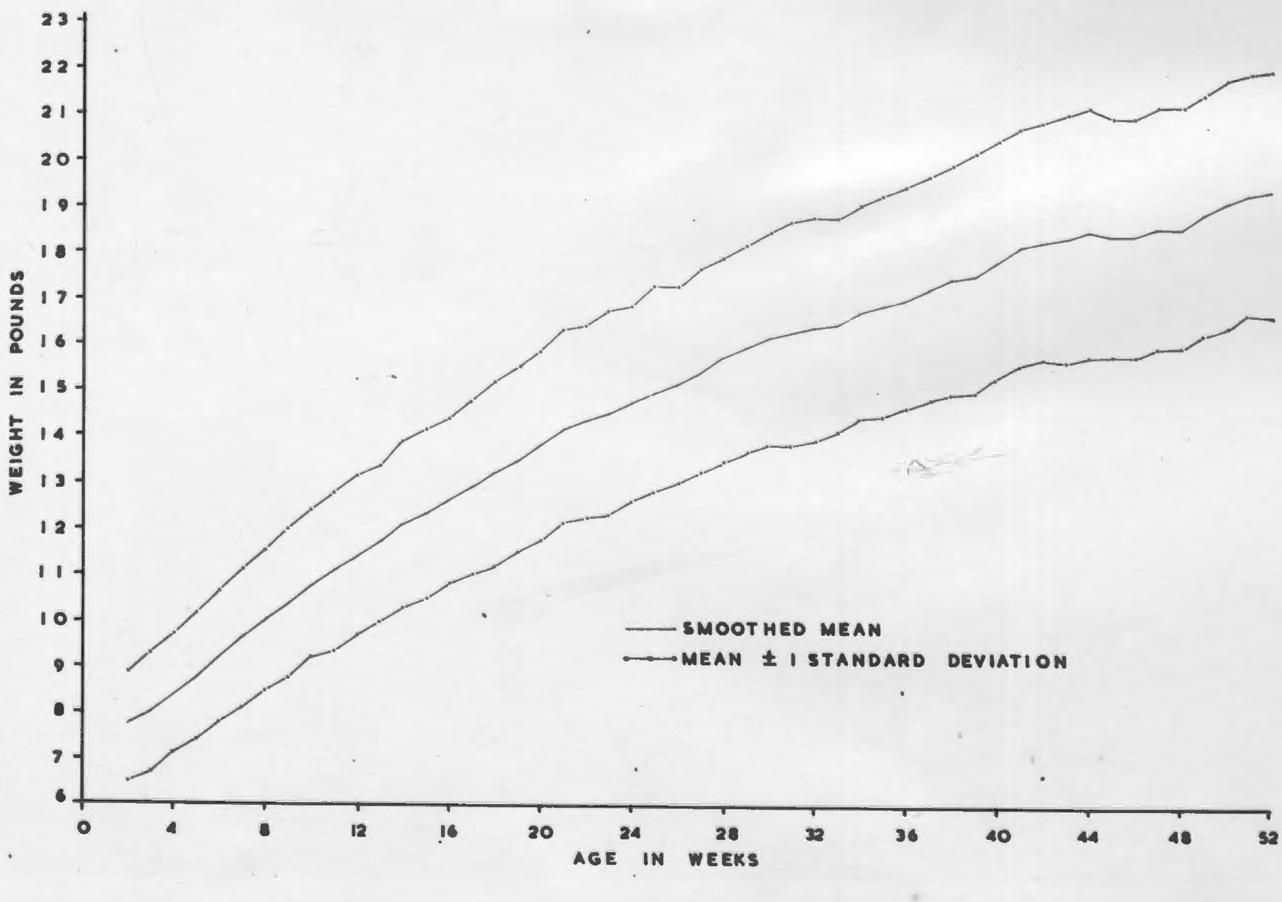
APPENDIX 29a

GRAPH OF MEAN WEIGHTS ± I.S.D. FROM 2-52 WEEKS : COLOURED BOYS ALL RANKS



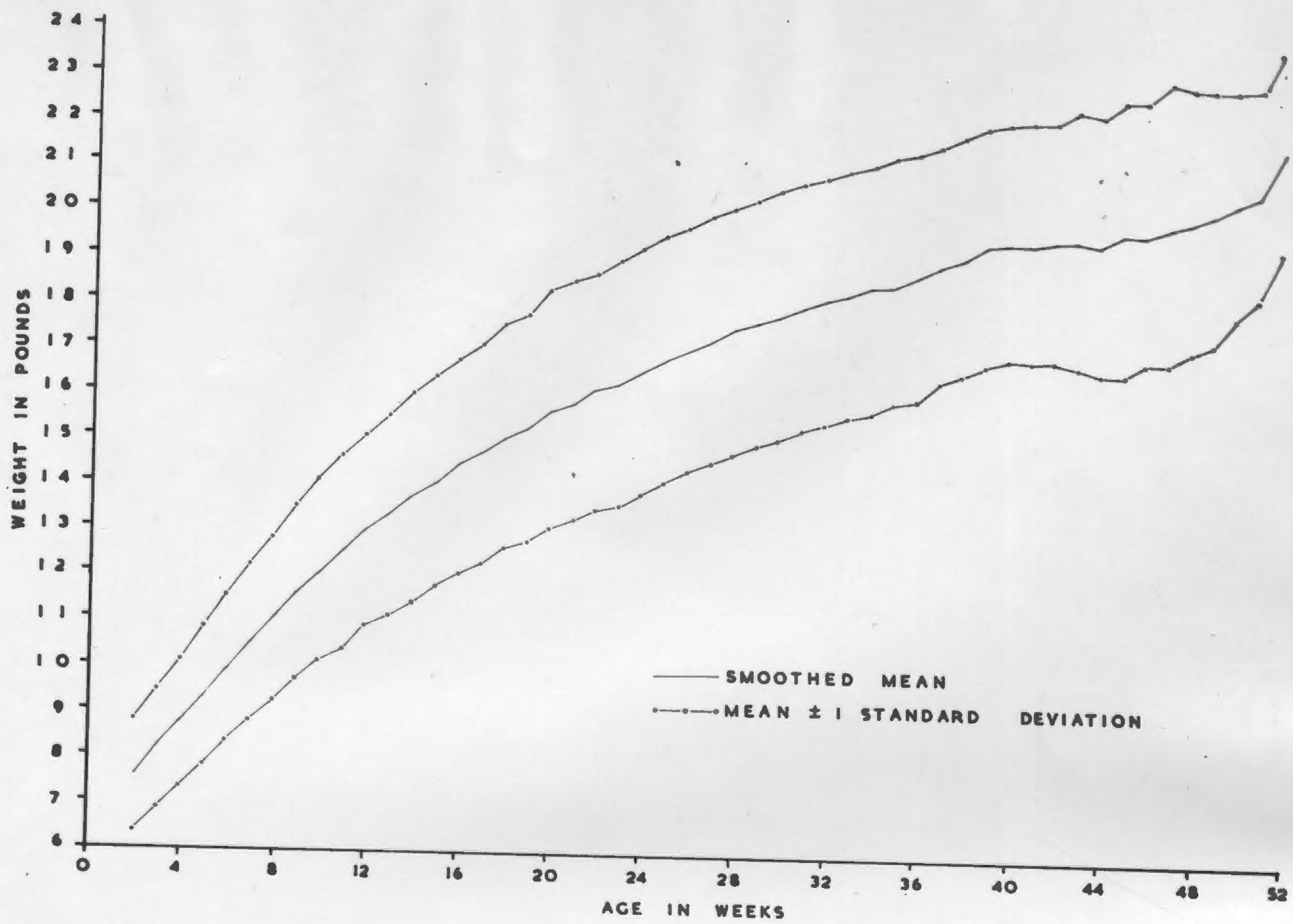
APPENDIX 29b

GRAPH OF MEAN WEIGHTS ± I.S.D. FROM 2-52 WEEKS: COLOURED GIRLS ALL RANKS



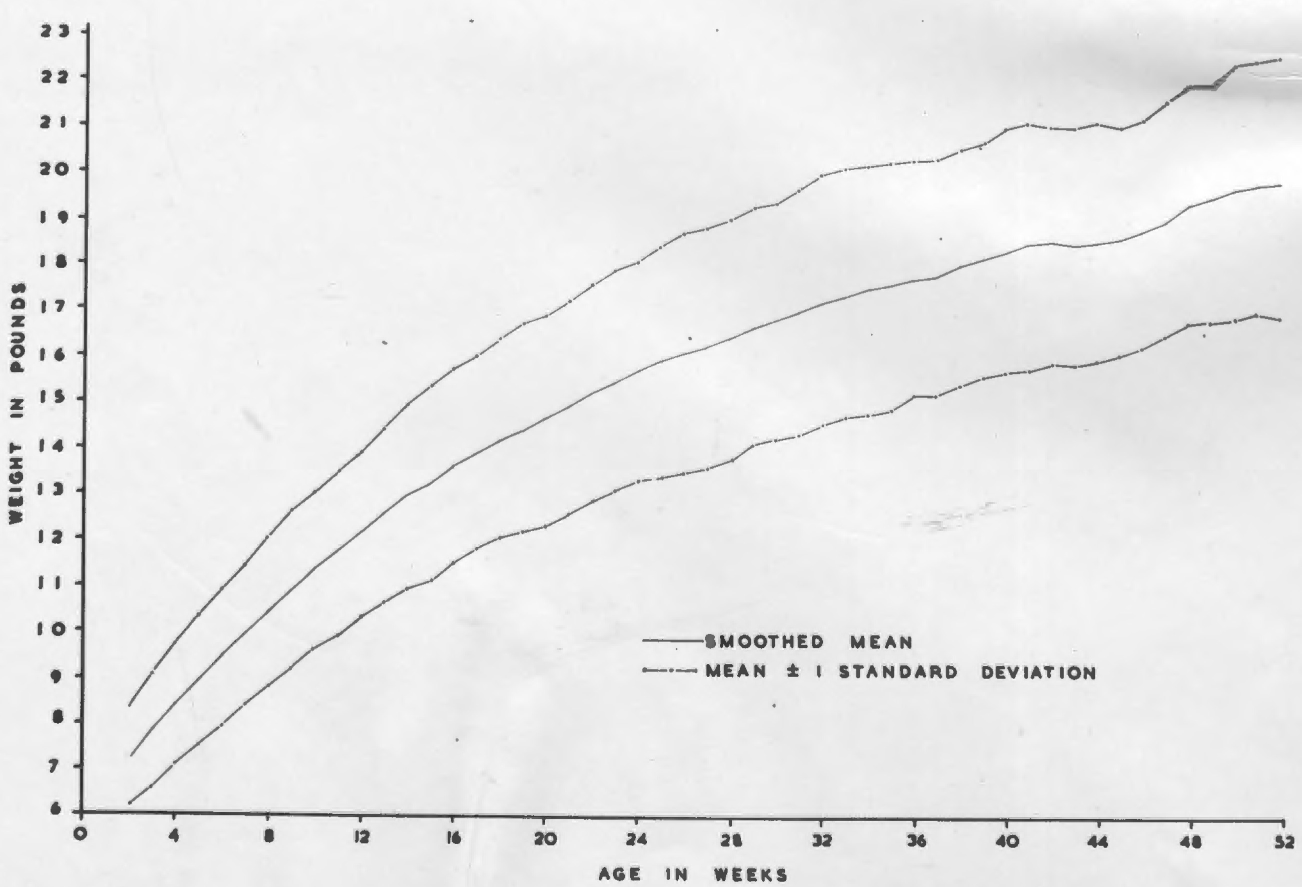
APPENDIX 30a

GRAPH OF MEAN WEIGHTS ± I.S.D. FROM 2-52 WEEKS : BANTU BOYS ALL RANKS



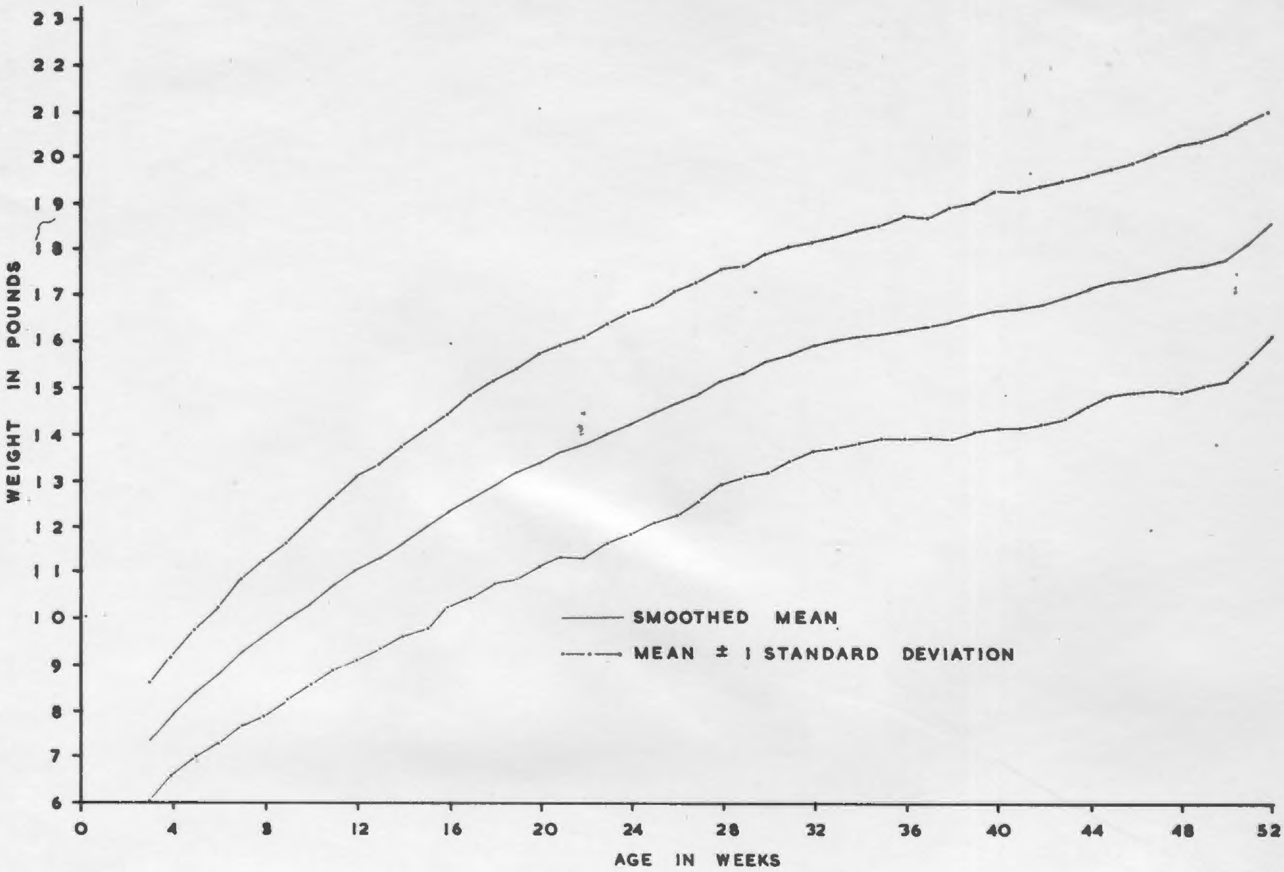
APPENDIX 30b

GRAPH OF MEAN WEIGHTS ± I.S.D. FROM 2-52 WEEKS : BANTU GIRLS ALL RANKS



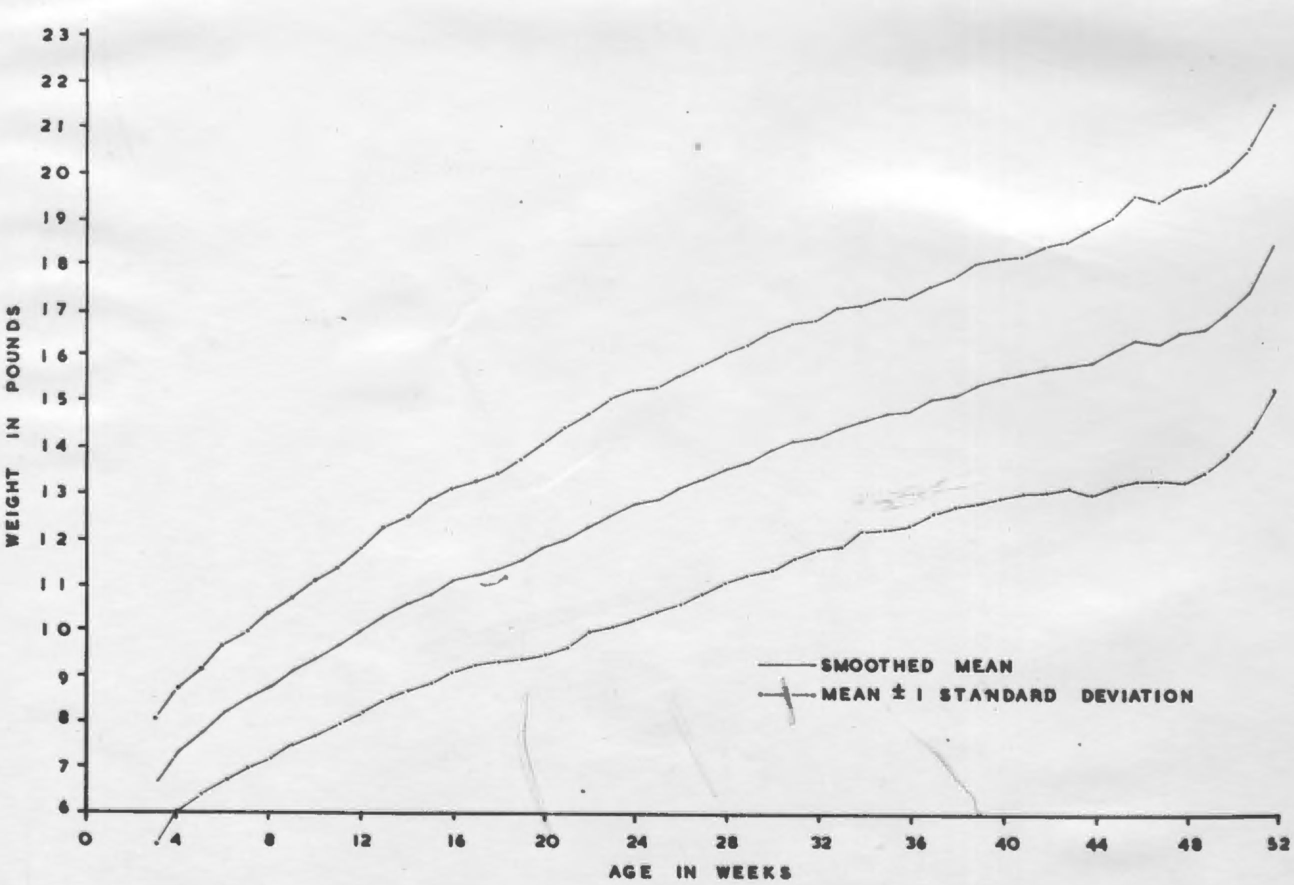
APPENDIX 31a

GRAPH OF MEAN WEIGHTS ± I.S.D. FROM 3-52 WEEKS : INDIAN BOYS ALL RANKS



APPENDIX 31b

GRAPH OF MEAN WEIGHTS ± I.S.D. FROM 3-52 WEEKS : INDIAN GIRLS ALL RANKS



CHAPTER XIV

THE EFFECT OF SEX, BIRTH RANK AND BIRTH WEIGHT ON GROWTH IN THE FIRST YEAR OF LIFE.

Chapter XIII discussed growth in the first postnatal year of babies of the four racial groups attending municipal child welfare clinics in Durban. This chapter analyses the effect of sex, birth rank and birth weight on that growth.

MATERIAL USED AND METHOD OF ANALYSIS.

The same sample of babies is used here as was used in the previous chapter, but the children are divided into Rank 1 (first-born) and Rank 2+ (later born), the numbers being:

EUROPEAN	Rank 1	Rank 2+	TOTAL
Male	458	658	1,116
Female	417	563	980
Total	875	1,221	2,096
COLOURED			
Male	79	205	284
Female	85	210	295
Total	164	415	579
BANTU			
Male	182	446	628
Female	150	525	675
Total	332	971	1,303
INDIAN			
Male	80	179	259
Female	70	180	250
Total	150	359	509

The babies are also divided into different groups according to their weight at birth. The non-Europeans were at first divided into three such groups:

1. Up to 6 lb 7 oz at birth.
2. 6 lb 8 oz to 7 lb 7 oz.
3. 7 lb 8 oz and over,

but this data had to be discarded because the numbers became too small for analysis.

European babies are divided into five groups:

4. Up to 4 lb 15 oz.
5. 5 lb 0 oz to 5 lb 15 oz.
6. 6 lb 0 oz to 6 lb 15 oz.
7. 7 lb 0 oz to 7 lb 15 oz.
8. 8 lb and over.

Mean weights and standard deviations are worked out for each week of life from 2 - 52 weeks for boys and girls, rank 1 and 2+ separately in each birth weight group.

Since there are insufficient data on birth weights for the non-European groups and their numbers of first born babies attending clinic are also small, it is only possible to analyse the effect of rank and birth weight in detail, and to graph the results for the European group.

Rates of growth (increments) are also presented for boys and girls rank 1 and rank 2+ separately. These are shown 4-weekly and 3-monthly and also expressed as number of ounces gained per week.

RESULTS.

A. EFFECT OF SEX ON GROWTH.

1. MEAN WEIGHTS DURING THE YEAR.

Tables of mean weights at each week of life from 2 - 52 weeks for each of the racial groups, boys and girls separately, have been shown already in Chapter XIII and do not need to be repeated here. The boys' weights are higher than those of girls throughout the year, but this is to be expected because boys weigh more than girls at birth. However, the difference between them is greater at the end of the year than at the beginning of the year. (Table 66).

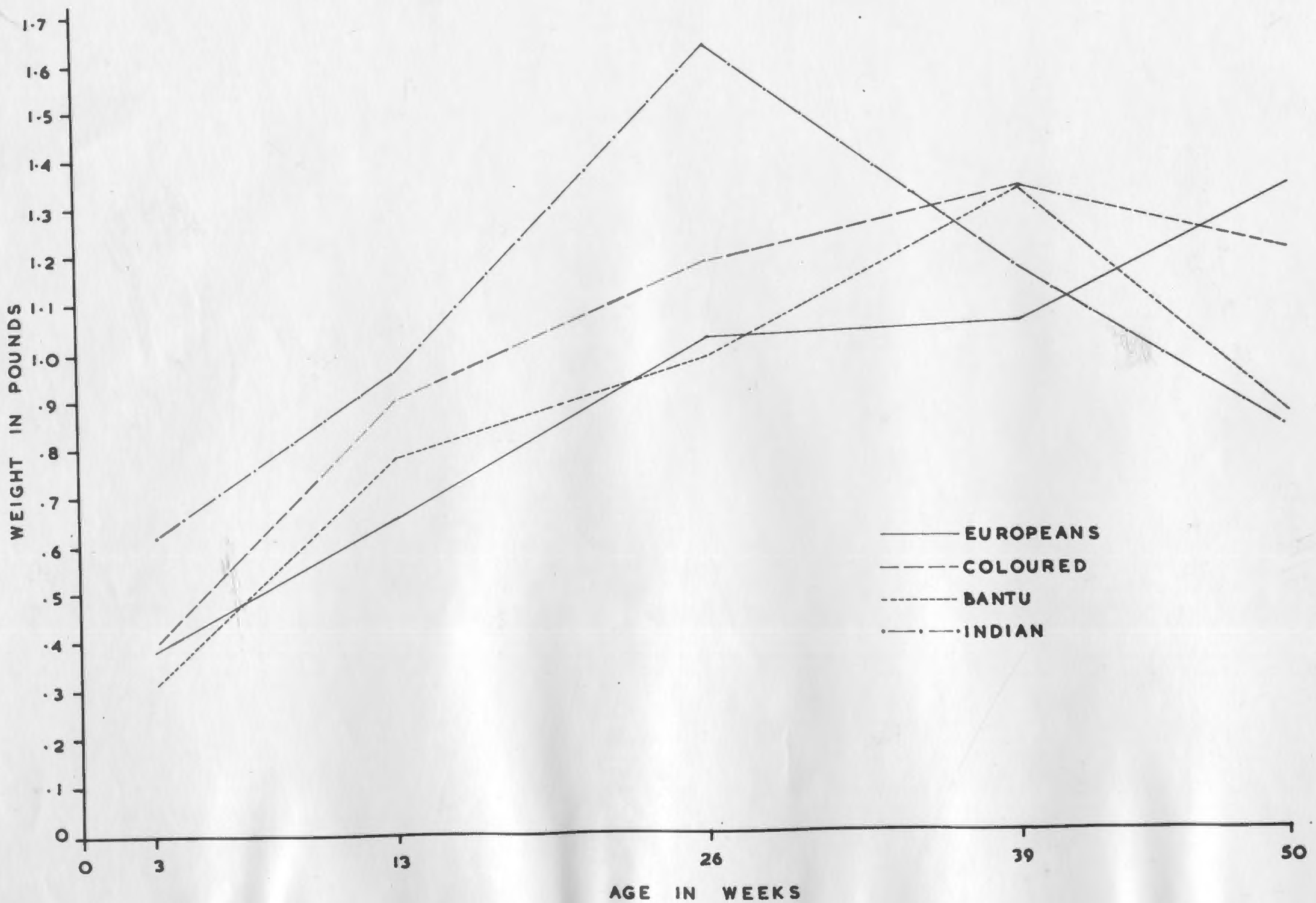
TABLE 66

WEIGHT DIFFERENCES BETWEEN BOYS AND GIRLS OF FOUR RACIAL GROUPS AT SELECTED AGES

BOYS - GIRLS	3 WEEKS (lbs)	13 WEEKS (3 mths) (lbs)	26 WEEKS (6 mths) (lbs)	39 WEEKS (9 mths) (lbs)	50 WEEKS (lbs)
European	0.39	0.66	1.03	1.06	1.34
Coloured	0.40	0.91	1.24	1.34	1.21
Bantu	0.32	0.79	0.99	1.33	0.87
Indian	0.63	0.97	1.64	1.17	0.84

CHART 10

WEIGHT DIFFERENCES BETWEEN BOYS AND GIRLS AT SELECTED AGES OF FOUR RACIAL GROUPS



Examination of this table and Chart 10 reveals that the difference between boys and girls at 3 weeks is almost the same for European, Coloured and Bantu, with Indians having the greatest difference. At 50 weeks difference is greatest for Europeans and least for Indians. European boys rise steadily above girls throughout the year, Coloured boys do the same until 39 weeks with a slight decline thereafter. The difference between Bantu girls and boys is less marked than for Coloureds until 39 weeks when it is the same, but after that the Bantu decline is steeper. Indians show the greatest disparity between boys and girls of all the racial groups up to 26 weeks followed by an equally sharp drop thereafter so that at 50 weeks they have the least difference between boys and girls of all the groups.

2. SHAPE OF GROWTH CURVES.

The effect of sex on growth can be studied most simply by examination of the graphs, (Charts 7 a and b) and by superimposing the graph for the girls on the graph for the boys in each race group. In general the shape of the growth curves in the first year of life is similar for boys and girls.

European. Growth curves of boys and girls run parallel to each other up to 10 weeks of age, after which there is a very gradual increase in the difference between them until the end of the year, with the boys consistently putting on slightly more weight.

Coloured. Boys' weights start rising faster than girls' from 2 weeks of age, with a gradually increasing difference up to 33 weeks, after which the gap narrows very gradually but not sufficiently to enable the girls to catch up to the boys by the end of the year.

Bantu. Curves of growth of boys and girls are parallel up to 6 weeks, then the difference between boys and girls gradually increases up to about 6 months, weights of boys being greater than of girls. From 6 months until about 44 weeks there is no further increase in difference between the sexes, and after 44 weeks the gap narrows until at 49 - 50 weeks the difference in weights between boys and girls is virtually the same as at the beginning of the year.

Growth curves of Indian boys and girls are parallel to each other up to 7 weeks, from 7 to 32 weeks there is a difference in favour of the boys, but from 32 weeks the difference narrows until by 51 weeks the difference is the same as at the beginning of the year.

In general it appears that non-European boys grow faster than girls during the first 6 - 8 months of life, and girls faster than boys during the rest of the year. European boys, however, consistently grow faster than girls throughout the year.

3. RATE OF GROWTH. (INCREMENTS).

Tables showing rate of growth for boys and girls separately at 4-weekly and 3-monthly intervals were shown in the previous chapter and commented on. (See Tables 60 a and b, and 62 a and b). The effect of sex per se on growth rate is now discussed.

European rate of growth is consistently higher for boys from 2 - 52 weeks, but the difference in growth rate is not as marked during the period 20 - 32 weeks as it is during the rest of the year. The total gain in weight for the sexes is as follows:

	BOYS	GIRLS
2 - 50 weeks	14.32 lb	13.41 lb
2 - 52 weeks	14.69 lb	13.97 lb

Coloured rate of growth is higher for boys than girls for most of the year, but from 36 weeks, with slight irregularities, girls appear to grow faster than boys:

Total gain.	BOYS	GIRLS
2 - 50 weeks	12.35 lb	11.23 lb
2 - 52 weeks	13.05 lb	11.46 lb

Bantu growth rate is higher for boys than girls with the exception of the period between 40 - 48 weeks when girls grow faster.

Total gain.	BOYS	GIRLS
2 - 50 weeks	13.10 lb	12.54 lb
2 - 52 weeks	14.30 lb	12.64 lb

Indian boys grow faster than girls from 2 - 32 weeks, but from 32 weeks onwards girls grow faster than boys.

Total gain	BOYS	GIRLS
2 - 50 weeks	10.81 lb	10.43 lb
2 - 52 weeks	11.62 lb	11.91 lb

The same point emerges once again - the effect of sex on growth is not quite the same in the European and non-European races. In the non-European races there seems to be a period late in the second half of the first year during which the girls grow faster than the boys. When the increments of growth are combined into 3-monthly periods, this picture becomes masked in Coloured babies but it is still seen in Bantu (39 - 50 weeks) and in Indian (from 26 weeks on). Among Europeans this is not so and boys grow consistently faster than girls.

B. EFFECT OF BIRTH RANK ON GROWTH.

Only in the European group are there sufficient data to analyse the effect of rank on growth fully, as the numbers of Rank 1 babies in the other groups are inadequate for analysis for half the year.

1. EUROPEANS.

a) Table 56 and Chart 11 show that in European babies the rate of growth of Rank 1 (first born) babies, both boys and girls, is greater than that of Rank 2+ babies, since although they start life with a lower birth weight (see Chapter IV), they end up heavier at the end of the year.

b) At 2 weeks, Rank 1 girls weigh 0.49 lb less than Rank 2+ girls, but they overtake Rank 2+ girls at 21 weeks and by 52 weeks are 0.38 lb heavier. This means that from 2 - 52 weeks Rank 1 girls have actually gained 0.87 lb more than Rank 2+ girls.

c) At 2 weeks, Rank 1 boys weigh 0.21 lb less than Rank 2+ boys, and do not overtake them until 42 weeks, but by 52 weeks they are 0.47 lb heavier, thus gaining 0.68 lb more during the year than Rank 2+ boys.

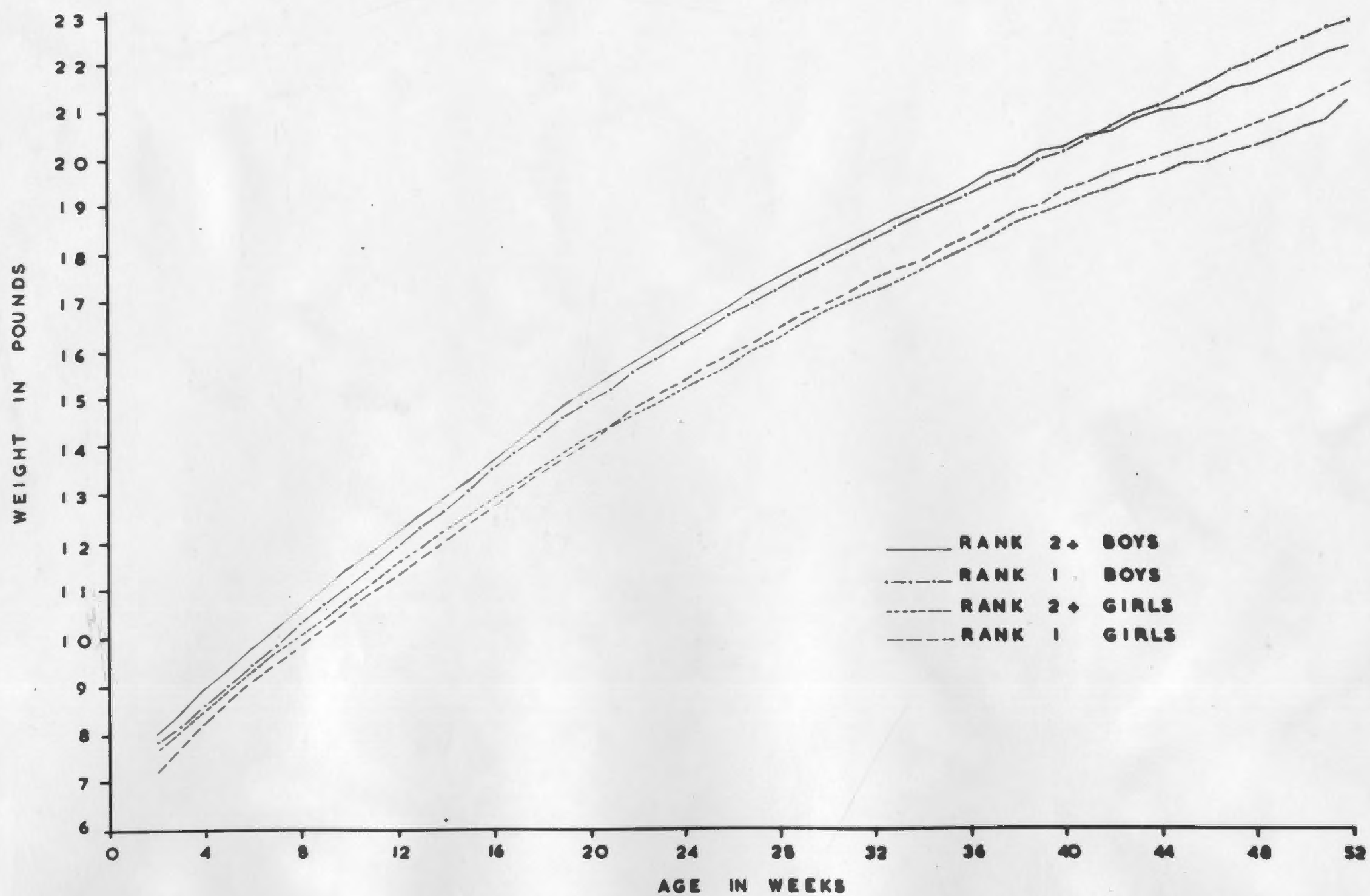
2. In the COLOURED group, information on Rank 1 babies is only available up to 27 - 28 weeks. By this time Rank 1 boys have not overtaken Rank 2+ boys. Rank 1 girls, however, overtake Rank 2+ girls at 17 weeks.

3. The BANTU group has information on Rank 1 babies up to 37 - 38 weeks. Rank 1 Bantu boys overtake Rank 2+ boys at 17 weeks, whereas Rank 1 girls overtake Rank 2+ girls at 29 weeks.

4. INDIAN group information on Rank 1 babies is complete up to 27 weeks. During this period the first born boys have not overtaken later born boys but the girls have done so at 24 weeks.

CHART 11

GROWTH CURVES IN THE FIRST YEAR OF LIFE ACCORDING TO BIRTH RANK OF EUROPEANS



EUROPEAN GIRLS AND BOYS SHOWING RANKS 1 AND 2+ SEPARATELY
(CURVES SMOOTHED)

TABLE 67a

BOYS: 4 WEEKLY INCREMENTS OF WEIGHT : (SMOOTHED CURVES).

	RANK I.								RANK 2+								ALL RANKS.							
	EUROPEAN :		COLOURED :		BANTU :		INDIAN :		EUROPEAN :		COLOURED :		BANTU :		INDIAN :		EUROPEAN :		COLOURED :		BANTU :		INDIAN :	
	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week
Birth Weight	7.35	-	-	-	-	-	-	-	7.63	-	-	-	-	-	-	-	7.48	-	-	-	-	-	-	-
0 - 2 Weeks	.50	-	-	-	-	-	-	-	.43	-	-	-	-	-	-	-	.50	-	-	-	-	-	-	-
2 - 4	.81	6.5	-	-	1.08	8.6	-	-	.90	7.2	1.11	8.9	1.26	10.1	-	-	.85	6.8	1.01	8.1	1.20	9.6	.85+	6.8
4 - 8	1.68	6.7	1.80	7.2	2.47	9.9	-	-	1.67	6.7	1.84	7.4	2.29	9.2	1.67	6.7	1.67	6.7	1.82	7.3	2.33	9.3	1.70	6.8
8 -12	1.60	6.4	1.57	6.3	2.03	8.1	1.58	6.3	1.59	6.4	1.52	6.0	1.83	7.3	1.41	5.6	1.59	6.4	1.56	6.2	1.92	7.7	1.43	5.7
12 -16	1.62	6.5	1.47	5.9	1.58	6.3	1.22	4.9	1.53	6.1	1.07	4.3	1.44	5.8	1.29	5.2	1.57	6.3	1.16	4.6	1.49	6.0	1.28	5.1
16 -20	1.41	5.6	1.44	5.8	1.54	6.2	1.37	5.5	1.43	5.7	1.29	5.2	1.15	4.6	1.01	4.0	1.42	5.7	1.34	5.4	1.23	4.9	1.10	4.4
20 -24	1.25	5.0	0.84	3.4	0.85	3.4	0.58	2.3	1.22	4.9	1.07	4.3	0.98	3.9	0.98	3.9	1.23	4.9	0.99	4.0	0.94	3.8	0.87	3.5
24 -28	1.11	4.4	-	-	0.87	3.5	1.04	4.2	1.15	4.6	1.00	4.0	0.92	3.7	0.89	3.6	1.14	4.6	0.96	3.8	0.93	3.7	0.93	3.7
28 -32	1.10	4.4	-	-	0.82	3.3	0.90	3.6	0.97	3.9	0.97	3.9	0.62	2.5	0.72	2.9	1.03	4.1	0.94	3.8	0.66	2.6	0.74	3.0
32 -36	0.89	3.6	-	-	0.62	2.5	-	-	0.96	3.8	0.44	1.8	0.66	2.6	0.12	0.5	0.92	3.7	0.67	2.7	0.63	2.5	0.36	1.4
36 -40	0.95	3.8	-	-	-	-	-	-	0.89	3.6	0.58	2.3	0.81	3.2	0.42	1.7	0.92	3.7	0.52	2.1	0.74	3.0	0.41	1.6
40 -44	0.92	3.7	-	-	-	-	-	-	0.68	2.7	0.39	1.6	0.01	0	0.61	2.4	0.80	3.2	0.38	1.5	0.04	0.2	0.47	1.9
44 -48	0.93	3.7	-	-	-	-	-	-	0.60	2.4	0.28	1.1	0.56	2.2	0.35	1.4	0.74	3.0	0.50	2.0	0.54	2.2	0.45	1.8
48 -52	0.82	3.3	-	-	-	-	-	-	0.82	3.3	1.50	6.0	1.36	5.4	-	-	0.81	3.2	1.20	4.8	1.65	6.6	1.03	4.1
48 -50	0.44	3.5	-	-	-	-	-	-	0.44	3.5	0.62	5.0	0.41	3.3	-	-	0.44	3.5	0.49	3.9	0.45	3.6	0.22	1.7
TOTAL 2 - 52	15.09	-	-	-	-	-	-	-	14.41	-	13.06	-	13.89	-	-	-	14.69	-	13.05	-	14.30	-	11.62	-
2 - 50 Weeks.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.32	-	12.35	-	13.10	-	10.81	-

+ Assuming the gain per week for 2 - 4 weeks to be at least as great as that for 4 - 8 weeks.

TABLE 67b

GIRLS: 4 WEEKLY INCREMENTS OF WEIGHT : (SMOOTHED CURVES).

	RANK I.							
	EUROPEAN :		COLOURED :		BANTU :		INDIAN :	
	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week
Birth Weight	7.01	-	-	-	-	-	-	-
0 - 2 Weeks.	0.24	1.9	-	-	-	-	-	-
2 - 4	0.97	7.8	-	-	1.27	10.2	-	-
4 - 8	1.66	6.6	1.68	6.7	2.19	8.8	-	-
8 - 12	1.48	5.9	1.51	6.0	1.84	7.4	1.60	6.4
12 - 16	1.41	5.6	1.22	4.9	1.44	5.8	1.16	4.6
16 - 20	1.36	5.4	1.38	5.5	1.08	4.3	0.79	3.2
20 - 24	1.25	5.0	1.00	4.0	1.11	4.4	1.04	4.2
24 - 28	1.09	4.4	-	-	0.77	3.1	-	-
28 - 32	1.04	4.2	-	-	1.05	4.2	-	-
32 - 36	0.95	3.8	-	-	0.32	1.3	-	-
36 - 40	0.94	3.8	-	-	-	-	-	-
40 - 44	0.74	3.0	-	-	-	-	-	-
44 - 48	0.68	2.7	-	-	-	-	-	-
48 - 52	0.90	3.6	-	-	-	-	-	-
48 - 50	0.40	3.2	-	-	-	-	-	-
TOTAL 2 - 52	14.47	-	-	-	-	-	-	-
2 - 50 Weeks.	-	-	-	-	-	-	-	-

	RANK 2+							
	EUROPEAN :		COLOURED :		BANTU :		INDIAN :	
	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week
Birth Weight	7.37	-	-	-	-	-	-	-
0 - 2 Weeks.	0.37	3.0	-	-	-	-	-	-
2 - 4	0.84	6.7	0.61	4.9	1.16	9.3	-	-
4 - 8	1.53	6.1	1.58	6.3	1.98	7.9	1.54	6.2
8 - 12	1.44	5.8	1.36	5.4	1.72	6.9	1.22	4.9
12 - 16	1.39	5.6	1.11	4.4	1.45	5.8	1.06	4.2
16 - 20	1.21	4.8	1.14	4.6	1.04	4.2	0.66	2.6
20 - 24	1.11	4.4	0.93	3.7	1.06	4.2	0.92	3.7
24 - 28	1.09	4.4	0.97	3.9	0.69	2.8	0.69	2.8
28 - 32	0.90	3.6	0.50	2.0	0.77	3.1	0.73	2.9
32 - 36	0.96	3.8	0.66	2.6	0.55	2.2	0.51	2.0
36 - 40	0.86	3.4	0.46	1.8	0.70	2.8	0.70	2.8
40 - 44	0.59	2.4	0.82	3.3	-.05	-.2	0.24	1.0
44 - 48	0.64	2.6	0.01	0	0.92	3.7	0.50	2.0
48 - 52	1.04	4.2	0.70	2.8	0.20	0.8	1.44	5.8
48 - 50	0.41	3.3	0.52	4.2	0.29	2.3	0.40	3.2
TOTAL 2 - 52	13.60	-	10.85	-	12.19	-	-	-
2 - 50 Weeks.	-	-	-	-	-	-	-	-

	ALL RANKS.							
	EUROPEAN :		COLOURED :		BANTU :		INDIAN :	
	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week	Incr. (lb.)	oz. per week
Birth Weight	7.20	-	-	-	-	-	-	-
0 - 2 Weeks.	0.35	2.6	-	-	-	-	-	-
2 - 4	0.88	7.0	0.67	5.4	1.17	9.4	0.72+	5.7
4 - 8	1.58	6.3	1.60	6.4	2.05	8.2	1.43	5.7
8 - 12	1.45	5.8	1.41	5.6	1.73	6.9	1.26	5.0
12 - 16	1.40	5.6	1.14	4.6	1.45	5.8	1.08	4.3
16 - 20	1.28	5.1	1.22	4.9	1.05	4.2	0.70	2.8
20 - 24	1.18	4.7	0.90	3.6	1.07	4.3	0.97	3.9
24 - 28	1.09	4.4	1.03	4.1	0.71	2.8	0.76	3.0
28 - 32	0.97	3.9	0.62	2.5	0.83	3.3	0.74	3.0
32 - 36	0.95	3.8	0.63	2.5	0.50	2.0	0.55	2.2
36 - 40	0.91	3.6	0.82	3.3	0.60	2.4	0.75	3.0
40 - 44	0.66	2.6	0.63	2.5	0.20	0.8	0.39	1.6
44 - 48	0.65	2.6	0.07	0.3	0.84	3.4	0.62	2.5
48 - 52	0.97	3.9	0.72	2.9	0.44	1.8	1.94	7.8
48 - 50	0.41	3.3	0.49	3.9	0.34	2.7	0.46	3.7
TOTAL 2 - 52	13.97	-	11.46	-	12.64	-	11.91	-
2 - 50 Weeks.	13.41	-	11.23	-	12.54	-	10.43	-

+ Assuming the gain per week for 2 - 4 weeks to be at least as great as that for 4 - 8 weeks.

T A B L E 68

THREE-MONTHLY INCREMENTS OF WEIGHT SEXES AND RANKS SEPARATELY

(a) BOYS, RANK 1

WEEKS	EUROPEAN Total (lb)	EUROPEAN oz per week	COLOURED Total (lb)	COLOURED oz per week	BANTU Total (lb)	BANTU oz per week	INDIAN Total (lb)	INDIAN oz per week
4 - 13	3.70	6.6	3.71	6.6	4.84	8.6	-	
13 - 26	4.43	5.4	3.63	4.5	4.03	5.0	3.39	4.2
26 - 39	3.26	4.0	-		-		-	
39 - 52	2.89	3.6	-		-		-	
39 - 50	2.51	3.6						

(b) BOYS, RANK 2+

WEEKS	EUROPEAN Total (lb)	EUROPEAN oz per week	COLOURED Total (lb)	COLOURED oz per week	BANTU Total (lb)	BANTU oz per week	INDIAN Total (lb)	INDIAN oz per week
4 - 13	3.63	6.4	3.73	6.6	4.49	7.6	3.34	5.9
13 - 26	4.38	5.4	3.64	4.5	3.70	4.6	3.41	4.2
26 - 39	3.23	4.0	2.41	3.0	2.46	3.0	1.54	1.9
39 - 52	2.27	2.8	2.17	2.7	1.98	2.4	-	
39 - 50	1.89	2.8	1.29	1.9	1.03	1.5		

(c) GIRLS, RANK 1

WEEKS	EUROPEAN Total (lb)	EUROPEAN oz per week	COLOURED Total (lb)	COLOURED oz per week	BANTU Total (lb)	BANTU oz per week	INDIAN Total (lb)	INDIAN oz per week
4 - 13	3.49	6.2	3.46	6.2	4.44	7.9	-	
13 - 26	4.23	5.2	3.58	4.4	3.64	4.5	3.03	3.7
26 - 39	3.25	4.0	-		-			
39 - 52	2.53	3.1	-		-			
39 - 50	2.03	3.0						

(d) GIRLS, RANK 2+

WEEKS	EUROPEAN Total (lb)	EUROPEAN oz per week	COLOURED Total (lb)	COLOURED oz per week	BANTU Total (lb)	BANTU oz per week	INDIAN Total (lb)	INDIAN oz per week
4 - 13	3.34	5.9	3.23	5.7	4.08	7.2	3.10	5.5
13 - 26	3.84	4.7	3.28	4.0	3.55	4.4	2.58	3.2
26 - 39	3.18	3.9	1.96	2.4	2.12	2.6	2.26	2.8
39 - 52	2.40	3.0	1.77	2.2	1.28	1.6	2.27	2.8
39 - 50	1.77	2.6	1.56	2.3	1.37	2.0	1.23	1.8

5. In general, Rank 1 girls overtake Rank 2+ girls faster than Rank 1 boys overtake Rank 2+ boys. In the Bantu group, however, the position is reversed with Rank 1 boys overtaking Rank 2+ boys sooner than do the girls.

6. Examination of rates of growth 4-weekly and 3-monthly (Tables 67 and 68) also show that in each racial group the gain per week is greater in Rank 1 than in Rank 2+ babies.

7. In European, Coloured and Indian babies the difference in rate of growth between the ranks is greater for girls than for boys, but in the Bantu the difference appears to be greater in the boys.

C. EFFECT OF BIRTH WEIGHT ON GROWTH.

Sufficient information on birth weight is available in the European group only (in the other groups birth weight is unknown for ½ - ¾ of each group). The European group is divided into five birth weight groups as mentioned earlier, but since the numbers of cases up to 4 lb 15 oz in weight and 5 lb 0 oz to 5 lb 15 oz are too small for separate analysis, these two groups are combined. Table 69 shows the smoothed weights, boys and girls separately, for the different birth weight groups, all ranks combined. The actual weights according to birth weight for all ranks, boys and girls separately, are shown in Appendix 32 a and b and for Rank 1 and 2+ boys and girls separately, in Appendix 33 a - d.

From Charts 12 a and b which are the pictorial representation of Table 69, it can be seen that:

1. Because of their superior birth weight, heavy babies at birth are heavier at the end of the year than babies who are light at birth. This is seen in each successive birth weight group.

2. Birth weight appears to have no effect on the gain in weight during the first year.

3. This means that the rate of growth is relatively greater for lighter babies.

4. These remarks apply equally well to both boys and girls.

DISCUSSION.

EFFECT OF SEX ON GROWTH IN FIRST POSTNATAL YEAR.

Almost all investigators of postnatal growth give separate figures for boys and girls and invariably the boys' weights are greater

MUNICIPAL CLINIC, 2-52 WEEKS

EUROPEAN GROWTH CURVES - SMOOTHED

ALL RANKS, ACCORDING TO BIRTH WEIGHT

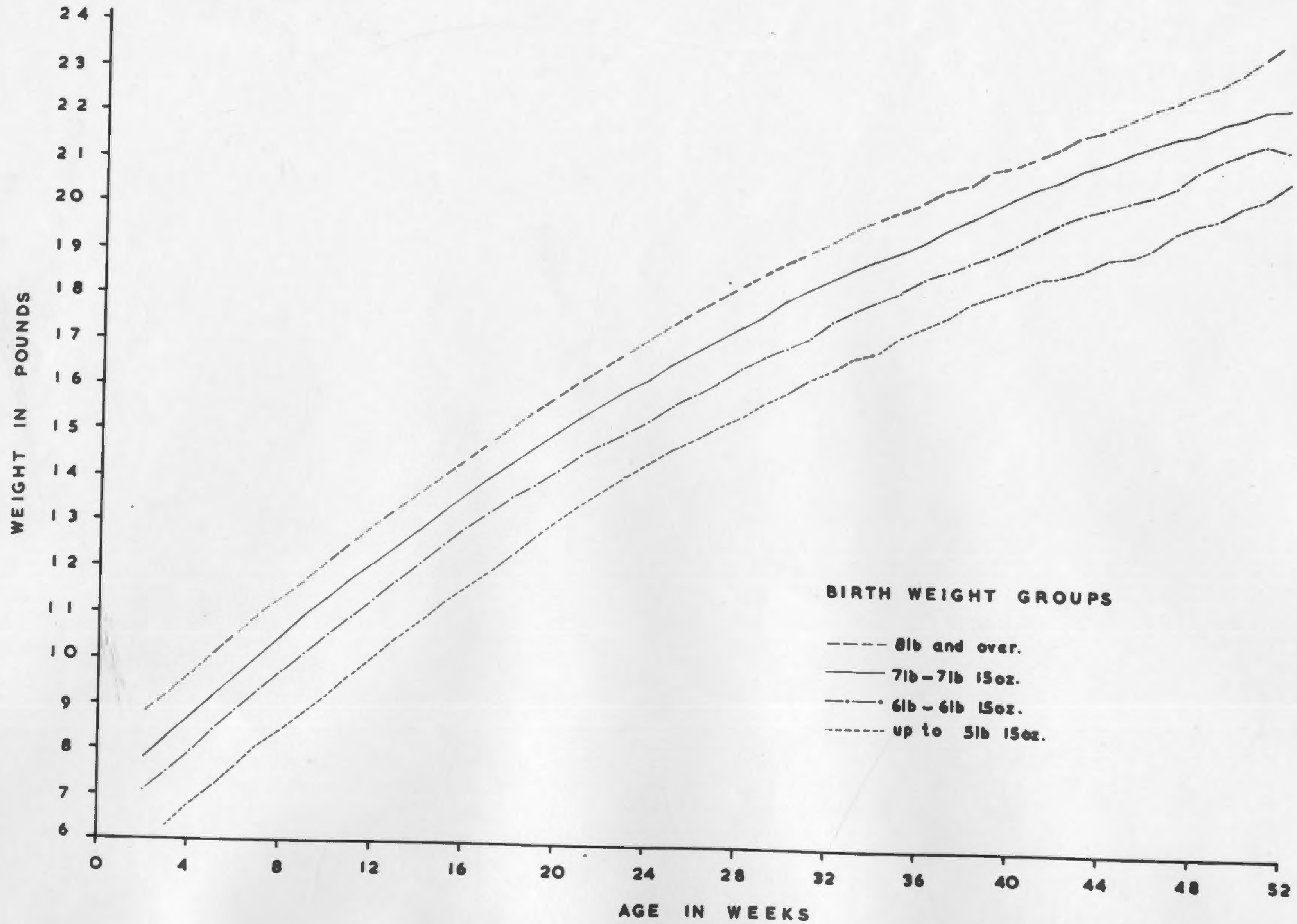
TABLE 69

66

WEEK	4		5		4 and 5		6		7		8	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
2							7.05	7.01	7.79	7.62	8.93	8.73
3			6.60		6.30	6.35	7.49	7.41	8.26	8.06	9.34	9.11
4	6.55		7.12	7.16	6.82	6.85	7.96	7.81	8.71	8.50	9.79	9.52
5	6.84	6.89	7.64	7.64	7.25	7.22	8.42	8.21	9.18	8.92	10.21	9.92
6	7.25	7.15	8.14	8.06	7.68	7.62	8.88	8.64	9.62	9.34	10.63	10.32
7	7.63	7.50	8.59	8.52	8.10	8.00	9.33	9.04	10.05	9.73	11.06	10.71
8	8.00	7.83	9.07	8.92	8.47	8.34	9.74	9.45	10.50	10.12	11.46	11.06
9	8.38	8.20	9.56	9.44	8.89	8.77	10.14	9.83	10.91	10.50	11.87	11.43
10	8.75	8.59	9.96	9.81	9.25	9.11	10.55	10.23	11.31	10.87	12.27	11.78
11	9.17	8.93	10.39	10.26	9.69	9.47	10.93	10.56	11.71	11.24	12.67	12.10
12	9.60	9.28	10.80	10.64	10.09	9.82	11.33	10.93	12.12	11.61	13.07	12.47
13	10.00	9.61	11.23	11.04	10.53	10.20	11.75	11.23	12.51	11.97	13.43	12.84
14	10.48	10.00	11.50	11.29	10.92	10.53	12.18	11.58	12.89	12.33	13.81	13.18
15	10.90	10.31	11.88	11.71	11.33	10.90	12.55	11.88	13.30	12.69	14.18	13.53
16	11.24	10.70	12.25	11.99	11.67	11.25	12.95	12.22	13.69	13.02	14.56	13.88
17	11.53	11.04	12.63	12.34	11.99	11.60	13.31	12.55	14.07	13.37	14.92	14.20
18	12.02	11.37	12.94	12.70	12.40	11.90	13.64	12.92	14.41	13.69	15.29	14.52
19	12.34	11.59	13.41	13.01	12.78	12.17	13.93	13.21	14.78	14.02	15.63	14.87
20	12.73	11.91	13.78	13.32	13.17	12.44	14.30	13.53	15.12	14.36	15.99	15.18
21	13.08	12.17	14.05	13.62	13.48	12.72	14.58	13.85	15.46	14.66	16.32	15.50
22	13.52	12.44	14.31	13.89	13.85	12.99	14.83	14.12	15.76	14.96	16.64	15.78
23	13.72	12.67	14.69	14.06	14.14	13.21	15.10	14.41	16.07	15.30	16.97	16.04
24	14.06	13.08	14.98	14.40	14.46	13.60	15.39	14.72	16.36	15.61	17.32	16.26
25	14.36	13.32	15.21	14.54	14.73	13.83	15.70	15.00	16.64	15.85	17.59	16.53
26	14.57	13.57	15.57	14.74	15.00	14.10	15.99	15.27	16.93	16.17	17.90	16.79
27	14.91	13.87	15.85	14.75	15.31	14.42	16.28	15.55	17.22	16.44	18.17	17.07
28	15.20	14.26	15.96		15.51	14.82	16.60	15.79	17.51	16.69	18.45	17.35
29	15.51	14.43	16.16		15.79	15.00	16.85	16.01	17.80	16.94	18.70	17.61
30	15.73	14.76	16.43		16.01	15.29	17.05	16.26	18.10	17.22	18.99	17.86
31	16.12	14.93	16.58		16.31	15.52	17.30	16.50	18.36	17.48	19.22	18.12
32	16.31	15.12	16.84		16.53	15.67	17.67	16.72	18.54	17.73	19.47	18.30
33	16.52	15.26	17.18		16.78	15.92	17.86	16.94	18.80	17.93	19.76	18.49
34	16.71	15.42	17.31		16.96	16.19	18.12	17.20	19.00	18.15	19.94	18.75
35	17.03		17.52		17.31	16.44	18.38	17.44	19.20	18.42	20.16	19.00
36	17.29				17.54	16.73	18.61	17.68	19.41	18.66	20.38	19.19
37	17.54				17.75	17.02	18.76	17.95	19.73	18.84	20.62	19.42
38	17.82				18.05	17.14	19.02	18.19	19.95	19.12	20.73	19.73
39	17.99				18.25	17.47	19.21	18.44	20.22	19.33	21.07	19.94
40	18.23				18.43	17.50	19.46	18.63	20.45	19.51	21.23	20.16
41	18.28				18.59	17.79	19.73	18.80	20.68	19.72	21.43	20.36
42	18.23				18.68	17.87	19.95	18.97	20.86	19.88	21.61	20.54
43	18.39				18.85	18.12	20.10	19.17	21.14	20.05	21.87	20.72
44	18.70				19.11	18.11	20.26	19.33	21.28	20.24	22.03	20.80
45	18.80				19.16	18.29	20.42	19.55	21.51	20.43	22.20	20.91
46	19.56				19.34	18.33	20.53	19.75	21.66	20.52	22.50	21.04
47					19.73	18.60	20.77	19.94	21.86	20.75	22.64	21.23
48					19.88	18.68	21.09	20.09	21.93	20.91	22.85	21.36
49					20.01	19.01	21.39	20.18	22.22	21.13	23.03	21.60
50					20.32	18.94	21.54	20.34	22.31	21.31	23.36	21.88
51					20.46		21.73	20.43	22.51	21.59	23.63	22.14
52					20.86		21.62	20.71	22.50	21.86	24.01	22.60

CHART 12a

GROWTH CURVES IN FIRST YEAR OF LIFE ACCORDING TO BIRTH WEIGHT OF EUROPEANS

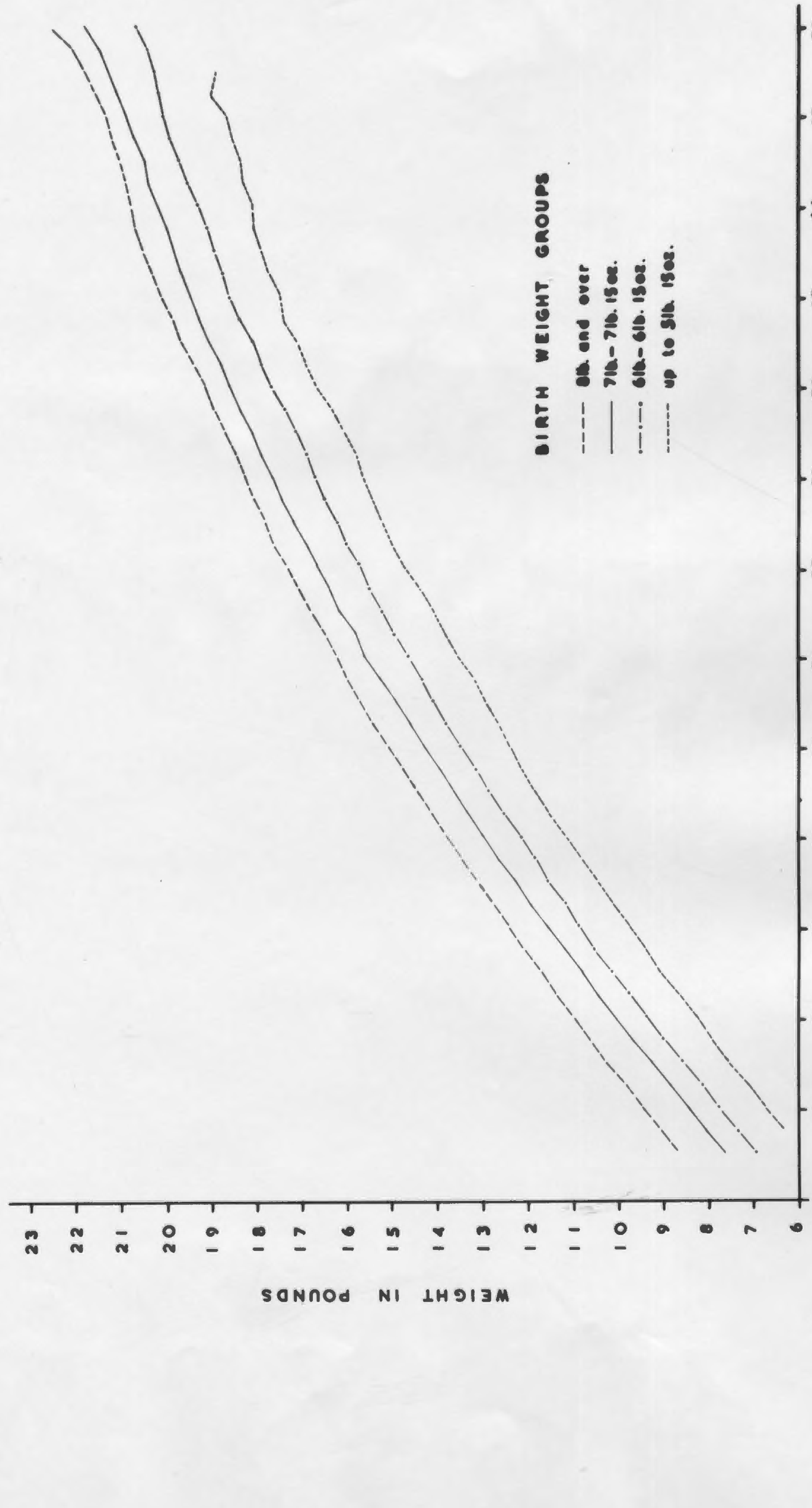


EUROPEAN BOYS SHOWING BIRTH WEIGHT GROUPS SEPARATELY

(CURVES SMOOTHED)

CHART 12b

GROWTH CURVES IN FIRST YEAR OF LIFE ACCORDING TO BIRTH WEIGHT OF EUROPEANS



EUROPEAN GIRLS SHOWING BIRTH WEIGHT GROUPS SEPARATELY
(CURVES SMOOTHED)

than those of the girls. This may be because boys weigh more than girls at birth, or because they actually grow faster. In fact, both factors appear to play a part.

Simpson (1952) and Hammond (1952) both found that boys gained on average 1 lb more than girls during the year.

Thomson (1954) shows that in addition to gaining weight more rapidly over the year, the pattern of weight gain in boys is different. They appear to forge ahead more rapidly in the first 12 weeks than subsequently. Thompson (1954) points out that although male infants are larger than female infants of the same age, and although their growth increments tend to be larger, the percentage rate of growth does not in general differ significantly in the two sexes. Hill and Magee (1938) also found that though the weight increment of boys slightly exceeds that of girls at each age, relatively there is little difference between them (i.e. in increases as a percentage of weight at the end of the preceding period).

Norval et al (1951) state that boys are longer and heavier than girls of the same age, and boys are also heavier than girls of the same length. The growth rates of length and weight are somewhat larger for boys than girls at the beginning of the year, but approach equality by the end of the year.

Parfit (1951) compared average weights at successive age periods in the first year, and found a significant difference between the boys and girls, which progressed with age. At birth her boys were 4 oz heavier than girls, at 6 months 20 oz, and at the end of the year 26 oz. This showed that the difference in rate of gain which had started prenatally continued for at least 12 months. However, examination of her figures shows that in the early period the boys have grown much faster than later in the year.

On the whole I think certain facts can be deduced from the foregoing:

1. Mean weights of boys are greater than those of girls throughout the first year of life.

2. Rate of growth of boys is faster than that of girls throughout this period, but the difference in rate of growth is greater in the

first 6 months of life than in the second 6 months.

My own investigation confirms these findings for European babies. European boys are about a pound heavier at the end of the year than European girls. They grow faster than the girls throughout the year, but the difference in their growth rate is greater in the first than the second six months of life.

The non-European pattern is rather different. Mean weights for boys are still greater than those for girls, Coloured difference being slightly less than European, and Bantu and Indian less than Coloured. Deviation from the usual pattern appears in the rate of growth.

If we express Table 66 somewhat differently and compare the differences in weight of boys and girls at successive periods we see this quite clearly, as follows: (Table 70)

TABLE 70

COMPARISON OF WEIGHT DIFFERENCES OF BOYS AND GIRLS AT SUCCESSIVE PERIODS

	3 - 13 weeks (lb)	13 - 26 weeks (lb)	26 - 39 weeks (lb)	39 - 50 weeks (lb)
European	+ .25	+ .37	+ .03	+ .28
Coloured	+ .51	+ .33	+ .10	- .13
Bantu	+ .47	+ .20	+ .34	- .46
Indian	+ .34	+ .67	- .47	- .33

In Europeans we have plus signs all the time (i.e. boys always maintain a faster rate of growth than girls). In the other three groups the signs become reversed - in Coloured and Bantu from 39 - 50 weeks and in Indians as early as 26 - 39 weeks. In other words, in those periods girls are actually growing faster than boys. They do not catch up with the boys by 50 weeks, partly because of the superior birth weight of the boys but the total gain of weight of Indian boys and girls is almost the same from 2 - 50 weeks and if one can accept the 52 weeks figure is actually greater than that of the boys from 2 - 52 weeks. Bantu still show a difference in favour of boys in total gain from 2 - 50 weeks of about ½ lb and Coloured about 1 lb but there is no question of the direction of the growth and it would seem that if one could follow these children into the second year of life one might find the girls to be actually heavier than the boys.

Phillips (1953) in a study of South African nursery school children (European and Bantu) found that unlike the European, Bantu girls were superior in weight though not in height, to Bantu boys. He also quotes a study by Robertson (1952) where Bantu pre-school girls were heavier and taller than boys. Kark (1952) discussing Bantu school children in Pholela also found when he compared them with overseas and European South African figures, that the Pholela boys were somewhat more retarded in stature and weight than the Pholela girls and had a higher incidence of clinical signs of malnutrition.

It would be most interesting to see whether the same remarks apply to Coloured and Indian pre-school and school children, if the information were available, but even on Bantu data only, it is possible that girls start growing faster than boys from some point in the first year of life, and I imagine that the differences in rate of growth of Indian boys and girls would be found to be even greater if follow-up studies could be done.

The reason for this difference in growth rate in non-Europeans can only be speculative at this stage. We know that boys are biologically inferior to girls at least as far as mortality rates are concerned. It is quite possible that in adverse conditions girls do better than boys as far as growth is concerned. In this connection it is most interesting to see that the Indian infants whose diets and general rate of growth in the first year of life are the poorest of the four races, show the increased rate of growth of girls at an earlier age than that shown by the Bantu and Coloured.

EFFECT OF BIRTH RANK ON GROWTH.

Wardlaw and Dart (1932) remark on the unique position which the first born male of a family occupies in the social organisation of many peoples, and are surprised that differences between first and later children are so infrequent in literature dealing with growth of children. "In the biblical writings there are, indeed, many instances in which the expression 'first born' is used to connote the possession of superior or outstanding qualities of some kind. But no clue is given to the nature of the qualities which the first born, in the literal sense, might be supposed to show. Any distinguishing qualities of the first born male which may exist have been obscured by the fact that only approximately half the total number of first born males are first children. The occurrence of first born female children is usually not taken into account".

A summary of their findings on the relationship between the weight of breast fed babies and their order of birth is as follows:

"The earlier infants of a moderate sized family tend to be lighter than those born later.

"For breast fed infants a similar relation between weight and order of birth holds up to an age of about six months.

"The growth of the infants of primiparae tends to be retarded more during the first four weeks of life than the growth of later children.

"The relatively heavier, later children of a family have available a more plentiful supply of breast milk than the earlier, lighter children".

Karl Pearson (1914) states that "the growth of the first child is hampered by conditions which exist to a far less extent for the following births".

I am interested to find, however, that despite this handicapping there is evidence to suggest that first children grow better than later born children at least in the first year of life.

Meredith (1950) reviewed the literature on birth order and body size. He quoted Schmid-Monnard (1892) who found that the relationship between birth order and body weight became reversed during the first postnatal year. Children of "old pluriparae" were heavier in early infancy than those of "young primiparae" but the latter were heavier in the second half of the first year. Meredith concludes that the available evidence in late infancy and childhood shows that body weight is inversely related to birth order.

Hewitt and Stewart (1952) found that parity was an important source of variation in birth weight and subsequent weight gain. The birth weight of first born babies was distinctly below average, but by the end of the year these babies were slightly heavier than subsequent babies.

MacKinlay (1926) investigated working class families in slum areas of Glasgow. With regard to position of child in family and its weight and height, his findings were that infants of the first and those over the eighth pregnancy, were lighter and shorter than those of the in-between pregnancies. "The inferiority of the first born, however, is replaced at the end of the year by a definite superiority both in height and weight, while that manifested in the early months by the last born of families over eight is still apparent at the end of the year".

MacKinlay says that maternal morbidity is most frequent in first pregnancies and the high incidence of deformed pelves in a slum community magnifies the dangers of parturition. The difficulty and length of a first labour is associated with greater shock to first infants. But, as the age of mother increases, and with it, the number of pregnancies, the environmental conditions change, and infants of later pregnancies may be born in over-crowded houses, in conditions of poverty and with exposure to infectious diseases more likely. First children, despite their low initial birth weight, may be expected to overcome their deficiencies if they receive good care, whereas later born children, particularly in big families of low income, would of necessity get less care, and MacKinlay considers that the relationship of weight in infancy to position of child in family is a secondary result of the efficiency with which the mother supervises her infant.

Hammond showed that later born children, especially girls, had a lower increase in weight in the first year. First born babies of both sexes gained more weight in the first year than second, third and fourth born.

Cawley et al (1954) also found positive correlations at birth between weight and birth rank (and between length and birth rank) - these correlations were rapidly eliminated after birth and at 2 years had become negative. These authors agree with MacKinlay in attributing the reason for this negative correlation to be the association between place in family and socioeconomic circumstances. First born children are more favourably placed than later born because well off parents have small families and because poor parents are better off at the birth of their first children.

My own findings confirm the evidence that first born babies, although they start life with a lower birth weight, overtake later born babies and end up heavier at the end of the year. This result is found in both boys and girls.

Although data for non-European groups are insufficient for full analysis, the same results apply. In European, Coloured and Indian babies, first born girls overtake later born earlier than first born boys overtake later born boys. In the Bantu the position is reversed for boys and girls. I can find no explanation for the difference in this respect.

EFFECT OF BIRTH WEIGHT ON GROWTH.

Illingworth et al (1949) demonstrated that birth weight had a constant and very important relationship to subsequent weight at all ages studied from 4 - 13 years. Throughout childhood the child who was small at birth weighed less than the child who was big at birth. Illingworth (1950) continued the study to include children up to 3 years of age, and found that the same rule held. For example, his average male child who at birth weighed 9½ lb or more, weighed more at 1 year than the child whose birth weight was 5½ lb or less, weighed at 2 years.

Lowe and Gibson (1953) found the mean weight at the third birthday to be closely related to birth weight; the correlation between them (with birth order and duration of gestation held constant) being +0.49 for males and +.50 for females.

Drillien (1948) also found that at any given age (up to 4 years) average weight rose steadily with increasing birth weight.

Cullumbine (1953) investigating the health of a tropical people obtained the same results for the children of Ceylon. In one group of 327 children the weight at birth was positively correlated with the weight at 15 months, $r = +0.468$, at 3 years $r = +0.496$ and at 6 years $r = +0.423$.

Parfit found similar results in the first year of life - namely that children maintained their relative weight position at the end of the year according to their weight at birth. She makes the point, however, that the weight actually gained from birth was the same for babies of all birth weights. The rate of growth was greater for small babies than for large.

Similar conclusions on the lack of association between gain in weight and birth weight were reached by the Divisional Medical Officer, Lancashire County Council (1950), by Simpson, and by Hammond.

Norval et al state that the observation of the weight at the end of the year being dependent on the weight at birth is a very old one, and quote Camerer who showed this as early as 1893. They make the point, however, that the same amount of weight gain in a small as a larger child would mean a larger percentage increase in weight. They found additional evidence by correlating birth weight with absolute gain of weight during the year. In both boys and girls the regression was negative, that is the amount of growth is larger for smaller children than for larger children.

Hill and Magee also agree that lighter babies have a relatively greater increase in weight gain than heavier babies. For instance, between the 4th and 28th week the lighter babies (male and female) rather more than doubled their birth weight, whereas the heavier group increased by 86 per cent. Between the 28th and 52nd week the lighter group increased by 36 per cent for males, 33 per cent for females, and the heavier group by 27 and 31 per cent respectively.

Herdan (1954) says that the relationship between birth weight and subsequent weight is not constant but decreases with increasing age, which is to be expected since in the early stages of life body weight exceeds birth weight by only a small amount, but as weight increases with age, birth weight becomes relatively smaller and less important compared with additional weight after birth. At 3 years of age he assesses the effect of birth weight as accounting for not more than 25 per cent of the variation in subsequent weight.

Thomson states that "it is wrong to say, and still worse to teach, that infants double and treble their birth weight at a fixed age". Thus he agrees with Parfit who made the same point in her investigation. The Divisional Medical Officer's Report referred to previously gives a table of expected weights at one year, which certainly shows this rule to be inaccurate.

TABLE 71

EXPECTED ONE YEAR WEIGHTS BASED ON THE WEIGHT AT BIRTH
(After Report of the Divisional Medical Officer,
Lancashire County Council, 1950).

BIRTH WEIGHT		EXPECTED ONE YEAR WEIGHTS			
		Males		Females	
lb	oz	lb	oz	lb	oz
3	12	20	8	18	4
4	0	20	11	18	7
4	4	20	14	18	11
4	8	21	1	19	0
4	12	21	4	19	4
5	0	21	7	19	8
5	4	21	10	19	13
5	8	21	13	20	2
5	12	22	1	20	6
6	0	22	3	20	11
6	4	22	7	20	15
6	8	22	10	21	4
6	12	22	13	21	8
7	0	23	0	21	13
7	4	23	3	22	1
7	8	23	6	22	5
7	12	23	9	22	10
8	0	23	12	22	15
8	4	23	15	23	3
8	8	24	2	23	7
8	12	24	5	23	12
9	0	24	8	24	1
9	4	24	11	24	5
9	8	24	14	24	8
9	12	25	1	24	15
10	0	25	4	25	2

Hahn (1955) found that two-thirds of the infants he surveyed completed the doubling time between 14 and 22 weeks (i.e. 3 - 5 months).

My own findings also suggest that this rule is inaccurate and that all babies, particularly those lighter at birth, double their birth weight before 6 months. Taking all ranks together, boys and girls separately, I find that European boys have doubled their birth weight by 20 weeks (girls 21 weeks) and trebled their weights by the end of the year. Using birth weights for non-Europeans given in Chapter II, I find that Coloured boys double their birth weight by 18 weeks (girls 20 weeks), Bantu boys by 14 weeks (girls 15 weeks) and Indian boys by 15 weeks (girls 14 weeks). Only Bantu males and females, and Coloured males, however, have succeeded in trebling their birth weight by one year.

SUMMARY.

The effect of sex, birth rank and birth weight is analysed on growth in the first postnatal year. The same sample of babies is used as in the previous chapter.

1. Boys' weights are higher than those of girls throughout the first year of life.

2. European boys grow consistently faster than girls in the first year.

3. Non-European boys grow faster than girls in the first 6 - 8 months of life but the girls grow faster than the boys thereafter.

4. It is suggested that in adverse environmental conditions girls grow better than boys.

5. First born babies of both sexes start off lighter than later born babies at birth, but overtake them during the first year.

6. In Europeans, Coloureds and Indians the difference in rate of growth between the ranks is greater for girls than for boys, but in the Bantu it is greater for boys.

7. Because of their superior birth weight, heavy babies at birth remain heavier throughout the year than babies who are lighter at birth.

8. Birth weight has no effect on gain in weight during the year.

9. This means that rate of growth is relatively greater for babies who are lighter at birth.

10. Babies double their birth weight before 6 months of age. This applies particularly to lighter babies and to non-European babies.

11. The literature on the effect of sex, birth rank and birth weight on growth is discussed.

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APPENDIX 32a

EUROPEAN BOYS - MUNICIPAL CLINIC - 2-52 WEEKS
ALL RANKS - ACCORDING TO BIRTH WEIGHT (ACTUAL WEIGHTS)

Age in Weeks	B. Wt Groups 4			5			4 and 5			6			7			8			TOTAL		
	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)
2	8			10			18			59	7.05	.65	101	7.79	.54	120	8.93	.77	298	7.98	1.15
3	14			24	6.60	.67	38	6.30	.78	97	7.47	.67	215	8.24	.67	214	9.37	.82	564	8.40	1.17
4	25	6.55	1.10	28	7.23	1.08	53	6.91	1.14	119	7.95	.78	274	8.74	.78	247	9.71	.90	673	8.81	1.21
5	23	6.97	1.03	31	7.52	.79	54	7.29	.94	141	8.50	.89	276	9.13	.81	267	10.32	1.04	738	9.30	1.29
6	29	6.99	1.24	26	8.14	.94	55	7.53	1.25	132	8.84	.92	291	9.65	.94	245	10.60	1.06	723	9.66	1.32
7	30	7.72	1.48	31	8.69	1.24	61	8.21	1.45	141	9.32	1.00	294	10.12	1.04	233	11.07	1.12	729	10.11	1.39
8	40	8.00	1.34	27	9.12	1.35	67	8.45	1.45	143	9.79	1.11	289	10.48	1.10	256	11.45	1.14	755	10.50	1.45
9	31	8.48	1.52	32	9.50	1.17	63	9.00	1.44	149	10.20	1.15	291	10.88	1.17	246	11.88	1.15	749	10.92	1.46
10	43	8.80	1.26	23	9.90	1.18	66	9.18	1.34	146	10.53	1.23	279	11.38	1.22	247	12.30	1.28	738	11.32	1.56
11	41	8.92	1.39	29	10.61	1.75	70	9.62	1.76	137	10.87	1.21	283	11.70	1.35	259	12.63	1.29	749	11.69	1.62
12	45	9.53	1.62	30	10.67	1.33	75	9.98	1.61	144	11.34	1.19	289	12.12	1.29	234	13.11	1.30	742	12.06	1.61
13	42	10.13	1.78	35	11.29	1.29	77	10.66	1.68	134	11.69	1.31	283	12.49	1.44	233	13.41	1.47	727	12.45	1.69
14	37	10.64	1.79	29	11.51	1.60	66	11.02	1.76	134	12.22	1.52	276	12.92	1.37	234	13.92	1.52	710	12.94	1.72
15	35	10.76	1.87	31	12.09	1.61	66	11.39	1.87	124	12.63	1.43	272	13.33	1.36	252	14.10	1.39	714	13.30	1.64
16	40	11.34	1.66	26	11.92	1.63	66	11.57	1.67	139	13.02	1.56	277	13.61	1.48	224	14.50	1.56	706	13.59	1.75
17	36	11.61	1.73	26	12.60	1.38	62	12.02	1.66	131	13.20	1.57	246	14.15	1.64	244	14.96	1.61	683	14.06	1.85
18	37	11.87	2.07	25	13.11	1.51	62	12.37	1.96	122	13.70	1.36	271	14.45	1.60	229	15.33	1.60	684	14.42	1.81
19	40	12.06	1.90	27	13.42	1.47	67	12.61	1.86	117	14.02	1.66	237	14.81	1.62	231	15.69	1.53	652	14.75	1.88
20	34	13.21	1.67	31	13.67	1.36	65	13.43	1.55	129	14.26	1.54	246	15.03	1.51	243	15.95	1.51	683	15.06	1.72
21	36	12.94	1.55	24	14.23	1.54	60	13.46	1.67	97	14.48	1.57	245	15.45	1.65	209	16.20	1.58	611	15.36	1.82
22	37	13.55	1.81	29	14.49	1.48	66	13.96	1.74	108	15.02	1.77	242	15.84	1.61	196	16.79	1.63	612	15.80	1.88
23	38	13.65	1.86	25	14.43	1.75	63	13.96	1.86	113	15.13	1.73	206	16.13	1.55	206	16.95	1.50	588	15.99	1.87
24	36	14.26	1.98	26	14.73	1.11	62	14.46	1.69	98	15.28	1.67	214	16.36	1.60	203	17.29	1.75	577	16.30	1.92
25	29	14.20	1.86	29	15.56	1.68	58	14.88	1.90	104	15.57	1.80	189	16.55	1.85	194	17.61	1.60	545	16.56	1.99
26	34	14.63	1.96	22	15.71	1.04	56	15.05	1.74	108	15.96	1.63	209	16.90	1.73	194	17.98	1.59	567	16.91	1.92
27	36	15.06	2.01	26	15.62	1.66	62	15.29	1.89	100	16.54	1.76	183	17.25	1.82	193	18.12	1.61	538	17.20	1.96
28	33	14.71	2.21	23	16.23	1.23	56	15.33	2.02	105	16.62	1.60	196	17.61	1.93	164	18.51	1.81	521	17.45	2.09
29	27	15.94	2.17	22	16.11	1.84	49	16.02	2.03	92	16.71	1.85	163	17.81	1.86	180	18.64	1.69	484	17.73	2.03
30	31	15.64	1.90	21	16.15	1.60	52	15.87	1.80	92	17.17	1.73	186	18.00	2.00	166	18.99	1.69	496	17.96	2.07
31	31	16.22	2.32	28	16.70	2.02	59	16.45	2.54	91	17.23	1.78	147	18.33	1.83	157	19.25	1.74	454	18.18	2.09
32	33	16.13	2.25	16	16.94		49	16.39	2.06	72	17.53	1.86	151	18.77	1.86	166	19.58	1.78	438	18.61	2.17
33	26	16.65	2.34	24	17.00	1.49	50	16.82	1.99	88	17.85	1.72	144	18.90	2.06	155	19.62	1.72	437	18.71	2.09
34	24	16.90	2.54	18	17.42		42	17.12	2.11	76	18.57	1.86	168	18.69	1.77	143	19.93	2.03	429	18.93	2.08
35	24	16.71	2.25	22	17.52	2.08	46	17.10	2.21	79	18.11	1.91	134	19.30	2.01	144	20.43	1.72	403	19.22	2.22
36	22	17.16	2.21	19			41	17.36	1.85	73	18.53	1.92	149	19.36	1.96	132	20.15	1.91	395	19.26	2.11
37	26	17.75	2.41	16			42	18.13	2.14	73	18.85	1.81	120	19.76	2.10	140	20.69	1.79	375	19.75	2.13
38	17	17.93		18			35	18.01	1.91	66	19.00	1.74	139	19.93	2.13	130	20.70	1.96	370	19.85	2.16
39	25	18.17	2.26	19			44	18.14	1.93	77	19.32	2.09	125	20.31	2.09	139	21.11	1.72	385	20.15	2.17
40	20	18.08	2.34	18			38	18.61	1.98	72	19.42	1.84	136	20.40	2.12	118	21.00	1.92	364	20.22	2.13
41	21	18.04	2.29	15			36	18.35	2.02	61	19.48	1.62	138	20.69	2.06	127	21.85	2.02	362	20.66	2.29
42	18	18.92		19			37	19.05	2.12	57	20.10	1.95	120	20.94	2.08	97	21.50	1.97	311	20.74	2.17
43	18	18.17		12			30	18.80	2.16	60	20.32	1.86	101	21.04	2.05	120	21.70	2.27	311	20.94	2.28
44	27	17.95	1.94	20	19.40	1.86	47	18.57	2.04	62	20.45	2.13	117	21.24	2.04	106	22.00	2.01	332	20.96	2.33
45	14	18.89		12			26	19.46	2.54	49	20.16	2.06	90	21.79	2.11	120	22.32	2.16	285	21.52	2.38
46	21	19.56	2.75	19			40	19.69	2.43	45	20.29	2.07	97	21.41	2.06	103	22.61	2.54	285	21.42	2.53
47	14			11			25	19.27	2.10	58	20.87	1.96	91	22.05	2.25	86	22.37	2.21	260	21.63	2.36
48	18			16			34	19.72	2.29	45	20.87	2.18	89	21.82	1.86	86	23.21	2.11	254	21.84	2.38
49	15			16			31	20.51	2.80	38	21.65	2.06	95	22.21	2.28	89	22.67	2.50	253	22.08	2.51
50	16			13			29	20.22	2.59	35	21.75	1.84	86	22.16	2.05	96	23.39	2.32	246	22.35	2.42
51	13			12			25	20.31	2.10	48	21.81	2.03	84	22.86	2.35	71	23.50	2.59	228	22.56	2.54
52	15			16			31	20.86	1.89	46	21.62	1.91	99	22.50	2.26	91	24.01	2.38	267	22.67	2.46

APPENDIX 32b

EUROPEAN GIRLS - MUNICIPAL CLINIC - 2-52 WEEKS
ALL RANKS - ACCORDING TO BIRTH WEIGHT (ACTUAL WEIGHTS)

Age in Weeks	B.Wt Groups 4			5			4 and 5			6			7			8			TOTAL		
	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D.. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)
2	10			9			19			96	7.01	.53	97	7.62	.49	64	8.73	.75	276	7.55	.97
3	20	5.93	.73	19			39	6.35	.83	161	7.36	.55	192	8.05	.60	134	9.09	.78	526	7.98	1.03
4	17			28	7.16	.66	45	6.89	.76	169	7.84	.59	235	8.52	.67	168	9.52	.77	617	8.49	1.03
5	29	6.89	.69	26	7.81	.72	55	7.32	.84	194	8.22	.71	256	8.94	.78	171	9.95	.85	676	8.86	1.11
6	30	7.08	.82	25	7.95	.89	55	7.48	.96	178	8.63	.83	256	9.35	.84	184	10.29	.91	673	9.26	1.19
7	32	7.47	.85	36	8.57	1.03	68	8.05	1.10	207	9.01	.85	259	9.76	.92	167	10.73	1.04	701	9.60	1.24
8	29	7.87	.91	29	8.80	1.09	58	8.34	1.11	183	9.50	.93	276	10.11	.89	180	11.13	1.08	697	10.07	1.25
9	36	8.19	.93	31	9.49	1.04	67	8.80	1.17	190	9.86	1.05	258	10.49	1.06	173	11.44	1.06	688	10.39	1.32
10	44	8.53	1.13	29	9.77	1.13	73	9.02	1.28	203	10.25	1.03	262	10.90	1.06	168	11.72	1.14	706	10.71	1.35
11	38	8.92	1.15	28	10.57	1.14	66	9.62	1.41	192	10.53	1.02	255	11.22	1.10	167	12.12	1.10	680	11.09	1.34
12	42	9.45	.90	23	10.40	1.23	65	9.79	1.12	191	10.99	1.03	249	11.64	1.18	191	12.47	1.20	696	11.52	1.39
13	47	9.58	1.20	28	11.07	1.41	75	10.14	1.47	191	11.18	1.13	250	11.96	1.24	178	12.74	1.17	694	11.75	1.46
14	37	9.93	1.47	26	11.40	1.29	63	10.54	1.58	204	11.70	1.16	271	12.35	1.33	180	13.28	1.29	718	12.24	1.52
15	37	10.16	1.23	32	11.77	1.48	69	10.90	1.57	167	11.74	1.18	251	12.70	1.32	193	13.59	1.30	680	12.53	1.57
16	42	10.87	1.48	30	11.83	1.46	72	11.27	1.55	202	12.30	1.20	237	13.00	1.27	174	13.83	1.33	685	12.82	1.51
17	36	11.01	1.52	28	12.46	1.54	64	11.65	1.69	175	12.47	1.35	234	13.42	1.42	176	14.19	1.35	649	13.20	1.63
18	40	11.51	1.26	27	12.47	1.54	67	11.90	1.46	177	12.90	1.32	237	13.65	1.44	173	14.49	1.38	654	13.49	1.60
19	36	11.65	1.33	25	13.19	1.36	61	12.28	1.54	187	13.34	1.33	225	14.10	1.50	158	14.92	1.59	631	13.90	1.67
20	38	11.79	1.55	21	13.56	1.25	59	12.42	1.68	178	13.57	1.39	244	14.30	1.57	162	15.17	1.39	643	14.14	1.69
21	30	11.98	1.77	23	13.38	1.10	53	12.59	1.67	170	13.79	1.42	214	14.65	1.45	146	15.58	1.51	583	14.45	1.72
22	39	12.61	1.55	28	14.02	1.40	57	13.01	1.72	197	14.05	1.25	227	15.08	1.63	142	15.72	1.64	633	14.70	1.73
23	28	12.84	1.92	20	13.93	1.23	48	13.29	1.75	170	14.52	1.31	210	15.14	1.49	153	16.10	1.52	581	15.06	1.67
24	37	12.97	1.67	27	14.57	1.63	64	13.64	1.83	162	14.66	1.56	196	15.65	1.73	146	16.31	1.57	568	15.31	1.86
25	32	12.95	1.95	22	14.39	1.91	54	13.54	2.06	160	15.01	1.36	202	15.99	1.64	131	16.48	1.59	547	15.58	1.82
26	30	14.03	1.75	27	15.08	1.71	57	14.53	1.81	159	15.34	1.32	217	16.20	1.67	146	16.71	1.82	579	15.93	1.78
27	34	13.82	1.57	20	14.75	1.74	54	14.17	1.69	152	15.47	1.51	180	16.29	1.60	125	17.04	1.64	511	16.01	1.82
28	36	14.07	2.16	19			55	14.61	2.20	148	15.86	1.49	182	16.70	1.79	124	17.41	1.73	509	16.41	1.84
29	22	14.46	1.66	22	16.09	1.72	44	15.27	1.88	145	16.06	1.35	174	17.04	1.70	114	17.73	1.61	477	16.75	1.78
30	26	14.94	2.22	18			44	15.51	2.08	136	16.21	1.54	173	17.20	1.61	124	17.88	1.78	477	16.94	1.85
31	23	14.88	1.88	16			39	15.37	1.82	127	16.46	1.56	168	17.47	1.86	118	17.99	1.88	452	17.13	1.95
32	32	15.44	1.79	18			50	15.70	1.84	131	16.72	1.55	153	17.69	1.81	103	18.30	1.84	437	17.32	1.93
33	24	14.92	1.90	18			42	15.77	1.96	136	17.04	1.61	158	18.00	1.57	99	18.68	1.75	435	17.64	1.88
34	26	15.42	2.30	14			40	16.01	2.31	124	17.18	1.65	157	18.30	1.73	108	18.66	1.99	429	17.85	2.01
35	17			22			39	16.74	2.15	112	17.31	1.62	148	18.17	1.77	99	18.80	1.78	398	17.94	1.90
36	23	16.21	2.32	18			41	16.74	2.10	110	17.74	1.39	147	18.57	1.74	105	19.30	2.06	403	18.35	1.95
37	14			17			31	16.96	2.40	102	17.94	1.53	128	19.06	1.90	79	19.54	1.90	340	18.64	2.02
38	15			16			31	17.22	2.76	110	18.24	1.59	131	19.20	1.95	101	19.66	2.00	373	18.88	2.09
39	17			15			32	17.45	2.26	97	18.50	1.64	141	19.19	1.74	97	19.81	2.07	367	19.02	1.98
40	15			19			34	17.34	2.68	95	18.53	1.61	131	19.60	1.83	94	20.32	1.93	354	19.29	2.11
41	17			12			29	18.39	2.13	103	19.01	1.55	110	19.58	1.82	84	20.38	1.83	326	19.50	1.88
42	16			16			32	17.11	2.49	99	18.85	1.79	105	19.98	1.81	78	20.64	2.19	314	19.49	2.25
43	16			13			29	18.65	3.13	88	19.10	1.74	119	20.27	1.79	92	20.66	1.88	328	19.92	2.09
44	9			18			27	17.88	2.34	77	19.35	1.87	99	19.95	1.70	83	20.72	2.26	286	19.82	2.14
45	22			8			30	18.55	2.59	99	19.56	2.02	99	20.46	1.92	75	21.19	1.99	303	20.16	2.20
46	16			16			32	18.34	2.40	72	19.79	1.73	77	20.54	1.64	72	20.78	2.59	253	20.12	2.22
47	14			7			21	18.04	2.95	71	19.93	1.50	92	20.94	2.04	75	21.20	1.89	259	20.50	2.15
48	15			15			30	18.85	2.05	83	20.14	1.88	87	20.71	2.03	57	21.32	2.56	257	20.44	2.25
49	12			9			21	19.23	2.38	71	20.26	1.69	81	21.10	2.03	68	21.67	1.88	241	20.85	2.07
50	14			17			31	18.94	2.29	72	20.35	1.94	94	21.28	2.18	56	21.84	2.14	253	20.85	2.30
51	10			7			17			61	20.23	1.75	75	21.62	2.03	48	21.97	2.03	201	21.14	2.21
52	13			19			32	20.09	2.50	79	20.71	1.96	99	21.86	2.11	72	22.60	2.25	282	21.52	2.32

APPENDIX 33a

EUROPEAN BOYS - MUNICIPAL CLINIC

RANK 1

ACCORDING TO BIRTH WEIGHT (ACTUAL WEIGHTS)

Age in Weeks	B. Wt. Groups 4 and 5			6			7			8			TOTAL		
	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)
2	12			25	7.01	.38	40	7.88	.47	45	8.83	.64	122	7.85	1.10
3	18			45	7.39	.51	98	8.22	.67	69	9.23	.67	230	8.22	1.05
4	22	7.18	.91	68	7.88	.73	119	8.66	.75	82	9.59	.83	291	8.63	1.08
5	27	7.57	.92	75	8.38	.77	133	9.05	.76	88	10.13	.93	323	9.06	1.13
6	22	7.71	1.19	69	8.81	.83	144	9.56	.86	89	10.48	1.05	324	9.53	1.21
7	27	8.47	1.12	76	9.34	.97	137	10.00	.96	82	10.97	1.11	322	9.96	1.25
8	32	8.58	1.14	82	9.79	1.11	140	10.39	1.03	90	11.32	1.11	344	10.32	1.33
9	38	9.17	1.36	76	10.20	1.10	135	10.74	1.05	88	11.84	1.05	337	10.73	1.37
10	38	9.25	1.18	76	10.68	1.12	136	11.25	1.18	89	12.23	1.22	339	11.15	1.47
11	34	9.65	1.35	70	10.94	1.12	138	11.49	1.29	91	12.70	1.24	333	11.52	1.54
12	42	10.16	1.19	73	11.37	1.20	154	12.00	1.23	82	13.04	1.29	351	11.89	1.50
13	42	10.76	1.39	72	11.90	1.30	140	12.40	1.36	81	13.56	1.30	335	12.37	1.58
14	38	11.03	1.46	63	12.43	1.44	142	12.83	1.29	88	13.75	1.44	331	12.79	1.59
15	34	11.57	1.25	63	12.78	1.38	130	13.20	1.40	97	14.22	1.30	324	13.25	1.56
16	39	11.62	1.45	81	13.07	1.50	124	13.55	1.42	80	14.50	1.61	324	13.43	1.71
17	37	12.09	1.27	69	13.46	1.59	120	14.07	1.64	85	14.98	1.46	311	13.95	1.77
18	34	12.62	1.69	66	13.79	1.32	131	14.51	1.52	86	15.36	1.44	317	14.39	1.69
19	36	12.75	1.55	61	14.11	1.59	123	14.72	1.55	78	15.53	1.36	298	14.57	1.73
20	35	13.55	1.42	72	14.38	1.48	123	15.07	1.52	88	15.84	1.39	318	14.96	1.63
21	32	13.45	1.37	53	14.68	1.46	130	15.38	1.70	75	16.19	1.37	290	15.25	1.74
22	34	13.87	1.74	64	15.20	1.67	114	15.88	1.69	73	16.55	1.57	285	15.66	1.85
23	36	14.08	1.48	61	15.23	1.72	99	16.12	1.53	80	16.88	1.40	276	15.88	1.78
24	31	14.73	1.56	57	15.58	1.74	105	16.39	1.65	80	17.28	1.57	273	16.29	1.83
25	33	14.95	1.60	57	15.62	1.72	103	16.47	1.69	69	17.62	1.61	262	16.40	1.88
26	29	15.34	1.57	55	16.07	1.60	107	16.97	1.72	73	17.89	1.59	264	16.86	1.83
27	32	15.23	1.61	59	16.56	1.63	84	17.20	1.91	66	18.05	1.58	241	17.02	1.93
28	30	15.37	1.72	49	16.85	1.69	102	17.52	1.93	62	18.50	1.72	243	17.37	2.04
29	25	15.83	1.71	51	16.74	1.69	72	17.79	1.69	57	18.57	1.56	205	17.50	1.89
30	24	15.79	1.65	50	17.17	1.69	98	18.02	1.86	63	19.14	1.58	235	17.91	2.00
31	32	16.41	2.08	49	17.61	1.69	70	18.34	1.61	49	19.56	1.55	200	18.15	1.99
32	23	16.34	2.31	37	17.62	1.60	87	18.66	1.86	68	19.42	1.60	215	18.47	2.03
33	27	16.86	1.96	50	18.11	1.81	66	18.98	1.90	64	19.60	1.59	207	18.69	2.01
34	20	17.38	2.21	38	18.67	1.80	89	18.74	1.69	51	20.04	2.03	198	18.92	2.02
35	24	16.90	1.85	43	18.11	1.91	68	19.39	1.81	52	20.33	1.69	187	19.04	2.14
36	25	17.17	2.10	34	18.57	1.85	70	19.48	1.67	48	20.22	1.85	177	19.18	2.07
37	24	18.19	2.25	41	18.95	1.92	62	19.52	1.84	56	20.80	1.57	183	19.61	2.05
38	18	18.42		33	18.90	1.77	67	19.92	1.92	47	20.91	2.11	165	19.84	2.11
39	24	18.08	2.07	44	19.61	2.17	68	20.21	1.78	45	21.19	1.76	181	20.03	2.13
40	19	18.46		35	19.55	1.88	71	20.37	2.00	38	21.21	2.12	163	20.17	2.15
41	21	18.63	1.82	36	19.38	1.56	69	20.79	1.92	49	22.06	2.01	175	20.59	2.21
42	19	18.67		32	19.97	2.20	56	21.25	1.83	40	21.60	1.84	147	20.73	2.23
43	20	19.23	1.85	35	20.51	1.91	57	21.08	1.86	39	22.42	2.03	151	21.05	2.21
44	24	18.38	2.12	34	20.60	2.24	54	21.66	1.87	39	22.53	1.88	151	21.09	2.43
45	16			27	20.45	2.13	56	21.91	1.79	48	22.56	2.13	147	21.51	2.39
46	19			18	20.42		45	21.63	1.54	38	23.22	2.31	120	21.57	2.48
47	10			35	21.08	1.77	58	22.23	2.07	34	23.19	2.10	131	21.97	2.20
48	17			24	21.13	2.13	47	22.23	1.69	29	23.61	2.17	117	21.92	2.47
49	16			19	22.12		46	22.49	2.25	36	23.31	2.39	117	22.48	2.32
50	12			18	20.08		37	22.49	2.21	33	23.80	2.39	100	22.65	2.45
51	14			31	21.51	1.82	43	23.29	2.15	28	24.75	2.33	116	22.81	2.59
52	15			23	21.84	1.93	43	22.95	1.90	36	24.60	2.45	117	22.94	2.46

APPENDIX 33b

EUROPEAN BOYS - MUNICIPAL CLINIC

RANK 2+

ACCORDING TO BIRTH WEIGHT (ACTUAL WEIGHTS)

Age in Weeks	B. Wt. Groups 4 and 5			6			7			8			TOTAL		
	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)
2	6			34	7.07	.79	61	7.73	.58	75	8.99	.83	176	8.06	1.19
3	20	6.23	.96	52	7.53	.78	117	8.25	.67	145	9.44	.87	334	8.53	1.22
4	31	6.72	1.24	51	8.03	.84	135	8.81	.81	165	9.77	.92	382	8.95	1.28
5	27	7.01	.89	66	8.63	.98	143	9.20	.85	179	10.41	1.08	415	9.49	1.37
6	33	7.42	1.28	63	8.87	.80	147	9.73	1.00	156	10.67	1.05	399	9.77	1.39
7	34	8.00	1.63	65	9.30	1.03	157	10.23	1.10	151	11.12	1.12	407	10.22	1.48
8	35	8.34	1.68	61	9.78	1.11	149	10.57	1.16	166	11.52	1.15	411	10.64	1.52
9	25	8.73	1.53	73	10.19	1.19	156	11.00	1.25	158	11.91	1.21	412	11.07	1.51
10	28	9.09	1.53	70	10.36	1.32	143	11.51	1.24	158	12.34	1.31	399	11.47	1.62
11	36	9.60	2.08	67	11.00	1.30	145	11.90	1.38	168	12.59	1.32	416	11.84	1.67
12	33	9.77	2.01	71	11.31	1.17	135	12.24	1.34	152	13.14	1.30	391	12.21	1.69
13	35	10.54	1.96	62	11.46	1.28	143	12.57	1.52	152	13.34	1.54	392	12.51	1.78
14	28	11.02	2.10	71	12.04	1.56	134	13.02	1.45	146	14.02	1.56	379	13.07	1.82
15	32	11.19	2.34	61	12.48	1.46	142	13.46	1.30	155	14.02	1.45	390	13.34	1.71
16	27	11.49	1.94	58	12.96	1.65	153	13.66	1.53	144	14.50	1.53	382	13.72	1.78
17	25	11.93	2.11	62	12.91	1.49	126	14.23	1.63	159	14.95	1.68	372	14.16	2.11
18	28	12.07	2.22	56	13.60	1.39	140	14.40	1.67	143	15.32	1.68	367	14.46	1.92
19	31	12.44	2.15	56	13.91	1.73	114	14.90	1.69	153	15.82	1.60	354	14.90	1.98
20	30	13.28	1.68	57	14.11	1.59	123	14.99	1.51	155	16.02	1.57	365	15.15	1.79
21	28	13.46	1.97	44	14.24	1.65	115	15.54	1.59	134	16.20	1.69	321	15.46	1.89
22	32	14.06	1.74	44	14.75	1.88	128	15.80	1.54	123	16.94	1.64	327	15.92	1.91
23	27	13.79	2.26	52	15.01	1.73	107	16.14	1.57	126	17.00	1.55	312	16.10	1.94
24	31	14.19	1.76	41	14.85	1.45	109	16.33	1.55	123	17.30	1.86	304	16.30	2.00
25	25	14.79	2.24	47	15.52	1.89	86	16.64	2.02	125	17.61	1.59	283	16.72	2.07
26	27	14.75	1.86	53	15.84	1.66	102	16.84	1.75	121	18.04	1.59	303	16.96	1.99
27	30	15.35	2.15	41	16.52	1.94	99	17.30	1.73	127	18.15	1.63	297	17.36	1.97
28	26	15.29	2.31	56	16.41	1.49	94	17.71	1.92	102	18.52	1.86	278	17.52	2.13
29	24	16.21	2.30	41	16.67	2.02	91	17.83	1.99	123	18.67	1.75	279	17.89	2.10
30	28	15.93	1.93	42	17.17	1.79	88	17.99	2.14	103	18.90	1.74	261	18.00	2.13
31	27	16.49	2.32	42	16.80	1.78	77	18.32	2.00	108	19.11	1.81	254	18.21	2.16
32	26	16.44	1.80	35	17.44	2.10	64	18.91	2.09	98	19.70	1.88	223	18.74	2.27
33	23	16.77	2.01	38	17.50	1.53	78	18.83	2.18	91	19.64	1.81	230	18.73	2.16
34	22	16.89	1.99	38	18.47	1.91	79	18.63	1.85	92	19.86	2.03	231	18.93	2.14
35	22	17.32	2.52	36	18.11	1.90	66	19.21	2.18	92	20.48	1.73	216	19.38	2.28
36	16			39	18.49	1.97	79	19.26	2.18	84	20.11	1.94	218	19.33	2.12
37	18			32	18.72	1.65	58	20.01	2.31	84	20.63	1.92	192	19.88	2.20
38	17			33	19.10	1.71	72	19.94	2.31	83	20.58	1.86	205	19.87	2.20
39	20	18.20	1.74	33	18.93	1.91	57	20.43	2.40	94	21.07	1.70	204	20.25	2.20
40	19			37	19.30	1.79	65	20.44	2.24	80	20.91	1.81	201	20.26	2.12
41	15			25	19.63	1.69	69	20.58	2.31	78	21.72	2.02	187	20.72	2.37
42	18			25	20.27	1.57	64	20.67	2.24	57	21.43	2.05	164	20.74	2.12
43	10			25	20.05	1.76	44	20.99	2.15	81	21.36	2.30	160	20.84	2.35
44	23	18.77	1.93	28	20.27	1.98	63	20.88	2.10	67	21.69	2.02	181	20.82	2.23
45	10			22	19.80	1.90	34	21.59	2.54	72	22.15	2.16	138	21.53	2.37
46	21	20.13	2.54	27	20.21	1.85	52	21.21	2.41	65	22.15	2.59	165	21.32	2.56
47	15			23	20.55	2.17	39	21.81	2.44	52	21.84	2.11	129	21.28	2.46
48	17			21	20.58	2.21	42	21.36	1.93	57	23.00	2.05	137	21.78	2.30
49	15			19			49	21.94	2.28	53	22.24	2.47	136	21.74	2.62
50	17			17			49	21.91	1.89	63	23.17	2.25	146	22.15	2.38
51	11			17			41	22.42	2.46	43	22.69	2.42	112	22.30	2.46
52	16			23	21.40	1.86	56	22.16	2.44	55	23.62	2.26	150	22.47	2.44

APPENDIX 33c

EUROPEAN GIRLS - MUNICIPAL CLINIC

RANK 1

ACCORDING TO BIRTH WEIGHT (ACTUAL WEIGHTS)

Age in Weeks	B. Wt. Groups 4 and 5			6			7			8			TOTAL		
	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)	No.	Mean (lb.)	S.D. (lb.)
2	9			49	7.01	.45	41	7.58	.49	14			113	7.25	.77
3	17			85	7.29	.51	89	8.08	.60	41	8.92	.72	232	7.81	.93
4	25	6.89	.50	90	7.78	.60	105	8.46	.66	49	9.39	.72	269	8.26	.95
5	30	7.33	.73	104	8.15	.71	108	8.96	.74	56	9.79	.81	298	8.67	1.04
6	31	7.67	.73	99	8.62	.81	116	9.29	.85	60	10.23	.86	306	9.10	1.11
7	35	8.02	.86	104	9.00	.79	112	9.69	.87	49	10.57	.97	300	9.40	1.13
8	32	8.44	1.01	92	9.60	.91	134	10.09	.86	56	11.02	1.14	314	9.95	1.17
9	38	8.83	1.00	102	9.95	1.10	116	10.53	1.04	64	11.38	1.00	320	10.31	1.28
10	39	9.21	1.02	104	10.39	1.03	128	10.89	1.06	59	11.60	1.07	330	10.66	1.24
11	36	9.69	1.09	112	10.63	1.00	132	11.24	1.14	57	12.03	1.11	337	11.00	1.27
12	41	9.82	1.03	111	11.07	.95	109	11.53	1.14	64	12.37	1.21	325	11.32	1.30
13	37	10.36	1.18	94	11.25	1.20	125	11.96	1.27	64	12.51	1.19	320	11.67	1.39
14	40	10.84	1.13	116	11.88	1.12	125	12.32	1.37	56	13.22	1.22	337	12.15	1.40
15	34	11.22	1.22	99	11.83	1.15	121	12.75	1.36	66	13.39	1.24	320	12.43	1.44
16	42	11.58	1.23	110	12.35	1.23	116	12.90	1.33	53	13.68	1.38	321	12.67	1.43
17	36	11.90	1.36	94	12.57	1.34	108	13.50	1.47	60	13.88	1.21	298	13.09	1.52
18	33	12.27	1.29	100	13.04	1.27	120	13.66	1.44	58	14.61	1.29	311	13.49	1.50
19	33	12.45	1.27	99	13.51	1.23	109	14.19	1.46	55	14.71	1.46	296	13.86	1.52
20	29	12.86	1.37	99	13.77	1.28	129	14.33	1.50	55	15.32	1.34	312	14.19	1.55
21	25	13.05	1.10	93	13.93	1.39	102	14.69	1.52	46	15.48	1.43	266	14.41	1.58
22	38	13.66	1.24	108	14.15	1.25	116	15.03	1.61	47	15.87	1.47	309	14.68	1.59
23	27	13.82	1.22	94	14.73	1.26	102	15.33	1.39	52	16.13	1.25	275	15.13	1.46
24	32	14.19	1.59	82	15.04	1.35	106	15.82	1.62	49	16.52	1.56	269	15.51	1.68
25	29	14.35	1.56	88	15.11	1.22	108	15.94	1.55	47	16.50	1.50	272	15.60	1.58
26	28	14.86	1.58	92	15.52	1.23	104	16.34	1.47	49	16.71	1.53	273	15.98	1.53
27	29	14.63	1.63	84	15.75	1.33	97	16.19	1.61	38	17.61	1.74	248	16.08	1.74
28	27	15.47	1.80	83	16.04	1.38	94	16.81	1.68	42	17.64	1.81	246	16.55	1.76
29	21	15.37	1.82	92	16.11	1.30	88	16.96	1.52	37	17.85	1.35	238	16.63	1.61
30	26	16.02	1.61	72	16.52	1.49	90	17.39	1.52	42	18.17	1.72	230	17.11	1.71
31	20	16.03	1.31	76	16.62	1.44	82	17.59	1.79	46	18.38	1.67	224	17.28	1.78
32	25	16.05	1.93	70	17.00	1.42	81	17.72	1.64	34	18.65	1.68	210	17.43	1.78
33	21	16.61	1.60	75	17.23	1.45	80	18.22	1.52	36	18.74	1.62	212	17.80	1.67
34	16			73	17.34	1.60	78	18.41	1.63	33	18.64	2.01	200	17.93	1.81
35	24	17.17	1.87	59	17.59	1.51	73	18.35	1.70	35	18.98	1.89	191	18.08	1.80
36	20	17.45	1.77	64	17.93	1.38	76	18.69	1.59	34	19.32	2.10	194	18.42	1.75
37	15			54	18.07	1.46	62	19.36	1.68	29	19.96	1.91	160	18.82	1.91
38	13			66	18.50	1.37	72	19.32	1.63	37	19.99	2.13	188	19.06	1.80
39	15			52	18.70	1.64	70	19.39	1.50	32	19.89	1.81	169	19.13	1.81
40	21	17.80	1.93	50	18.74	1.58	69	19.70	1.55	33	20.49	1.84	173	19.34	1.86
41	13			60	19.20	1.44	52	19.61	1.63	31	20.86	1.94	156	19.61	1.79
42	16			58	19.22	1.82	58	20.38	1.56	31	21.04	2.14	163	19.84	2.02
43	14			54	19.20	1.66	59	20.24	1.67	32	21.02	2.09	159	20.02	1.95
44	18			53	19.50	1.80	49	20.20	1.80	29	21.34	2.57	149	19.98	2.12
45	15			51	19.95	1.99	53	20.65	1.73	29	21.44	2.00	148	20.40	2.06
46	16			44	20.07	1.84	39	20.56	1.60	27	21.64	2.54	126	20.44	2.09
47	8			41	20.14	1.42	47	21.18	1.82	18			114	20.75	1.87
48	20	19.38	1.94	50	20.35	1.83	37	21.14	1.89	20	21.95	2.41	127	20.68	1.94
49	11			47	20.53	1.75	39	21.11	1.84	24	22.13	1.85	121	21.01	1.95
50	16			41	20.48	1.60	43	21.67	1.89	24	22.79	2.35	124	21.24	2.18
51	7			35	20.51	1.75	40	22.08	1.95	15			97	21.47	2.16
52	19			46	20.82	1.68	47	22.22	1.87	29	22.97	2.71	141	21.72	2.27

APPENDIX 33d

EUROPEAN GIRLS - MUNICIPAL CLINIC

RANK 2+

ACCORDING TO BIRTH WEIGHT (ACTUAL WEIGHTS)

Age in Weeks	B. Wt. Groups 4 and 5 No.	4 and 5 Mean (lb.)	4 and 5 S.D. (lb.)	6 No.	6 Mean (lb.)	6 S.D. (lb.)	7 No.	7 Mean (lb.)	7 S.D. (lb.)	8 No.	8 Mean (lb.)	8 S.D. (lb.)	TOTAL No.	TOTAL Mean (lb.)	TOTAL S.D. (lb.)
2	10			47	7.01	.59	56	7.64	.49	50	8.87	.73	163	7.74	1.04
3	22	6.36	.93	76	7.44	.58	103	8.02	.59	93	9.17	.79	294	8.11	1.08
4	20	6.90	1.00	79	7.90	.57	130	8.57	.67	119	9.58	.79	348	8.66	1.05
5	25	7.31	.96	90	8.31	.71	148	8.92	.82	115	10.03	.85	378	9.01	1.14
6	24	7.23	1.14	79	8.64	.85	140	9.40	.83	124	10.32	.93	367	9.40	1.23
7	33	8.08	1.30	103	9.02	.90	147	9.82	.94	118	10.80	1.07	401	9.76	1.30
8	26	8.21	1.20	91	9.39	.95	142	10.13	.91	124	11.19	1.05	383	10.17	1.31
9	29	8.75	1.37	88	9.76	.99	142	10.45	1.09	109	11.47	1.10	368	10.46	1.36
10	34	8.81	1.50	99	10.09	1.01	134	10.91	1.05	109	11.78	1.18	376	10.76	1.43
11	30	9.53	1.71	80	10.40	1.02	123	11.21	1.05	110	12.17	1.09	343	11.18	1.40
12	24	9.73	1.27	80	10.88	1.12	140	11.72	1.21	127	12.52	1.20	371	11.68	1.43
13	38	9.92	1.68	97	11.12	1.05	125	11.97	1.21	114	12.86	1.15	374	11.81	1.51
14	23	10.01	2.04	88	11.45	1.16	146	12.38	1.30	124	13.31	1.31	381	12.32	1.61
15	35	10.59	1.80	68	11.61	1.22	130	12.65	1.29	127	13.69	1.32	360	12.62	1.67
16	30	10.83	1.82	92	12.25	1.16	121	13.10	1.20	121	13.90	1.30	364	12.96	1.57
17	28	11.32	1.99	81	12.35	1.35	126	13.35	1.37	116	14.35	1.39	351	13.29	1.71
18	34	11.54	1.52	77	12.73	1.36	117	13.64	1.44	115	14.43	1.42	343	13.49	1.69
19	28	12.09	1.79	88	13.15	1.41	116	14.01	1.52	103	15.04	1.64	335	13.94	1.80
20	30	12.00	1.83	79	13.31	1.48	115	14.25	1.64	107	15.10	1.41	331	14.10	1.81
21	28	12.18	1.95	77	13.61	1.44	112	14.63	1.39	100	15.63	1.55	317	14.48	1.83
22	29	12.56	1.89	89	13.93	1.24	111	15.13	1.64	95	15.65	1.71	324	14.73	1.85
23	21	12.61	2.07	76	14.27	1.32	108	14.96	1.56	101	16.08	1.64	306	14.99	1.84
24	32	13.09	1.89	80	14.28	1.66	90	15.46	1.82	97	16.21	1.58	299	15.14	1.99
25	25	12.59	2.15	72	14.89	1.51	94	16.06	1.73	84	16.46	1.63	275	15.56	2.03
26	29	14.22	1.36	67	15.09	1.41	113	16.08	1.83	97	16.71	1.95	306	15.89	1.97
27	25	13.63	1.61	68	15.13	1.64	63	16.68	1.73	87	16.79	1.52	263	15.94	1.87
28	28	13.79	2.22	65	15.64	1.58	88	16.59	1.89	82	17.29	1.68	263	16.27	2.08
29	23	15.19	1.92	53	15.97	1.42	86	17.13	1.86	77	17.68	1.72	239	16.86	1.92
30	18			64	15.87	1.53	83	16.99	1.67	82	17.74	1.80	247	16.79	1.97
31	19			51	16.21	1.69	86	17.31	1.91	72	17.74	1.96	228	16.98	2.09
32	25	15.35	1.67	61	16.40	1.63	72	17.67	1.98	69	18.13	1.89	227	17.21	2.06
33	21	14.94	1.94	61	16.80	1.77	78	17.78	1.59	63	18.66	1.82	223	17.49	2.05
34	24	15.46	2.48	51	16.96	1.68	79	18.19	1.81	75	18.66	1.97	229	17.79	2.17
35	15			53	17.01	1.69	75	17.98	1.81	64	18.70	1.71	207	17.82	1.97
36	21	16.06	2.17	46	17.47	1.35	71	18.44	1.88	71	19.29	2.03	209	18.28	2.12
37	16			48	17.79	1.59	66	18.77	2.05	50	19.29	1.84	180	18.48	2.10
38	18			44	17.83	1.78	59	19.05	2.28	64	19.47	1.89	185	18.68	2.32
39	17			45	18.27	1.61	71	19.00	1.92	65	19.77	2.18	198	18.93	2.11
40	13			45	18.31	1.62	62	19.48	2.09	61	20.23	1.97	181	19.23	2.32
41	16			43	18.74	1.65	58	19.55	1.97	53	20.09	1.70	170	19.39	1.95
42	16			41	18.32	1.62	47	19.48	1.97	47	20.37	2.19	15[illegible]	19.12	2.41
43	15			34	18.94	1.85	60	20.29	1.90	60	20.47	1.73	169	19.83	2.21
44	9			24	19.02	1.97	50	19.71	1.56	54	20.39	1.99	137	19.64	2.15
45	15			48	19.15	1.98	46	20.24	2.10	46	21.02	2.00	155	19.92	2.31
46	16			28	19.36	1.43	38	20.51	1.70	45	20.26	2.48	127	19.80	2.29
47	13			30	19.65	1.61	45	20.69	2.21	57	21.08	1.78	145	20.31	2.33
48	10			33	19.81	1.99	50	20.39	2.08	37	20.98	2.57	130	20.21	2.34
49	10			24	19.75	1.44	42	21.10	2.20	44	21.42	1.85	120	20.70	2.16
50	15			31	20.11	2.38	51	20.96	2.36	32	21.13	1.64	129	20.46	2.37
51	10			26	19.87	1.67	35	21.11	2.01	33	21.67	1.75	104	20.83	2.22
52	13			33	20.57	2.29	52	21.54	2.25	43	22.34	1.82	141	21.34	2.35

S E C T I O N   I V

S O M E   F A C T O R S

A F F E C T I N G   M A T E R N A L   E F F I C I E N C Y

INTRODUCTION

Multiracial investigations are always interesting. Comparison of Bantu and Indian infants is particularly fascinating and at the same time puzzling.

The Indian baby starts off life with a lower birth weight and throughout the first year of life growth is less rapid. But (as has been shown in Chapter III) the Indian infant mortality rates are markedly lower than Bantu rates.

The answer to this puzzle must, I think, be sought in detailed studies of family life and patterns of child rearing among the Bantu and Indian.

Paton and Findlay (1926) stressed the importance of maternal efficiency in the nutrition and health of children. "Even among animals there are good mothers and bad mothers - good mothers who rear a large proportion of their young and bad mothers who neglect or are indifferent to their offspring". They quote Ashby (1915) to the effect that in efforts made in New York to reduce mortality it was the unanimous opinion of the doctors concerned that neither the surroundings of the infant, nor the exact character of the milk consumed were as important factors in the health of the baby as the intelligent care of the mother. Paton and Findlay talk of the effect of 'mothering' on the child, and classify mothers into good, bad and indifferent. "When children are repeatedly found to be dirty or verminous, badly clothed, and left in bed till all hours of the day, when the house is constantly dirty and uncared for, the mother without doubt is inefficient".

In my opinion the relative efficiency of the Bantu and Indian mother will give at least part of the answer to the problems both of the better growth of the Bantu baby in early life and of the lower mortality rate of the Indian infant.

This Section discusses some aspects of maternal efficiency in Bantu and Indian mothers. I have no wish to be dogmatic and I realise that my conclusions are merely tentative, but I do suggest that anthropological, psychological and sociological studies of maternal efficiency would help to clear up many of the mysteries of growth and nutrition which cannot be explained by diet alone.

In the first few months of life, almost all a baby's needs will be satisfied by indulgent and adequate breast feeding. The breast supplies both food and comfort. I have mentioned earlier the superiority of the Bantu mother as a lactator. Walker et al (1954) stated that the mean values of breast milk of South African Bantu mothers approximate closely to British and American figures - "The composition of the milks does not appear to be influenced by the tribal group of the mothers, by their habitual diet (largely composed of maize, bread, legumes) nor by their nutritional state. Their capacity to breast feed is almost invariable, moreover impressions suggest that the yield is satisfactory at least for the first six months".

In the Lamontville Native Village, served by the Institute of Family and Community Health, Durban, we found it exceptional for a Bantu mother to wean her baby because of inadequate lactation. Breast feeding stopped when it was decided that the baby was big enough or if a pregnancy supervened, or if the mother thought her milk had been poisoned.

I found in an investigation on breast feeding (not yet analysed) which I conducted in the Springfield Indian Village during 1953 that of 100 mothers questioned, 40 stated that they had insufficient milk to feed their babies. Over half of this group said that the insufficiency occurred before the baby was two months old.

According to the medical officer at the Newlands Health Centre, Natal, in a review of 24 co-operative Indian families, 13 of the babies were getting full cream milk, sweetened condensed milk, or cow's milk, by the fourth month, in addition to breast feeds.

While collecting data for my growth study I looked at the records of many hundreds of Indian and Bantu babies attending municipal child welfare clinics. It was common to find that cow's milk supplements were given in the first few months of life to Indian babies because the mothers complained of a failing milk supply, and the babies were not gaining well, whereas this story was exceptional among the Bantu.

In Chapter XII I mentioned that the Bantu incidence of breast feeding was the highest of the four racial groups, though 50 per cent of Indian babies were still breast fed in the second year of life. It is not usual for Indian babies to be weaned early but they appear to need supplements early.

If I am correct in thinking that almost all the baby's needs in the first few months will be met by adequate and satisfying breast feeding then I think it must be conceded that the Bantu mother is more efficient than the Indian (in this respect at least) during early infancy, and this is reflected in the growth curves of their babies. (Although I am here concerned only with Indian and Bantu mothers, I might add at this stage that I do not consider the European to be a particularly efficient mother in her baby's early life, either).

There comes a time, however, when a baby needs foods other than breast milk, and its interests and activities are not satisfied by the mother's breast or back. (Bantu babies are customarily carried on their mothers' backs). I consider the Bantu mother no longer to be so efficient at this period and here the Indian mother probably scores. Kuper (1955) considers that the Indian mother has a more sensitive understanding of her child's needs than the African mother. I have seen many cases of infantile diarrhoea in the Bantu where the mother complains that an ill wisher has poisoned her milk and so weans the baby on the inyanga's advice, with dire results.

Dean (1955) mentioned that many cases of kwashiorkor in African babies in Uganda resulted from abrupt weaning when the child was sent away to the granny. The child develops anorexia due to emotional deprivation and this sets off the train of events which leads to kwashiorkor.

Abrupt weaning, sometimes accompanied by separation of the mother and child, is the rule amongst South African Bantu. My impression in health centre practice is that kwashiorkor is far less common in Indian babies than in African babies and this impression is confirmed by Walt (1955) at McCord's Hospital. According to Kuper the weaning of Indian babies is very gradual and the mother often relents and re-starts breast feeding after she has decided to stop. She mentioned one case where the child was finally weaned at 8 years!

Newton (1955) considers that "the number of months of breast feeding are probably much less important psychologically than the type of breast feeding and the type of weaning involved ..... ". "A successfully breast fed baby who is suddenly weaned may be more psychologically hurt than the artificially fed baby who has never known such close intimacy with another human being".

Albino and Thompson in a study (as yet unpublished) of Bantu weaning in Pholela, found that the reaction to weaning varied, but that every child was disturbed by it. This disturbance could be "a transitory upset lasting only a week or so, or a gross change in the personality of the child which was still present at the end of seven weeks after weaning".

Kuper is impressed by the handling which the Indian infant receives in the bathing ritual. The Indian baby is oiled and massaged and exercised by the granny and mother daily, whereas bathing of the African child is a far more mechanical process.

Interestingly enough Kuper has personally encountered Indian mothers who rejected their children but has never met this situation among Africans. However, we have encountered maternal rejection amongst the Bantu at the Lamont Health Centre. I think that the joint family living of the Indian would tend to cushion the blow among Indian children when and if maternal rejection occurs, while in Bantu urban families large extended family living is not the rule.

But quite apart from cultural patterns of child rearing which may well make the Indian a more efficient mother than the Bantu, (except for lactation), I think present conditions of Bantu urban society militate against efficient family life.

Krige (1952) gave figures of housing for Bantu in Durban as follows: (Table 72)

TABLE 72

HOUSING OF THE BANTU POPULATION OF DURBAN, ESTIMATED AT 150,000
(figures from Municipal Native Affairs Department)
(after KRIGE, 1952)

TYPE OF ACCOMMODATION	NUMBERS ACCOMMODATED
Municipal family housing schemes	15,000
Single accommodation	43,000
Domestic servants	29,000
Native-owned property	500
Shacks (estimated)	35,000
Balance	27,500
TOTAL	150,000

The balance of 27,500 is made up of Natives living in back yards, chiefly of Indians, but also of Europeans, and other unsuitable accommodation, and includes those overcrowding municipal institutions.

On food habits and feeding of children some of her comments are as follows:

"The disorganization in the homes in shack areas, especially when mothers are brewing and drinking beer, is also a factor in malnutrition. Women go drinking, neglect their cooking and do not feed the children. It has become customary for children to wander about picking up scraps of food from one home to another ..... "

"Another factor in urban malnutrition is the chaos resulting from the sudden breaking away of a people from its traditional social background and customary diet. The urban Bantu are eager to accept everything European. But, unable to distinguish between advertizing and sound advice, they readily fall prey to commercial propaganda. An uprooted people, cut off from traditional family life, unable to have the foods to which they are accustomed, miserably poor, they suffer the additional disability of being ignorant of the values or properties of the foods to which they do have access. Contrast the Indian who, however poor he may be, lives a closely-knit joint-family life and eats traditional Indian foods abounding in herbs, mostly home grown. For the poorest Indians are essentially agriculturally based with access to herbs and wild relishes. Their women do not go out into employment but remain at home, breast-feeding their babies under the watchful eye of the mother-in-law who, moreover, has a considerable store of knowledge of home remedies for diarrhoea and other infant ailments, tested over centuries of life in India. Poverty and ignorance are important causes of malnutrition but these alone are not sufficient to account for the extent and seriousness of malnutrition and gastro-enteritis among Bantu children. Greater in importance are their social disintegration and the appalling conditions of their urban life".

In Merebank, Durban (Annual Report, I.F.C.H., 1951) the average number of persons per home were:

Indian 10.6
Coloured 7.6
Native 3.5

and the percentage of homes with children:

Indian 96.4
Coloured 86.4
Native 59.6

Family living was a feature of both the Indian and the Coloured population, but not of the Native. Even if the man and woman were married it was not unusual for children to be sent "home" to relatives in the rural native reserves.

It is hardly surprising that the Bantu infant mortality rate is so high. It must be pointed out that Bantu mothers who take their children to clinics probably represent the more stable section of their communities, whereas infant mortality rates are calculated from the total population.

Bantu infant mortality rates are much lower under relatively stable conditions. In Lamontville Native Village, houses are let only to persons who are married and have families. In this housing scheme we achieved an infant mortality rate of 83.7 in 1951. (See Annual Report, Lamont Health Centre, 1950 - 1951). The infant mortality rate for Natives in Durban in 1950 - 1951 was 369.4, though this figure is probably an overstatement since 100 per cent registration of Bantu births is unlikely.

Two factors affecting maternal efficiency are discussed - the incidence of breast feeding on discharge from hospital (Chapter XV) and the incidence of illegitimacy in Durban (Chapter XVI).

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CHAPTER XV

THE INCIDENCE OF BREAST FEEDING ON DISCHARGE FROM HOSPITAL.

We have seen in Chapter XIII that the shape of the growth curves was not the same in the four racial groups. The Bantu babies grew very much faster than the others in the first few months of life. My preliminary postulate was that the Bantu, with their complete acceptance of breast feeding and their easy self-demand regime, were supplying their babies with more milk, and that this accounted for their rapid growth. The Indian babies, however, though fed by the same method, did not grow as well, and I have given some evidence to show that Indian mothers often need to supplement their breast milk in the first few months of their babies' lives.

In order to see if there are differences in lactation ability from birth, I discuss in this chapter:

1. The incidence of breast feeding on discharge from hospital for the four racial groups, and

2. The time when milk first comes into the breasts of Bantu and Indian mothers.

MATERIAL USED AND METHOD OF ANALYSIS.

1. Incidence of breast feeding.

I commenced this study on 1st May, 1951, and collected records for a year, till 30th April, 1952. The data were obtained from Addington Hospital, Durban, for the European and Coloured births, and from McCord Zulu Hospital, Durban, for Bantu and Indian births. Since Addington Hospital is a provincial hospital, additional data for Europeans were collected from a private nursing home - Mothers' Hospital, Durban, which caters mainly for members of the middle income group. I considered that the European sample was then representative of the Durban European population, with the exception of the wealthiest section.

At the end of the year there were complete records for 1,480 Europeans, 326 Coloureds, 1,482 Bantu and 197 Indians.

Premature babies and multiple births are excluded from this study, as are children with abnormalities such as cleft palate or other conditions which would make a normal breast feeding situation difficult. Babies whose mothers died are also excluded.

Methods of feeding on discharge from hospital fall into three groups:

(i) Breast only.

(ii) Breast and bottle.

(iii) Bottle only.

The percentage of babies in each of these three feeding groups is calculated for the four racial groups.

2. Time when milk first comes into the breasts.

The examination of mothers for this study was undertaken by a nursing sister at McCord Zulu Hospital, who examined the breasts of the mothers at 8 a.m., 2 p.m. and 8 p.m. each day. I did a sample check to confirm her results. Since the important point here was the comparison between Bantu and Indian mothers, the same sister examined both groups. Being from England, she had no preconceived ideas about lactation in these two groups. This study started in February, 1951 and unfortunately terminated in June, 1951 when the sister returned to England.

Information is available on 103 Bantu and 61 Indian mothers. The time at which the milk first came into the breasts is calculated from the time of birth. Frequency distributions are drawn up, and means and standard deviations calculated for the two racial groups. Where differences are found, the significance of these differences is calculated.

RESULTS.

1. INCIDENCE OF BREAST FEEDING ON DISCHARGE FROM HOSPITAL.

(a) Age of baby on discharge from hospital.

Table 73 shows the frequency distribution of the ages of the babies on discharge from hospital. The range varies from 1 to 34 days, long delays usually being due to illness of the mother or baby, while early discharges either sign off against hospital advice, or go home to be visited by the district nursing service. The investigation is therefore confined to those babies who are in hospital from 5 - 14 days. On the whole, European mothers stay in hospital about 9 days, and non-European mothers about half a day less, with Indian mothers staying the shortest time ($7\frac{1}{2}$ days).

TABLE 73

FREQUENCY DISTRIBUTION OF AGES OF BABIES ON DISCHARGE FROM HOSPITAL

DAYS	EUROPEAN			BANTU	COLOURED	INDIAN
	Addington Hospital	Mothers' Hospital	Total	McCord's Hospital	Addington Hospital	McCord's Hospital
1 - 2	5	3	8	1	-	5
3 - 4	15	2	17	12	7	18
5 - 6	79	18	97	201	24	66
7 - 8	349	139	488	654	216	73
9 - 10	463	301	764	480	62	39
11 - 12	44	56	100	108	19	12
13 - 14	16	15	31	38	6	7
15 - 16	10	8	18	16	10	5
17 - 18	6	2	8	8	4	2
19 - 20	4	-	4	4	1	1
21 - 22	3	1	4	2	-	1
23 - 24	2	1	3	-	-	-
25 - 26	-	-	-	2	1	-
27 - 28	-	-	-	1	-	-
29 - 30	-	-	-	-	-	-
31 - 32	1	-	1	-	-	-
33 - 34	1	-	1	-	-	-
	998	546	1544	1527	350	229
Mean (days)	8.8	9.3	8.9	8.5	8.4	7.6
S.D.	2.54	2.05	2.39	2.35	2.34	3.09

(b) Incidence of breast feeding.

Table 74 shows the number and percentage of babies on the breast, on breast plus bottle, and on bottle only, for all the mothers (i.e. primiparae and multiparae together) of the four racial groups. Several extremely interesting facts emerge. 98.6 per cent of the Bantu mothers breast feed their babies completely - very few have to supplement, and only one baby out of 1,482 is bottle fed. In this case the hospital records stated that the mother was infectious, and the baby was fed on the expressed breast milk of other mothers. The Coloured mothers are almost as successful, 97.9 per cent of their babies being completely breast fed, with a correspondingly small percentage partly or fully bottle fed.

T A B L E 74

METHOD OF FEEDING OF NEWBORN INFANTS ON DISCHARGE FROM HOSPITAL (MOTHERS STAYING 5-14 DAYS)

All Mothers

	EUROPEANS						COLOURED		BANTU		INDIAN	
	Mothers' Hos		Addington		Combined		Addington		McCord's		McCord's	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Breast	473	89.1	909	95.8	1382	93.4	319	97.9	1462	98.6	140	71.1
Breast plus bottle	24	4.5	18	1.9	42	2.8	6	1.8	19	1.3	53	26.9
Bottle	34	6.4	22	2.3	56	3.8	1	.3	1	.1	4	2.0
TOTAL	531		949		1480		326		1482		197	

A surprisingly high percentage of European babies are found to be wholly breast fed (93.4 per cent). An interesting feature here is that more babies are on the bottle only, than on breast plus bottle, indicating probably a definite decision on the part of the mother not to breast feed. The nursing staffs of both the Addington and the Mothers' Hospital are strongly in favour of breast feeding, but at the latter the majority of mothers have their own doctor, whereas at the former they are attended by the hospital staff. At the Mothers' Hospital, the decision to breast feed is made by the mothers, the nurses and the doctors, whereas at the Addington Hospital there is a definite ward policy. The effect of this can be seen in the high breast feeding figures (95.8 per cent) at the Addington Hospital as against 89.1 per cent at the Mothers' Hospital.

Health visitors in Birmingham reported that "doctors are still responsible for weaning babies more than any other single factor. They still take babies off the breast, whenever there is any difficulty, rather than take the trouble to go into the whole difficult question of successful breast feeding". (Neale et al, 1943).

The lowest figures of all are found in the Indian group, where only 71.1 per cent of the babies are completely breast fed. A very small number (2 per cent) are bottle fed, but over a quarter of the total group requires supplementary feeding. Hence it seems clear that the mothers do not wish to put their babies on the bottle, but have some difficulty with the full establishment of lactation.

(c) Effect of Parity.

In order to investigate the effect of parity on breast feeding, the mothers are divided into primiparae and multiparae (see Tables 75 a and b).

TABLE 75

EFFECT OF PARITY ON BREAST FEEDING

(a) Primiparae

	EUROPEANS						COLOURED		BANTU		INDIAN	
	Mothers' Hos. No.	%	Addington No.	%	Combined No.	%	Addington No.	%	McCord's No.	%	McCord's No.	%
Breast	187	83.9	239	95.6	426	90.0	100	98.0	436	98.0	38	70.4
Breast plus bottle	13	5.8	2	.8	15	3.2	2	2.0	8	1.8	15	27.8
Bottle	23	10.3	9	3.6	32	6.8	-	-	1	.2	1	1.8
TOTAL	223		250		473		102		445		54	

(b) Multiparae

	EUROPEANS						COLOURED		BANTU		INDIAN	
	Mothers' Hos. No.	%	Addington No.	%	Combined No.	%	Addington No.	%	McCord's No.	%	McCord's No.	%
Breast	286	92.8	670	95.8	956	94.9	219	97.8	1026	98.9	102	71.3
Breast plus bottle	11	3.6	16	2.3	27	2.7	4	1.8	11	1.1	38	26.6
Bottle	11	3.6	13	1.9	24	2.4	1	.4	-		3	2.1
TOTAL	308		699		1007		224		1037		143	

In all cases except the Coloured group (where the difference is 0.2 per cent), multiparae are more successful breast-feeders than the primiparae. The greatest difference is seen in the European group from

TABLE 76

METHOD OF FEEDING OF NEWBORN INFANTS ON DISCHARGE FROM HOSPITAL EUROPEAN LEGITIMATE BIRTHS ONLY, SHOWING RANKS SEPARATELY.

	PRIMIPARAE						MULTIPARAE						ALL RANKS					
	Mothers'		Addington		Combined		Mothers'		Addington		Combined		Mothers'		Addington		Combined	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Breast	185	90.2	232	98.3	417	94.6	286	93.1	669	96.5	955	95.5	471	92.0	901	97.0	1372	95.2
Breast plus bottle	11	5.4	2	.85	13	2.9	11	3.6	16	2.3	27	2.7	22	4.3	18	1.9	40	2.8
Bottle	9	4.4	2	.85	11	2.5	10	3.3	8	1.2	18	1.8	19	3.7	10	1.1	29	2.0
TOTAL	205		236		441		307		693		1000		512		929		1441	

Mothers' Hospital, where there is an increase of almost 9 per cent in favour of the multiparae. Although this result is not unexpected, I thought that the marital status of the mothers might be an additional factor influencing the incidence of breast feeding in the European group. The records reveal that most of the illegitimate European babies are destined for adoption, and therefore likely to be bottle fed from birth. In the next chapter I show the incidence of illegitimacy for Durban Europeans to be 1.6 per cent. Since the incidence of illegitimacy in the European group at these two hospitals is 2.6 per cent, it would appear that they cater for a large number of the unmarried mothers in Durban, and in fact we know this to be the case. The incidence of breast feeding for European legitimate babies is shown in Table 76.

(d) Effect of Illegitimacy.

The difference is most marked in primiparae, as one would expect, as most illegitimate births are first babies. It will be seen that when legitimate births only are considered, the 9 per cent difference in incidence of breast feeding between primiparae and multiparae of the Mothers' Hospital becomes only 3 per cent, and that there is an increase of over 6 per cent in the percentage of first babies completely breast fed. There is also a corresponding decrease of babies completely bottle fed. The trend is the same for the Addington Hospital, although not as marked. Since there is such a high incidence of illegitimacy among the Bantu and Coloured communities, and yet an almost one hundred per cent breast feeding picture, it is obvious that the marital status of the mothers does not affect the results in these groups. There were no records of any illegitimate Indian births in this group, except for one case which was discarded owing to incomplete data on feeding. The comparatively low incidence of breast feeding in this Indian group then, is not related to the marital status of the mothers.

(e) Effect of age of mother and rank of baby on feeding.

The effects of age of mother and rank of baby on feeding, are analysed in the European and Indian groups only, since so few Bantu and Coloured babies are not breast fed. Table 77 shows the percentage of babies breast fed according to these two factors. The babies are divided into first born (Rank 1), second to fourth born (Ranks 2 - 4) and fifth and later born babies (Rank 5+), and the mothers into three age groups: up to 19 years, 20 to 29 years, and over 30 years. Only legitimate babies are considered. In the European group having their first babies the youngest mothers are the most successful breast-feeders.

TABLE 77

PERCENTAGE OF BABIES BREAST FED, ACCORDING TO RANK AND AGE OF MOTHER. (LEGITIMATE BIRTHS ONLY).

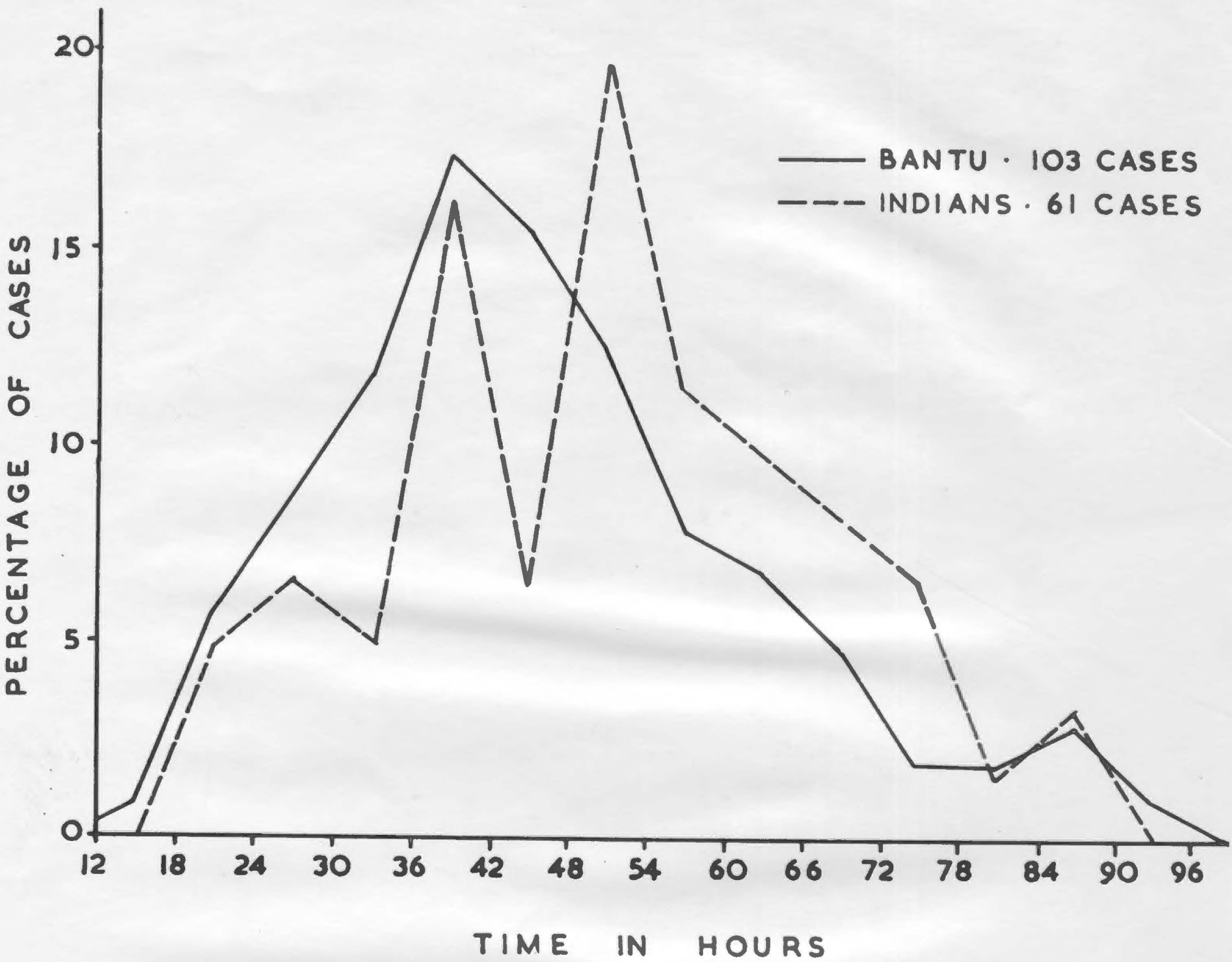
EUROPEANS

AGE OF MOTHER	RANK 1		RANK 2 - 4		RANK 5+	
	No. in group	% Breast fed	No. in group,	% Breast fed	No. in group	% Breast fed
→ 19	96	99.0	16	87.5	1	-
20 - 29	294	94.6	541	98.0	55	100.0
30 +	50	86.0	270	91.1	105	92.4
INDIANS						
→ 19	19	73.7	10	50.0	1	-
20 - 29	32	68.8	75	73.3	29	69.0
30 +	3	-	4	-	22	72.7

For both Ranks 2 - 4 and Rank 5+ the optimal lactation age appears to be 20 - 29 years. The most successful single group is that of mothers of 20 - 29 years having Rank 5+ babies. Here 100 per cent breast feeding is recorded. In the Indian group the same results are found, except that in Rank 5+, mothers of 30+ are more successful. The most successful Indian group is that of the youngest mothers having their first babies, and even here, only 74 per cent are recorded as wholly breast feeding. It is interesting to note again that by the time an Indian mother is 30+, she is almost invariably having her 5th or higher born baby, whereas the majority of babies born to European mothers of this age are 2nd to 4th babies. The most unsuccessful breast feeding group are the elderly European primiparae and the very young Indian mothers having their 2nd to 4th babies.

CHART 13

FREQUENCY DISTRIBUTION OF TIME AFTER BIRTH AT WHICH MILK CAME INTO THE BREASTS



2. TIME AT WHICH MILK FIRST COMES INTO THE BREASTS.

Chart 13 depicts the frequency distribution of time after birth at which milk came into the breasts. Table 78 shows the mean time in hours between birth and the appearance of milk, for Bantu and Indian mothers, primiparae and multiparae, separately and combined.

T A B L E 78

TIME AT WHICH MILK CAME INTO BREASTS

	RANK 1			RANK 2+			COMBINED		
	No.	Mean (hrs)	S.D. (hrs)	No.	Mean (hrs)	S.D. (hrs)	No.	Mean (hrs)	S.D. (hrs)
Bantu	39	47.46	17.33	64	45.65	16.02	103	46.34	16.55
Indian	26	55.39	16.27	35	48.26	15.53	61	51.29	16.24

It will be seen that for both groups the milk appears earlier in the multiparae than the primiparae. The difference is most striking in the Indian mothers, being 7 hours earlier, as against only 2 hours earlier in the Bantu mothers. Milk is found to come in earlier in the Bantu than the Indian group for both primiparae and multiparae, 8 hours sooner in the primiparae and about 2½ hours earlier in the multiparae. These differences are not statistically significant, but the trend is consistent and it is possible that if the experiment had continued longer, with a larger number of cases, a significant difference might have been found.

DISCUSSION.

Incidence of breast feeding.

There are several features of great interest in the incidence of breast feeding in these four racial groups. In the first place, the incidence of 93.4 per cent among Europeans is very high in comparison with the findings in America and Britain. This can be seen very clearly when comparing results with those of thirteen other recent surveys (Table 79). I found also, as did the Ministry of Health Report (1944) that illegitimacy amongst Europeans militates against breast feeding. A further factor to be considered is the attitude to breast feeding on the part of the people responsible for the delivery. The sister in charge of the maternity ward at the Addington Hospital was determined that the

TABLE 79

INCIDENCE OF BREAST FEEDING IN PREVIOUS SURVEYS COMPARED WITH PRESENT SURVEY

AUTHOR	DATE PUBLISHED	PLACE AND DATE OF SURVEY	NO. OF CASES	RESULTS
Gordon	1942	Borough of Ilford 1920-24	1,168	87% breast fed at health visitor's first visit (2-3 weeks after birth)
		1930	1,772	87% breast fed as above
		1938	1,093	73% breast fed as above
McNeil	1942	Edinburgh Children's Hospital	100	62% weaned by the end of the first month
Ministry of Health Report	1944	Country-wide 1931-41	?	80% breast fed on discharge from hospital 95% breast fed when midwife leaves (if delivered at home)
Bain	1948	2,513 hospitals, U.S.A. 1946	39,171	38% breast fed completely on discharge from hospital
Hughes	1948	Newbiggin-by-the-sea 1941-45	548	29% weaned by 2 weeks
"Maternity in Great Britain" Survey. Quoted by Douglas	1950	Great Britain, 1946	13,687	78.3% breast fed completely at 2 weeks 55.1% breast fed at 8 weeks
Newton and Newton	1950	Hospital of the University of Pennsylvania	91	55% successful breast feeders during hospital stay
Ross and Herdan	1951	Bristol, 1947-48	1,047	81.5% completely breast fed at 2 weeks
Lussky	1951	Evanston Hospital, Illinois	1,754	37.2% completely breast fed on discharge from hospital
Miller	1952	Simpson Memorial Maternity Pavilion, Edinburgh 1948-49	2,024	77% breast fed on discharge from hospital
Stocks and Stang	1953	Health Division No. 14 of Lancashire County Council, 1950	650	62% breast fed at 2 weeks
Curtin	1954	Cork, 1952-53	1,007	46.6% breast fed at 2 weeks
Hytten	1954	Aberdeen Maternity Hospital, 1951-53	6,456	84.5% fully breast fed on discharge from hospital
Present Investigation (Europeans)	1955	Durban, South Africa, 1951-52	1,480	93.4% breast fed on discharge from hospital

babies would be breast fed, and she achieved very good results. The nursing staff at Mothers' Hospital could not be as dogmatic, since many of the mothers had private doctors, and the incidence of breast feeding is lower there. The fact, however, that 93 per cent of European babies are completely breast fed on discharge from hospital does not mean that breast feeding is continued for long thereafter. Although I have not followed up these children, it is my opinion, an opinion confirmed by the hospital staffs, that there is a very rapid falling off in breast feeding, as can be seen when the mothers return with their babies to baby clinics. Since artificial feeding has become safe and easy, there has been a swing against universal breast feeding by European mothers, but in South Africa it is quite definitely the custom of the non-European groups to breast feed their babies, the general pattern being a self-demand regime. Barrow (1952) in an analysis of the feeding of 1,565 infants at St. Monica's Home, Cape Town (mainly Coloured patients) found 96.5 per cent to be fully breast fed on discharge from hospital. I expected to find an almost one hundred per cent breast feeding picture in the non-European groups, and was surprised at the comparatively low incidence (71 per cent) in the Indian mothers.

From our experience at the Institute of Family and Community Health, which deals with all races, and at the Springfield Health Centre, which is predominantly an Indian health centre, Indian mothers continue to breast feed their babies for a long time, 18 months to 2 years being quite common. There is certainly no desire to put their babies on the bottle, and in fact, studying the figures, very few are on the bottle (2 per cent). A large percentage however, (27 per cent) are supplemented by bottle feeding in addition to the breast, when delivered in hospital.

Mention has been made of the influence exerted by the medical and nursing staff of a hospital. Indian babies are small - average weight at birth 6.46 lb, (Chapter 1), and it is possible that their smallness influences the sister of the ward to supplement their feeds. If the babies continue losing weight for 4 days, they are test weighed on the 5th day, and if this result is unsatisfactory the feeds are supplemented. However, the sister is not likely to advise supplements on discharge from hospital if she does not consider it essential, since she is fully aware of the poverty of the people.

With these facts in mind I examined one year's records of the Health Centre midwife at Springfield, about a quarter of the total births in the area. This sister was a determined protagonist of breast feeding, and 95 per cent of the babies were fully breast fed on the 9th day. However, an examination of one year's records of babies attending the mother and baby sessions at the Springfield Health Centre shows 87 per cent totally breast fed at 0 - 2 weeks, 86.6 per cent at 2 - 4 weeks and 72.6 per cent at 4 - 8 weeks. The truth probably lies somewhere between the hospital and the Health Centre figure, but the indication is that Indian mothers are not as successful in breast feeding as the Coloured and Bantu mothers. This confirms my earlier impression.

One possible factor which militates against breast feeding in hospital for Indian mothers is the complete lack of privacy. African mothers breast feed their babies in the streets with no self-consciousness; Indian mothers, on the other hand, are extremely shy, and conceal their breasts and the baby during feeding. As visiting hours at McCord's Hospital are very free and easy, and as Africans and Indians occupy the same wards, the breast feeding situation must often be embarrassing for the Indian mothers. Newton and Newton (1950) consider that, amongst other causes, embarrassment inhibits the let-down reflex, and therefore should be avoided in the feeding situation.

<u>The effect of parity and age of mother</u>.

The Maternity in Great Britain Report found that age of mother or parity were of little importance as factors affecting the success of lactation. Norval (1947), though she did not consider parity to influence the supply of breast milk, stated that there was a decrease in the adequacy of the breast milk supply after the age of 30, particularly in women having their first child. Miller agreed with Norval, and Lussky also found that while parity was not important, breast feeding decreased with increasing age of mother. Hughes (1948) and Dummer (1949) found incidence of breast feeding to be higher among primiparae, but Neale et al found a lower incidence among first born up till 2 months of age. Waller (1950) found that younger women produced more milk than older women, and that multiparae produced more than primiparae.

Dean (1951) found a fall in milk yield with increasing age of mother in the first week, and Hytten (1954) found a highly significant negative correlation between age of mother and success of breast feeding in hospital. Age for age, multiparae were more successful than primiparae. In this investigation multiparae are more successful breast-feeders than primiparae, and European elderly primiparae are not as good lactators as young primiparae. On the other hand, in the Indian group the most unsuccessful breast-feeders are mothers under 20 years having their 2nd - 4th babies. This last finding points directly to the importance of adequate nutrition in the establishment of lactation.

The effect of nutrition.

There is abundant evidence in the literature that markedly inadequate calories, and particularly deficiency in protein, will reduce the yield of milk - Adair (1925), Ebbs and Kelley (1942), Debré (1945), Williams (1945), Stuart (1947), Antonov (1947), Platt and Moncrieff (1947), and Kon and Mawson (1950). Dean says that undernutrition and anxiety usually occur together and that it is difficult to say which is the more important in lactation failure. Our experience at the Institute of Family and Community Health has shown that the diets of the pregnant Indian mothers are markedly deficient in both calories and protein, and that their nutritional state is the worst of the four racial groups. Added to that is their high fertility rate and close birth spacing, so that, as previously mentioned, mothers of 30+ years are almost invariably having their 5th and later babies. In addition, Indian custom is to eat very little for the first few days following delivery and to increase food intake from the third day. Further, the food provided by the hospital is predominantly a Bantu-type diet, which the Indian mothers do not like.

It is doubtful if the Indian mothers at McCord's Hospital can be regarded as representative of the Indian community in Durban, as it is not the general custom among Indians to have their babies in hospital. Although this is slowly changing, on the whole it is probably the better-off section of the population who are delivered in hospital. Their nutritional state would presumably be better than that of the mothers who have their babies at home. The fact that a greater percentage of babies delivered at home are wholly breast fed may mean that the home environment is more conducive to breast feeding, but it may also mean that the babies are inadequately fed.

The incidence of breast feeding in a community cannot be taken as a complete measure of lactation success. Much depends on the attitude of the mothers, doctors, nurses and relatives concerned in the delivery at hospital or at home, the availability of artificial foods, and of the money to buy them, quite apart from the production of milk in the mother's breasts.

I do not know whether inadequate nutrition has any effect on the time when milk first comes into the breasts, but it is interesting to note that the Bantu mother lactates earlier than the Indian mother.

Quantitative and qualitative studies of breast milk production in the four racial groups, both in hospital and at home would provide some of the answers to our questions if done in conjunction with growth analysis and detailed studies of community attitudes to breast feeding.

SUMMARY.

The incidence of breast feeding on discharge from hospital is analysed in 1,480 European, 326 Coloured, 1,482 Bantu, and 197 Indian mothers delivered in Durban from May, 1951 to April, 1952. The time when milk first comes into mothers' breasts is studied in 103 Bantu and 61 Indian mothers from February to June, 1951.

1. The mean length of stay in hospital varies from 7½ to 9 days.
2. Using only those babies who stay 5 - 14 days, the incidence of breast feeding on discharge is found to be: Bantu 98.6 per cent, Coloured 97.9 per cent, European 93.4 per cent and Indian 71.1 per cent.
3. There are more European babies bottle fed than partially breast fed, but the Indian group have a small percentage on the bottle only, and a large group receiving supplementary feeds.
4. With the exception of Coloured mothers, where the difference is 0.2 per cent, multiparae are more successful breast-feeders than primiparae.
5. When illegitimate babies are excluded, the percentage of European babies who are breast fed rises to 95.2 per cent. Illegitimacy does not appear to affect the feeding in the non-European groups.
6. Multiparae are more successful breast-feeders than primiparae.

Increasing age in European mothers is inversely related to lactation success, the most unsuccessful group being the elderly primiparae. Very young Indian mothers having first babies are the most successful group in that community, but this same age group shows the worst results if they are having their 2nd to 4th babies.

7. It is considered that the poor nutritional state of the Indian mothers, due largely to a very inadequate intake of calories and proteins, plus a high fertility rate resulting in big families with closely-spaced births, is probably responsible for their difficulty in the establishment of lactation.

8. Milk comes into the breasts sooner in Bantu than in Indian mothers, and in both groups earlier in multiparae than primiparae.

9. It is doubtful if the incidence of babies who are wholly breast fed can be taken as a complete measure of lactation success. Quantitative and qualitative studies of breast milk production, together with analysis of growth and investigation of community attitudes to breast feeding, would provide valuable information.

10. The literature is discussed.

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CHAPTER XVI

ILLEGITIMACY IN DURBAN

Illegitimacy is culturally defined. This investigation, therefore, does not purport to be a detailed sociological study, since for that, figures of illegitimacy must be related to the social conditions of the communities represented - their modes of marriage, family structure, religious sanctions, and legal and moral codes; economic standards also influence the incidence of illegitimacy and attitudes towards it.

In Western society illegitimate children are those born out of wedlock, in urban African society marriage rites may be delayed, but children are regarded as legitimate by virtue of the stability of the relationship between parents, or the promise of marriage when economically possible. Among Indians the same applies, though to a much lesser extent.

Malinowski (1930) in his writings on marriage and kinship stresses the "principle of legitimacy". By this is meant that in all human societies a woman has to be married before she is allowed to conceive. This attitude prevails not only among European but among primitive peoples as well. Even where pre-nuptial intercourse is tolerated, there is no tolerance to conception. He states further "the most important legal rule concerning the physiological side of kinship is that no child can be brought into the world without a man, and one man at that, assuming the role of sociological father, that is guardian and protector, the male link between the child and the rest of the community".

Kaberry (1949) queries whether in Australia, where there is no recognition of physiological fatherhood among the aborigines, one can speak of illegitimate children at all. She states that "as a rule a girl was living with her husband at puberty, and since there is no recognition of physical paternity, all the children she bore were regarded as his". Malinowski's principle of legitimacy is seen in Durban Indians where the desire is not for many children but for many legitimate children.

DATA USED.

Durban offers a fruitful field for a comparative study of illegitimacy, as it has at least four distinct race groups - European, Coloured, Bantu and Indian. I collected data from the records of the Registrar of Births and Deaths for European, Coloured and Bantu births, and from the records of the Protector of Indian Immigrants for "Passenger Indians" and "Indian Immigrants". Every live birth, multiple and single, for the year 1948 was extracted from the records. Since Indian birth registrations are often very long delayed, sometimes until school-going age, I used the 1948 records because this enabled me to get information in later years on babies born in 1948, but registered later. Although registration of birth is compulsory by law for all racial groups, the only group fully covered by registration is the European. Registration is particularly incomplete among the Bantu where most of the births registered are of babies born in the maternity hospitals.

It will also be noted that there are two distinct Indian communities recorded. The first, the "Indian Immigrant" group are the descendants of the Indians who were brought from India from 1860 onwards by the Government of Natal to work in the sugar fields, or as domestic and general labourers. The "Passenger Indians" are free Indians (not indentured) who paid their own passage fare from India to this country, and settled in Natal, mainly as traders among the indentured Indian population. (Ferguson-Davie, 1951). The Passenger Indians represent a small percentage of the total Indian population of Natal, an approximate estimate being 10 per cent, and they are predominantly Moslem. Most of the Indian trade is in their hands, and they are better off financially than the Indian Immigrants who are mainly Hindu, and predominantly unskilled labourers economically depressed. Birth and death records for these groups are kept separately. Unfortunately the ages of the Indian Immigrant mothers at the time of birth of their babies is not recorded in the registers. For all the other groups the age is given.

RESULTS AND DISCUSSION.

Table 80 and Chart 14 compare the European, Coloured, Bantu and Passenger Indian percentage of illegitimate births by age of mother. Only the total for Indian Immigrants is shown. The European, Coloured and Bantu births show a common feature in that most of the illegitimate births are of young mothers. The number of illegitimate births of Passenger Indians is so small that a very much greater sample would have to be used

TABLE 80

AGE DISTRIBUTION OF MARRIED AND UNMARRIED MOTHERS. BIRTHS REGISTERED IN DURBAN 1948.

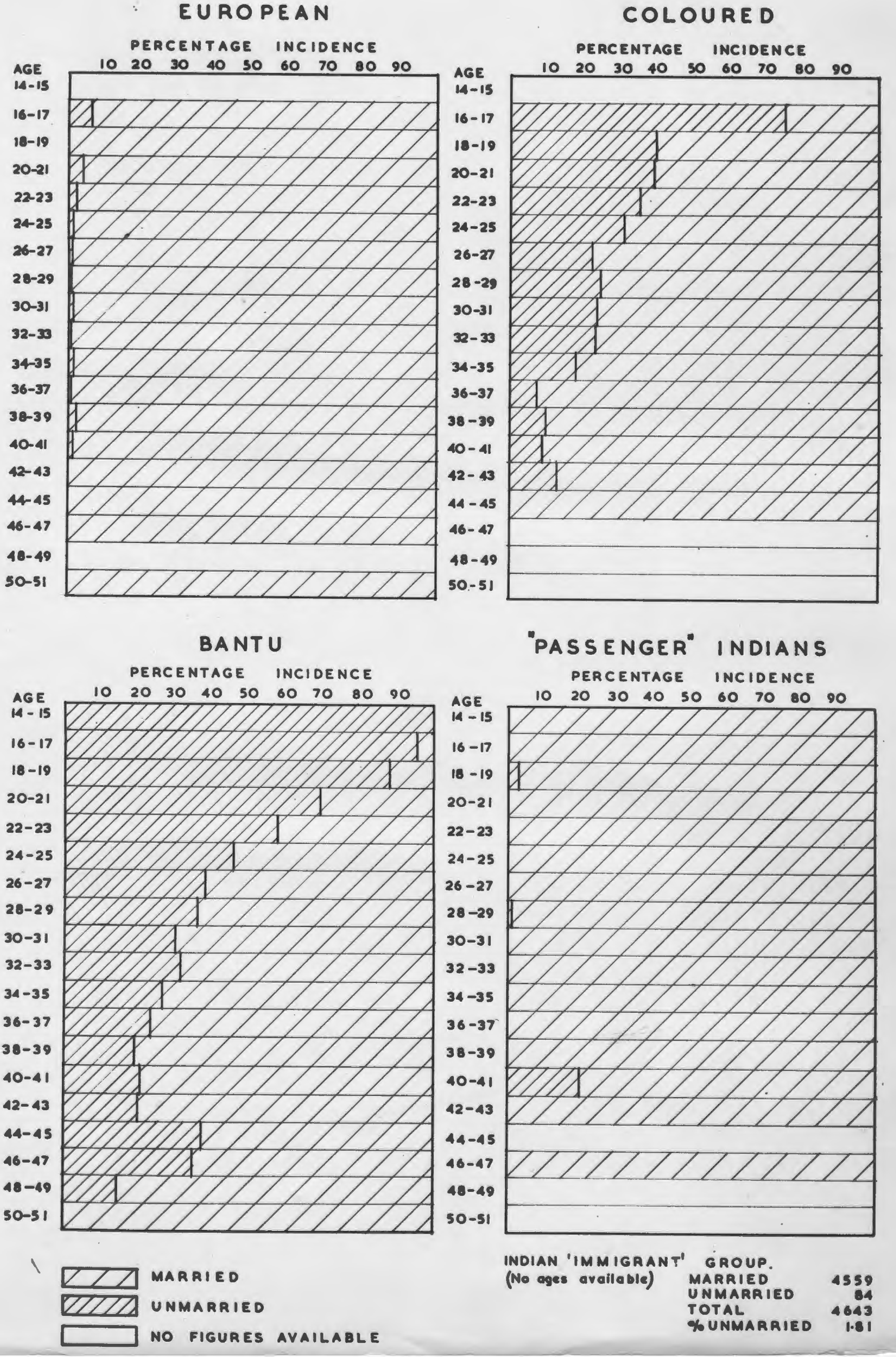
AGE :	EUROPEAN :				COLOURED :				BANTU :				"PASSENGER" INDIAN :			
	Married	Unmarried	Total	% Unmarried	Married	Unmarried	Total	% Unmarried	Married	Unmarried	Total	% Unmarried	Married	Unmarried	Total	% Unmarried.
14-15	-	-	-	-	-	-	-	-	-	16	16	100.0	1	-	1	0.0
16-17	14	1	15	6.7	4	12	16	75.0	9	220	229	96.1	18	-	18	0.0
18-19	138	-	138	0.0	42	28	70	40.0	80	607	687	88.4	54	2	56	3.6
20-21	335	15	350	4.3	65	42	107	39.3	299	696	995	69.9	60	-	60	0.0
22-23	420	10	430	2.3	53	30	83	36.1	425	604	1029	58.7	73	-	73	0.0
24-25	448	6	454	1.3	68	31	99	31.3	489	428	917	46.7	68	-	68	0.0
26-27	439	4	443	0.9	58	17	75	22.7	408	264	672	39.3	63	-	63	0.0
28-29	370	3	373	0.8	43	14	57	24.6	370	216	586	36.9	58	1	59	1.7
30-31	284	4	288	1.4	35	11	46	23.9	258	115	373	30.8	51	-	51	0.0
32-33	259	2	261	0.8	23	7	30	23.3	171	81	252	32.1	41	-	41	0.0
34-35	193	3	196	1.5	22	5	27	18.5	144	55	199	27.6	32	-	32	0.0
36-37	126	1	127	0.8	23	2	25	8.0	142	45	187	24.1	20	-	20	0.0
38-39	100	3	103	2.9	18	2	20	10.0	145	36	181	19.9	19	-	19	0.0
40-41	65	1	66	1.5	10	1	11	9.1	70	18	88	20.5	4	1	5	20.0
42-43	20	-	20	0.0	6	1	7	14.3	39	10	49	20.4	5	-	5	0.0
44-45	9	-	9	0.0	1	-	1	0.0	13	8	21	38.1	-	-	-	-
46-47	3	-	3	0.0	-	-	-	-	9	5	14	35.7	3	-	3	0.0
48-49	-	-	-	-	-	-	-	-	11	2	13	15.4	-	-	-	-
50-51	1	-	1	0.0	-	-	-	-	2	-	2	0.0	-	-	-	-
	3224	53	3277	1.62	471	203	674	30.12	3084	3426	6510	52.63	570	4	574	0.7

INDIAN "IMMIGRANT" GROUP : (No ages available)

MARRIED	:	4559
UNMARRIED	:	84
T O T A L	:	4643
% UNMARRIED	:	1.81

CHART 14

AGE DISTRIBUTION OF MARRIED AND UNMARRIED MOTHERS
BIRTHS REGISTERED IN DURBAN · 1948



to see if the same trend is present there as well. There is a striking contrast, however, in the percentage of legitimate and illegitimate births in these groups. The Passenger Indians have the highest percentage of married mothers, 99.3 per cent. They are closely followed by the Europeans with 98.38per cent married, which figure hardly differs from that of the Indian Immigrant mothers, 98.19 per cent. The Coloureds, however, have only 69.88 per cent of their mothers married, and the Bantu have more unmarried than married mothers, 47.37 per cent being married.

However inaccurate the registration figures may be, they are startling enough to warrant an exploration of the sociological background of these racial groups, in order to measure the effects illegitimacy may have on their respective communities.

Among Europeans strong social disapproval is shown towards unmarried mothers and their offspring. It is the exception for an unmarried girl to keep her baby. I examined the records of two large European maternity hospitals in Durban and found that in almost all cases European illegitimate babies are adopted, and are weaned during their stay in the hospital preparatory to that adoption. (See Chapter XV).
The sanctions of European society would tend to keep the incidence of illegitimacy low, and both unmarried mothers and their babies would suffer.

The Indian Hindu community is very strict in its attitude to premarital conception. The family is a large well-knit unit and the girls are closely chaperoned. They maintain their traditional marriage customs. The Hindu in South Africa are, however, in a transition period. The traditional joint family is gradually breaking down, owing to unsatisfactory conditions of housing, increasing education of girls, and their gradual employment outside the home in factories and domestic work. This results also in a conflict between the generations. Caste regulates marriage and especially among upper-caste families violation of regulations involves out-casting. Marriage is a family affair and there is no divorce among the Hindu. The family regard illegitimate conception as a disgrace, and the mother, though not the child, is stigmatised. Hindu girls who become pregnant before marriage have been known to commit suicide rather than bear the disgrace. Full marriage rites cannot be performed for an unmarried mother, though she may have the opportunity to marry an old man or a widower.

In a preliminary field study on illegitimacy in Merebank Indians, Kuper (1953) found that in a number of cases the girls' parents shifted from the area to avoid the disgrace. Every attempt was made by them to arrange for the girl's marriage to the father of her child, although no full ceremony could be performed, since this would involve the marriage of the unborn child as well. If a marriage did not take place, they tried to have the baby adopted. The boy's parents were usually very unwilling to accept the girl. In only two of the 22 cases studied did the boy marry the girl; the other girls remained unmarried and two of them became pregnant again by other men. In 14 cases the baby remained with the mother and her parents, in 4 cases the babies were adopted by childless relatives of the mother.

The low incidence of illegitimacy among the Indian group is therefore not surprising, but it is possible that the true figure may be a little higher than is actually recorded, since illegitimate births may be concealed by non-registration, late registration, or registration after adoption.

I know very little about the Moslem community but it appears that the girls are even more strictly kept than among Hindus. They are hardly allowed to venture outside the family fold, and they have even less schooling than the Hindu girls. So strong is the family solidarity and so carefully are the girls looked after that Indian Health Assistants working at the Institute of Family and Community Health expressed surprise that any illegitimacy at all was found in this community. It is interesting in this regard, that the few cases which did occur, were among older rather than younger women, but the number is too small to enable me to decide whether this is a chance occurrence or not.

For the purpose of official statistics, the term Coloured, "embraces not only the Cape Coloured and 'other persons of mixed race', but also the Cape Malays, the Bushmen, and the Hottentots ..... In 1936, not less than 75.21 per cent of all Coloured were classified as 'Cape Coloured'. As the name suggests, these products of miscegenation originated chiefly in the Cape Province. The bulk came from unions between Cape Malays or Europeans and the aboriginal Hottentot population.

At a later stage, the number of Coloured further increased by miscegenation between European and Bantu and by secondary miscegenation, that is, the crossing of pure with mixed races". (Sonnabend, 1949).

The attitude of the Coloured folk in Durban to illegitimacy varies depending on whether the parents come from the country or are townspeople. Those coming from the country are much stricter and deplore their daughters' "bad ways". In the town, however, illegitimacy is perforce accepted now, though with shame. There is no stigma attached to the baby, and the unmarried mother very often marries subsequently. Studies of this community at the Institute of Family and Community Health, showed that they lacked a cohesive family or community life, and a unifying tradition.

The Bantu present a rather different problem. Here we have a change of attitude which is very marked and very rapid, and which is an important aspect of the tremendous revolution in the habits of the Bantu since their contact with Europeans.

Customary marriage is legalised by the transfer to the wife's people of lobola (Nguni) or boxadi (Sotho), a material consideration generally taking the form of cattle. (Shapera, 1934). The primary function of lobola is to legitimise the marriage and its resultant offspring. All children born to a woman for whom lobola has been transferred or promised are considered to be the legal offspring of her husband, even though he may not be their physiological father. Children born to a woman for whom lobola has not been transferred or contracted are regarded as illegitimate. They belong to their mother's family and kin, their father having no claim to them unless he makes a special payment.

A child born of an adulterous intercourse does not belong to its natural father but to its sociological father. The child born to a widow at her late husband's home is regarded as his, it bears his name and has the same rights as the children born during her husband's lifetime, particularly when the widow has been taken over by her husband's brother or some other approved relative under the levirate custom. (Krige, 1937).

The lobola system has survived although the missionaries strenuously opposed it. It has, however, changed in some respects, becoming more of a commercial transaction, in many cases money being substituted for cattle.

According to Shapera (1937) there has also been a marked change in the relationship between parents and children. The decline of ancestor worship has deprived the father of his role of family priest, and the abolition or modification of the old initiation ceremonies has led to a slackening of family discipline. Labour migration deprives the family of parental authority for long periods at a time, and the sons migrate to the towns and live independently of the family. The young people no longer accept the guidance of their parents in all things, but tend to do as they please. Sexual life in the reserves has been affected. The decline of polygamy means that many women can no longer marry young. When young men leave the reserves, it leads to a disproportion of the sexes, and as a result the age of marriage rises. Sexual morality has consequently relaxed, particularly since the young are now much more independent than of old, and illegitimacy is becoming increasingly common in the reserves, although it is still frowned upon by parents and elders.

Migration takes place for various reasons, but the most important reason is economic. The peculiar feature of Bantu migrant labour is that so many workers are regarded as and regard themselves as merely temporary residents in the town. They work in the towns, going back periodically to their homes in the Reserves. There is a growing tendency, however, for the family to establish itself in the town, but this is restricted by lack of land and housing. The migratory labour system has far-reaching consequences, and is disrupting the stability of family life as it was in the Reserves. (Van der Horst, 1949).

"Bantu urbanisation has not been a straightforward process of the townward migration of a rural population ..... ". A permanent labour force in secondary industry dependent on a cash wage and living a family life in the town is gradually developing, but there is also a large floating population of whom the great majority are men. The ratio of Bantu men to women in the towns is often two to one, rising to four to one in certain places. The presence of large numbers of unattached males leads inevitably to casual unions and an increase of prostitution. There are no forces to integrate the developing urban society, for the sanctions of the tribe no longer operate. (Hellmann, 1949). Under these conditions illegitimacy becomes extremely common, as is reflected in my figures. The parents are very worried about this, but are powerless to prevent it.

It is impossible to say whether the actual incidence of illegitimacy among Durban Bantu would be higher or lower if registration were complete. Births outside of the hospitals are more likely to be notified by married people, but the great bulk of registrations are from hospitals, whose figures are probably not weighted in one or the other direction.

A very important factor, however, which would tend to exaggerate the incidence of illegitimacy, is that, although the registration clerks accept customary as well as civil marriages, they do not know the family background of the people concerned, and many cases which may be recorded as illegitimate may in fact be sociologically legitimate in the Bantu community.

I decided therefore to investigate the incidence of illegitimacy in two communities served by the Institute of Family and Community Health, and used the birth records of Bantu babies born in Lamont location, Durban, from 1950 to 1953, and of Indian babies born in the Springfield housing scheme, from 1948 to 1952. (See Table 81).

TABLE 81

PERCENTAGE OF ILLEGITIMATE BIRTHS ACCORDING TO RANK OF CHILD, IN TWO COMMUNITIES SERVED BY THE INSTITUTE OF FAMILY AND COMMUNITY HEALTH.

	BANTU: Lamont, 1950-53			INDIAN: Springfield, 1948-52		
	All Births	Primip.	Multip.	All Births	Primip.	Multip.
No. of total births +	977	193	750	415	55	329
% Legitimate	68.4	35.8	77.2	96.1	83.6	98.2
% Illegitimate	28.4	61.1	19.7	3.9	16.4	1.8
% Unmarried but stable union	3.2	3.1	3.1	-	-	-

+ It must be noted that the numbers of primiparae and multiparae do not add up to the numbers of total births, as the rank of the child was not known in many cases.

It will be seen that there is far less illegitimacy in Lamont than in Durban as a whole, 28.4 per cent as against 52.63 per cent. One would expect this result since Lamont Location is a family housing scheme. It has the disadvantage, however, of having a barracks for single men on its outskirts. The young girls again have most of the illegitimate births, only 35.8 per cent are married and 61.1 per cent unmarried when they have their first babies.

The other interesting feature of Lamont is the presence of a group of people who are not married, either by civil or customary rites, and yet have stable unions, so that the child is born into a stable family and to all intents and purposes is not sociologically illegitimate. Such children would certainly be reflected as illegitimate in the figures collected by the Registrar of Births and Deaths.

The Springfield Indian figures (mainly Hindu) on the other hand show an increase in the percentage of unmarried mothers, 3.9 per cent as against 1.81 per cent for Durban. This is probably due to the fact that at the Springfield Health Centre we know about all the births, and illegitimacy would not be concealed as it might be in Durban as a whole by non-registration, or late registration by adoptive parents. The young mothers again are responsible for most of the illegitimate births, 16.4 per cent of the primiparae being unmarried.

On the whole medical practitioners are interested in illegitimacy chiefly from the point of view of infant morbidity and mortality. It is well known that in European society illegitimate infants have a higher infant mortality rate than legitimate infants, the figures given in the Maternity in Great Britain Report (1948) being 65 per thousand live births for illegitimate as compared with 45 for legitimate births.

In the introduction to Section IV I mentioned the use of figures of incidence of illegitimacy as a measure of family stability, and implied that where the figures were high, maternal efficiency was likely to be low, and infant mortality high.

The evidence presented in this chapter proves that Indian urban family life is more stable than that of the Bantu. The unmarried Bantu mother (particularly the young girl) is hardly likely to be efficient in the rearing of her offspring. Since more than half the Bantu babies registered in Durban in 1948 belonged to unmarried mothers, it is hardly surprising that the Bantu infant mortality rate is so high.

The Indian mother on the other hand is seldom unmarried, and lives in a community with very strong family ties. Despite the poverty and poor nutritional state of the Indians, their babies live. I feel that in these two communities, at least, there is a very strong positive correlation between incidence of illegitimacy and infant mortality rates.

SUMMARY.

1. Illegitimacy is defined in relation to the society in which it occurs.

2. The incidence of illegitimacy is given for the four racial groups in Durban in 1948. The incidence is lowest of all in the "Passenger" Indians and highest in the Bantu.

3. Illegitimacy is inversely related to age of mother.

4. Some sociological data is given for the Coloured, Bantu and Indian groups, and the attitude to illegitimacy in the four races is discussed.

5. It is concluded that incidence of illegitimacy is a measure of family stability, and indirectly of maternal efficiency, and that there is a strong positive correlation between incidence of illegitimacy and infant mortality rates.

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SUMMARY

This thesis is a study of South African infant growth, and is a comparative analysis of groups of European, Coloured, Bantu and Indian babies. The work is divided into four sections:

Birth weight (Chapters I - VI).

Growth in the first 10 days of life (Chapters VII - XI).

Growth in the first year (Chapters XII - XIV).

Some factors affecting maternal efficiency (Chapters XV - XVI).

A. BIRTH WEIGHT.

Birth weights and incidence of prematurity are calculated for the four racial groups and the effects of race, sex, birth rank, age of mother and season of birth on the birth weights are discussed.

Europeans have the highest and Indians the lowest birth weights of the four groups. The incidence of prematurity is lowest in the Europeans and highest in the Indians. It is suggested that socio-economic status (which includes nutritional state) is responsible for these findings, and not race per se.

Boys weigh more than girls in all racial groups.

Mean birth weight increases with birth rank in all racial groups.

The effect of age of mother on birth weight is different in Europeans and non-Europeans. In general, maternal age is inversely related to birth weight in Europeans and positively related in non-Europeans. It is suggested that cultural factors may be responsible for the differences found.

Indian babies show more seasonal variation in birth weight than the other groups, which may be related to their mothers' nutritional state.

B. GROWTH IN THE FIRST 10 DAYS OF LIFE.

In this section the weight of Bantu babies in the first 10 days of life is discussed, with special reference to the effect of birth rank, sex, marital status, birth weight and time of first feed on this growth. A comparison is made of the neonatal progress in the first week of life of the four racial groups, with respect to seven factors, and

the effect of birth weight on this progress is analysed. This section also includes an analysis of the effect of three-hourly, four-hourly, and self-demand feeding, on the progress of Bantu babies in the first week. The effect of season of birth on the neonatal progress of European and Coloured babies is discussed.

Bantu babies grow well from the third day after birth, and have regained their birth weight by the ninth day. No relationship exists between marital status of mothers or sex of babies and this growth, but later born babies do better than first born. The effect of birth weight on this progress is slight, and less than the effect of time of first feed, which is best given within six hours of birth.

Comparison of neonatal progress in the four racial groups shows that although European babies do not lose much weight after birth, they gain the least weight and end up the worst of the groups by the seventh day. This is probably due to the difference in the ease with which European and non-European mothers accept and establish lactation.

The effect of birth weight is not consistent for first and later born babies.

Babies fed on a self-demand regime progress better than those who are clock-fed, and babies fed three-hourly do better than those fed four-hourly.

Babies born in the summer months lose less weight than those born in the winter months.

C. GROWTH IN THE FIRST YEAR.

The diets and growth of Coloured, Bantu and Indian infants attending the Springfield Health Centre are compared. Growth curves are constructed for the four racial groups from babies attending the Durban Municipal Child Welfare Clinics, and the effect of sex, birth rank and birth weight on growth is discussed.

Although Coloured babies appear to have the most varied diet, Bantu babies grow faster and are heavier than Coloured.

European babies grow more slowly than non-Europeans in the first two months of life, but are heavier than all the other groups at the end of the year. Bantu babies are heavier than all the rest until 30 weeks of age. The relatively slow growth of European babies in early life is due to underfeeding and the method of feeding employed; the retardation of growth of the non-European groups in the second six months of life is due to inadequate and unsatisfactory mixed feeding. The superiority shown by Bantu babies in the first six months of life is due to the remarkable ability in lactation of the Bantu mothers.

Boys are consistently heavier than girls, but although European boys grow faster than girls throughout the year, non-European girls start growing faster than boys in the second half of the year. It is suggested that under adverse environmental conditions girls grow faster than boys.

First babies, though lighter at birth, overtake later born babies during the year.

By virtue of their superior birth weight, babies who are heavy at birth remain heavier throughout the year, but gain in weight is unrelated to birth weight.

D. SOME FACTORS AFFECTING MATERNAL EFFICIENCY.

Indian babies are lighter at birth and grow less well throughout the first year, but Indian infant mortality rates are far lower than those of Bantu. It is suggested that these facts may be explained, in part at least, by a comparison of the relative efficiency of Indian and Bantu mothers. Two indices of maternal efficiency are discussed:
The incidence of breast feeding on discharge from hospital, and
The incidence of illegitimacy.
Both measures are analysed in all the groups.

Bantu mothers are better lactators than Indian mothers from the time their babies are born, and since all a baby's needs are satisfied by indulgent and adequate breast feeding in early life, in this respect, at least, the Bantu mother is more efficient than the Indian. This is reflected in their babies' growth curves.

Incidence of illegitimacy among Indians is low, but over half the Bantu births registered in Durban are those of unmarried mothers. This is related to the breakdown in urban Bantu family life. Under these conditions family stability and maternal efficiency is low, and infant mortality high.

Detailed summaries appear at the end of each chapter.