DIETARY INTAKE IN AN URBAN AFRICAN POPULATION IN SOUTH AFRICA - WITH SPECIAL REFERENCE TO THE NUTRITION TRANSITION

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Thesis presented for the Degree of

DOCTOR OF PHILOSOPHY

in the Department of

Community Health

UNIVERSITY OF CAPE TOWN

August, 1996

To my parents

Clive and Shirley

who taught me about perseverance

AND

to my husband, David, and sons,

Gerald and Jonathan

for their endurance and loving support

This thesis is presented in fulfilment of the requirements for the degree of Doctor of Philosophy (Ph.D) in the Department of Community Health, Faculty of Medicine, University of Cape Town. The work on which this thesis is based is the author's original research except as stated in the acknowledgements, and has not, in whole or in part, been submitted for another degree at this or any other university. The university is empowered to reproduce all or part of the contents for the purposes of research.

Signed by candidate

signature removed

Lesley Thelma Bourne

Date: August 1996

"Maize (what we called mealies and people in the West call corn), sorghum, beans and pumpkins formed the largest portion of our diet, not because of any inherent preference for these foods, but because the people could not afford anything richer. The wealthier families in our village supplemented their diets with tea, coffee and sugar, but for most people in Qunu [Transkei] these were exotic luxuries far beyond their means..."

"Of my mother's three huts, one was used for cooking, one for sleeping and one for storage. In the hut in which we slept, there was no furniture in the Western sense. We slept on mats and sat on the ground. I did not discover pillows until I went to Mqhekezweni. My mother cooked food in a three-legged iron pot over an open fire in the centre of the hut or outside. Everything we ate we grew and made ourselves. My mother planted and harvested her own mealies. Mealies were harvested from the field when they were hard and dry. They were stored in sacks or pits dug in the ground. When preparing the mealies, the women used different methods. They could ground [sic] the kernels between two stones to make bread, or boil the mealies first, producing umphothulo (mealie flour eaten with sour milk) or umngqusho (samp, sometimes plain or mixed with beans). Unlike mealies, which were sometimes in short supply, milk from our cows and goats was always plentiful."

Nelson Mandela. *"Long Walk to Freedom."* Little Brown, 1994. (Chapter 2 pp 9, 10).

"Five years ago the bleak salt flats outside Cape Town were empty and desolate, nothing there but sand dunes, scrub, thousands of corrugated iron toilets shaped like sentry boxes and wind blowing sand around.

Now it's a city of sorts, a metropolis of shacks and shanties, as densely packed and alley-driven as a walled medieval city and populated by fantastic characters — bootleggers, Cape Rastas, daggarokers, witchdoctors, thugs and revolutionaries plus a million ordinary working people for whom life is tough.

It's a liberated zone of sorts, a place where the white government has virtually no influence, and even the police dare not set foot. Some parts of it are ruled by people's committees, others by dictatorial strongmen in the traditional African mould.

There is courage here and resourcefulness, and laughter, but there is appalling violence, hunger and hopelessness too."

Di Caelers. *The Argus*, Newspaper, Cape Town, March 15, 1991.

ACKNOWLEDGMENTS

I would like to thank the successive heads of the Department of Community Health, Professor J.M.L. Klopper and Professor J. Myers, as well as my supervisors, Dr K. Steyn, Dr P.L. Jooste and Professor M.N. Hoffman for their guidance.

Dr C.J. Lombard and Mrs J.A. Laubscher of the Medical Research Council (MRC) and Mr A.R. Sayed of the University of Cape Town provided invaluable statistical advice. I am grateful also to Mrs M.L. Langenhoven for her dietary insight and support.

Dr Spinnler Benadé of the NRPNI, MRC is thanked for his support and access to facilities.

I am grateful to Judy Katzenellenbogen then of CERSA, MRC for her enthusiastic flow of ideas.

Professor D. Labadarios from the Department of Human Nutrition, University of Stellenbosch is thanked for organising the blood vitamin analyses, and for sharing his expertise.

I would like to express my sincere appreciation to the intrepid team of nursing sisters for collecting data and drawing samples under difficult circumstances.

I owe a debt to the many people (far too numerous to list) both in government structures, and those in opposition, who at a turbulent time in South African history, opened many a door to facilitate this study.

Financial assistance for the study was mainly provided by the MRC. I was also in receipt of doctoral bursaries from the MRC and the University of Cape Town.

Jean Fourie is especially thanked for the typing and layout of this thesis, and for her continued support throughout.

Finally, I am indebted to my family and friends for bearing with me until its completion.

ABSTRACT

An assessment of the nutritional status of a representative sample of an urban African population has not previously been conducted, nor the extent to which the traditional diet has been abandoned for a western diet. To meet this end, a cross-sectional analytic study was carried out on a representative sample (N=1146) of the urban African population, aged 3 - 64 years in 1990. Particular attention was paid to specific at-risk groups viz. preschoolers (aged 3 - 6 years; N=163), adolescents (aged 15 - 18 years; N=119) and adults (19 - 44 years; N=649). The interrelationships of dietary intake with socio-economic status, demographic indicators as well as measures of urban exposure were also examined. A further aim was to determine the extent to which this rapidly urbanising population's macronutrient profile had shifted from a traditional towards a western atherogenic dietary pattern.

This analytic study was nested in a community-based descriptive survey on risk factors for cardiovascular disease. A multi-staged, proportional sampling strategy was used. Quotas were used in the final stage of sampling, based on the age/sex distribution of a 1988 census conducted by the local authorities. Dietary data were collected by means of the 24-hour recall method, by Xhosa-speaking registered nurses who had received intensive training. Anthropometric measurements were taken, and blood samples were drawn according to standard procedures. Socio-demographic questions elicited information on the physical environment and facilities, educational level and employment status. Information was also elicited regarding urban exposure relating to lifetime migration history, thus incorporating retrospective temporality into the study design. From these data, an index of urban exposure was established by calculating the percentage of life spent in an urban environment.

Univariate analyses of dietary, anthropometric and biochemical vitamin status were used for the descriptive components of the study of the three specific at-risk age categories. Bivariate analyses examined the effects of selected proxies of socio-economic status, and urban exposure on dietary intake. Finally, multiple linear regressions were performed on the preschoolers (N=163) and adult sample, aged 15 - 64 years (N=983) incorporating additional indicators of socio-economic status as predictors, and dietary intake data as outcome measures. Correspondence analysis further explored the relationships between dietary atherogenicity (using the Keys score) and other risk factors for degenerative disease.

The results of the 24-hour dietary recall data reflected a population consuming a diet meeting prudent dietary guidelines in all the three age categories (i.e. 3 - 6, 15 - 18 and 19 - 44 years). However, 50% or more subjects in all subgroups reported intakes <67% of the Recommended Dietary Allowance (RDA) for the following micronutrients: vitamin A, ascorbic acid, thiamin, riboflavin, niacin, vitamin B_6, iron, zinc and copper. Among adults low micronutrient intakes were supported by biochemical serum vitamin analyses, conducted on a sub-sample. Of the three age categories, the adolescent age group reflected the highest proportion of respondents reporting micronutrient deficient diets. Women of childbearing age were also particularly micronutrient deficient.

Examination of reported median food group intakes in terms of generally accepted guidelines, revealed that the diets in all age groupings were deficient in dairy intakes (≤0.5 portions) and fruits and vegetables (≤2 portions). The evening meal emerged as the main meal of the day in all age categories, with a considerable proportion of nutrients being consumed during 'snacking' periods distributed throughout the day. A particularly disturbing finding was that on the day of recall, only 45% of preschoolers consumed three meals.

A complex picture of under- and overnutrition emerged from examinations of the anthropometric data in all subgroups. In 3 - 6-year-olds, 27.6% were stunted (z-score <-2 height-for-age), 7.9% were wasted (z-score <-2 weight-for-height) and 7.7% were underweight (z-score <-2 weight-for-age) while 20.1% reflected a z-score >+2 weight-for-height, reflecting a substantial proportion of obese children. Gender disparities in anthropometric status were apparent in 15 - 18-year-old adolescents. In young men, 39.7% were underweight (vs. 4.8% in women), while 30.6% of female adolescents were overweight (vs. 10.4% in men). Anthropometric differences between the genders were particularly striking in men and women aged 19 - 44 years, where 31.2% of women were obese (body mass index >30) as opposed to 5.6% of men.

In bivariate analyses, higher socio-economic status was associated with diets of better micronutrient quality, particularly in preschoolers and adult women. However, a general finding was that higher socio-economic status was also associated with significantly higher dietary atherogenicity. Also consistent with the literature, it was found that dietary intakes became significantly more western in macronutrient composition with increasing urban exposure. Intakes of fats and animal protein increased significantly, while consumption of carbohydrates, plant protein and fibre decreased significantly. The Keys score also reflected these findings by increasing significantly with increasing urban exposure.

Regression analyses corroborated these shifts. However, the relatively low R^2 values did not permit accurate predictive modelling of dietary data. The correspondence analysis again confirmed an association of high urban exposure and formal housing with higher dietary atherogenicity, while the more prudent scores were associated with low urban exposure, low educational status and informal housing.

The study shows that diets of urban Africans are becoming increasingly westernised, and the data suggest that this occurs within a lifetime. It was concluded that with continuing urbanisation and improvements in socio-economic status, dietary intake will contribute to an accelerating, increased risk of degenerative disease in this population. The diet remained micronutrient deficient (expressed in terms of <67% RDA) at all levels of urban exposure.

Comparison of the macronutrient data reported in this study with other local studies on urban Africans over time, indicates the occurrence of a nutrition transition.

A NOTE ON RACIAL AND ETHNIC TERMINOLOGY

The use of terms to describe the racial and ethnic stratification of the South African population is both complex and contentious. Ramphele and Heap (1991)* have discussed this in detail, specifically referring to Cape Town:

"In South Africa the categories 'white' 'coloured' and 'black' based on population classification legislation were, and still are (for comparisons drawn in the literature) often used as surrogates for social conditions. Use of these categories in the literature highlights at a broad level the relationship between the health policy of the previous government and health status, and the relationship between this policy and the unequal distribution of health care resources. However, this approach did not take account of the considerable material and social differentiation within these political categories. Also, the categories 'urban' and 'rural' are often used without sufficient attention to definition and in the case of mobile populations, when neither strictly applies. Many South Africans are migrants, whose lifestyle has been one of forced oscillation between 'rural' home-base and 'urban' work-base. The effects of mobility on disease prevalence and its investigation are generally recognised as a neglected area in epidemiology. These issues are very pertinent in the greater Cape Town area where no 'population group' is homogenous with respect to socio-economic status, and where a large proportion of the population have experienced frequent rural-urban movement over the years."

Nonetheless the choice of acceptable terminology changes continuously. It is presently customary to refer to the indigenous black population as 'African'. Hence this term will be used in this thesis.

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* Ramphele, M.A. & Heap, M. (1991). Health status of hostel dwellers (Part I). *S. Afr. Med. J.* **79:** 697-701.

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CHAPTER 1 INTRODUCTION

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTORY COMMENTS

Changing epidemiological profiles of developing countries are leading, in many countries quite rapidly, to fundamental changes in the volume and composition of demand for health services and needs for health promotion (Mosley, *et al.*, 1993). South Africa as a developing country is no exception. However, this country has certain unique features primarily owing to its heterogenous mix of cultures, and variations in socio-economic conditions, exacerbated by over four decades of apartheid rule. The African population of South Africa which forms the bulk of its total population, has been particularly disadvantaged by the political philosophy of apartheid. Just one of the manifestations of this, were the legislative attempts to confine Africans (with the exception of migrant workers) to the generally impoverished rural areas or 'homelands'. Despite these constraints, Africans, including the families of migrant workers, surged to the cities in search of better employment prospects, health care, and the gamut of benefits afforded by the urban infrastructures.

It was estimated that in 1990, 35.5% of the population of Africa as a whole, lived in urban areas (Population Crisis Committee, 1990). In South Africa, a projection for the year 2010 estimated that by then, 70% of South Africa's population will be urbanised (De Coning, 1990), affecting mainly the African population. Another estimate has suggested that changes in the urban African population would be from 32.6% in 1980 to 75% in the year 2000 (Yach, 1988). According to the 1991 Census 43.4% of the African population lived in urban areas (Central Statistical Services, 1992). The rapid urbanisation and acculturation of the African population, places it at risk for several diseases (Yach, 1988). Progressive urbanisation and industrialisation have been linked to changes in mortality and morbidity, embodied in the notion of the 'epidemiological transition' (Omran, 1971). Transition is characterised by declines in infectious diseases and increases in the occurrence of chronic diseases and trauma. South Africa and other developing countries in Africa may well experience a 'protracted transition' where the mixture of chronic disease and infection could coexist for some time (Soberon, *et al.*, 1986). Consequently in setting out dietary recommendations many international agencies have opted for the prevention not only of nutritional deficiency diseases but of chronic and degenerative diseases as well (Harper, 1987).

There are a number of international examples, documented in the late 1970s and early 1980s of dietary transitions associated with new health and disease effects. These have usually arisen as the result of Western influence and more particularly through the introduction of such nutrients as refined sugar, saturated fat, salt and alcohol. Earlier examples of dietary shifts of the hunter-gatherer ecosystem are the Australian Aborigines (Elphinstone, 1971), and the Eskimos, and from the peasant agricultural ecosystem, Papua New Guinea (Sinnet and Whyte, 1981) and the Pacific Islanders (Zimmet and Whitehouse, 1981). In addition, a notable dietary transition has been recorded in Japan since the second World War (Yamamoto, 1981). Studies of immigrant groups have provided solid data of the dietary transitions and their nutrition-related physiological outcomes – notably the Japanese immigrants to Hawaii and California (Marmot, 1975), and the Western European immigrants to Australia (Stenhouse and McCall, 1970; Mc Michael and McCall, 1980). In all these examples, adoption of the western diet has been associated with the appearance of diabetes mellitus, hypertension, obesity and coronary heart disease.

Popkin has more recently investigated the links between nutrition and chronic disease patterns both in the U.S. (Popkin, 1993) as a high income country and in several low income countries (Popkin, 1994). In the developing world he has noted a 'simple imitation' of the Western diet. From this data he has pointed out that "concurrent changes in demographic and epidemiologic outcomes are linked with the nutrition transition." He has summed up the linkages of these transitional phases in the model presented below.

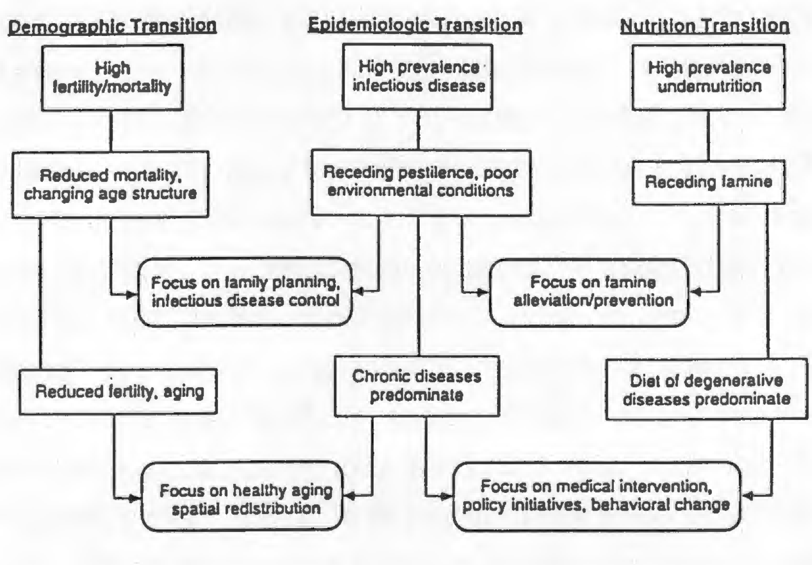

Figure 1: Stages of health, nutritional and demographic change (Popkin, 1994)

Since these shifts are occurring worldwide in many countries across many cultures, and because they are associated with urbanisation, industrialisation, and migration, it is pertinent to examine the situation among Africans in South Africa. It is well known that there has been an erosion of the traditional African lifestyle and diet over many decades. The traditional food of rural Africans is low in fat and high in unrefined carbohydrate and fibre, and there has been much speculation about the shift from this pattern to a Western atherogenic* diet with increasing urbanisation (Burkitt, 1982; Segal and Walker, 1986).

Manning, *et al.* (1974) reported that such atherogenic changes were already evident in Cape Peninsular Africans during the early 1970s, and Rossouw (1990) found urban African 11-year-old children of Cape Town to have higher levels of atherosclerotic risk factors than their rural counterparts. However, no study describing the dietary intake of a representative sample of urban adult Africans has been conducted in South Africa. Since the abolition in 1986 of laws preventing the migration to the cities by Africans, this urban population has increased dramatically with in-migration from former 'homelands', thus exposing ever-increasing numbers of Africans to the pressures of urban life. This highlighted the need to determine current nutrient intake, the contribution of the diet to degenerative disease risk, and to pinpoint problem areas with respect to dietary deficiencies or excesses for preventive or remedial action in this population.

Apparent rural-urban differences in cardiovascular disease (CVD) morbidity and mortality among black South Africans, have suggested that the process of urbanisation may predispose the burgeoning urban African population to develop this and other diseases in the decades to come. The lack of data on the prevalence of risk factors in this population prompted a Risk Factor Study (BRISK, acronym for risk factors in blacks) in the urban African population of Cape Town (Steyn, *et al.*, 1992). This study included an investigation of dietary intake, since dietary intake has been shown to contribute to several CVD risk factors, and degenerative diseases in general (Rossouw, 1983). Simultaneously an examination of nutritional status was included because of the poverty endemic in Cape Town (Wilson and Ramphele, 1989). Attempts were also made to link dietary intake with urban exposure, and changes in socio-economic status (SES), in order to establish the extent to which dietary atherogenicity is associated with features of urban life. Papers published to date from the BRISK study appear in Appendix **A**.

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* It must be noted that the term 'atherogenic' does not denote the presence of atherosclerotic lesions. The term is used as a relative indicator to demonstrate the direction of changes to the diet, as promotive or otherwise of atherogenesis.

1.2 AIMS AND OBJECTIVES

1.2.1 AIMS OF STUDY

The overall aims of this study were to determine the dietary intake of the African population of Cape Town, with special emphasis on at-risk subgroups, and to examine the interrelationships of indicators of SES, including urban exposure, on dietary intake. In view of these aims, appropriate recommendations for remedial action will be made and explained in terms of the nutrition transition. The descriptive components of this study were essential because no previous population-based studies have been conducted on a representative sample of urban Africans.

1.2.2 OBJECTIVES

(i) To determine the nutrient intake and food and meal patterns of the target population.

(ii) To measure the heights and weights of the target population, as an indication of nutritional status.

(iii) To ascertain the blood vitamin status of a subset of the study sample in order to investigate biochemical supportive evidence of the dietary data and to comment on biochemical assessment of the study sample.

(iv) To determine the interrelationships between nutrient intakes with socio-economic and demographic indicators and measures of urban exposure.
Proxies for SES include:
housing type, availability of electricity, fridge ownership, level of education attained, employment status, and degree of urban exposure.

(v) To report the findings set out in objectives (i) - (iv) of the target population, with particular emphasis on the age groups 3 - 6, 15 - 18, and 19 - 44 years*.

(vi) To discuss the findings in the light of shifts from a 'traditional' dietary pattern towards a 'western' dietary pattern.

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* In order to reduce the complexity of analysing the data by age strata, the following age categories were examined in detail. The justification for this is in terms of the life cycle approach indicated in section 2.3.2. However, in certain sections where appropriate, such as in the multivariate analyses, age is analysed as a continuous variable in the age ranges 15 - 64 years.

Preschoolers are globally considered to be an at-risk age group. The cut-off of 3 years was chosen in view of prolonged breastfeeding in certain cases. Adolescents were included from the ages 15 - 18, since this age group has unique features. A considerable proportion of individuals from this age category are either scholars, already employed and/or bearing children (see Chapter 2, section 2.5.2). A relatively young adult age category was investigated, since this group comprises the most economically active age sector, who largely represent the decision-makers regarding food choice and preparation for the family. Additionally the women are of childbearing age.

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CHAPTER 2 REVIEW OF THE LITERATURE

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CHAPTER 2

REVIEW OF THE LITERATURE

In this literature review some key features relating to the objectives will be explored. The following sections of this chapter will cover aspects of nutritional assessment, as far as it relates to the evaluation of dietary intake and anthropometric status, as well as the nutrition transition in the African population of South Africa. This serves as a background to the motivation for the choice of methods used in this study. A review of local literature on the nutritional status of the African population will then be included. This will cover rural/urban comparisons and where possible, changes over time. From the international literature an examination of some socio-economic and other forces impacting on dietary intake, including a section dealing with migration and urbanisation will follow. Finally, the last section will place the local situation in context, thereby providing the background to the study.

2.1 NUTRITIONAL ASSESSMENT

2.1.1 Definition and descriptions of terms used

This section with its definitions and clarifications of terminology contextualises their use in this manuscript.

NUTRITIONAL ASSESSMENT:

"The interpretation of nutrition-related information obtained from dietary, biochemical, anthropometric and clinical studies."

The information is used to determine the health status of individuals or population groups as influenced by their intake and utilisation of nutrients (World Health Organisation, 1976).

MALNUTRITION:

". . . an impairment of health resulting from a deficiency, excess or imbalance of nutrients. It includes *undernutrition*, which refers to a deficiency of calories and/or one or more essential nutrients, and *overnutrition*" (Robinson, 1972).

A classification of malnutrition is presented in Table 2.1.

Table 2.1: Classification of malnutrition (McLaren, 1976)

1. Cause	Primary (exogenous) Secondary (endogenous)
2. Type	(i) Excess, toxicity (overnutrition) (ii) Deficiency (undernutrition)
3. Nutrient	Vitamins, elements, protein, energy sources
4. Degree	Mild, moderate, severe or alternately depleted stores, biochemical lesions, functional changes, structural lesions
5. Duration	Acute, subacute, chronic
6. Outcome	Reversible, irreversible

Malnutrition and its sequelae will be discussed briefly under the following headings:

(a) Undernutrition

(b) Overnutrition

(c) Vitamin and mineral deficiencies

(a) Undernutrition

Definition:

"The pathological state resulting from an inadequate quantity of food over an extended period of time" (Jelliffe, 1966).

A reduced food intake in both adults and children, leads to weight loss, largely through loss of fat, muscle and skin. However, with time, important losses also occur from the intestinal tract, kidneys, liver, heart, lungs, reticuloendothelial tissue and even the brain. When undernutrition is severe, subcutaneous fat virtually disappears and muscle mass may be reduced by more than half. Such extremes are rarely noted in South Africa.

As body weight is reduced with continued food restriction, a corresponding reduction takes place in the energy and nutrient requirements. Ingested food is utilised more efficiently. Voluntary activity or external work is greatly reduced, resulting in a state of apathy. In young children the capacity to compete for food resources in the household may be lost, creating a vicious circle. Such children may be perceived as 'well behaved' and undemanding, which can exacerbate the situation.

Another very serious consequence of chronic undernutrition is the decrease in the inflammatory and immune responses. Because invading organisms are not resisted, repeated or chronic infections occur. This in turn will lead to specific nutrient deficiencies (Golden and

The term *Protein Energy Malnutrition* (PEM) refers to the entire spectrum of undernutrition, which may occur in young children from the very mild, subclinical form, to degrees of stunting, including 'nutritional dwarfs', to the severe acute forms such as kwashiorkor and marasmus. In adults this is manifest firstly as wasting and ultimately as marasmus. Other nutrients are frequently deficient in PEM, namely iron, folate, vitamin A as well as magnesium, potassium and zinc. Currently, at least as many children are underweight not because of protein and/or energy deficiency, but due to infectious diseases and micronutrient deficiencies. The effects of stunting and wasting in preschoolers and school children differ greatly, in that stunting and wasting are far more conducive to morbidity and mortality in the younger segment. The effects of different forms of PEM in late childhood and adult life are currently under much consideration due to their relative significance regarding more immediate or more long term priority. One of the most recently studied issues is the potential contribution of childhood deprivation to the onset of degenerative diseases in later life (Barker, 1992).

The prevalence of undernutrition in South Africa and its implications is dealt with in section 2.3.

(b) Overnutrition

Definition:

Obesity has been defined in a variety of ways. One such definition is:

"... an increase in body fat out of proportion to other tissues (Wolff and Lloyd, 1974) and should not be confused with overweight, although this is also a manifestation of an excess intake of energy in relation to energy output" (Pizak, 1983).

The most common definition of obesity is the finding of "a body weight of more than 20 percent of the mean standard weight for age, height and gender" (Wolff, 1965). Overweight is defined as a weight of 110 to 119 percent above the standard.

A third definition, which in practice approximates the previous one, is that obesity is considered present when a person has a body mass index (weight [kg]/height [m]^2) equal to or greater than 30. Overweight is expressed as >25 - ≤30 in men and >24 - ≤30 in women (Bray, 1978).

Obesity is increasing in both the developed and the developing countries (Walker, 1983; Popkin, 1994), and has been described as the most common nutritional disorder after dental caries of all populations (Walker, 1985). In the past obesity has been associated with affluence, however, currently it is well established that obesity exists in situations of poverty, particularly among women. In South Africa the prevalence of obesity in African women is more than five times that of men, while in more affluent local groups there is only a slight gender difference. Another local phenomenon in rural African women (De Villiers 1988) also noted in Afro-American women, is the possible existence of 'healthy obesity' among individuals who apparently exhibit minor or no negative health sequelae usually associated with obesity (Callaway, 1984; Walker, 1995).

Brooke and Abernathy (1985) have summarised the effects of obesity across the age groups as follows:

(i) Overnutrition results in an increase in height during childhood, and consequently obese children tend to be taller than average. However, obesity may also occur earlier with a retardation in growth resulting in an adult with a height below the full potential.

(ii) Impaired glucose intolerance has been found in a number of obese children and the assumption has been made that insulin resistance develops. The same pattern occurs in adults, and in all age groups this is reversible on weight loss.

(iii) Respiratory effects have been noted in very obese children and adults. Chronic hypoventilation, particularly during sleep may result in respiratory failure with carbon dioxide retention and hypoxaemia. If allowed to persist this may result in heart failure and death can occur.

(iv) Hypertension is more frequent among obese than non-obese individuals, including children.

(v) In adults, obesity is closely associated with a multitude of diseases including diabetes, hypertension, stroke, congestive heart failure, coronary heart disease and toxaemia of pregnancy. It also increases the risk for hernias, gallstones, varices, osteoarthritis, menstrual disorders, depression and several forms of cancer (Straw, 1982).

(c) Vitamin and mineral deficiencies

Vitamin and mineral deficiencies can occur in individuals who are underweight (i.e. experiencing energy deficits) and those who are overweight (i.e. experiencing an excess energy intake). For example, both wasted and obese individuals may be anaemic.

According to Marks (1975), vitamin deficiencies are the result of four major factors that are usually interrelated:

(i) Poor climatic conditions result in areas where adequate food cannot be produced. These include periods of excess rainfall or drought and areas such as the polar regions, deserts and rain forests.

(ii) A high population density and a low socio-economic status give rise to an insufficient and inadequate food supply.

(iii) Food taboos are still very common in undeveloped countries. These may contribute to deficiencies in the sense that foods, which are primary sources of particular micronutrients, may be excluded from the diet (even when they may be available at low cost).

(iv) Inadequate facilities for health and nutrition education still occur in many areas of the world. This impacts on food production and food choices.

The following general consequences of vitamin deficiencies are found in the international literature.

(i) Vitamin A deficiency is very common in many parts of the world particularly in those areas where there is a prolonged dry season and/or periods of drought (Mamdani and Ross, 1988).

(ii) Riboflavin deficiency is extensive due to its poor absorption from vegetable sources, and insufficient intakes, particularly from milk (Ajayi, 1984).

(iii) Vitamin C deficiency is also seen frequently in areas with prolonged dry seasons, where fresh fruit and vegetables are limited.

(iv) Most deficiencies of B vitamins are seen as a mixed deficiency involving riboflavin, thiamine, nicotinic acid, folic acid and rarely pantothenic acid. Thiamine deficiency is still found in wheat- and rice-consuming populations, and niacin deficiency where maize is the staple diet.

As regards micronutrient mineral deficiencies, iron deficiency is one of the most common deficiency diseases in the world second only to PEM (Florentino and Guirriec, 1984). However, endemic goitre resulting from iodine deficiency is also a problem of worldwide importance (Hetzel, 1988).

2.2 MEASURING NUTRITIONAL STATUS

2.2.1 Measuring nutritional status by dietary methods

The literature on dietary survey methodology is vast, and during recent years interest appears to have gained momentum. Workers tend to hold strong views regarding the complexities in measuring intakes of individuals and particularly at efforts to validate the various methods. As long ago as 1962 Mann, *et al.* complained that "a superficial examination of the technical problems experienced in measuring dietary intake meets such a morass of conflicting opinions that the first inclination is apt to be a decision for abandonment." Although this field of enquiry has become increasingly sophisticated in Western populations, very few studies actually deal critically with methodologies pertaining to semi-literate or functionally illiterate populations in developing countries. This makes the above quotation extremely relevant to the Third World Countries.

Willett (1990) stated that "conventional wisdom suggests that diets of poor populations in non-industrialised areas are homogeneous, so that within-person variation may not be a serious consideration for epidemiological studies." This view has been supported by a study conducted by De Villiers (1988) among rural Zulu women living in a very remote area. She found that the women followed a relatively simple diet with little day-to-day variation, a finding supported by Majoli (1986).

However, Willett (1990) further speculated that where economic resources are severely restricted, food intake is strongly linked to income so that even small economic differences are directly reflected in diet, and that this linkage would increase between-person variation.

Moreover, he mentioned that day-to-day variation may be particularly large in developing countries if expensive foods can be afforded only irregularly, for example meat. This would impact on both inter- and intra-individual variation. He further commented on the impacts of seasonality, cultural taboos and personal preferences. It can be argued that many of these variables apply to a lesser extent in industrialised countries.

In cross-cultural studies (e.g. Western oriented researchers investigating traditional societies in developing countries), cognitive issues regarding perceptions of time, size, shape, and volume, have hardly received any attention in dietary research. This pertains especially to African populations. In urban African populations there can be wide disparities in educational status ranging from no education to completed tertiary education, and cultural differences varying from a traditionally oriented lifestyle and mind-set to a 'sophisticated' western way of living. The choice of an appropriate dietary method encompassing all this diversity represents a pressing challenge.

Therefore, there is a need for researchers who are 'Western-trained' working cross-culturally to recognise how Western constructs influence their own thinking, and how these in turn influence their interpretations of the various dietary methodologies. Cassidy (1994) has drawn attention to the Western constructs such as 'the individual' and 'the meal', which may not apply in different cultures where alternative constructs operate, such as 'the group', the 'shared pot' and nibbling through the day (sometimes technically referred to as 'grazing'). She has called for a culturally sensitive approach, as outlined in her model (see Fig. 2.1 below), where existing methods can be adapted to the study population.

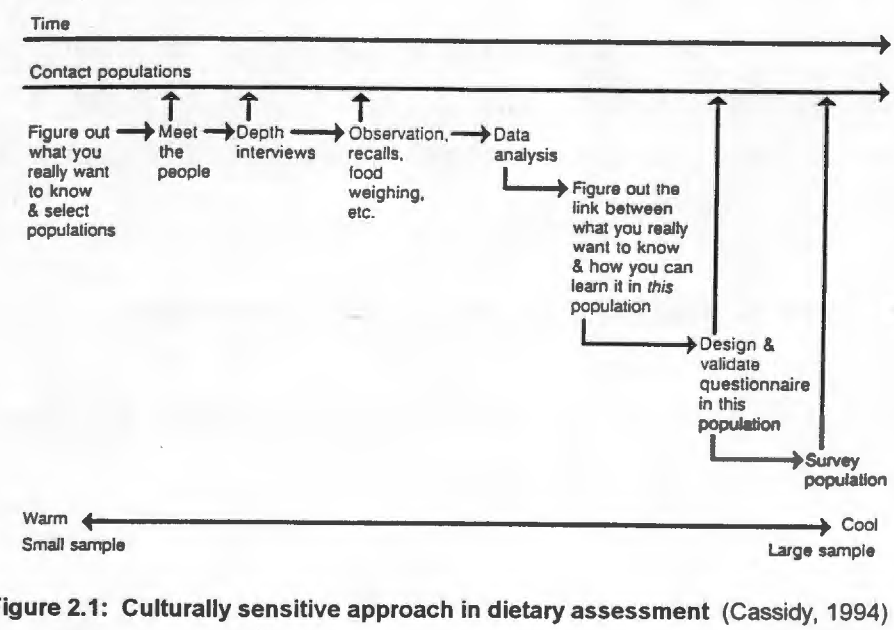

Figure 2.1: Culturally sensitive approach in dietary assessment (Cassidy, 1994)

(a) Issues in the choice of an appropriate dietary method

The Life Sciences Research Office report, *Guidelines for Use of Dietary Intake Data* (Anderson, 1986), suggests that the researcher ask two questions in the search for an appropriate method:

(i) What does the study purport to measure?

(ii) Does the method suit the purpose of the study?

While these questions address the two fundamental issues that have to be faced by any researcher, teasing it out is important as are attempts to have an incisive view of the underlying factors. A set of recommendations for selecting dietary methods was recently put out by the National Centre for Health statistics (NCHS) at the Center for Disease Control and Prevention (CDC) (Wright, *et al.*, 1994), which succinctly provides guidance regarding issues in selecting a dietary intake method. These appear to be universal. (See Table 2.2 on p. 15).

All these issues certainly pertain to developing countries, and while it may prove easier to answer certain questions utilising a body of literature, questions relating to educational status and those relating to the implications of ethnic diversity, may be in the field of unchartered or less understood territory. The relevance of cultural perceptions relating to any form of enquiry has been raised above, as is the need to draw upon other disciplines.

Nevertheless, there remains a requirement to investigate existing methodologies and examine their advantages and disadvantages though the research may be based in contexts very different to the population under question. Furthermore, the limitations imposed by certain methods when conducting analyses and interpreting results have to be considered.

(b) Methods available – advantages and disadvantages

The various methods are described, with advantages and disadvantages inherent in their usage, in the summary table (Table 2.3) on page 16.

Table 2.2: Issues in selecting a dietary intake method

Dietary methodological considerations	Dietary component of interest	Food(s) or food group(s) Nutrient intake (from foods and supplements)
		Supplements (including vitamin/mineral and other dietary supplements)
		Non-nutrient food component(s), such as caffeine, additives
	Temporal pattern of interest	Usual or chronic
		Acute
	Why is diet of interest? What is the intended purpose for the data?	Mean intake of a particular food, nutrient or food component
		Comparison of intakes of different groups
		Proportion of population above or below a recommended standard level of food or nutrient intake.
		To assess trends in the mean or distribution of food and/or nutrient intakes
		To associate intake of food(s) to health or disease
Population characteristics of study sample	Geopolitical Unit	National sample
		State sample
		Regional sample
		Reservations or other geographical areas
	Demographic characteristics	Age/birthrate
		Gender (sex)
		Income
		Race/ethnicity
	Education	Cognitive skills
		Literacy skills
	Ethnic diversity	Primary language other than English
		Cultural sensitivities
		Food patterns
	Physiologic differences	Pregnancy, lactation, pre-post-menopausal state, illness
Operational/administrative constraints:	Resources	Staff/personnel required
		Computer resources/capability for automation

Source: Wright, et al., (1994) CDC Consensus Workshop

Table 2.3: Methods available to determine dietary intake

METHOD	DESCRIPTION	ADVANTAGES	DISADVANTAGES
WEIGHED FOOD RECORD	The precise weighing method involves the weighing of every item eaten by the individual, including ingredients used in the preparation of food and plate waste. The weighed inventory method is a simplified method and only food already prepared is weighed prior to eating. Plate waste is taken into consideration. Analysis is done by means of aliquot samples or calculation from food composition tables.	Most accurate method can be used to validate other methods suitable for studies on individuals	Expensive. Non-random sampling sample size limited. Heavy respondent burden. Literacy essential. Simplification of diet by respondent. Meals away from home create problems.
ESTIMATED FOOD RECORD	Amounts of food consumed are recorded in detail. Portion sizes are estimated using food models, standard measuring instruments or photographs.	No special equipment needed. Higher degree of co-operation than with weighed food record. Suitable for studies on individuals	Not so accurate. Loss of detail when household measures are converted to weights. Literacy required. High respondent burden.
DIETARY HISTORY	Questions are asked on the general food patterns and habits over a longer period of time to establish usual dietary intake.	Usual eating pattern determined. Large numbers possible. Lower respondent burden than with weighed records. Random sampling possible. Once – only interview that can be conducted anywhere. No change in normal eating habits.	Long interview. Heavy demands on interviewer. Experienced interviewer required. Present eating habits influence past habits. Relies on memory. Not for children (< 12-13 years).
DIETARY RECALL	Food consumption for a previous time period is recalled as accurately as possible. The recall period may vary from one day to two weeks although the 24-hour recall is most commonly used.	Low respondent burden. Takes relatively little time. Low refusal rate. Relatively low cost. Suitable for most age groups. Suitable for large numbers. Representative of intake for groups (N > 50) Reliable for groups with a relatively monotonous diet. Random sampling possible. Complete information which can be converted to nutrients.	Relies on memory. One recall not representative of individual's intake. 'Flat slope syndrome'. Underestimation of intake.
FOOD FREQUENCY (Qualitative)	Foods are grouped into categories and the respondents are asked to recall the frequency with which they eat various foods per day, week or month.	Lends itself to large scale epidemiological research. Allows a rapid feedback to studied population. Low respondent burden. Classify respondents into categories of low, medium or high intake.	Not suitable for nutrient calculations, especially on a micro-level.
QUANTIFIED FOOD FREQUENCY	Foods are grouped into categories and the respondents are asked to recall the frequency with which they eat various foods per day, week or month, and to determine the quantities typically consumed.	Low burden on respondent. Usual pattern determined. Large numbers possible.	Experienced interviewer required. Heavy demands on interviewer, overestimation of intake.
FOOD BALANCE SHEETS	An indirect estimate of the amounts of food consumed by the population of a country at a certain time.	Gives a total view of food supplies of a country. Conclusions can be drawn about food habits. Can be used to evaluate development. Can be used to plan international nutrition policy.	Shows only total amounts of food available. Food wastage is not recorded. Does not indicate actual amounts consumed. Does not indicate distribution of food. Does not indicate use by non-residents. Reliability depends on the statistics used for calculations.
FOOD ACCOUNTS	Records are kept for food items purchased over a specific period of time. This is usually accompanied by an inventory of all foodstuffs at the beginning and end of the period.	Large numbers possible. Annual mean consumption can be determined. General food patterns and habits can be determined. Data can be collected over a relatively long period of time. Does not change diet. An inexpensive method.	Literacy essential. Data not very accurate. Does not indicate wastage. Distribution of food between individuals is unknown. Sample is often not representative.

Sources: Jensen, 1981; Krantzler, et al., 1982a; Marr, 1971; Pekkarinen, 1970; Roberge, et al., 1984; Langenhoven, 1991

(c) Sources of error in dietary assessment

Dietary investigations in any cultural setting are subject to errors in measurement. The primary sources are discussed below:

(i) Respondent biases, may lead to respondents over reporting consumption of 'good' foods such as fruits and vegetables and underreporting of 'bad foods' such as salty snacks, sweets and alcohol. However, perceptions of 'good' and 'bad' foods can be culturally based and are also influenced by the degree to nutrition knowledge of the respondent. Overweight respondents may underreport intakes while underweight individuals may over report consumption (Kumanyika, 1987; Braitman, *et al.*, 1985). This may depend on cultural perceptions relating to body size and shape.

(ii) Interviewer biases may occur if different interviewers probe for information to varying degrees, intentionally omit certain questions and/or record responses incorrectly.

(iii) Respondent memory lapses may result in unintentional omission or addition of foods in recall methods.

(iv) Incorrect estimation of portion size occurs when respondents fail to quantify the amount of food consumption of when interviewers record portion sizes incorrectly (e.g. 50 ml instead of 500 ml).

(v) Condiment usage may be omitted from the dietary record or recall, causing significant errors in the calculated nutrient intakes. This is particularly the case when added fats as flavour enhancers are omitted.

(vi) The 'flat slope syndrome' is a bias that may be introduced by a tendency to over report low intakes and to underestimate high intakes in recall methods.

(vii) Coding and computation errors when serving size estimates are converted from household measures into grams, or when food items are incorrectly coded. (This may occur if figures are transposed or if for example skimmed milk is coded as whole milk.) Adapted from Marr (1971).

(d) Validity of dietary methods

Validity describes the degree to which a dietary method measures what it purports to measure (Klaver, *et al.*, 1988). Dietary methods designed to characterise usual intakes of individuals are the most difficult to validate because the 'truth' is never known with absolute certainty (Block, 1982). To detect any changes in usual intake during the study, observations of actual intake before or after the study period should be compared. Such a procedure presents overwhelming practical difficulties, and consequently validity is generally determined in dietary methods covering relatively short time frames.

The errors that affect the validity of a dietary method are generally systematic errors, while those associated with precision are random. At present, very little is known about the extent or direction of systematic errors associated with validity. They are more difficult to control than the measurement errors described above. Attempts have been made to assess relative validity by utilising a variety of combinations of dietary methods. However, for any combination, good agreement does not necessarily indicate validity. On the other hand, disagreement between the two methods suggests that at least one dietary method is invalid (Mahalko, *et al.*, 1985).

Anthropometric as well as physiological measures have been used to measure the validity of different dietary intake methods (Rush and Kristal, 1982). Biochemical indicators give a more accurate reflection of nutritional status than dietary intake (Hegsted, 1982). However, the use of anthropometric, physiological and biochemical indicators raise questions of the time frames involved in both the indicators and the dietary methodologies. For example, anthropometric extremes (such as obesity or underweight) reflect food intake over a long period of time, so it may be unrealistic to expect good agreement between anthropometric measures and dietary intake determined by a single 24-hour recall.

(i) Validity of dietary histories

Very few studies have measured the validity of the dietary history method by comparison with actual food intake.

The relative validity of the dietary history method has been extensively assessed using the seven-day weighed or estimated food record as the reference method. In general this method produces higher estimates of group mean intake than the seven-day record if the time frame for the history has been assessed over a fairly lengthy period (six months to a year) (Young, *et al.*, 1952; Jain, *et al.*, 1980). However, in cases where a shorter time frame for the dietary history method has been used smaller differences in mean intake have been reported (Dawber, *et al.*, 1962; Reshef and Epstein, 1972).

The validity of the diet history method appears to be based not only on typical patterns but also on time constructs. In populations with high mobility and questionable incomes, its validity has yet to be examined. Literacy is not essential for the administration of this method.

(ii) Validity of food records

Attempts to directly validate the seven-day weighed food record have been made by comparing noon meals with each record with actual intakes, weighed surreptitiously during lunch at a congregate meal site for the elderly (Gersovitz, *et al.*, 1978). Although the record tended to underestimate the actual mean intakes, differences were only significant for energy and thiamin. Regression analysis showed that records from the first two days of record keeping were more valid for assessing group comparisons because of deterioration in accuracy of recording. Usable records during days five to seven were from the more highly educated respondents, resulting in sample biases. This has obvious implications for samples where both literacy and educational status are questionable.

Intermittent duplicate diet collections have also been used to validate weighed and estimated food records (Gibson and Scythes, 1982; Sherlock, 1983; Holbrook, 1984; Kim, *et al.*, 1984). For example, in a U.S. study, 29 subjects consuming self-selected diets kept detailed food records for one year and periodically made duplicate diet collections (Kim, *et al.*, 1984) the daily energy and nutrient intakes calculated from the one-year food records were significantly higher than those calculated from the records made during collection of the duplicate diets. Gibson and Scythes (1982) also demonstrated a decrease in energy intake of as much as 20%, associated with the collection of duplicate diets for analysis.

Hence, duplicate diets are not an ideal method for validating food record methods (Stockley, 1985) and certainly would be highly impractical both logistically and economically in impoverished African study populations.

(iii) Validity of food frequency questionnaires

Willett (1990) has done extensive research on both the validity and reproducibility of the food frequency questionnaire method and has concluded that this method "is the most appropriate for dietary assessment in epidemiologic studies". However, it has to be stressed that the majority of the research undertaken has been conducted in western populations and in the U.S. in particular. The method is based on western time constructs (notably 'weekly', 'monthly') and the unstated assumption is that such study populations can afford a dietary intake which can be expressed in those terms. The method has not been validated in the developing world and, in view of its undoubted value elsewhere in epidemiological research, there is a great need to investigate this in Third World populations.

In his book, entitled *Nutritional Epidemiology*, Willett (1990) has provided an excellent overview of validation studies by other researchers of this method. However, one of the seminal studies is the Nurses Health Study conducted by his own group in Boston (Willett, *et al.*, 1985), which commenced in 1980 and was completed in 1984 (N = ±170). The methodology employed was complex, including repeated diet records in the design so that these could be correlated with the food frequency questionnaire (FFQ), for a very broad range of nutrients. The adjusted correlations between nutrients estimated by the 116-item semi-quantitative FFQ and the average four 1-week diet records collected 3 - 4 years earlier, were in general of the order of 0.53 for 19 nutrients, ranging from 0.28 to 0.61, based on the responses of 150 women.

(iv) Validity of the 24-hour recall

The motivation for the choice of method used in this study appears in Chapter 3, subsection 3.5.1. The 24-hour recall can be validated directly, in terms of the actual intake, more readily than other methods of dietary assessment because the time frame covered is short. Methods used include unobtrusive observation, or weighing duplicate portions of the actual intake of foods recalled by the same subjects, over the same 24-hour period or for one meal. This method has been employed in institutional settings such as congregate meal sites (Madden, *et al.*, 1976; Gersovitz, *et al.*, 1978), school lunch programs (Emmons and Hayes, 1973), college cafeterias (Krantzler, *et al.*, 1982), a metabolic unit (Greger and Etnyre, 1978), hospitals (Linusson, *et al.*, 1974) and summer camps (Carter, *et al.*, 1981).

Beaton (1994) has pointed out the effects using one day compared with multiple days to characterise usual nutrient intakes of individuals. Specifically, this has a great impact on the apparent prevalence of inadequate or excess intake (as defined by cut-off points) in the population.

Although the variety of food items eaten by the African population is relatively small (Rossouw, 1990; De Villiers, 1988), the quantity can vary considerably from day to day. This is particularly the case in urban areas where a variable cash flow is an important determinant of food intake. It is therefore not clear, *a priori*, how many consecutive 24-hour intakes are needed to approximate the 'usual' intake. No studies have been carried out in South Africa on the approximation of the usual intake by repeat 24-hour recalls. Most studies utilise a single 24-hour recall (Vorster, *et al.*, 1995), and therefore to some extent, a *de facto* local standard has arisen. With highly mobile populations in informal settlements, it may prove logistically impossible to conduct repeat 24-hour recalls.

Since it is not possible in free living populations to validate the 24-hour recall method based on individual intakes, this method is conventionally utilised to describe mean intakes of groups with sample sizes exceeding 50 individuals (Block, 1982).

Table 2.4 presented below, features macronutrient intakes from two dietary methods on the same African age groups in rural Ciskei: the diet history method and the 24-hour recall. From this Table it can be seen that while absolute intakes reported by the diet history method exceed those represented in the 24-hour recall, the percentages of energy calculated from both methods are close. *This Table is an illustration of the fact that while percentages of energy from macronutrients increase by age, there is minimal variation within each age category, despite the differences in methods.* In this thesis macronutrient intakes will be expressed both as absolute intakes, and as percentages of energy.

Table 2.4: Mean intakes of macronutrients for four groups of subjects (resident in rural Ciskei)* for two dietary methods, expressed as absolute intakes (g) and percentages of energy (% E)

	Infants (6 - 23 months)		Toddlers (2 - <3 years)		Schoolchildren (7 - <9 years)		Lactating women (16 - 44 years)	
Sample size	N=150		N=282		N=222		N=96	
Methods	24-hour recall	Diet history	24-hour recall	Diet history	24-hour recall	Diet history	24-hour recall	Diet history
Energy (MJ)	5.3	6.4	6.1	7.6	8.6	11.0	11.0	14.9
Protein (g)	45	56	43	57	58	74	73	101
Protein (% E)	*13.9*	*14.0*	*11.6*	*11.5*	*11.5*	*11.4*	*11.3*	*11.5*
Fat (g)	40	49	29	40	34	45	41	61
Fat (% E)	*26.9*	*26.7*	*17.0*	*18.3*	*14.6*	*15.1*	*13.8*	*15.1*
Carbohydrate (g)	193	243	265	337	381	482	495	656
Carbohydrate (% E)	*56.1*	*57.2*	*67.3*	*66.6*	*70.9*	*70.1*	*72.0*	*70.4*

* Adapted from Richter *et al.* (1984)

(v) Use of biochemical markers to validate dietary data

As stated previously, good agreement between the dietary intake results of the test and reference methods does not necessarily indicate validity. It may indicate similar errors in both methods. Recognition of this problem has prompted the development of more objective methods, independent of the measurement of food intake, to validate dietary intake data. In this approach, external variables such as biochemical indices or markers are used to validate dietary survey methods.

A biochemical marker is defined as: "any biochemical index of an easily accessible sample that gives a predictive response to a given dietary component" (Bingham, 1987). Several have been proposed, although their accuracy as absolute standards for establishing the validity of dietary assessment methods requires further investigation. Furthermore, it is not within the scope of this thesis to explore all alternatives in this regard. There is exhaustive and frequently contradictory literature on this topic. Nevertheless, since certain biochemical indicators were examined in this study, the discussion will be confined to those and referred to in Chapter 4, subsection 4.4.1.

(e) Reliability

Ascertaining the reliability of a method can be equally difficult. Since it is not known whether what is being measured remains unchanged, it is not known whether dissimilar results on two occasions reflect an unreliable measure, or whether a changed condition is being measured (Black, 1982). If there are changes in nutrient intake after a four-year period as was found with a repeated dietary history (Dawber, *et al.*, 1962), weight changes and other objective indicators about diet stability must also be considered before conclusions can be drawn regarding the reliability method.

Reliability has two components namely biological (respondent) variation and measurement (observer) variation (Jensen, 1981). Both variations have intra- (within) and inter- (between) components (Marr and Heady, 1986).

Intra-respondent variation is usually larger than inter-respondent variation and includes methodological errors as well as the true day-to-day variation in intake within respondents (Woteki, 1986). Day-to-day variations tend to be random and cancel each other out when large groups are surveyed (Jensen, 1981).

Measurement variation (especially inter-measurement variation, which is of a more serious nature) can be minimised by rigorous standardisation of the interviewer and testing of the questionnaire. Probing questions should, however, be designed to facilitate memory without suggesting a correct answer to the respondent (Caster, 1985).

Additionally, both the reliability and validity can be improved by conducting shorter, but more frequent surveys throughout the year, instead of longer surveys over consecutive days (Hackett, *et al.*, 1983). However, in highly mobile populations the identification of the sampled individuals can be extremely problematic.

(f) Food Composition Tables

The method of conversion from foods to nutrients most often used, is by adhering to Food Composition Tables (FCT). Nutrient values in FCTs are based on a quantitative analysis of samples of each food. Ideally the data should be representative of the average composition of a particular foodstuff on a year-round nationwide basis. However, since the analytic procedures required are costly this is seldom, if ever achieved. Methods of chemical analysis may also yield values that are inexact (Jensen, 1981).

Most often the values in food tables are without the addition of seasonings, e.g. salt, and in some cases only the analysis of the raw product is provided (Gouws, *et al.*, 1991). Food table figures generally represent average values and the tables may be incomplete by not giving the food composition of certain food items or dishes. This is particularly true of composite dishes and traditional dishes where individualised recipes may be used. Finally, information on bioavailability is not included in the food tables (Jensen, 1981). Nevertheless, it is still concluded that while food tables do not represent data with an accuracy of atomic weight determination, they are not so unreliable as to be worthless (Marr, 1971).

In South Africa, 'NRIND Food Composition Tables' were first compiled in 1981 and revised in a 1986 edition (Gouws and Langenhoven, 1981 & 1986) and again subsequently in 1991 (Langenhoven, *et al.*, 1991). The 1991 edition was being compiled and updated while this study was planned and executed and consequently included new food items particular to the African population. (This was as a result of missing food items and prepared dishes being identified by the author during in-depth interviews and piloting phases prior to the survey.)

Since the Institute concerned is not equipped to do any food analyses, all the analyses were obtained from other sources. The United States Department of Agriculture's Handbook No.8 (Watt and Merrill, 1975) and its subsequent revisions were used as main references, supplemented by Paul and Southgate's *McCance and Widdowson's 'The Composition of Foods'* and its supplements. Additional information was obtained from South African manufacturers and 'various literature and other sources' (Langenhoven, *et al.*, 1991). The full set of references is, however, listed in the publication. Nevertheless, some local foods do not appear in the table (only 20% of the analyses are from local foods) in which case the food item closest to the local food has to be selected (Langenhoven, *et al.*, 1996). The basis of this choice can be made in consultation with the authors.

Food composition data have many limitations. The number variations in which food can be prepared is beyond the scope of any table. Recipes vary and frequently need to be modified according to ingredients available in the household. Additionally, commercial foods are continuously introduced into the marketplace, making it impossible for any table to be completely updated. Chemical analyses of foods are also frequently prohibitively expensive for food manufacturers and scientists. Another difficulty lies in the fact that the nutrient content of any food is inconsistent and samples of food may differ largely due to genetic, environmental, processing and preparation differences. Many food items have not been chemically analysed and in certain cases good analytic methods have not been developed (Anon., 1985).

Researchers utilising food tables/databases have to keep these issues in mind and cautious interpretation of results is required. Nevertheless, studies using the same tables are comparable.

In South Africa, a *Food Quantities Manual* has been compiled based on household and objective measurements (Langenhoven, *et al.*, 1991). This manual includes gram weights of for example, ladles of items in terms of various levels of heaping. Since ladles can be found in most homes (ranging from informal shack structures to expensive housing) and are frequently used for 'dishing up' for household members, serving sizes can easily be determined utilising this table. Additionally, this manual assists in the production of comparative local data, and the use of standardised portion sizes for different food items.

(g) Measuring dietary adequacy

The traditional method of evaluating the adequacy of a diet is by means of ascertaining the nutrient content of foods in a food composition table, and then comparing the daily nutrient content with a standard such as the Recommended Dietary Allowances (RDA) (Food and Nutrition Board, 1989) of the United States of America.

The majority of South African studies utilise the American RDAs. The most recent edition of the RDAs (i.e. the tenth edition, Food and Nutrition Board, 1989) has been drawn up on the basis of 'substantive new information or where there were inconsistencies in the way evidence was evaluated in previous editions'. In this edition, each nutrient is treated individually to allow for variability within a population, since there is little evidence that requirements follow a normal distribution with the 'possible exception' of protein. The report states that the RDAs can 'serve as a guide' such that a 'varied' diet will probably meet requirements for nutrients for which it is not possible to set RDAs for all the known nutrients. The subcommittee emphasises that diets 'should be composed of a variety of foods derived from diverse food groups rather than by supplementation of fortification and that losses of nutrients during the processing and preparation of food should be taken into consideration'. However, this statement is qualified by stating that where further deficiency is commonly observed, food fortification and individual supplementation are appropriate. This last statement would be more applicable in a developing country where large proportions of individuals consume a narrow range of foods in frequently small quantities, rather than is the case in the western world.

The RDAs allow a safety margin allowing for increases in requirements due to minor stresses such as infections. Black (1986) expresses caution in the utilisation of RDAs in group studies. She states that three pieces of information are required:

(i) a good measure of the mean intake of that group and the range of intakes
(ii) a good measure of the mean requirement and the range of requirements
(iii) a knowledge of the correlation between individual intakes and requirements.

The first item (i) requires an understanding of the limitations of the methodology utilised in collecting dietary data from the group. Items (ii) and (iii) require a knowledge base of the population being investigated. In South Africa, as in many other countries, this core of knowledge is still being developed. Moreover, in the African population for example, it has been shown that persons ingesting far less of the RDA for calcium have not been shown to be disadvantaged.

Dietary scores are used to express the adequacy of an individual or group's dietary intake as evidenced by the various methods appearing below, some of which include the use of RDAs (Guthrie and Scheer, 1981; Hemon, *et al.*, 1986). More recently, Patterson, *et al.* (1994) used a diet quality index based on the extent to which individuals met dietary goals associated with chronic disease risk.

(i) As a percentage of the RDA

Energy and nutrient intakes are frequently expressed as a percentage of the RDA for a specific nutrient or energy intake.

(ii) Nutrient density

Nutrient density (ND) is calculated as:

$$\text{ND} = \frac{\text{group's mean intake of nutrient}}{\text{group's mean energy intake}} \times 1\,000$$

(iii) Nutrient adequacy ratio (NAR)

$$\text{NAR} = \frac{\text{daily intake of a nutrient}}{\text{RDA of that nutrient}}$$

(iv) Mean adequacy ratio (MAR)*

As a measure of overall dietary adequacy, MAR can be calculated as:

$$\text{MAR} = \frac{\text{sum of NARs for nutrients}}{\text{number of nutrients}}$$

The dietary score method is an attempt to eliminate some of the complexity and time required for the traditional method of analysing every food group, with the assumptions that diets including foods from each of four to six food groups are nutritionally adequate. In this thesis MAR (Guthrie and Scheer, 1981) has been used because it is a composite index, based on RDAs.

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* This score was used in multivariate analyses in this thesis (see Chapter 5)

(h) Other dietary evaluations

Diet has a key role in the prevention of the major life-threatening conditions of middle and later life, especially cardiovascular disease and probably cancer (particularly cancers of the colon and breast). Its role in the aetiology of diabetes, osteoporosis, arthritis, inflammatory bowel disease, and dementia is also under investigation. The benefit of a correct diet in preventing constipation, obesity and dental caries has been proved (Bingham, 1991). Furthermore, it has been acknowledged that such diseases or conditions of ill-health are becoming increasingly prevalent in developing countries in situations of poverty, whereas previously they were associated with affluence in the developed world. Consequently, in setting out dietary recommendations, many international agencies have opted for the prevention not only of nutritional deficiency diseases but chronic and degenerative diseases as well (Harper, 1987).

For example, in 1982 the World Health Organisation's *Guidelines on the Prevention of Coronary Heart Disease* provided general recommendations applicable to the prevention of chronic disease risk. "Based on many attractive traditional eating patterns" they were set out descriptively as follows:

Emphasise:

- appropriately combined foods of plant origin: beans, cereal grains, vegetables (cooked and raw), and fruit (offering good-quality protein, low fat, low saturated fat, low cholesterol, low sodium, low refined sugar, high complex carbohydrates, high minerals, vitamins and fibre, and lower energy intake);

- fish, poultry and lean meats, used in small portions and eaten less often as the main dish (offering good-quality protein, low fats, low saturated fat, low cholesterol, and lower energy intake);

- low-fat dairy products for adults (offering good-quality protein, low fat, low saturated fat, low cholesterol, and lower energy intake);

- less oils and fats in food preparation and in spreads; preference to be given to liquid vegetable oils.

De-emphasise:

- high-fat meats from domestic breeds as principal protein source (also high in saturated fat and cholesterol, and providing high energy intake);

- high-fat dairy products: whole milk, cream, cheeses (also high in saturated fats and cholesterol, and providing high energy intake);

- whole eggs, unless a major source of protein (egg yolks are high in dietary cholesterol);

- commercially baked products (high in saturated fat and providing high energy intake);

- alcoholic beverages (providing high energy intake and low in nutrients).

Such recommendations are valuable but do not lend themselves to quantitative analyses of intake in individuals or study populations. Consequently, in seeking to prevent dietary related chronic diseases, many countries have opted for the quantitatively defined 'prudent diet'. Guidelines for different countries show some variations but are remarkably consistent, and in most cases call for adjustments in macronutrient intakes. In South Africa the prudent dietary guidelines were determined by a locally convened Diet Consensus Panel (1989). These are in line with the guidelines defined by the American Heart Association (1988), and similar to those set out by the WHO in 1990, as can be seen in Table 2.5 below.

Table 2.5: A comparison of prudent dietary guidelines

GUIDELINES	%E Total Fat	%E Saturated Fat	%E Poly-unsaturated fat	%E Mono-unsaturated fat	%E Total Carbo-hydrate	Total Dietary fibre	%E Total Protein	Cholesterol mg/day	P/S ratio	Salt gm/ day	Alcohol oz. ethanol
WHO (1990)	15-30	<10	3-7	–	55-75	27-40	10-15	<300	–	<6	–
USA (American Heart Association, 1988)	<30	<10	<10	–	≥50	–	–	<300	1	<3	1-2
South Africa (Diet Consensus Panel, 1989)	<30	<10	<10	<10	–	20-30	–	<300	–	<3	2-3

Ideally dietary intakes should be evaluated both in terms of nutrient adequacy and macronutrient profiles, as this combination would reflect dietary inadequacies (or otherwise) with respect to nutrient intakes as well as the extent to which a study population meets prudent dietary guidelines.

2.2.2 Measuring nutritional status by anthropometry

There are two main methods of evaluating the distribution of anthropometric indices in a population:

(i) the number and percentages (percentiles) of individuals compared to a reference set of data

(ii) the development of the anthropometric measurements from the *reference median* in terms of standard deviations or Z-scores.

The formula is:

$$\text{Z-score} = \frac{\text{Individual's value - median value of reference population}}{\text{Standard deviation value of reference population}}$$

The reference set of data currently in most use is the United States National Center for Health Statistics (NCHS) reference standards (Hamill, *et al.*, 1977). It should be noted that these three curves are from a highly developed country with a healthy 'well nourished' population, and it is recommended by some workers that percentiles should not be used in evaluating data from developing countries. This is because a proportion of the study population may have indices below the extreme percentile, i.e. below the 5th percentile of the reference population. This would make it very difficult to accurately classify potentially large numbers of individuals in impoverished countries (Waterlow, *et al.*, 1977).

The earlier proposed use of ethnic standard curves for South Africa has generally been discounted. International standards are currently generally considered appropriate for local use (Coovadia, *et al.*, 1977; Kow, *et al.*, 1991). Consequently, most recent South African anthropometric studies have utilised the NCHS reference standards and data were often expressed in terms of percentages of children < 3rd or 5th percentiles for the various anthropometric indicators. However, in recent years the use of Z-scores has become more common.

The anthropometric assessment of a population should assist in identifying groups at risk, of poor functional outcomes (morbidity and mortality), and who therefore are in need of further evaluation or intervention. The two preferred anthropometric parameters in children are height-for-age and weight-for-height, since these discriminate between different physiological and biological processes (World Health Organisation Working Group, 1986).

(i) Height-for-age (Stunting)

Height-for-age is a very stable parameter (Béhar, 1981), and a high prevalence of low height-for-age is frequently associated with poor overall economic conditions and repeated exposure to adverse conditions such as infections (Martorell, 1988; Sullivan, 1989; Gorstein, *et al.*, 1994). An acute episode of undernutrition will reduce the weight of a child but will not affect height that has already been achieved. Chronic undernutrition is reflected by growth failure resulting in a child who might have a normal weight-for-age. This is also known as 'stunting' (Waterlow, 1972).

(ii) Weight-for-height (Wasting)

In some situations the concern should be with low weight-for-height (i.e. wasting or thinness), a condition that reflects a failure to gain weight or a loss of weight. One advantage of weight-for-height is that it can be calculated without knowing age, which makes it useful in populations that do not record dates of birth or for whom such information is unreliable.

Weight-for-height can also be used to determine whether obesity is present. The nutritional status of a subject can thus be classified by comparing the weight of a normal child of the same height.

(iii) Weight-for-age (Underweight)

Weight-for-age is primarily a composite index of both weight-for-height and height-for-age and fails to distinguish tall, thin children from those who are short with adequate weight (Gorstein, *et al.*, 1994). It assumes that all subjects of a certain age should have the same weight. The use of weight-for-age for predicting or identifying 'wasted' children was found to have a low sensitivity and specificity in three U.S. populations (Sullivan, 1989). Similar problems can arise with this index and the ascertainment of obesity (Richardson, 1980).

(iv) The body mass index

Weight-height indices are formulae used to relate body weight to stature. Many researchers have found that body mass index (BMI) or Quetelet index to be the most suitable when compared with other indices. The BMI is defined as:

$$\text{BMI} = \frac{W}{H^2} = \frac{\text{weight (kg)}}{\text{height squared (m)}}$$ (Du Randt and Linder, 1981)

The BMI is most commonly used as a measure of both thinness and adiposity in adult population groups, as it is the least biased by height and easily calculated (Khosla and Lowe, 1967; Garrow, 1985), "although in children it is apparently more dependent on stature" (Garn, *et al.*, 1986). Nevertheless, more recently Gasser, *et al.* (1994), have found that the Quetelet index turned out to be a reasonable index from childhood to adulthood. In adults, BMI correlates with many health-related indices such as mortality risk (Waaler, 1984) and other indices of adiposity (Florey, 1970; Goldbourt and Medalie, 1974; Killeon, *et al.*, 1978; Gonk and Roche, 1982).

Gibson (1990) expresses caution with the use and interpretation of the BMI, since the index cannot distinguish between excessive weight produced by adiposity, muscularity, oedema or pregnancy.

2.2.3 Measuring nutritional status by biochemical evaluation

Theoretically, subclinical states can be identified by measuring the levels of a nutrient or its metabolite in a preselected biopsy material (e.g. fat deposits to ascertain lipid composition) or samples of body fluids, such as blood or urine. Laboratory assessment is used primarily to detect subclinical deficiency states, and is becoming increasingly important with the growing emphasis on preventive medicine. The procedures can be used to supplement other methods of nutritional assessment – for example dietary, clinical, and anthropometric assessment – enabling specific nutritional problems to be identified (Gibson, 1990). Very importantly it provides an objective means of assessing nutritional status. In studies with large sample sizes, biochemical evaluation of each subject may not be cost-effective; it may then be preferable to perform evaluations on a subset of individuals in order to provide some objective evidence to supplement dietary and other assessments. This makes it possible to comment on the accuracy of other measures.

2.2.4 Measuring nutritional status by clinical assessment

Clinical assessment consists of a routine medical history and a physical examination to detect physical signs (i.e. observations made by a qualified examiner) and symptoms (i.e. manifestations reported by the patient) associated with malnutrition. These assessment procedures are normally used in community nutrition surveys and in clinical medicine, e.g. in children the diagnosis of kwashiorkor can be determined by clinical examination, and in both children and adults the presence of pellagra can also be ascertained clinically. They are most useful during the advanced stages of nutritional depletion. Many of the critical physical signs are nonspecific and must therefore be interpreted in conjunction with laboratory, anthropometric and dietary data before specific deficiencies can be identified (Gibson, 1990).

In community surveys it is very necessary to standardise fieldworkers and take into account the heavy respondent/interviewer burden involved. These issues often make the utilisation of clinical examinations impractical in large samples and are consequently seldom performed.

2.3 NUTRITIONAL STATUS OF THE AFRICAN POPULATION IN SOUTH AFRICA

2.3.1 Introduction and historical background

Before the full impact of colonisation on Africans was manifest, there is much historical evidence suggesting that while some indigenous groups procured food by hunting animals and gathering plant foods, others were subsistence farmers. However, with the arrival of settlers from Europe, these lifestyles were gradually eroded, affecting all forms of food procurement, and in turn, health status.

With the discovery of diamonds in 1867 and gold in 1886, Africans were regarded as a cheap source of labour, and recruitment offices were set up to recruit workers for the mines. White authorities also promulgated a series of laws and acts to force Africans into wage labour. It is not surprising then that the initial concern for the diets of Africans was motivated by the necessity for improved productivity among mine labourers. By 1902, scurvy was so common in the mines that the number of cases was said to exceed that of accidents (Fox, 1963).

Certain laws and acts concentrated vast numbers of Africans in prescribed areas, which led to overcrowding in both rural and urban areas:

- The **Natives' Land Act** of **1913** laid aside 9 million hectares as Native** Reserves. Africans thus had ownership rights in 7% of South Africa. 'Tribal' areas were reserved for African occupation in Zululand, Ciskei and Transkei

- In **1920**, the **Native Affairs Act** led to the creation of separate administrative structures for reserve inhabitants and reinforced tribal leadership

- According to the **Natives (Urban Areas) Act** of **1923**, authorities could establish African locations outside white areas. Segregated areas were set aside for African residents, to control the influx of Africans and to remove 'surplus' persons not employed.

The food-related implications of the Natives' Land Act of 1913 were that Africans were forced into subsistence agriculture in very small areas, ultimately leading to overstocking of the limited land available, and in turn, overgrazing of these areas. Furthermore, organised farming was in the hands of white control. On the other hand, the Natives (Urban Areas) Act of 1923, in terms of which urban Africans were confined to segregated areas, meant that many were forced to rely greatly on hawkers in the locations for food procurement, or were compelled to travel into the white areas to purchase foods.

The early history of dietary investigation has been summarised by Packard (1989):

"There exists very little data on the diets of urban Africans at the beginning of the century, compared to what we know about later periods. The role of food in the maintenance of health was not in general given much attention. In addition, white authorities lacking knowledge of 'traditional' African diets assumed that Africans were used to living on maize meal. Therefore, the first effort to establish a minimum ration for African workers in 1905, resulted in a diet that was wholly inadequate, being composed almost exclusively of maize meal.

"There has been a noticeable shift in the types of food consumed by Africans in comparison with their rural counterparts. Descriptions of rural African diets of the nineteenth century cite the frequent consumption of a variety of beans, pumpkins, millet, sorghum, and a variety of fruits. Meat and milk (either fresh or soured) were also commonly consumed (Webster, 1981). Urban diets were much more limited by comparison. Fresh fruits and vegetables, peddled by

** The term 'Native' was then in common usage for what is today referred to as 'African'

African women in the locations were seen by many Africans, especially those at the lower end of the economic spectrum as expensive luxury items (Union Government Report, 1982).

"Urban Africans also tended to substitute relatively unnutritious white bread in place of maize and other grains. In addition, coffee frequently replaced soured milk as a staple beverage. The extent to which more nutritious, resistance building foods such as meat, milk and fresh vegetables were included in African diets was closely tied to income levels and therefore sensitive to shifts in household income. Thus during periods of hardship, the range of foods consumed narrowed and the more nutritious foods were excluded. More generally removal to the locations meant residents faced increased transport costs, which cut into household budgets and thus the quality of diets."

In 1932 the reports of the Native Economic Commission and the Carnegie Commission into poverty (1932) were published. The former had little to say about diet, but pointed to the overstocking of pastures, resulting in poor yields of cereal crops and a diminution in the supply of milk. However, the latter report included a volume, which for the first time pointed to the interrelationships between low socio-economic status, ignorance, inadequate food intakes, agricultural factors and disease outcomes (Murray, 1932).

In 1939 Fox, demonstrating great insight, stated, "the chief factor which is disturbing the nutrition of the Natives in South Africa is, of course, their contact with Western civilization, which is revolutionising both the manner of production and the nature of the foods they employ". He further commented on the advent of the trading store in rural areas and the subsequent availability of Western nutrient-empty foods in areas where the traditional diet still existed. Very prophetically, he noted that, "the changes brought about by this contact with Western civilization are bound to continue at an ever-increasing pace, both in the changing diet of the more sophisticated country Natives, and in a much more extreme form, amongst town dwellers".

The first epidemiological study among Africans was carried out by Kark and le Riche (1944a). This study, conducted among 7 000 school children across the country and including remote rural areas, pointed to a prevalence of pellagra and pellagra-like dermatitis, which the authors considered to be on the increase, as well as the presence of ariboflavinosis and vitamin A deficiency. A summary article of this study, published in the South African Medical Journal, included an eloquent statement: "The thin, round-shouldered, flat-chested, pot bellied child with spindly legs was such a common sight that it can only be concluded that many were on the borders of starvation".

In 1940, a study of African income and expenditure was carried out by the City of Johannesburg's 'Non European and Native Affairs Department' (Janish, 1941). In this study the increasing drift to the towns by Africans was noted. The following attractions of the town were identified:

(i) high cash wages
(ii) regular hours of work
(iii) better food and housing
(iv) freedom of restraint
(v) opportunities of entertainment and participation in sport
(vi) educational facilities lacking in rural areas
(vii) better medical facilities
(viii) freedom from parental control
(ix) necessity for earning cash for taxes and increasing domestic requirements.

Fifty years hence, when the study for this thesis was conducted, many of the same 'pull' factors still applied. The extent of the influx of African families into towns was unknown in the absence of accurate census returns. However, this had started at the turn of the century with male migrant labourers seeking employment on the mines, but by the 1940s women and children also formed distinct elements in the migrating population. By this time "the perpetual illegal overcrowding of houses in the townships" was making "serious social and economic incursions on the life of the urban African population" (Janish, 1941).

Dr. F. W. Fox was commissioned to investigate diet in the African locations as part of the above study leading to the first documentation of nutrient data. For practical purposes he studied 'diet as purchased' and made the following observations from detailed analyses: Protein intakes were adequate, despite the expense of animal protein, which constituted approximately 50% of the total protein intake. Fat intakes were low, while intakes of calcium, vitamin A, vitamin B_1 and vitamin C were extremely low when compared with "requirements of overseas workers" [not referenced]. He expressed particular concern for the low energy intakes relative to the requirements of the active adult male, and the implications of the low nutrient density for children and pregnant or lactating women, concluding that this was "a disgraceful state of affairs".

A review of dietary surveys among Africans from 1948 - 1952 was included in a technical report published in 1959 by the National Nutrition Research Institute of the CSIR (Council for Scientific and Industrial Research). However, the authors questioned the accuracy of the data, as full details of the procedures employed were not always provided. In the conclusions section of the report the authors noted that the variations in nutrient intakes of families were so wide as "to render average figures for nutrient intakes applicable to all but a few individual families, and of value only as an index of the total supplies available to the group studied". Nevertheless, a picture of dietary inadequacy emerged and the authors commented on the following trends:

(i) maize constituted the bulk of food intakes, wheat products being used in smaller amounts, particularly in rural areas; white bread was preferred to brown

(ii) milk was not consumed by all families and in many localities by very few, particularly in rural areas

(iii) meat and poultry were used by most urban families, but much less widely and in much smaller amounts by the rural families; fish and egg intakes were minimal or non existent

(iv) dry legumes were commonly used, but not in large amounts

(v) some evidence was obtained that weaning foods were overdiluted.

Echoes of these problems persist over time and still existed at the time of the study as will be seen in the sections which follow. What will also become evident is the relative paucity of nutritional data on Africans, particularly in view of the many pressures militating against improvements in nutritional status.

For example, by 1946 Johannesburg's African population stood at 400 000 - a rise of over 100 percent in one decade. Despite the legislation of 1923, the Johannesburg municipality reacted to calls for the construction of African housing by claiming that it did not have the cash to deal with the needs of the spiralling African population. Local industry, on the other hand, had the cash but not the will to assist African employees. And so a belt of slums sprang across Johannesburg from east to west (Reader's Digest, 1988).

In 1990, according to Cape provincial and Regional Services Council figures, between 500 000 and a million squatters lived in the Greater Cape Town Metropolitan area. For historical background see section 2.5 (Western Cape Regional Services Council, 1992).

Because of the virtual eradication of overt clinical deficiencies (such as kwashiorkor and pellagra) seen in the past, it was not deemed essential to include clinical examinations in this thesis study.

The following section addresses local literature from the 1940s (when nutrient data first became available) to the present. Where possible, comparisons over time will be made, thereby highlighting shifts in the structure of the diet, as well as changes in body composition and other concomitant nutrition-related outcomes. Contrasts will be drawn between rural and urban areas to illustrate the impact of urbanisation and modernisation. Furthermore, since changes in SES occur concurrently with populations in transition, comparisons between lower and higher SES will be made, where data are available.

Although the focus of this thesis is the African preschool child, the adolescent and the adult, it is important to examine the literature beyond these age categories, since each phase of the life cycle impacts both specifically and cumulatively on the health status of the next.

It must be pointed out, however, that data on Africans are scanty. Most of the data originate from isolated *ad hoc* studies on small samples, many of which are convenience samples.

2.3.2 Women of childbearing age

Conventionally, the age category 15 - 44 years is used to represent women of childbearing age. This section is included to illustrate the eating behaviour of young women, since this age category is included in two of the target groups. Furthermore, women of childbearing age (15 ~ 44 years) represent a particularly vulnerable population whose nutritional status is important to infant survival and household welfare in numerous ways.

African women are thought to be particularly prone to anaemia because of low haem iron intakes coupled with high intake of inhibitors of iron absorption, such as phytates from their cereal-based diets and polyphenols in tea. However, recent epidemiological studies have questioned the prejudicial effect of phytates on the absorption of iron (Scrimshaw, 1991). This is exacerbated by low intakes of promotors of iron absorption, such as vitamin C from fruits and vegetables. Accurate national statistics are not available on the extent of iron and folate deficiency in women.

There is speculation suggesting that rural women could be at greater overall risk than urban women. For example, intakes of inhibitors of iron absorption such as fibre are likely to be higher in rural populations, while intakes of promoters of iron absorption, such as ascorbic acid, are lower. The higher intakes of meat in urban populations yield more haem iron than is available from rural diets. This is further supported by a study of 578 rural households in the Transkei, where it was found that between 50% and 60% of women did not consume meat, egg or fish (Bembridge, 1987).

A recent urban-based study (Soweto, Johannesburg) conducted on first time attenders at an antenatal clinic found sub-clinical iron deficiency in 40 - 51% of women in all three trimesters. However, it was found that 40% of the sample had lived in Soweto for less than five years. In other words, a substantial proportion of the sample was essentially rural. The authors concluded that continued supplementation is necessary during pregnancy, in the light of the rapid immigration of rural women into Soweto (Patel, *et al.*, 1992).

Gavalkis, *et al.* (1986) estimated that among low income urban women of childbearing age the incidence of iron deficiency anaemia is in the region of 25%, a finding supported by Kruger, *et al.* (1995) where a prevalence of 25% of anaemia and 21% of iron deficiency anaemia was found in low income pregnant women resident in Cape Town.

A study conducted in rural Gazankulu indicated that 60% of a sample of antenatal attenders had folate deficiency. In this study, deficiency was severe enough to cause anaemia in 33% of the women studied. The authors attributed this to the low iron content of maize, which constituted the bulk of their diets (Baynes, *et al.*,1986). Folate deficiency during the first trimester of pregnancy is linked to neural tube defects (NTD) in the fetus, and Sayed, *et al.* (1994) have shown that the incidence of NTD shows seasonal peaks corresponding to conception at the time of drought. Urban populations are generally less affected by drought and should therefore be protected from this problem to some extent.

2.3.3 The infant and child

This section delineates the food-related behaviour of women of childbearing age with respect to the feeding of the young, since the nutritional status of 3 - 6-year-olds is largely predetermined during infancy, owing to infant feeding and weaning practices introduced by the mother .

Breastfeeding practices

The duration of breastfeeding depends on the circumstances surrounding the mother. In general, the local picture from several urban (Ross, *et al.*, 1983; Hoffman, *et al.*, 1984;

Ransom, *et al.*, 1989; Van der Elst, *et al.*, 1989) and rural (Ross, *et al.*, 1983; Brink, 1984; Bergh, 1986; Steyn, *et al.*, 1993; Zöllner and Cartier, 1993) studies indicates very strongly that rural women are more likely to breastfeed exclusively and for longer periods than their urban counterparts (Mac Intyre and Walker, 1994). Jacobs (1992) suggests that "the declining gradient in the duration of breastfeeding may reflect a transition from rural to urban life, as well as financial needs forcing women to seek employment".

Weaning

Countless studies have shown that the weaning process, if not handled appropriately, is the second phase of growth retardation after pregnancy. Weaning mixtures prepared by African mothers often, perhaps usually, are calorically deficient and infected with *E.Coli* and other organisms - a frequent cause of the gastroenteritis so common among infants around weaning time. Most local studies dealing with weaning practices have been based in rural areas (Brink and Boshoff, 1981 & 1983; Steyn, *et al.*, 1993) showing strong evidence of a traditional basis to the diet in those areas. However, Gericke, *et al.* (1987) conducted a comparative urban/rural study of Venda mothers resident in Pretoria, and in rural Venda. The urban mothers opted for bottle feeding far more readily than their rural counterparts. Supplementary foods introduced by the urban mothers were far more 'western'. The urban babies received more meat, fish and eggs than their rural counterparts, but also received more sweets, carbonated drinks, salty snacks, tea, salt and sugar. The fact that the rural babies also received some of these western foods (albeit in small quantities) led the authors to conclude that in terms of food intake, urbanisation is a two-way process, with a pronounced adoption of western dietary practices in urban areas and an outward spread of urban influences into rural areas. The traditional basis of weaning foods in rural areas (also noted by Steyn, *et al.*, 1993) is partly due to their low cost in the face of rural poverty, but also rural mothers have more time for the long cooking periods of traditional staples than their urban counterparts.

The preschool child

As was the case with data on the previous sections, there is insufficient data to track trends over time with African children under school-going age. Earlier work was focussed on identification and treatment of overt clinical deficiencies in all age groups and not specifically on preschoolers, although the seminal work on kwashiorkor, was clearly directed at very young children (Brock and Autret, 1952).

Most of the bigger studies investigating anthropometric status are relatively recent, dating from the late 1970s, many taking place in the late 1980s, utilising a variety of sampling frames. The first 'national' survey (the RHOSA [Regional Health Organisation of South Africa] study) conducted in 1986 was aimed at determining the nutritional status of rural African children (DNHPD, 1987). Although 1 745 children were included, utilising a 'stratified multi-stage cluster sample design', the study ignored children in the impoverished traditional rural areas of Transkei, Bophutatswana, Venda, Ciskei (TBVC states) - the then independent homelands. Consequently, the picture that emerged was biased in the direction of better nutritional status. Based on the NCHS reference values, 8.4% of the survey population were estimated to have a low weight-for-age (< 3rd percentile). Stunting was observed in 24.5% of the population (< 3rd percentile) and wasting in 1.8% of the children (< 3rd percentile). Despite the bias in the sample, the study reflected the oft-reported fact that the greater proportion or malnourished African preschoolers are stunted rather than wasted.

It has also been recognised in the past that growth retardation is generally more pronounced in rural than in urban areas, although comparisons were hampered by the fact that several studies were based on samples from clinic catchments, while others were more representative of a defined area. Some reported figures < 3rd percentile NCHS, while others reported data utilising < 5th percentile NCHS for the various parameters. For example, a study in rural Gazankulu (Ijsselmuiden, 1984) (utilising a systematic sampling technique of every tenth or fifteenth child, N=658) found that 29.8% of under-fives were below the 3rd percentile weight-for-age (Hamill, *et al.*, 1977). Another rural study in the eastern Cape on African preschoolers (stratified random sampling procedure, N=1 468) found that 15.3% were underweight (Krynauw, *et al.*, 1983). Similar difficulties are presented with urban data. Nevertheless, figures from all the literature for stunting in both rural and urban African preschoolers range from 1 in 4 to almost 1 in 3. A recent national survey using a national probability sample incorporating all SES groups (N=11 430) has, in a preliminary paper (DNHPD, 1995), reported a 1 in 4 national prevalence of stunting and a 1 in 10 prevalence of underweight. The prevalence of stunting was higher in rural areas than in urban communities. Table 2.6 reflects the fairly consistent results of anthropometric data from various studies. The prevalence of stunting generally exceeds 20%. Data from other anthropometric indicators are not as consistent.

Table 2.6: Comparative anthropometric data on African preschoolers (NCHS reference values)

	% Z-score -2; 2 SD			% < 3rd Percentile		
Urban data	Weight-for-age	Height-for-age	Weight-for-height	Weight-for-age	Height-for-age	Weight-for-height
Fincham (1983)				6.3 8.2	16.7 48.1	- -
Hugo-Hamman, *et al.* (1987)				10.3	23.5	2.5
Le Roux & Le Roux (1991)				16.8	29.6	2.8
Coutsoudis (1994)				13.0	27.0	4.0
Rural data						
Fincham (1983)				13.0	44.5	-
Krynauw, *et al.* (1983)				15.3	24.6	12.5
Ijsselmuiden (1984)				29.8	27.2	-
DNHPD (1987)				8.4	24.5	1.8
Bitalo (1993)	8.1	22.9	1.1			

A few studies have investigated rural/peri-urban/urban differentials in nutritional status in preschoolers. One of those directed specifically at preschoolers was conducted by Byarugaba (1991) in Transkei (one of the previously designated 'independent' states). This study classified young children in terms of relative distances from a central metropole (Umtata), including a total of 1 080 children. The peri-urban children (a radius of 5 km from the town) had the poorest anthropometric profiles for underweight (10.3 % <-2 SD weight-for-age) and wasting (5.0% <-2 SD weight-for-height) as opposed to the urban (8.1% <-2 SD weight-for-age) and rural (1.9% <-2 SD weight-for-height). The rural children (>10 km from the town) reflected the highest proportions of stunting (33.8% <-2 SD height-for-age), while the urban children had the lowest figures (13.6%). The peri-urban children reported the highest incidence of diarrhoea in the previous two weeks (24.9%) with 59% consuming water from a spring/river, while the diarrhoeal figures for urban (18.3%) and rural (19.2%) children were considerably lower, despite the fact that as many as 44% of the rural children also consumed water from a spring/river. The author concluded that both peri-urban and rural children were most disadvantaged in comparison with the urban sample. Nevertheless, the peri-urban children were in certain respects the most compromised.

Yach, *et al.* (1990) investigating urban preschoolers, but differentiating those born outside Cape Town from those born in the city, found that the former group were more likely to be below the 3rd percentile for the various anthropometric indicators than the latter. Furthermore, the 'new arrivals' to the city had inferior immunisation coverage, while carers of these children were the least informed about immunisation, least able to prepare a sugar/salt solution and least visited by a community health worker. Children identified for being at greatest risk were those born in the (rural) Transkei.

There is a paucity of information on food intake of preschoolers, but the little information available reveals some interesting trends. The micronutrient status of both rural and urban African children are generally considered to be inadequate to support optimal growth. However, urban preschool children consume a more atherogenic diet than their rural counterparts. A gradient of increasing macronutrient atherogenicity (in terms of percentages energy from fats, protein and carbohydrates in 24-hour recalls) from remote rural, 'small town' rural and urban children is reflected in the histogram below.

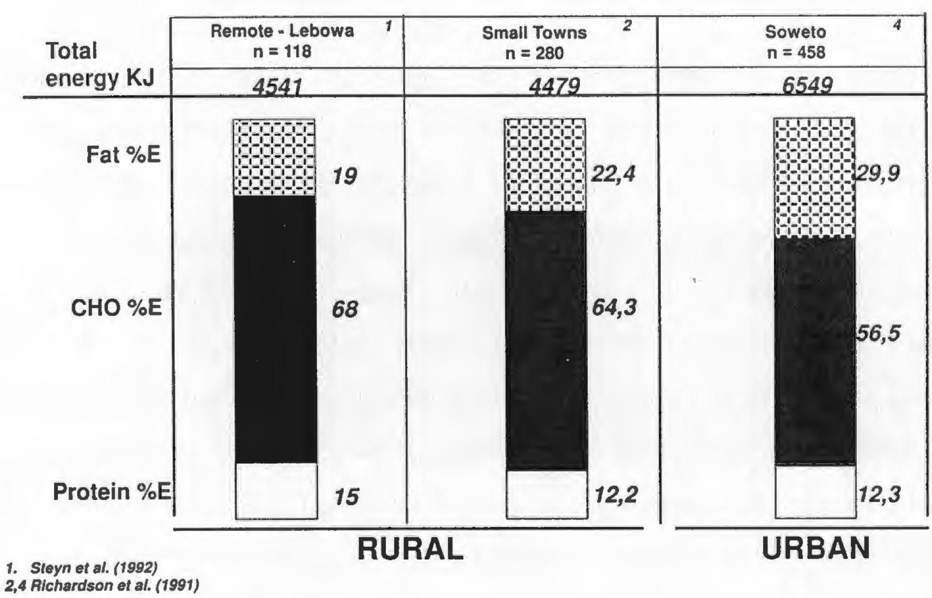

Figure 2.2: Gradient of macronutrient distribution in preschoolers with increasing urbanisation

Analyses of food group intakes also revealed a more traditional basis to the diets of rural children, as opposed to those in urban areas (Bourne, *et al.*, 1994). For example, rural children consumed 9.6 portions of cereals, while among the urban children reflected a mean intake of 6.6 portions was reported.

The micronutrient intakes of young children reveal no clear-cut trends with respect to urbanisation, except that, in general, diets could be improved with higher intakes of dairy products and fruits and vegetables in both rural and urban areas. The recent national survey (DNHPD, 1995) found that one in three children had a marginal vitamin A status (serum vitamin A concentration below 20 μg/dℓ). Children living in the rural areas were the most disadvantaged. On the other hand anaemia and poor iron status were more prevalent in urban areas.

2.3.4 The school child

There is very scanty information on the nutritional status of adolescents. However, several studies have investigated school children of various ages, including children approaching or in the early phases of adolescence. Hence, this review.

As has been suggested in the previous section, a considerable proportion of African school entrants begin their school careers already stunted and many are underweight. This has been illustrated in a recent nationwide study by the Department of National Health and Population Development (Department of Health, 1994). Anthropometric data were gathered from 'more than' 3 300 schools, including more than 105 000 school beginners aged 6 - 8 years. A comparison between the African children from the National database and those resident in the Western Cape (see Table 2.7) shows that the latter group has superior nutritional status in terms of the three anthropometric parameters reported (NCHS reference values).

An earlier national survey on school children aged 6 - 9 years (N=20 000) revealed a range of 14 - 34% of children falling below 80% (~ 3rd percentile) for weight-for-age of the NCHS reference values, the percentages increasing with age (Kotze, 1982). This suggests that the prevalence of underweight has decreased between 1982 and 1994.

Anthropometric data from older school attenders are scant and scattered over time and space and a range of anthropometric reference values and cut-off points are used, hampering comparisons (Dhansay, 1989). Such few studies as exist before 1970 did not use methodology comparable to contemporary anthropometric measurement. Relatively recent cross-sectional data (Table 2.7) suggests that stunting persists in older children, however, a large scale longitudinal study is currently underway to investigate this (i.e. the Birth to Ten study).

Table 2.7: Percentages of school children falling below certain Z-score and percentile categories (NCHS reference values) from selected studies

	Z-score		Percentile							
	< -2		< 3rd	< 5th						
	Rural and urban		Rural and urban	Urban		Rural				
	Dept. Health 1994 (National)	Dept. Health 1994 (Western Cape)	Kotze *et al.* 1982	Steyn *et al.* 1989		Badenhorst *et al.* 1993		Walker *et al.* 1993		
	6 - 8 yrs		6 - 9 yrs	11 yrs		6 - 10 yrs		11.5 yrs		
	(N=97 790)	(N=11 260)	(N=20 000)	(N=94)		(N=100)		(N=160)		
	M & F	M & F	M & F	M	F	M	F	M	F	
Height-for-age	14.6	11.2		17	14	23	19	36.2	27.5	
Weight-for-age	8.7	5.5	14.0 -34.0*	9	11	25	12	30.0	25.0	
Weight-for-height	2.4	0.7		0	-	8	2	2.5	1.2	

* 6 yrs = 14.0; 7 yrs = 25.0; 8 yrs = 22.5; 9 yrs = 34.0

Similarly, dietary data of school-goers emanates from isolated studies spread over time. Macronutrient distributions of rural and urban investigations are presented in Table 2.8. In general the data suggest that fat intake increases over time and from rural to urban areas, while carbohydrate intake decreases. Protein intakes show no obvious trend. The highest value, 14% energy, is reported in a recent study carried out in a remote rural area (Badenhorst, *et al.*, 1993). More than half of this protein (9%) came from plant protein, a feature of a traditional basis to the diet.

Table 2.8: Macronutrient distributions of schoolchildren in remote rural and urban areas in South Africa

	Remote rural		Urban		
	1981 6 - 9 yrs Groenewald *et al.* (Transkei) *(N=143)*	1993 6 - 10 yrs Badenhorst *et al.* (Lebowa) *(N=100)*	1967 7 - 11 yrs du Plessis *et al.** (Pretoria) *(N=293)*	1973 11 yrs Lubbe (Pretoria) *(N=552)*	1989 11 yrs Steyn *et al.* *(Cape Town)* *(N=94)*
Energy KJ	6300	6448	7602	8933	8404
% E Carbohydrate	74	70	68	68	53
% E Fat	12	18	20	17	29
% E Protein	11	14	13	12	13

* Modified diet history
† Diet history

In the absence of more representative national data, it is impossible to draw general conclusions about the anthropometric status of older (including adolescents) African scholars. Certain studies (Kark and le Riche, 1944b; Chaning-Pearce and Solomon, 1986; Richardson, 1978) have concluded that African children 'grow more slowly' and that their attained height is lower than in white children for example. Speculation continues locally about the appropriateness of NCHS reference values as a norm to assess nutritional status, particularly in different ethnic populations (Hansen, 1984). Linked to this debate, the question whether maximum growth of children is associated with longevity and good health in later life, has not been answered satisfactorily (Vorster and Venter, 1992; Walker, *et al.*, 1990).

Very little information on the micronutrient intakes is available. From existing data mean calcium, folate and iron intakes below 67% RDA have been reported, but in general nutrient intakes are lower than the RDAs. Since RDAs provide a margin of safety for most healthy individuals, lower intakes cannot always be interpreted as necessarily insufficient. Indeed, there is very little evidence of clinical symptoms or signs of micronutrient deficiency (Steyn, *et al.*, 1991; Badenhorst, *et al.*, 1994). Furthermore, biochemical indicators of undernutrition such as levels of serum albumin and transferrin did not point to the presence of severe malnutrition. There is, however, evidence of anaemia, for example Badenhorst, *et al.* (1993) found a high prevalence of anaemia in 24 - 35% of the subgroups studied. The authors attributed this to iron deficiency. This contrasts greatly with the evidence reported by Kark and le Riche (1944b) in their study of 7 000 school children. In this study, overt pellagra, pellagra-like dermatitis, scurvy, oedema and evidence of ariboflavinosis were observed in many children. If such obvious signs were currently observed, possibly more clinical biochemical investigations would be made. Nevertheless, there is a general agreement that a large proportion of African school children suffer from mild-to-moderate malnutrition. Consequently, a national school feeding programme has been implemented. Ideally, feeding schemes should target preschoolers, but since there is no convenient collective access to very young children, the next best alternative is to address the nutritional needs of school attenders. This scheme was introduced in 1994, so it has not been possible or feasible to investigate anthropometric outcomes, but there is evidence of increased school attendance, and subjective reports of improved attention spans (NPPHCN, 1995).

2.3.5 The adolescent

No studies on the nutritional status of older African adolescents in South Africa have been published. One of the objectives of this thesis was to provide this missing information.

2.3.6 Adult men and women

This section will deal with dietary intake, anthropometry and other diet related outcomes in adult men and women, since at this stage of life the cumulative manifestations of diet and lifestyle over time become evident.

Dietary intake

In Table 2.9 macronutrient data (expressed as percentages of energy) are presented in chronological sequence. The study samples have been classified as 'rural' or 'urban' on the basis of the authors' descriptions. (Many studies did not include micronutrient data but this aspect will be dealt with in Chapters 4 and 5.)

Table 2.9: Macronutrient data expressed as percentages of energy (% E) of urban African adults

First author	Year	% E Protein		% E Fat		% E Carbohydrate	
		Rural	Urban	Rural	Urban	Rural	Urban
Fox	1940		13.5		16.4		69.3
Du Toit	1953		11		14		75
Batson	1953				17		
Bronte-Stewart *et al.*	1955				17		
Walker *et al.*	1969	11.9		18.8		68.9	
Manning *et al.*	1971		12		21-30		62-70
Walker *et al.*	1978	10		13		75	
De Villiers	1988	13		17		69	
Gericke *et al.*	1989		12		30		53
Walker *et al.*	1989	14.9		22.0		59.8	
Albertse *et al.*	1990		16		31		50
Silvis *et al.*	1992	13		26.5		56.6	

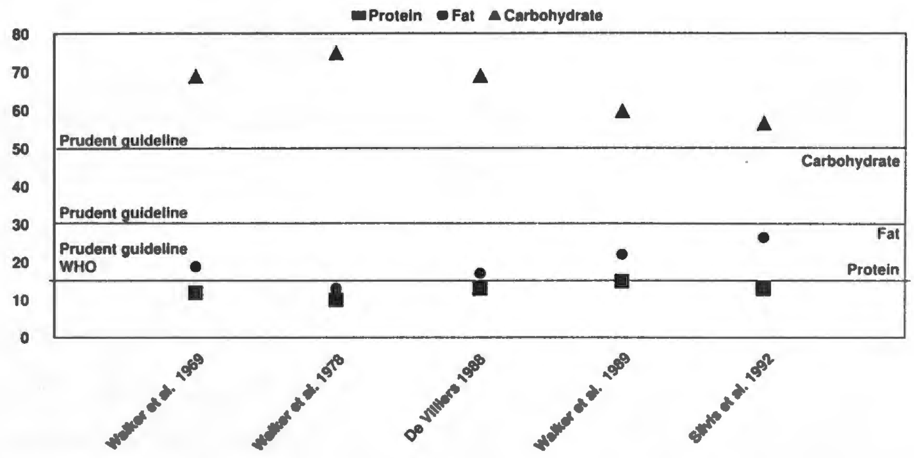

Figure 2.3: The mean % energy of macronutrients among adult Africans in rural areas of South Africa illustrating changes in the structure of the diet 1940 - 1992

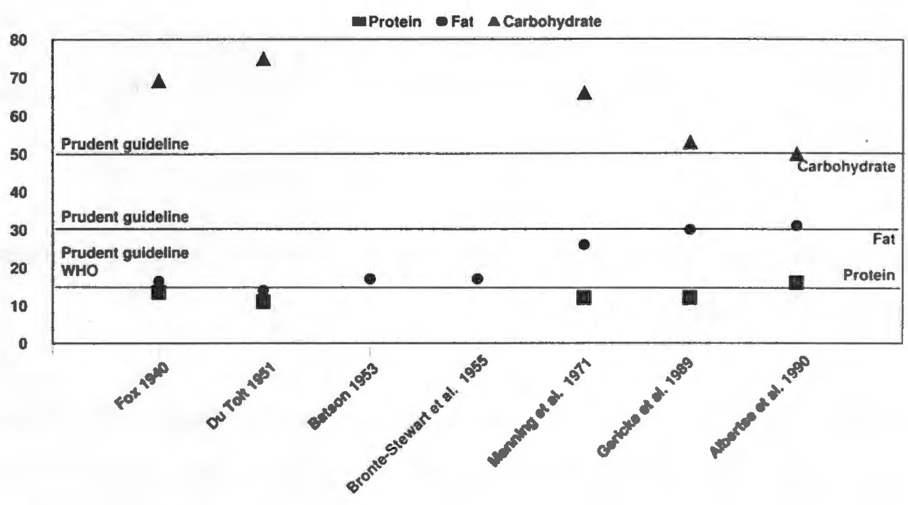

Figure 2.4: The mean % energy of macronutrients among adult Africans in urban areas of South Africa illustrating changes in the structure of the diet 1940 - 1992

Despite the variety of methodologies employed, and the incompleteness of much of the data (e.g. in many cases no standard deviations provided, sampling procedures not well described) the table serves to illustrate certain trends:

- there is little variation in the proportion of protein intake both over time, and between rural and urban areas
- fat intakes show an overall upward trend over time in both rural and urban areas
- conversely, the proportion of energy derived from carbohydrates decreases.

The collective evidence of these data, therefore, illustrate that although there is much evidence of diets meeting primary prudent guidelines, there has been a slow shift in the direction of a Western diet over time.

In 1939 Fox described the African diet in the Eastern Cape as follows:

> 'The diet consists principally of maize meal and to a lesser extent Kaffir corn [sorghum], milk, mfino [wild spinaches] meat and Kaffir beer [made from fermented maize and/or sorghum]' (Fox, 1939).

By contrast Manning, *et al.* (1974) referred to refined bread, rice and potatoes assuming greater prominence in the diet (as opposed to maize and sorghum); vegetables being eaten only at weekends, and that tea, coffee and mineral drinks were tending to reduce milk consumption. They further commented on the fact that, 'many blacks are developing an increasing fondness for fat'.

Many earlier studies refer to varying prevalences of pellagra, scurvy, as well as deficiencies of vitamin A and carotene, as well as calcium in adults (Fox, 1939; Fox, 1940; Brinton, *et al.*,1952; Smith, 1958; Keyter, 1961; Keyter, 1962; Packard, 1989).

Although frank deficiency stigmata occur rarely in recent times, dietary inadequacies of fruit and vegetables and milk are frequently reported.

Despite low calcium intakes in African women, osteoporosis is uncommon. However, anaemia appears to be widespread in women (see subsection 2.3.2. Women of childbearing age). Conversely, several studies have shown abnormal iron retention or siderosis, particularly in men (Bothwell and Charlton, 1988). In one study by Walker and Arvidsson (1953) a high iron intake was recorded, reaching 50 - 100 g daily. This was found to be "quite common" and attributed to the preparation of food and beer in iron utensils. This issue is currently subject to controversy, since iron utensils are being replaced by cheaper aluminium and plastic (in the case of fermented beer), particularly in urban areas.

Anthropometry

In 1972 Walker predicted that increasing urbanisation and a rise in SES in developing populations would increase their proness to obesity, hypertension, diabetes and strokes. These predictions have largely been borne out in the African population.

The early anthropometric studies in African samples were either purely descriptive (i.e. good, sturdy or poor "physiques") or used measures not comparable with those in use today. Moreover, the majority of studies were performed on children. However, more recent work shows high mean BMIs (>25) in samples of rural and urban African women in particular (Table 2.10). Conversely, men fall in the normal range.

Obesity (BMI >30) is also more prevalent in African women than in men (Mollentze, *et al.*, 1990) (Table 2.11). As can be noted in the comparison with Afro-Americans (Garrow, 1983), local figures are approaching those in developed Western populations.

Comparisons of mean heights of local African men and women show no secular trends, and are in line with samples of individuals of African origin elsewhere (Tables 2.12 and 2.13).

Table 2.10: Comparison of the mean BMIs of African male and female respondents in selected surveys

Survey	Year	Area	Ethnic group	Age	Mean BMI kg/m²	
					Men	Women
Seftel	1978	Rural Johannesburg	African	20 - 39	22.3	26.1
O'Keefe & Ndaba	1985	Rural Kwazulu	African	20 - 54	21.4	25.5
De Villiers	1988	Rural Kwazulu	African	24 - 46	-	28.0
Mollentze *et al.*	1990	Urban Mangaung	African	25 -44	23.2	28.4
Mollentze *et al.*	1990	Rural QwaQwa	African	25 -44	24.4	28.1

Table 2.11: Comparison of BMIs >30 of African male and female respondents in selected surveys

Survey	Year	Area	Ethnic group	Age	% Men	% Women
Garrow	1983	USA	Black	'Adults'	16.0	40 - 50
Mollentze *et al.*	1990	Rural QwaQwa	African	25 - 44	15.6	33.8
Mollentze *et al.*	1990	Rural Kwazulu	African	25 - 44	7.8	37.5

Table 2.12: A comparison of the mean heights of African male respondents in selected surveys

Survey	Year	Area	Ethnic group	Age	Mean Height (cm)	SD
Slome *et al.*	1960	Urban Durban	African	20 -50+	165.5	6.1
O'Keefe *et al.*	1983	Urban Durban	African	42 (16)	171.0	8.0
O'Keefe *et al.*	1985	Rural Kwazulu	African	37 (17)	165.0	7.0
Ndaba & O'Keefe	1985	Rural Kwazulu	African	41 (19)	166.0	7.0
Ostwald & Gebre-Medhin	1978	Addis Abbaba	African	20 - 30	168.0	6.3

Table 2.13: A comparison of the mean heights of African female respondents in selected surveys

Survey	Year	Area	Ethnic group	Age	Mean Height (cm)	SD
Slome *et al.*	1960	Urban Durban	African	20 -50+	155.3	5.8
O'Keefe *et al.* (patients)	1983	Urban Durban	African	41 (19)	161.0	7.0
O'Keefe *et al.*	1985	Rural Kwazulu	African	45 (15)	156.0	6.0
Ndaba & O'Keefe	1985	Rural Kwazulu	African	44 (18)	158.0	7.2
De Villiers	1987	Rural Kwazulu	African	24 - 46	158.0	6.0
Wing *et al.*	1989	USA Urban Pittsburgh	Black	42 - 50	162.4	6.3

Walker (1991) has repeatedly referred to the phenomenon of 'healthy obesity' in African women, which was also reported by De Villiers (1988) in her study of women living in a remote area of Zululand. These studies show that obesity is less associated with hypertension, diabetes and dyslipidaemia than is the case with the white population (Cornoni-Huntley, *et al.*, 1989). There are indications that under circumstances of rapid urbanisation, obesity becomes more 'noxious' especially with respect to hypertension and diabetes.

Hypertension

In rural Zulus the prevalence of hypertension is in the region of 2% and 8% (Seedat, *et al.*, 1981) and 13% (De Villiers, 1988). Likewise other non-urban African communities have a low prevalence of hypertension.

It follows that the process of urbanisation of Africans in this country may considerably increase the risk of hypertension. Urbanised Zulus have a higher incidence (25%) than the figures reported above (Seedat, *et al.*, 1981), while Mollentze, *et al.* (1995) reported an overall prevalence of 29%. He also found that significantly more women (34.5%) than men (22.1%) were hypertensive. This study was conducted in QwaQwa, which although 'officially' referred to as 'rural', reflects many features of urban settings as well as an urban lifestyle.

Two of the theories for hypertension in Africans relate to diet:

- Nutritional defects early in life might have late effects in precipitating diabetes, a disease often associated with obesity and hypertension (see subsection 2.3.3. on young children).

- Obesity, hypertension and non-insulin dependent diabetes may be linked through the common denominator of insulin resistance. Although not well studied among Africans in South Africa, it is a common clinical observation that these three conditions frequently coexist (Opie, 1995).

Diabetes

In the past when the traditional lifestyle was followed, diabetes was near absent in Africans in rural areas, as it still is in rural Tanzania (McLarty, *et al.*, 1989) . Early studies dating from 1960 to determine the prevalence of diabetes in this country were entirely hospital-based. Consequently, the results merely represented an approximation of the true prevalence of diabetes in the communities studied. However, population-based studies were published in the late 1960s. In a Cape Town study, the crude prevalence was 2,7% (with no age or sex standardisation to the population being calculated) (Goldberg, *et al.*,1969).

More recent community-based studies using the 1985 WHO criteria suggest that the prevalence of diabetes is considerably higher in African subjects than approximately 25 years ago ranging from 5,3% in Durban (Omar, 1993) to 8,0% in Cape Town (Levitt, *et al.*, 1993). However, differences in methodology from those utilised in the past make it difficult to determine whether an actual increase has occurred.

Importantly the Cape Town survey (Levitt, *et al.*, 1993) identified the following factors as independent risk factors: age, upper segment body fat distribution, urbanisation (i.e. more than 40% of life spent in an urban area) and obesity.

Cancers

The adoption of more western, drinking and smoking patterns in addition to low intakes of anti-oxidant vitamins is bound to influence the pattern of cancers seen in this population.

In African males the most common form of cancer is that of the oesophagus (Walker, *et al.*, 1992). Transkei has one of the highest reported incidence rates for oesophageal cancer in the world (Jaskiewicz, *et al.*, 1987). Although there are other important risk factors, from a nutritional perspective, low intakes of animal protein (sometimes noted in rural Africans) and dietary deficiencies in vitamins A and C, magnesium, niacin and riboflavin are also believed to increase the risk of developing oesophageal cancer (van Rensburg, 1981). In Transkeians, a low status of niacin, riboflavin, vitamin C, zinc, calcium and magnesium was confirmed in a dietary survey (Groenewald, *et al.*, 1981). Locally pellagra has been associated with high maize intakes, which in turn is associated with acute oesophagitis. It has been suggested that chronic oesophagitis (also associated with alcoholism) is a precancerous lesion, but the link between the acute and chronic forms of oesophagitis are uncertain (Segal, *et al.*, 1990).

The incidence of cervical cancer in local African women is among the highest in the world (Sitas and Norman, 1995). Although this is an essentially sexually transmitted disease, it has been linked to vitamin A deficiency, which increases the risk (Bernstein and Harris, 1984). Breast cancer is not particularly evident in African women. However, since this has been correlated with high intakes of animal fats (Willett, *et al.*, 1992), current dietary trends may increase breast cancer risk in this group.

Although colorectal carcinoma is one of the most common cancers in the world, the incidence in Africans in South Africa is one of the lowest in the world (Segal, 1988). Walker, *et al.* (1986) have shown that the frequency of colon cancer in the different South African ethnic populations is associated more with faecal pH than with the level of dietary fibre intake. It appears that differences in fermentation due to difference in intestinal flora or the high ingestion of maize starch by Africans may explain differences in faecal pH and differences in the incidence of colorectal cancer in the different ethnic groups.

In conclusion, the low micronutrient intakes in adult Africans, coupled with increasing westernisation of the diet, place them at risk for borderline low micronutrient status. Their risk of developing degenerative diseases in the decades to follow also increases. It is clear that it is the adults who have food purchasing resources, and the power to make nutritional choices that are imposed on the younger members of family units. Nevertheless, there is still much scope for preventive work.

Dyslipidaemia

The first survey of serum total cholesterol (TC) and diet in this country that included Africans was conducted by Bronté-Stewart, Keys and Brock (1955) in Cape Town. Their subjects were middle-aged men and they showed that Africans had the lowest mean TC of about 4 mmol/ℓ and whites the highest at 6 mmol/ℓ. These levels were closely correlated with intakes of animal fat. At about the same time Walker and Arvidsson (1954) found that mean TC levels of Johannesburg Africans were between 4 mmol/ℓ and 4.5 mmol/ℓ and the rise with age was slight.

In the 1960s two studies on Africans, with proven myocardial infarction, showed that these early sufferers were considerably westernised and habituated to a diet high in animal fat, and reflected raised TC and triglyceride levels (Seftel, *et al.*, 1963; Seftel, *et al.*, 1970). Nevertheless, although it had been noted that CHD had emerged in Africans, rates were low.

About a decade later, Seftel (1978) investigated TC levels in free-living Africans in Johannesburg, including 499 men and 503 women aged 16 - 59. Mean TC levels varied from about 3.5 mmol/ℓ in the younger groups to 5 mmol/ℓ in the middle-aged group.

From the late 1970s into the 1990s six South African communities were compared, using the same methodologies and standardised training of fieldworkers. Three African groups were included; a sample of 986 urban Africans resident in Cape Town (Steyn, *et al.*, 1991), a sample size of 758 men and women living in urban Mangaung (Mollentze, *et al.*, 1995) and a rural sample of 853 respondents from QwaQwa. Cut-off values for high risk TC and low density lipoprotein cholesterol (LDLC) levels were used as defined by the action limits of the Heart Foundation of Southern Africa (Rossouw, *et al.*, 1988).

Hypercholesterolaemia and increased LDLC were most common in the coloured, Indian and white groups than in the three African samples. An unusual finding was the higher prevalence of hypercholesterolaemia and increased LDLC levels in the rural African group from QwaQwa, compared with those in urban Cape Town (Steyn, *et al.*, 1992). However, it has been noted that in QwaQwa "urbanisation and industrialisation have affected this region profoundly" (Mollentze, *et al.*, 1995). Prevalences of hypercholesterolaemia and LDLC levels were higher in urban Mangaung than those in 'rural' QwaQwa and urban Cape Town.

In the Seven Schools Study conducted in the 1990s, CHD risk factors were surveyed, for the first time, among male scholars aged 15 - 20 years. The sample consisted of a range of ethnic and socio-economic groups, and included rural and urban Africans. In general, the CHD risk factor profile was worse in the higher SES groups and it also tended to be worse in urban than in rural Africans. However, in respect of the CHD risk factor, lipoprotein (a) (Lp (a)), the African scholars were distinctly worse off, being 50% higher than those of whites, coloureds and Indians (Seftel, *et al.*, 1993). On the basis of a previous study (Vermaak, *et al.*, 1993) in which the Lp (a) in the neonatal cord blood of Africans and whites was investigated, the Lp (a) levels in Africans were 45% higher than those of whites. In the light of the latter finding, suggesting a genetic predisposition, and of the previous results reflecting exposure to a western lifestyle, the potential of Africans to develop CHD exists, particularly if their overall CHD risk factor profile deteriorates.

In summary, subsection 2.3.2 shows that the earlier work carried out among Africans revealed much evidence of frank nutrient deficiencies. While evidence of undernutrition still exists, this is manifest primarily as growth retardation rather than kwashiorkor or other clinical stigmata. Among adults the emergence of degenerative diseases in Africans is becoming increasingly evident. In the past rural groups were nutritionally compromised to a greater extent than those in urban areas, although more recently these distinctions are becoming increasingly blurred.

2.4 DIETARY SHIFTS AND TRANSITIONS

2.4.1 Introduction - Transition theories

As a field of study, 'health transition' echoes several earlier theories of health change. Two of the most prominent are the 'demographic transition' and the 'epidemiologic transition' (Murray and Chen, 1994). However, some workers currently refer to a 'family of transitions' drawing attention to other dimensions of health change, such as socio-cultural and behavioural shifts, as well as political, economic, technological and educational changes. It is likely that these dimensions in fact propel, or drive shifts in morbidity and mortality.

In the South African context Yach (1995) has drawn attention to five factors that influence long-term health. Each of these factors is currently subject to very rapid changes.

(i) Educational transition, which increases people's knowledge to become more qualified to demand services.

(ii) Technological change in the areas of biotechnology, information science and telecommunications which will increasingly influence local abilities to prevent, diagnose and treat disease.

(iii) Cultural changes, for example, the dissemination of rational explanations and evidence of the power of technology, have raised expectations of a better quality of life and the willingness to accept modern medical treatment. (Concurrently, there may be a decreasing tendency to opt for traditional forms of medicine, some of which are detrimental to health).

(iv) Political changes, which lead to recognition of health care as a social right, have led to health care being embodied in the new constitution.

(v) Transformation in the South African economy will lay the foundations for household income growth, which in turn, accelerate changes in lifestyles that influence health. In the long term, these will boost demand for medical care.

What are the origins of transition theory?

In 1964 Stolnitz, and subsequently in 1975, Teitelbaum, in summarising a good deal of earlier work, noted that demographic transition theory seeks to describe the historical changes of fertility, mortality and population dynamics in now-industrialised populations over the past century. These societies progressed over time from very high levels of fertility and mortality to very low levels of both. One derivative of demographic transition theory, is the hypothesis that many of today's developing societies are in the midst of their own demographic transitions, repeating the experience of now industrialised countries. Since the theory includes both fertility and mortality change, it contains the implication that fertility and mortality processes are interlinked - through, for example, the possibility that improved child survival can influence decision making and fertility. However, in its full form, the theory also postulates various social and economic forces that shaped the initial mortality and later fertility decline (Murray and Chen, 1994).

To analyse the mortality component of demographic change, Omran (1971) coined the term epidemiologic transition to focus on, "the complex change in patterns of health and disease and on the interactions between these patterns and their demographic, economic and sociological determinations and consequences". In shifting from high to low mortality levels, all populations experience a shift in the major causes of illness and disease. Whereas infectious diseases and nutritional and reproductive health problems predominate in high mortality populations, the chronic and degenerative disease predominate in low mortality populations.

Omran (1971) identified three phases in this transition:

(i) the age of pestilence and famine
(ii) the age of receding epidemics, and
(iii) the age of degenerative and man made diseases.

Olshansky, *et al.* (1986) proposed a fourth phase in the epidemiologic transition - the age of 'delayed degenerative diseases'. This phase was proposed because of the progressive declines in the death rates from some chronic diseases associated with steady gains in life expectancy among the aged in the United States and some other industrial countries.

Also in 1986, Soberón, *et al.* referred to a protracted transition where a mixture of infectious and chronic diseases would persist for a long time, suggesting that developing countries may not necessarily follow the same path as in developed nations. This, the authors proposed, would most likely reflect an epidemiologic polarization of society, whereby the better-off segments would have completed the transition, while the poorer groups would continue to suffer from the pretransitional pathology. They concluded that in order to eliminate such inequalities, it would be necessary to continue the fight against infections and malnutrition while at the same time preventing the negative health effects of industrialisation and urbanisation.

Mosley, *et al.* (1993) have provided a schematic model, which encompasses all changes or transitions described above.

Collectively these changes fall under the umbrella of the health transition. The model also illustrates relations among the demographic, epidemiologic and health transitions and includes the protracted-polarized epidemiologic transitions.

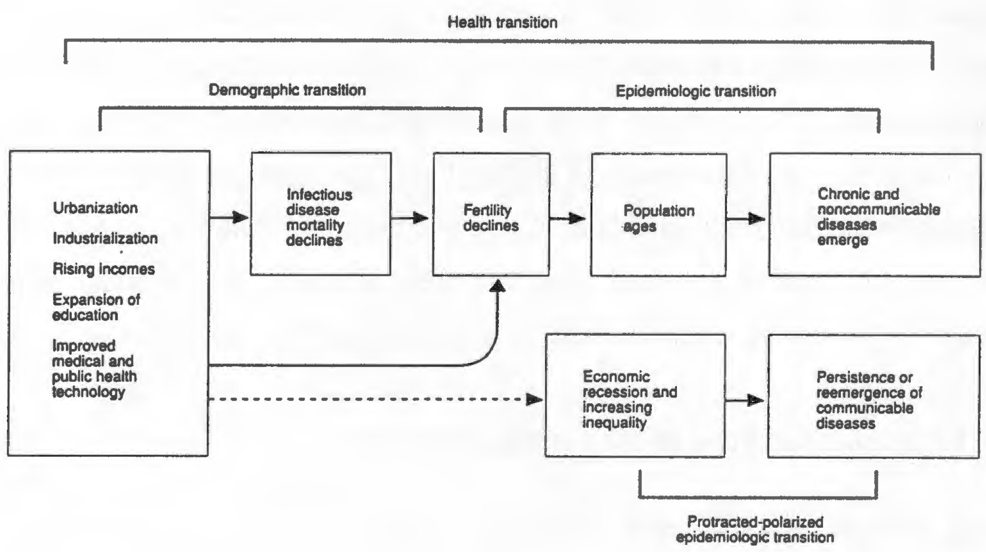

Figure 2.5: Relationships among demographic, epidemiologic, and health transitions (Mosley, *et al.* 1993)

Frenk, *et al.* (1994) have provided some critical insight into the relevance of such models pointing out that the basic change patterns described above proceed at different rates among the different social strata and regions of a country, which effectively worsens health inequalities. Attention was also drawn to the fact that the dynamics of epidemiological change not only vary substantially within countries but also among countries. Therefore, the authors suggested the need to use the plural in referring to the varied health transitions. This would apply to the South African situation with its diverse population and socio-economic groups.

2.4.2 The nutrition transition

As indicated in the Introduction (p. 53) the 'nutrition transition', a term coined by Popkin (1993), is linked to the demographic and epidemiologic transitions. He has also demonstrated the strong implications for developing countries, embodied in these dietary shifts, whereby the nutritional problems usually associated with poverty (mainly nutritional deficits) coexist with those relating to rises in SES (nutritional excesses). Simplistically these are often referred to as under- and overnutrition, with the former linked to deficiency syndromes and the latter, to degenerative diseases. However, it is clear that from the case studies cited from developing countries around the world (Popkin, 1994), that this 'double burden' of disease presents developing countries with an extremely complex agenda for future health and nutrition policy.

There is an awareness of a number of common threads unifying most countries, which have undergone a rapid nutrition transition during this century (Monteiro, *et al., 1995).* Normally, there appears to be a progression from a period in which attainment of dietary sufficiency (on a per capita basis) - adequate energy and protein intake - to one in which a shift in the structure of the diet is the main source of nutritional change. Although there are unique features to what constitutes 'the traditional diet' in each case, the 'traditional diet' in most countries has a starchy or carbohydrate-rich basis that is also high in fibre, while protein (especially animal protein) and fat intakes are low. These common elements are abandoned, with time, for a pattern high in fat and refined carbohydrates, which constitutes, a simple, low cost, micronutrient-deficient Western diet. Associated with these dietary shifts, are changes in nutrition-related outcomes such as increases in the prevalences of obesity and in turn increased prevalences of hypertension, diabetes, cancers and in most countries, cardiovascular disease.

Information on a broad diversity of countries, representing a great variety of dietary cultures, which were classified as low income at the time of their transition, show a striking rapidity of structural change in their diets - particularly in China (Popkin, 1993) and countries in South East Asia (Popkin, 1994). However, poorer pockets of the population remain undernourished - reflecting a form of "protracted transition".

Earlier pioneering work by Burkitt (1973) on the role of fibre and its context in western vs. traditional societies led to his examination of many of the diseases that have become common in the Western world, particularly in Europe and the U.S.A. in the past century. These same diseases are rare or unknown in traditional, non-Western societies, but they increase in frequency under the influence of culture change - that is, where Western customs and lifestyles are adopted. These 'new' diseases include: appendicitis, diverticular disease, benign colonic tumours, cancer of the large bowel, ulcerative colitis, varicose veins, deep vein thrombosis, pulmonary embolism, haemorrhoids, coronary heart disease, gallstones, hiatus hernia, obesity hypertension and diabetes.

Burkitt (1973) observed that obesity is the "commonest form of malnutrition in the West", and suggested how changes in technology and dietary culture may be related to the increased incidence of certain diseases. Food fads and the high prestige given in some cultures to refined forms of carbohydrate, all contribute towards this effect.

In a subsequent paper Burkitt (1982), in reference to Africans stated, "It can confidently be assumed that the ancestors of Black Americans on first arrival in America cannot have been more affected by these diseases than are rural Blacks today". He further suggested that, "in view of the fact that all these diseases can be shown to be either directly or indirectly related to the alimentary tract, it seems likely that the environmental factors most likely to be responsible are dietary. Contrasts between the composition of the diet in communities with high and in those with low prevalences of these diseases are similar to the respective dietary situations that prevailed in Western nations before and during the rise in prevalence of these diseases".

He further demonstrated that, "when sources of energy in communities with minimal prevalences of Western diseases are compared with those of maximal prevalences, the direction in which changes should be made were obvious".

Fig. 2.6 illustrates the main contrasts between Third World and Western diets, according to Burkitt (1982) and Fig. 2.7 the contrasts between Third World, Western diets and recommended changes (Burkitt, 1982). These recommended changes were then in line with the 1977 Dietary Goals for the U.S.

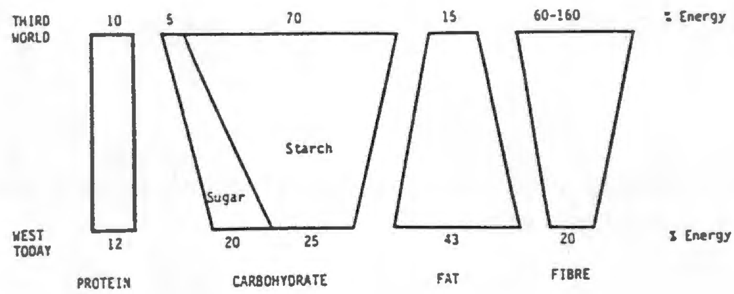

Figure 2.6: Main contrasts between Third World and Western diets

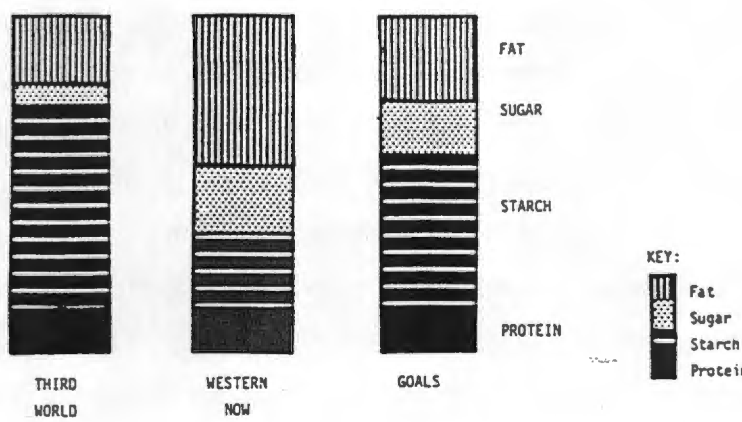

Figure 2.7: Contrasts between Third World and Western diets and recommended changes

Prudent dietary guidelines for the prevention of degenerative diseases in general and CHD in particular, have differed little over the passage of time and between countries. (See also Table 2.5 in subsection 2.2.1: *(h) Other dietary evaluations* in this Chapter). However, the recent attention to antioxidant vitamins and the important role of micronutrients in general, call for diets that are balanced in every respect. In other words, nutrition policies should ideally be based on a 'marriage' between prudent dietary guidelines and the food group approaches based on RDAs or RNIs - depending on the specific requirements of the population in question. In developing countries, constraints such as availability and affordability should also be taken into consideration.

In this thesis, dietary intakes will be evaluated with the above issues in mind. Transition is examined in two ways:

(i) shifts in dietary intakes and nutrition-related outcomes over time, and
(ii) comparisons between rural and urban populations.

2.4.3 Some effects of migration and urbanisation and changes in socio-economic status, on diet and nutritional status

The migrant coming to town is faced with many problems: The change from a rural to an urban environment and way of life, finding employment and housing, as well as the social experience of separation from the family if the family remains in the village (Freedman, 1973). The new urban environment affects food habits and dietary intake in many ways, frequently making it difficult for newcomers to maintain their former 'dietary culture' (Helman, 1995). Migrants to the cities frequently depart from a subsistence agricultural food supply, supplemented by purchases from a local trading store. The provision of fresh foods - meat, milk, fruit and vegetables in rural areas is subject to seasonal variations and periods of drought. In the cities, however, a variety of conditions operate - food supply is more consistent, more attractively packaged and marketed, and there is a tempting array of ready-to-eat convenience foods from commercial outlets and vendors. These are generally refined, and have high fat, starch and salt contents (den Hartog and van Staveren, 1985). However, fruits and vegetables are frequently prohibitively expensive, so that diets can easily be micronutrient deficient.

Since newcomers may not easily find employment or proper housing, there is a tendency worldwide for them to settle in shanty towns on the peripheral fringes of cities. The following issues around food procurement and preparation are typical of peri-urban informal settlements, both locally and elsewhere in the world:

- informal dwellings have inadequate food preparation facilities and individuals are often forced to cook 'one pot' dishes in unhygienic, overcrowded circumstances;

- food storage facilities are similarly limited, leading to the purchase of small units of unperishable items;

- piped household water may not be available. This contributes to unhygienic practices, furthermore, the collection of water is time-consuming and requires much energy;

- fuel costs are high, imposing a further drain on the food budget;

- poverty compels individuals to buy food items in small units, which are more expensive per unit than bulk purchases;

- cash flow is inconsistent. There are periods when cash becomes suddenly available when a feasting syndrome occurs (particularly if food cannot be stored) and times when there is no money and a period of deprivation follows;

- although credit facilities are advantageously available (e.g. through hire purchase agreements), individuals easily become enmeshed in a financial web that they do not understand and are powerless to control;

- the poor consumer can easily be swayed by salesmen and hawkers and are frequently led to make inappropriate purchases;

- low literacy rates further hamper food-related decision making;

- food inflation frequently spirals in larger cities because of food chain monopolies;

- long commuting distances impose additional expense and commuters are very often only able to purchase what they can carry, or are forced to buy from more expensive outlets nearer home;

- women are often forced to seek employment, thereby compromising the nutritional status of their children

Adapted from den Hartog and van Staveren, 1985; Popkin and Bisgrove, 1988; Gross and Monteiro, 1989.

Not surprisingly, most studies investigating intra-urban differentials in morbidity in South America, South East Asia and parts of Europe, have shown that those in informal settlements have the poorest nutritional status. Various reviews of the literature have shown that stunting, anaemia and micronutrient deficient diets are more prevalent among preschoolers, while adults increasingly reflect the previously designated diseases of affluence, such as hypertension, diabetes, heart disease, exacerbated by obesity (Harpham and Stephens, 1991; Popkin, 1994; Gross and Monteiro, 1989).

It has also increasingly been recognised that peri-urban dwellers are not only comprised of new arrivals to the city from rural areas, but also consist of low income individuals who are city bred (intra-urban migration) and those who oscillate between rural home base and city work base (cyclical migration) (Atkinson, 1992).

Locally Dewar, *et al.* (1991) have shown that cyclical migration is widespread and should not be seen as transient. Rather, it is an attempt by families and clans to spread economic risk across several household units, which may even consist of a series of bases in several cities with strong rural ties. They have also noted that in Cape Town a simpler dual migratory pattern exists - between rural former Transkei/Ciskei and Cape Town - than is the case further north in the Transvaal area and in the east, in Natal.

These processes also have nutritional implications in that there is an outward spread of urban influence with its more affluent lifestyle and Western diet into rural areas. In spite of this, rural ties ensure that some features of the traditional diet, and certain dietary customs (e.g. those associated with cultural events) are maintained. Since the rural home base is regarded as a 'place of retirement', a 'safety net' and a 'base for school-going children' (Watson, personal communication 1994), it seems likely that rural ties will exist for some time to come.

Relatively few studies have attempted to quantify the effects of urbanisation, such as increased income and changes in socio-economic status, and their associations with nutritional status and dietary intake in particular. Most that exist seem to focus on the nutritional status of children using anthropometric status as an outcome. Predictor variables used in such models depend on circumstances particular to the context involved, but generally some indicators of SES or income are included. Some examples follow:

Socio-economic status, education and health variables were examined to determine the underlying factors of malnutrition in preschool Haitian children (Smith, *et al.*, 1983). It was found that the money available for food had the greatest impact on the child's anthropometric status. In one of the few analytic studies using diet as an outcome, Caliendo and Sanjur (1978) investigated determinants of dietary quality in preschoolers in the United States. Variables exerting predictive influence on dietary quality, were those of gender, ordinal position, maternal employment status, education and nutrition knowledge.

Turning to Africa, preschool children in an urban community in Gambia were studied in order to determine relationships between nutritional status and socio-economic factors (Tomkins, *et al.*, 1985). Height-for-age was significantly associated with factors such as 'European style' houses, or in homes with refrigerators, flush toilets or a private water supply. Another African study investigating the relationship between living conditions and anthropometric outcomes in preschoolers, was conducted in Lesotho (Daniels, *et al.*, 1991). This case control study examined the association between attained height and latrine ownership. Children in homes with latrines were significantly taller (i.e. height-for-age) than those without, suggesting that anthropometric status of children may be responsive to improvements in sanitation facilities. Relationships between nutritional status and several dimensions of SES were investigated in under-five-year-olds in peri-urban areas in Zimbabwe. Variation in anthropometric status was principally associated with the SES of parents, which included education, occupation, income and housing tenure (Mazur and Sanders, 1988). Among African women, both the circumstances of poverty and the consequent search for employment, as well as increased affluence, have shown to be associated with the abandonment of breastfeeding.

From the studies cited above, it is clear that the nutritional status of very young children is determined by the circumstances into which they are born (i.e. SES), and parental attributes mainly related to educational level, and in turn, employment status. Similar patterns have been demonstrated in older children, and adults.

For example, an investigation of the relationship between socio-demographic variables and growth of schoolchildren in Dhaka city, Bangladesh. This showed that family income made a significant contribution to the variation in the anthropometric indices of these children (Ahmed, *et al.*, 1991). In a subsequent study also carried out in the slums of Dhaka, non-pregnant mothers were studied in order to examine levels and correlates of maternal nutritional status. Various anthropometric parameters were positively correlated with mothers' years of schooling and household economic status (Baqui, *et al.*, 1994).

Certain studies focus on the family or household unit as a whole. Two examples of this approach were conducted among families in Mexico and Brazil. Dewalt and Pelto (1977) used a diet quality index derived from six food categories, for the purposes of investigating predictor variables associated with diet. The analysis revealed that the most powerful predictor of nutritional adequacy in this community was 'material lifestyle' accounting for 29% of the variance in the diet quality index. Among the conclusions reached, the authors stated that 'people who enjoy a higher standard of living in housing and furnishings, also enjoy a more varied and nutritionally adequate diet'.

De Mello Amorozo and Shrimpton (1984) investigated the influence of income and length of urban residence over dietary patterns, food intakes and nutrient adequacy in a slum suburb of Manaus, in Brazil. They found that length of urban residence (measured in years) was significantly related to family income, significantly affected the frequency of meat, fish and milk (in the direction of increased intakes), but did not exert a significant influence over dietary adequacy.

The overall impression gained from the above studies shows that higher SES expressed in various ways and across ages, in low income groups, has a positive association with better nutritional status.

2.5 BACKGROUND – THE LOCAL SITUATION

2.5.1 Demographics of Cape Town

Statistics relating to population size and growth of Cape Town are notoriously inexact and estimates vary considerably.

The natural growth and spatial distribution of the African component of the population have been severely distorted by the application of laws and during this century, particularly during the apartheid era of Nationalist Party rule since 1948 (Horrell, 1978). (However, since the abolition in 1986 of laws preventing migration of Africans to the cities, and thereby permitting free movement within cities, the circumstances of Africans were irrevocably changed.)

In 1948 African migrant workers were rehoused in single sex (i.e. male) hostels in Langa and an emergency camp was set up at Nyanga for those African families who qualified to remain in Cape Town. This latter site expanded over the years and the western portion of it was named Guguletu

(Elias, 1983). These areas formed the main sites for the 'official' African residents of Cape Town under the Group Areas Act (Act No. 41, 1950). During the early 1980s increasing pressure of migration to the city led to the development of the Crossroads squatter camp. In 1983, the authorities bowed to pressure to provide more land for African settlement on a 3 200 hectare site (Khayelitsha). This area contained both formal housing and squatter areas.

During the mid 1980s, internal power struggles and political unrest led to a rise in violence in Cape Town African townships. This resulted in a number of new squatter settlements in and around Nyanga and Guguletu, and the establishment of a large emergency tent town at Green Point, Khayelitsha.

In 1986, influx control of Africans to urban areas was abolished, resulting in greatly increased migration to the city (Dewar, *et al.*, 1991).

The 1991 census provided the following official population for the greater Cape Town area (Table 2.14) (Central Statistical Services, 1992).

Table 2.14: Adjusted census population for greater Cape Town, 1991 (01 Statistical Region)

	Number	%
White	483 526	25.9
Coloured	947 037	50.6
Asian	25 722	3.8
African	412 858	18.7
Total	1 869 144	100.0

The age-sex composition of the African population of greater Cape Town, calculated from the 1991 census, is given in Table 2.15.

Table 2.15: Percentage age/sex composition of the African population of Cape Town, 1991

Age in Years	% Men	% Women	% Both
< 15	13.5	13.9	27.4
15-64	38.2	32.1	70.3
≥ 65	1.4	0.9	2.3
All ages	12.3	14.9	100.0

The population was a young one with 27.4% less than 15 years of age and only a very low percentage, 2.3% aged ≥ 65 years. As a legacy of the migrant labour phenomena of the apartheid years, there is a preponderance of males in middle and old age, contrary to usual demographic expectations.

2.5.2 Selected mortality and morbidity profiles

In the light of the inequities in health status between different sectors of the population brought about by apartheid, some leading indicators pertaining to the African population in Cape Town are presented in this section. For comparative purposes data from other sectors of the population are also included. Because of fragmentation in the delivery of health services in greater Cape Town, there is no single source of health statistics covering the whole area. The area covered by the then Western Cape Regional Service Council (WCRSC) contained the bulk of the areas housing the African population and large proportions of other population groups, including a range of socio-economic status. Most of the data presented here, are from their 1990 Annual Report (WCRSC, 1992). This reflects aspects of health status at the time of the survey, while the graphical displays reflect trends over the previous decade up to 1990.

(a) Pregnancy and child birth

(i) Infant Mortality Rate (IMR)

White	< 8/1 000
Coloured	17.3/1 000
African	33.7/1 000

The causes of death among African infants are poorly diagnosed – 43.5% were 'ill defined' and 11.6% were from gastroenteritis.

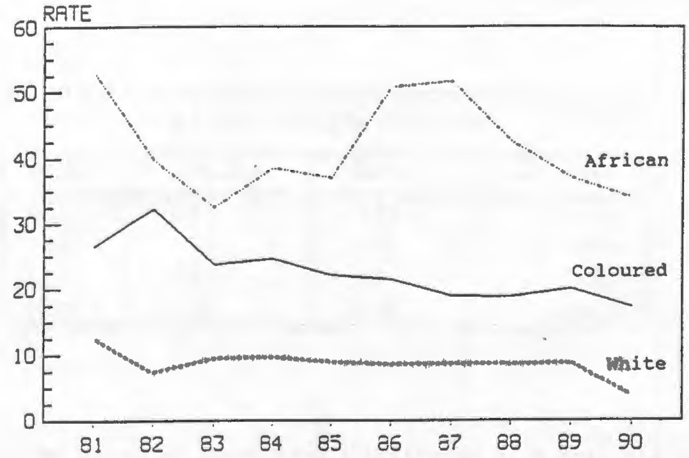

Figure 2.8: Infant mortality rates for the Western Cape Regional Services Council of greater Cape Town for the years 1981 - 1990 (WCRSC, 1992)

Rises in IMR and perinatal mortality rates among Africans, probably reflect the results of rapid migration following the relaxation of influx control in 1986.

(ii) Low birth weights

In 1990 the percentage of African babies with birth weights <2 500 g was 13.1% of total births, while that for coloured births was 18.5%, contrasting with whites (6.5%). However, in the graphical analysis (Figure 2.9) reflecting trends over time, it can be seen that rates of low birth weights for African births were increasing after 1988, following a peak in 1986. The overall highest percentage in coloured births is generally attributed to smoking habits and alcohol intake in coloured mothers, compounded by the impact of low socio-economic status.

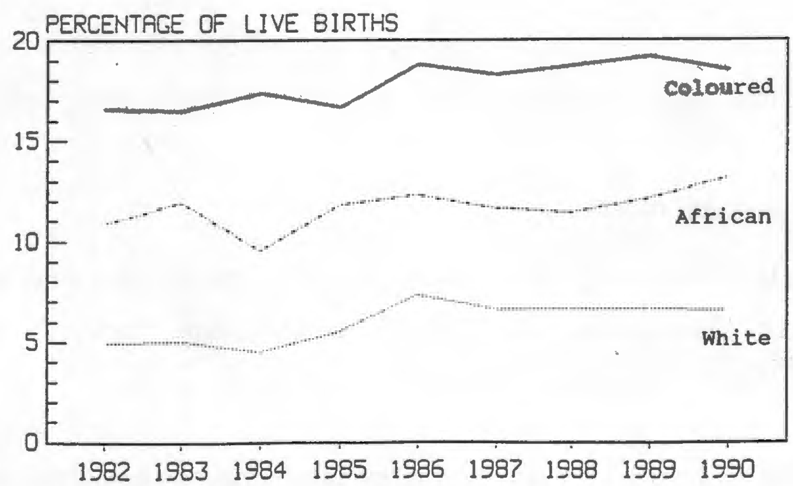

Figure 2.9: Low birth weight (<2 500 g) rates for the Western Cape Regional Services Council of greater Cape Town for the years 1981 - 1990 (WCRSC, 1992)

The graphical display of the trends of low birth weight are shown above. It is very disturbing that the rate in African babies rose over two 'most recent' years after having shown declines in the previous two years — possibly reflecting the impact in the decline of influx control measures.

(iii) Teenage Pregnancy Rate

Since this thesis will include a focus on 15 - 18-year-olds, data on teenage pregnancy rates are presented below.

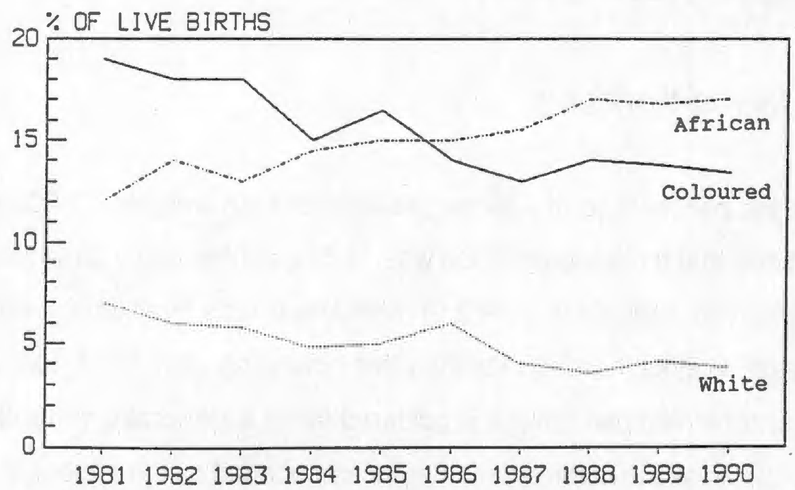

Figure 2.10: Teenage pregnancy rate for the Western Cape Regional Services Council of greater Cape Town for the years 1981 - 1990 (WCRSC, 1992)

These graphs reflect an increasing trend of teenage pregnancy rates in Africans, suggesting increasing compromises to nutritional status of African adolescents.

(b) General mortality

Among the African population, violence is the most important cause of deaths (36.8%) followed by 'ill-defined' conditions (15.1%) and circulatory causes (6.1%). [These account for 58.0% of deaths.]

By way of contrast in local whites, total circulatory causes amounted to 39.6% of mortality, while in the coloured population total circulatory mortality accounted for 22.9% of deaths. These figures suggest that non communicable diseases are probably least prevalent among Africans.

Concluding remarks

Data concerning Africans in Cape Town are considered by many to be inaccurate both due to the high mobility and poor reporting in this population. Nonetheless, they reflect a picture of greater health risk in many respects (as indicated in the graphical displays), in comparison with the generally low income coloured population. The extent to which these differences may be attributed to contrasts in nutritional status is not clear. Nevertheless, the lower SES of Africans in comparison with the coloured population is undoubtedly a causative factor.

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CHAPTER 3 METHODS

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CHAPTER 3

METHODS

3.1 INTRODUCTION

The opportunity to conduct this study on the dietary intake of urban Africans arose because of the availability of funding for a large scale study on the prevalence of risk factors for ischaemic heart disease (IHD) in this population. The execution of this thesis topic consequently fitted in with the overall strategic design of the BRISK study of which the author was one of three principal investigators.

The overall aim of the BRISK study was:

- to determine the IHD risk factor patterns, the dietary pattern and nutritional status in the African population of the Cape Peninsula.

The objectives of the BRISK study were:

- to determine the degree of urbanisation, the demographic characteristics, physical activity, smoking and alcohol consumption patterns

- to determine the nutrient intake, meal patterns and some habitual dietary intake patterns of the target population

- to measure the height, weight and blood pressure of the target population

- to measure the serum level of a variety of biochemical and haematological parameters related to IHD and nutritional status

- to determine the interrelationships of the abovementioned variables with particular emphasis on measures of urbanisation.

Certain constraints were imposed on the dietary study in the planning stages, so that it would be consistent with the overall BRISK study, and two preceding coronary risk factor studies; one a population-based representative sample on a rural white community, the CORIS (acronym for coronary risk factors) study (Rossouw, *et al.,* 1983), and another on a representative sample of an urban coloured population, the CRISIC (acronym for coronary risk factors in the coloured population) study (Steyn, *et al.*, 1985).

As it was not clear, *a priori*, which age groups would ultimately be examined in detail in all phases of the BRISK study, provision was made in planning for a potential wide range of age categories. The dietary survey used the same sampling frame as other components of the BRISK study.

3.2 STUDY DESIGN

A cross-sectional analytic study was planned, aimed at a representative sample of both the formal and informal housing areas of the African population of the Cape Peninsula.

The dietary topic of this thesis has to be seen as a component of a broader study, the BRISK study, which was to be a prevalence study of risk factors in a representative sample of the African population aged 15 - 64 years and living in the Cape Peninsula. The dietary study was nested within this framework and was planned to include 3 - 6-year-olds. The overall mechanism of funding for this study was such that the sample had to be comparable with previous large local studies on ischaemic heart disease (IHD) risk factor prevalence i.e. the CORIS (on rural whites) and CRISIC (on the coloured population) studies (Rossouw, *et al.*, 1983; Steyn, *et al.*, 1985). Therefore, the sampling frame firstly required cells in five ten-year age categories for men and women i.e. 15 - 24 years, 25 - 34 years, 35 - 44 years, 45 - 54 years and 55 - 64 years. In addition, the dietary requirements meant that the sampling frame was constrained to sample also the 15 - 18, 19 - 24, 25 - 50 and ≥ 51-year age and gender categories. The age categories are founded on age-specific requirements as set out in the Recommended Dietary Allowances (RDA) USA (Food and Nutrition Board, 1990). Since the 24-hour recall method was utilised (see subsection 3.5.1 on Rationale for choice of method), an additional constraint was that a minimum of 50 individuals were required for each age and gender cell (Block, 1982).

For the purpose of this thesis it was decided to focus on 3 - 6-year-olds to represent a preschool group, 15 - 18-year-olds, to represent an adolescent group, and 19 - 44-year-olds to represent adults and reflect a childbearing group (for women). In addition, the larger 15 - 64-year-old group as a whole was investigated in multivariate analyses.

3.3 SAMPLING PROCEDURE

The overall BRISK study required a representative sample of both the formal and informal housing areas of the African population of the Cape Peninsula.

As is mentioned above, there were two main components to the study that had to be considered when deciding on the sampling method:

(i) an IHD risk factor study, which required data in ten-year age strata for both genders for the age range 15 - 64 years (ten cells)

(ii) a dietary study requiring the following age/gender strata 3 - 6 years (both genders combined) and for men and women separately 15 - 18, 19 - 44 years (five cells), within which a minimum of 50 persons were necessary.

Recent South African censuses have been of dubious quality, particularly in respect to the African population. The last national census prior to the study was held in 1985, but had already become dated because of recent large scale migration following the abolition of influx control legislation. The Cape Provincial Administration contracted the Human Sciences Research Council (HSRC) under the direction of Prof. D.J. Stoker, to conduct a more up to date census of the African population of the Cape Town metropolitan area (*unpublished report*). This carefully designed census involved a sampling strategy particularly in the squatter areas, where special aerial photographs were taken in order to obtain accurate information on that sector of the population. Accordingly, up to date and accurate population data (and mapping) were available for planning the sampling strategy for this survey.

From a theoretical viewpoint, a pure probability sample would have been ideal. This however, would have required repeated follow-up visits if selected individuals were not at home. It would not only have been prohibitively expensive, but also would have been impossible in practice in squatter areas, particularly at night when it is not possible to identify individual shacks.

Accordingly the sampling scheme used was a stratified probability sample with quotas (Sudman, 1966). The quota sampling was only used in the final selection stage of the individuals in a household, and stratification ensured good representation of the household. The adopted scheme would yield results closely approximating a pure probability sample, but at a lower cost.

The availability of the local 1988 census meant that properly designed age-specific quota could be drawn up for the final stage sampling.

Each geographic area was further subdivided into sectors. Sectors containing houses and hostels were then divided into blocks, with each block containing approximately 50 sites. A random sample of blocks were selected from each sector, and within these blocks four sites were again randomly selected. If the site contained more than one dwelling, a random selection of a dwelling was used. This procedure was repeated if the selected dwelling accommodated more than one household (defined as a group of individuals who cook and eat together). At the final stage of selecting an individual, a quota list for that sector was used. The quota lists were drawn up in such a way that a specified number of men and women were selected within the given age categories. An example of a quota list is attached (Fig. B.1, Appendix **B**).

The sample was designed so that with 100% realisation it would be self-weighting. It was however, necessary to inflate certain cells of the self-weighting sample to comply with the specified minimum cell frequencies of the dietary survey. In order to obtain population estimates for both genders and all ages, the observed data in these cells had to be deflated by the corresponding factor. In calculation of the weights, provision had also to be made for the over- or underrealisation of the sample in certain cells. The technical details of these adjustments and the weights used are given in Appendix **B**.

In all calculations in this thesis (unless otherwise stated) the *weighted* values are reported.

3.4 CONSULTATION WITH THE COMMUNITY

In general, the support and participation from a community for successful community-based research cannot be over-emphasised. The particular complex socio-political climate in the African townships of the Cape Peninsula in 1989 necessitated that the research team gain support from the community for the BRISK study. The townships are spread over vast areas with a high population density. In addition, political diversity, criminal activity and sporadic outbursts of unrest and violence contributed to the difficulty in identifying the appropriate community leaders and effective communication channels within the townships. It was thus decided to adopt an approach of both consultation with the community as well as the use of the media to inform the public of the study.

The responsibility for this aspect of the study was carried by the author. The fostering of good public relations, and the positive portrayal of the study required much time and patience. Furthermore, this contact-making phase was at times extremely dangerous. The activities and jurisdiction of warlords (Dewar, *et al.*, 1991) had to be taken into account, and at times this required risky informal meetings with opposing leaderships. Several political parties were at that time banned by the Nationalist Government, then in power. These included the African National Congress (ANC), the South African Communist Party (SACP) and the Pan African Congress (PAC). These parties operated by underground networks which were extremely efficient, making contact with them essential, but this again raised issues of bona fides.

Although the study was scheduled for October 1989 up to early December, it became clear from the levels of political violence and from sources of information that it should be postponed to take place early in 1990. Hence the final stages of informing the community commenced in mid-January 1990.

3.4.1 Overall aims and approaches followed

It was decided to make contact with the community via leadership structures, thereby establishing ways in which the study and what it involved, could be made both meaningful and acceptable to individuals ultimately participating as subjects. Furthermore, the safety of the fieldworkers, who would be working at night, had to be ensured.

Firstly, this involved identification of key networks, organisations and individual leaders, particularly those in health-related fields and the establishment of contact with these to explain the purpose of the study and the implications of the findings. Having done this, opinions were sought as to:

- how the survey content would be perceived by individuals
- how awareness could best be created without raising suspicion against the researchers
- where permission should be sought to work in certain areas (e.g. squatter camp committees, Hostel Dwellers Association, political organisations and local authorities)
- which groups could provide support and assistance during the fieldwork.

In most cases this contact-making phase led to other contacts and the network grew in complexity. At this stage it became apparent that a one-page hand-out, briefly outlining the study would make the task easier. For example, very often only a few members of a local leadership committee would be available during the day and these members did not feel they could speak on behalf of those absent; furthermore, there was the potential problem of distorting the message. A one-page hand-out bearing the MRC (Medical Research Council) and UCT (University of Cape Town) logos was thus drawn up, simply and clearly outlining the study in Xhosa and English (Appendix **C**). This proved to be extremely useful.

Having consulted various individuals and organisations, it also became apparent at this stage that the purpose of the study was well-received and that the study itself would be welcomed. Notes were made of potential problem areas where sensitivities could be offended, and if possible, avoided. Some frequently questioned and potentially sensitive areas were:

- suspicion of the nursing sisters (being 'officially' affiliated, medically trained persons) asking relatively personal questions on lifestyle such as alcohol intake, smoking patterns and a migration history

- the respondent burden, since the interview was to be fairly lengthy and would take place after a day's work when people would be tired or involved with domestic chores

- suspicions and superstitions regarding the blood sample (what would it reveal and who would then have this information? Could the equipment potentially contribute to the spread of AIDS? Would the blood be tested for AIDS?)

- concern over confidentiality (could this interviewer really be trusted with information such as permission to reside in the Cape Peninsula, or young persons' smoking habits?)

- concern about why apparently healthy people were included in the sample if this study was about "diseases of the cities". The concept of random sampling was difficult to convey as was the need not to replace a randomly selected participant with a volunteer

- suspicion of the questions on migration patterns – did these have something to do with forced removals?

3.4.2 Communication via local institutions

As the date for the commencement of the fieldwork drew nearer, three lists were compiled which outlined the groups that would be contacted.

(i) The most important organisations/institutions/associations who were in a position to distribute the pamphlets outlining the study just as the survey was launched, so that the awareness was fresh in everyone's minds.

(ii) Groups and individuals from whom permission was to be sought to ensure that the fieldworkers would not be hampered in any way.

(iii) Contact was made with the appropriate mass media. Press releases were compiled for targeted newspapers and arrangements made for broadcasts on Radio Xhosa.

At this final stage just prior to the launching of the survey, the formal contact list was as follows:

i) *Health-related institutions in the townships*

LOCAL AUTHORITIES:

- Regional Services Council's Clinics
- City Council Clinics
- Day Hospitals

NON-GOVERNMENTAL:

- SACLA Clinics
- SHAWCO Clinics
- Health Workers' Forum

All sisters-in-charge and in some cases medical officers as well as district sisters were informed. Pamphlets were distributed to each clinic.

ii) *Church groups*

- The Western Province Council of Churches (450 churches)
- The Western Cape Council of Churches (125 churches)

Each congregation received a pamphlet to be pinned up on the church notice board. In a covering letter, each minister/pastor was asked to announce the commencement of the survey during the services on the Sundays prior to the start of the survey.

iii) *Local Authorities*

- Cape Town City Council (This involved a phone call only. Support was granted on the proviso that participation in the survey was based on informed consent).

- Khayelitsha Town Council. (A meeting with the Mayor and Councillors was set up by the Town Clerk and they were addressed by the research team).

iv) *Squatter Camp Committees*

A list of four had been drawn up. Ultimately only one (KTC) was approached and several members were addressed.

v) *Other Organisations*

The list included the United Democratic Front (UDF) (which served as a front for banned political structures), the United Women's Congress, the Hostel Dwellers' Association, Cosatu and the Western Province Taxi Association. (Ultimately only the Hostel Dwellers' Association and the UDF were seen. In the case of the former, a few committee members from the Executive were consulted, and in the latter the President was consulted with, personally).

Two important resources backing the team were a doctor who had run Guguletu Day Hospital for some years, and IDASA (Institute for Democratic Alternatives in South Africa). They acted as 'sounding boards' regarding interactions with problem areas, and during phases of unrest.

3.4.3 Communication via the media

Brenda Fassie, a pop star hailing originally from Langa, was finally chosen as 'the media personality' to appear in a photograph accompanying press releases of the study. A photograph of her having her blood pressure taken by one of the fieldworkers was set up and appeared in the following local newspapers: *South, The Argus, IMVO, City Press and Grassroots.*

Interviews with the most senior-ranking fieldworker (a matron) were broadcast on the Xhosa channel of the South African Broadcasting Corporation. She presented the study and then answered questions during a live broadcast. This was very successful in that it evoked much interest, and the matron was invited to make subsequent broadcasts on health issues.

Options that were considered, but rejected were the use of posters in prominent places and the distribution of handbills at taxi ranks.

3.4.4 Comment

In retrospect, it is difficult to evaluate the impact of this contact-making and awareness-creating aspect of the study. Nonetheless, the ability of local leadership to disrupt such a study must not be underestimated. This was particularly relevant at the time the study was conducted. Certainly the research team gained valuable, if confusing, insights from it. The survey period was fortunately politically stable (perhaps because some notably positive events occurred just as it was launched; immediately after the 2nd of February 1990 speech of President de Klerk, and the subsequent release of Mr. Nelson Mandela as well as the unbanning of the opposition political parties).

3.5 DIETARY METHODS

The advantages and constraints of the various dietary methodologies have been dealt with in the literature review. With these in mind, the search for a method most appropriate for the study population was conducted over a period of a year, by the author.

3.5.1 Rationale for choice of the method and interviewers

The broad aims of the dietary study were to determine food intake, and describe meal patterns of the sub-groups. It was also required that each food item should ultimately be expressed in grams so that nutrient intake could be calculated quantitatively, using Food Composition Tables.

The dietary study had to be seen in the broader context of the study as a whole (which necessitated a detailed IHD risk factor profile and socio-demographic status assessment of each subject). The consequent respondent/interviewer burden was a major consideration, and strongly influenced the choice of dietary method used.

For example, the fieldworker on arrival at any address had to do the following:

- introduce the BRISK study explaining its purpose and what was required from respondents
- motivate participation in the study
- explain and carry out the sampling procedure to select subjects
- interview the subject with a general questionnaire covering:
  - demographic information
  - questions on rural-urban movements
  - tobacco usage
  - alcohol intake
  - physical activity
- take anthropometric measurements
- determine blood pressure
- draw blood samples
- administer the dietary questionnaire

Since the sample included children and adults, the fieldworker was required to gear the procedure so as to be age-appropriate.

In selecting a dietary method the following requirements had to be met:

- good quality data had to be obtained to permit accurate coding and conversion to gram weights

- the need to extract information in a short interview (approximately 20 minutes)

- simplicity of procedure had to be ensured so as not to overburden respondent and interviewer, thereby possibly sacrificing quality

- simplicity would also ensure ease of training of people with no previous experience in dietary research

- budget limitation for an expensive survey imposed cost-benefit considerations

- the data had to be comparable with two other major South African studies that included dietary data (Rossouw, *et al.,* 1983; Steyn, *et al.,* 1985).

The problem of low literacy rates automatically eliminated any self-administered methods such as record keeping. Both the diet history and food frequency questionnaire (FFQ) methods were rejected since they are based on 'typical' intakes. Since the study population was an essentially low income group with a large proportion of individuals living a 'hand-to-mouth' existence, the concept of 'typical' dietary intake was questionable. It was found during random pilot interviews that households experienced great variability in cash flow within a month, and even within a week, which in turn impacted on basic purchases and especially on food. In-depth probing revealed that many individuals experienced difficulty in defining usual intake. All methods involving follow-up had to be ruled out, since it would be difficult to trace individuals, because:

(i) the study population is extremely mobile, both with respect to intra-urban movement and rural/urban cyclical migration

(ii) in the squatter areas where the shacks are haphazardly arranged, it can prove impossible to identify the same shack twice, particularly at night.

From the several internationally known, used and reviewed dietary study methods, the single 24-hour recall method was selected, as the one meeting most of the demands and limitations of the study protocol. There are many reports in the literature for the 24-hour recall being suitable for determining the intake of a group of people or a population.

Factors which made the 24-hour recall an appropriate choice were:

(i) According to Block (1982) a sample of at least 50 persons in an age/gender cell need to be included when a ten percent error can be tolerated. In the BRISK study the proposed sample size made it possible to meet the requirements of the 24-hour recall. Group intakes (and not individual intakes) were being investigated, for which the method is geared.

(ii) The 24-hour recall method is one of the least expensive methods available, requiring no extensive follow-up of subjects by trained staff.

(iii) It takes little time to administer (20 - 30 minutes) which apart from being a cost benefit, especially with a large sample size, made it fit well into the context of the data collection.

(iv) It is relatively non-invasive requiring a response based on food already consumed, thus not encouraging subjects to change eating habits prospectively. The non-invasive nature of the method also facilitated a low interviewer/respondent burden, most necessary in this particular study.

(v) It was suitable for the selected sample as it overcame the illiteracy problem and with modifications could easily be made age-appropriate.

(vi) Household measures could be used to quantify foods and thus be expressed in units meaningful to both fieldworker and respondent.

(vii) Some degree of verification methods of food preparation was possible as the interviewer could view cooking facilities. She could also read labels of commercial products in the home, ensuring they were correctly described, and if left-over food was available she could measure quantities (e.g. pot bread) and classify ratios of ingredients (e.g. ratio of samp : beans). Since the interview would take place in the subject's home the volumes of cups and spoons actually used could be measured.

(viii) An expensive set of food models was not necessary, as foods and commercial products in the home could be used. A simple set of inexpensive food models sufficed, consisting mainly of popcorn (to represent heaped maize dishes) and high density foam cut to various shapes and sizes. This is described in Appendix **D**, *The Food Models*.

(ix) It was possible to account for the day-of-week effect of dietary intake as constraints in time available for the survey period necessitated that the study be rotated through the seven days of the week.

(x) The 24-hour recall method is relatively simple in concept for both interviewer and interviewee and is practical to administer.

(xi) The method was also chosen for the CRISIC and CORIS studies. Matching methodologies made the results of the studies comparable.

The choice of dietary intake method also had to be considered in tandem with the selection of fieldworkers, as the method had to be pitched at the level of their capability. It was necessary to select fieldworkers who were Xhosa-speaking and it was preferable that they should be from the community being surveyed. Furthermore, they had to be intellectually and psychologically able to meet the demands and intricacies of collecting a wide range of data, under challenging circumstances.

For the risk factor study, it was essential that the field work team had to be registered professional nurses who could draw blood samples from the participants under the supervision of the medical doctors on the team. There were other advantages to having chosen nurses as fieldworkers:

- their nursing background gave them an innate understanding of nutrition and its association with health. It also gave them the necessary awareness of the concepts of quantity such as volume, weight and size

- they had worked in the community at some stage of their careers (as opposed to clinical hospital experience only). This was an important recommendation as it gave them the necessary insight and sensibility to adapt to difficult circumstances in the field

- they were able to motivate the study to prospective subjects and to handle the dynamics of family life in the townships. (For example, they pointed out that teenagers should not be interviewed within earshot of their parents)

- their nursing experience at community level lent them a degree of 'street-wise' knowledge necessary to handle the implications of the lack of personal safety in the townships in the evenings.

- they are respected members of the African community

3.5.2 Questionnaire development and design

3.5.2.1 Development of the questionnaire

The author was responsible for the development of the dietary questionnaires, after various fact-finding investigations were conducted, prior to the study.

These included:

- Visits to shacks, houses, and tents throughout the African townships covering all socio-economic strata. In each visit food was prepared and dished and then weighed for a young child, an adolescent, one or two adults and an elderly person. Bread was also cut for each individual to determine the number and thickness of slices. Thus, the preparation of foods with differing cooking facilities was observed and variations in the distribution of meal items in families for various meals recorded.*

- Many informal discussions with health workers, and individuals in the community, were held regarding food choices and portion sizes. An example of such an exercise appears in Appendix E.*

- Investigations of purchasing habits, with visits to township shops, 'spaza stores', vendors, domestic 'fast-food' outlets (selling 'vetkoek' for example) and the bulk-buy shops on the peripheries of some of the townships.

- In the course of determining which method to use, several pilot studies were conducted by Xhosa-speaking medical students, who lived in the African townships, to determine:

  - the most appropriate method of collecting data
  - the range of portion sizes
  - various meal patterns
  - cooking facilities and how they influenced intake and food preparation
  - the types of condiments added during cooking
  - the basic items needed for the interviewer kit.

The basic questionnaire was designed and piloted on small samples of individuals of different ages. In this way it went through various stages of refinement until a final product emerged to be tested out in a formal pilot study.

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* An underlying objective behind these exercises was to provide data on food items not previously included in the 1986 edition of the FCT. At the time of the study, in 1990, the 1991 FCT were being compiled.

3.5.2.2 Design and description of the questionnaire

The final questionnaire consisted of an open-ended format for the 24-hour dietary recall with 6 time periods of the day built into the layout and additional closed-ended questions on habitual intake. An example of the questionnaire appears in Appendix **F** together with instructions as to its completion in Appendix **G**.

The 24-hour recall

The period of 24-hours was defined as 'yesterday' from waking up on the previous day 'to waking up this morning' i.e. the day of the interview. This way, anything consumed during the night was included.

Food intake was recorded in five allocated columns as follows – from left to right:

(i) The time of day when the appropriate time meal slot had to be selected. These appeared chronologically.

- from waking up till ± 9:00 am
- midmorning 9:00 am - 12:00 noon
- lunch ± 12:00 - 2:00 pm
- afternoon 2:00 pm to just before the evening meal
- evening meal
- after the evening meal and during the night

A comments section allowing open responses was provided, to explain anything unusual about the eating pattern, at the end of the 24-hour recall (e.g. 'the subject was ill').

(ii) The next broad column was for listing the food items with adequate descriptions (e.g. 'brown' bread, 'hard' or 'brick' margarine).

(iii) The amount consumed was entered under the following column with appropriate defined abbreviations (e.g. 'SS' represented two shop slices).

(iv) The fourth column was provided for a description of the method of preparation such as raw, boiled or whatever.

(v) The fifth column was used to categorize every food item as to whether it was consumed at 'home' or 'away' from home. This facilitated the choice of codes.

(vi) A broad border on the right hand side of the page provided space for entering food codes.

The closed questions

These were included to provide additional information on habitual intake and for cross-checking with the data in the recall section. Some were based on questionnaires utilised in the CORIS and CRISIC studies – for the purpose of comparability.

(i) Three questions dealt with salt intake, since it is not possible to calculate total sodium intake from food composition tables.

(ii) Questions on egg intake, and a question which elicited information on the frequency of intake of protein-rich foods (meats, fish, cheese, peanut butter and legumes) over the past seven days, were included for sponsorship purposes.

(iii) Two questions on personal intake of meat and chicken determined whether the respondent ate fatty meat or the skin on chicken. This information facilitated the interpretation of the 24-hour recall and the appropriate choice of codes.

(iv) The final question clarified the usage of all forms of fat (oil, margarine, dripping, butter) in cooking, as a spread, etc.

All these questions were used to interpret the 24-hour recall, and ultimately assisted in the choice of appropriate food codes. Instructions also appeared on the questionnaire to prompt the fieldworkers on its application as set out in the training manual.

The Training Manual

This was set out in considerable detail, based on up to date information of commercially available foods. Foods were divided into categories or food groups and these same groups were used as a basis for the training procedure. The instructions for probing and quantifying foods had been determined through the trial-and-error testing phases of the questionnaire, and from the insights gained from observing meals being dished up.

The fieldworker training manual is reproduced as Appendix **G**

3.5.3 The pilot study

A formal pilot study was planned to test out the entire procedure to be followed by each interviewer.

The objectives for the evaluation of the dietary questionnaire were as follows:

(i) To establish how the dietary study fitted into the context of data collection and when it should take place in the sequence of procedures.

(ii) To investigate the respondent/interviewer burden in order to establish how many subjects an interviewer could cover without getting fatigued, and whether respondents themselves could commit themselves to the entire procedure giving seemingly accurate information throughout.

(iii) To determine whether the format of dietary questionnaire was practical to use.

(iv) To evaluate the applicability of the instructions and the appropriateness of the food models in quantifying food items.

(v) To determine whether the mothers or childminders of children under 10 years old had been given sufficiently detailed descriptions of food items and the quantities involved.

The pilot study was conducted by four nurses, who tested out the questionnaire as a whole, incorporating the anthropometric measurements, blood pressure determinations and the drawing of blood samples. The nurses underwent a rigorous training procedure over four days, including practical exercises. A sample of 50 households was covered, randomly selected [on the basis of instructions from one of the statisticians] from strata representing different types of housing and socio-economic conditions, so that as far as possible, the fieldworkers experienced the realities of the fieldwork that would be faced in the final study.

As a result of the pilot study, two changes were made affecting the recording of dietary intake:

(i) The fieldworkers felt quite strongly that the dietary interview should take place at the very end of the entire procedure. It was felt that after drawing blood, administering other sections of the questionnaire and taking measurements, there would be sufficient rapport established for the subject to move to the kitchen to complete the dietary interview.

(ii) Insights gained from the study made possible certain refinements to the usage of dietary kit. Modifications in the size and applications of the sponge models were introduced to facilitate their representativeness to real foods consumed. It was found that the popcorn had worked well and that it had survived the rigours of usage without being consumed by children or crushed in the kit bag.

The pilot study proved to be an extremely valuable exercise in other respects too. Discussions with the interviewers introduced improvements into the training procedure. Furthermore, the training manual (which was still in draft form) was tested out in terms of clarity and the information entered onto the questionnaires indicated where any pitfalls lay in respect of interpretation.

3.5.4 Training procedures – the final study

The dietary training of the fieldworkers was conducted by two experienced research dieticians, one reviewing the other's input. The fourteen fieldworkers were divided into two groups as one large group would have become unwieldy and contact with individuals would have been lost, thus sacrificing quality of training.

During training real foods were used in the form of cooked dishes, as well as raw foods and examples of commercial products. The application of the food models was also included. The sequence of food in groups in the manual was followed, and the fieldworkers' kit was used throughout to measure quantities so they became familiar with its correct usage.

The training for the dietary part of the study took approximately 13 hours over four days and the following aspects were covered:

- The correct completion of questions with suitable methods of probing for information, without introducing bias.

- The means of conducting the 24-hour dietary recall, linking foods and drinks consumed, to the previous day's time periods and activities.

- The validation of information by observing cooking facilities, cooking and serving utensils, and by interpreting labels.

- The standardisation of portion sizes where appropriate, for 'small', 'medium' and 'large', and 'thickly', 'medium' and 'thinly' spread.

- The appropriate ways of measuring portions of regular and irregularly shaped food items, using the kit.

- The importance of accurate reporting necessary for coding purposes (a coding exercise was conducted to illustrate this).

Role play methods were employed, and trial interviews were conducted in pairs at the training venue. These completed questionnaires were checked and errors corrected. Finally, trial interviews were carried out in the field, as a training exercise, to identify and correct problem areas in the practical situation.

3.5.5 Procedures for interviews with adults

Exact procedures in quantifying food items were outlined in the training manual and demonstrated during the training. The fieldworkers were permitted to adapt the interview so as to function optimally in a usually crowded home in which the evening meal was being prepared, served and/or eaten. The dietary interview took place after the anthropometric and the blood pressure measurements had been recorded. This afforded the subjects and interviewers a little activity and change of pace to break the tedium of administering questionnaires.

The questions on habitual intake served as an icebreaker as they allowed respondents to focus on food without the more rigorous task of having to quantify items. Respondents were made aware of the necessity of reporting what was actually eaten and not what they 'thought' they 'should' have been eating. The subject was then asked to recall all the food and liquids consumed during the previous day. Probing was based around the activities of the day as recommended by Farris, *et al.* (1984), as eating is often linked to social events or activities. On completion of the interview, the fieldworker recapped the previous day, with additional probing based on the day's activities, to ensure complete reporting.

3.5.6 Procedures for interviews with children and mothers/childminders

Since children below the age of 10 years could not be expected to supply valid information and/or understand certain time-related concepts, such as a week, their mothers or a suitable childminder had to be sought (Basch, 1990). Interviews were consequently conducted by eliciting information from both the child and the mother/childminder. Bias may have occurred for those children who had inadequate day care and may consequently be more likely to be undernourished.

Similarly, a few children regularly attending a créche which could not easily be located or those spending the day with a day mother who could not easily be contacted, had also be excluded from the sample. Those attending crèches for which addresses could be supplied were included. The procedure then followed by the interviewer was that she was required to administer the 24-hour recall for all intake other than that consumed at the créche. The address of the créche was then entered on to the questionnaire with a specification as to the time period spent there. Subsequently, the author visited the créche where a typical meal pattern with typical portion sizes for a child of that age were entered on to the questionnaire. In some cases where a cycle menu was followed, it was possible to select a meal pattern appropriate for the day.

3.5.7 Quality control of data collection

Each evening after the fieldwork had been completed, the following procedure took place at the research institute, where the blood samples and questionnaires were delivered:

Blood samples, questionnaires and person numbers were checked and all items entered into the logbook. The next morning the dietary questionnaires were then thoroughly checked by any one of three dietitians for completeness and clarity; the 24-hour dietary recall in particular. A separate log was kept by the dietitians, with comments on each questionnaire thus giving a more detailed record with respect to the dietary study. Day-to-day queries were dealt with in several ways, such as telephone calls to the fieldworker or personal visits. Where necessary questionnaires were also sent back via supervisors to be corrected and returned. In this case, a sealed letter was attached explaining the nature of the problem and suggesting specifically how it could be corrected.

At the beginning, about 1 in 5 questionnaires had to be returned for corrections, but towards the end of the study this had been reduced to approximately 1 in 10. Some queries arose from unclear handwriting, or the use of unknown brand names or terminology, and it was often possible to solve these problems by means of a second opinion or a consensus decision. In a general sense, problem areas were dealt with in the form of a 'dietary newsletter'. The aim of this newsletter was to encourage and motivate the fieldworkers, and to point out common mistakes in an attempt to pre-empt further queries, as this was mutually time-consuming.

Although these methods of monitoring were explained to the fieldworkers during their training and cleared with them, the queries were not always well-received. Because of the great variation in dietary intake, ranging from no intake, to large quantities of food, the completeness of a 24-hour dietary recall cannot easily be determined, nor can it be 'validated' in the strictest sense of the word.

3.5.8 Data coding and entry

Coding was carried out by a home economist who had previous experience of dietary coding, had observed food being prepared and quantified in the African townships, and had been involved at relevant stages of the pilot study. The 24-hour dietary recall was coded on the questionnaire and checked by 1 of 3 people (1 home economist and 2 dietitians). The encoded data was checked by the author.

The codes for each 24-hour dietary recall consisted of:

- the person number
- the interviewer and sequence number
- who reported – self, or in the case of a child, mother or other
- day of week.

Within the 24-hour dietary recall, for each food item the following codes were assigned:

- the food code
- the mass consumed in grams.

The 1991 Food Composition Tables (FCT) as well as the Food Quantities Manual were used as a basis for coding and quantifying items. For certain items which could not be quantified during coding, practical exercises were carried out to determine weights – e.g. sheep's head, ox heel, specific lengths of 'vetderm'.

Assumptions were used in instances where the fieldworkers were not specific in their description of food items. These assumptions were based on observed practices in the community and discussions during the pre-piloting stages of the study. These assumptions were in general:

- the use for specific codes for fatty or lean cuts of meat, and types of gravies
- the ratios of samp : beans
- the selection of alternative codes for items not yet included in the FCT.

Data were checked for invalid food codes. The distribution by weight of food consumed by single food codes was plotted, and outlying values were checked against the original questionnaires.

3.5.9 Processing of dietary data

The dietary data were analysed for the three age groups using the NRIND Food Composition Tables (Langenhoven, *et al.*, 1991) with mean intakes being calculated for macronutrients, eight vitamins, eight minerals and trace elements, and added sugar. Macronutrient intakes were evaluated according to the dietary recommendations of the South African Diet Consensus Panel (1989), which are in line with the American Heart Association dietary guidelines (American Dietetic Association,1979). Mean nutrient intakes of respondents were also compared to the Recommended Dietary Allowances (Food and Nutrition Board, 1990) and the percentage of subjects with intakes falling below 67% and above 120% of the RDA was determined (National Research Council, 1986). Nutrient ratios such as percentages of total energy from macronutrients, the polyunsaturated: saturated fatty acid ratio and nutrient intake per unit energy were calculated. Additional information on salt usage, derived from three questions on habitual intake was also analysed.

The numbers of portions from each of the Five Basic Food Groups were calculated using the Diabetic Exchange Lists as reference (American Dietetic Association, 1986). One milk portion was calculated as total protein from this group divided by 8 (8 g protein per 250 ml milk or 30 g cheese). One meat portion (red, white and organ meats) was calculated as total protein from these foods divided by 21 (3 exchanges of 7 g protein each, representing a 90 g portion of meat). For egg and legumes one meat portion was calculated as protein from these foods divided by 7 (7 g protein equals 1 egg or 125 ml cooked legumes). Total available carbohydrate minus sugar (sucrose) for potato was divided by 15 (15 g carbohydrate represents one medium potato) for number of portions. For all other vegetables total available carbohydrates minus sugar was divided by 5 for number of vegetable portions, and for fruit by 15 for number of fruit portions (5 g carbohydrate represents one 125 ml vegetable portion and 15 g carbohydrate one fruit portion). For the cereal group total available carbohydrate from cereal foods was divided by 15 for number of portions (15 g carbohydrate equals one slice of bread). For the fat group total fat was divided by 5 for number of portions (5 g fat equals one teaspoon of fat).

The same procedure was followed for the 3 - 6-year-olds, with the exception of the meat group. One meat portion was calculated as total protein from this group divided by 6 and 7 (6 g protein equals 1 egg, and 7 g protein equals 30 g meat and 125 ml cooked legumes).

The time of day any food item was eaten was classified and coded into one of six periods: breakfast (food intake from waking to about 09:00), morning snacking (between breakfast and lunch), lunch (intakes between 12:00 and 14:00), afternoon snacking between lunch and supper), supper (the meal after about 17:00) and lastly, after supper snacking.

For the adolescent and adult study groups food intake was evaluated by comparing the calculated number of food portions consumed in each of the Five Basic Food Groups with the recommended number of portions (Dept. of Health, 1983). The Five Basic Food Groups and the foods included in each food group are summarised in Table 3.

Table 3: The Five Basic Food Groups and the foods in each group used in South Africa

Food group	Foods included in the food group
Milk	Whole milk (whole milk, whole milk products, dishes made with whole milk where 70% or more of the dish comprises whole milk) Skim milk (same as above for skim milk) Full fat and low fat hard cheeses Cottage cheese (creamed, low fat and fat free)
Meat	Red meat (beef, mutton, pork, dishes and cold cuts made of these and commercial pies) White meat (chicken and fish) Organ meats Eggs Nuts, peanut butter, legumes
Vegetables and fruit	Ascorbic acid-rich Carotene-rich Potato and sweet potato Other vegetables and fruit
Cereal	Whole grain products (whole grain bread, rusks, crispbread, porridge, instant breakfast cereals, scones, pasta) Refined grain products (same as above for refined grains)
Fat**	'Saturated' fats (butter, cream, beef, pork and chicken fat, coconut oil) 'Monounsaturated' fats (brick margarines, olives, avocado) 'Polyunsaturated' fats (oil, tub margarines, salad dressings)

The Non Basic Food Group comprises the following:

cakes, tarts, puddings

meat pies/sausage rolls

snacks

cold drinks, sweets, jam, sugar

soups

alcoholic drinks

sauces and gravies, stock cubes (Langenhoven, *et al.*, 1989).

Meal eating and snacking

The percentage contribution of each of the six intake periods to total intake of energy and macro- and micronutrients were determined. Meal frequency was determined by defining a meal as the intake of 600 kJ or more per meal period (breakfast, lunch or supper). The percentage contribution of snacking to total daily intake was also determined. Snacking was defined as the intake of 200 kJ or more per snacking period (namely, during the morning and/or the afternoon and/or after supper).

** This fat group denotes 'added' fat *per se*, and excludes fats incorporated into recipes or composite dishes.

3.6 METHODS DEALING WITH OTHER VARIABLES AND GENERAL QUESTIONNAIRE ADMINISTRATION

In addition to the main dietary and nutrition-related variables, other ancillary demographic, socio-economic and risk factor data were collected. This section deals with these variables, expanding on the general development and testing of these questions, the fieldworker training undertaken and the administration and quality control of the questionnaires. Finally, the data cleaning procedures are outlined. Copies of the questionnaires appear in Appendix **H**.

3.6.1 Questionnaire layout and design

The layout of the questionnaire was designed to enable fieldworkers to record information rapidly by circling answer codes of closed-ended questions and then transferring the correct code to the data capture field in the right hand margin of each page. To minimise fieldworker errors, answers and options were tabulated on horizontal lines connected to the answer codes. A flow chart design was created using broken lines and arrows to direct the sequence of questioning in the event of 'no' response (e.g. a non-smoker would not need to respond to questions on smoking patterns).

An identification (ID) code number was printed on each questionnaire, which was then sealed in a plastic bag that also contained the vacutainer tubes pre-marked with the same ID number. Fieldworkers, therefore, did not have to allocate ID codes or mark tubes in the field.

After the prototype questionnaire was tested in the formal pilot study and several subsequent small piloting phases (designed to evaluate changes) it was adapted to its final form. The mini-pilot studies, were supervised by the author, and carried out by two Xhosa-speaking medical students who resided in the study area.

It was important to construct a comprehensive questionnaire that covered all the relevant aspects of coronary risk factor status and urbanisation, but did not take too long to complete. The time required varied among subjects. During the training sessions completion of the risk factor part of the questionnaire lasted approximately 15 minutes and the dietary section another 20 minutes.

3.6.2 Contents of the general questionnaire

The questionnaire (Appendix **H**) was subdivided into five major parts, each aimed at different aspects of the overall study. One of these components was the dietary questionnaire described previously in this chapter. Allocations for the entry of anthropometric data were included (also described above) together with blocks for the entry of blood pressure determinations. The remaining four categories of questions were as follows:

(i) The cover-page

The sampling procedure was extremely important because this study aimed to provide coronary risk factor and dietary information representative of the African population in the townships of the Cape Peninsula. Information collected enabled the evaluation of the sampling process through collection of relevant information. The cover-page was designed to allocate an identification code to the participant, to identify the fieldworker for monitoring purposes, to provide information on the sampling procedure itself and to determine whether the individual qualified as a study subject in terms of the quota lists.

Provision was made at the base of the cover-page for the fieldworker to record summary information of the blood samples (i.e. the number of tubes and the code on the tubes).

(ii) General information

Participants were given the option of providing their names, addresses and home and work telephone numbers, if available. The address was needed to forward results of the study to the participants.

General information was then obtained on the type of dwelling, availability of electricity and water, and information relating to the environment and lifestyle such as fuel used for cooking, refrigeration facilities, household and motor car ownership, and the use of the media (radio, TV, newspaper).

(iii) Demographic and urbanisation information

No standardised questions concerning urbanisation for quantitative studies have been developed locally. This is partly due to the multifactorial nature of urbanisation as well as the relative inexperience in this field. Inevitably, the complexity of urbanisation information collected, had to be traded off against respondent burden and competing needs for other study information.

Besides collecting information on time spent in a city, information concerning age, sex, socio-economic status and living environment were also considered part of the urbanisation profile. Place of birth, age of arrival in the city and number of years spent in the city provided the raw data with which to calculate urban exposure and some migratory data.

Key socio-economic variables were educational level and occupation. Variables concerning the living environment are discussed in the previous section.

(iv) Risk factor information

In this part of the questionnaire, data about physical activity, the use of tobacco and alcohol and medical history were obtained. Physical activity was evaluated qualitatively in terms of broad activity categories during working hours and leisure time (after hours), ranging from none to strenuous activity.

Concerning tobacco use, the questionnaire was designed to distinguish between smokers, ex-smokers and non-smokers. In the case of smokers, the number of cigarettes smoked per day, duration of the habit and the form of tobacco use (cigarette, pipe, snuff, chewing tobacco) were recorded.

The question about alcohol use was to distinguish between drinkers and non-drinkers. For drinkers the average alcohol consumption over week-ends and during the week was asked in separate questions. The response was recorded in terms of the number of drinks per day. The definition of a 'drink' in terms of alcohol equivalents, was given in the questionnaire.

3.6.3 Training for completing the general questionnaire

Fieldworker training firstly emphasised that participants be reassured before completing the questionnaire in the field that the information would be treated confidentially and would only be used for research purposes.

The fieldworkers were then trained how to conduct a personal interview. The general strategy of how to circle the correct answer option and transfer the information to the data capture field on the questionnaire was explained. Training for the risk factor questionnaire was divided into subsections such as form-filling conventions, general and urban information, and risk factors.

The fourteen fieldworkers were subdivided into two groups of seven for the intensive training sessions. Time was allowed for role-play and practical training. The fieldworker manual served as a reference during these training sessions, providing instructions for the standardised way of interpreting and completing the questionnaire.

A BRISK fieldworker manual (Appendix **G**) was compiled to ensure that standard procedures were followed. This explained all practical aspects of the study and was prepared to assist fieldworkers in interpreting the questionnaire correctly during the training course before the study, as well as serving as a reference during the study.

An information brochure was provided to the fieldworkers in a booklet with plastic covered pages (flip file). It included the following as separate pages:

- guidelines for introduction to participants
- a letter of introduction in English and Xhosa
- an information brochure in Xhosa and English explaining the purpose of the study
- a copy of a press release announcing the study
- a list of the fieldwork teams
- addresses and phone numbers of research team members
- a summary of the sampling record for each participant
- a list of exclusion criteria
- a variety of work lists and instructions
- summary of the blood sampling procedure
- referral letters for medical services or other services should the professional nurse identify anybody in the household who needed treatment.

Finally, they had to be made aware of the process of continuous quality control procedures that are an essential aspect of the data collection stage. They needed to understand that these procedures were not acts of mistrust and did not reflect badly on them personally, but were essential to identify human error, thus ensuring better quality data.

3.6.4 Fieldworker coordination and supervision

The data collection coordination and supervision had to be planned and executed with military precision as there were so many different working teams involved in facilitating the smooth running of the fieldwork.

The fieldwork coordination and sampling procedure was in the hands of a team subcontracted from the Western Cape Branch of the HSRC under the leadership of two research managers, two drivers and two fieldworker supervisors. Their task was to identify the addresses and specific blocks of houses that each fieldworker could visit to fulfil the requirement of quota lists in accordance with the sampling frame. They were also in daily contact with the fieldworkers, supplying them with questionnaires and consumable equipment such as tubes for blood sampling. They were to make contact with the fieldworkers at the homes where data were being collected. At the end of an evening the supervisors received and checked the completed questionnaires and blood samples. One of the drivers then transported all the questionnaires and blood samples to the MRC Research Institute for Nutritional Diseases' (RIND) laboratory.

The fieldworkers were subdivided into four teams who were transported in four cars. Those who owned cars were to act as drivers for each team (they received extra remuneration for the use of their cars). The drivers were to meet their team members at about 17:00, and then go to the fieldworker supervisor's home for the necessary address lists, quota lists and consumables. The questionnaires and blood samples were delivered to RIND the same night where further checking took place, and the blood samples dealt with by laboratory staff.

The fieldworkers required considerable moral support during the ten weeks of the study and it was necessary for team members to provide encouragement through regular contact. This helped to offset the criticism fieldworkers received as a result of the quality control procedures. Praise for thorough reporting was also essential to maintain morale and aspirations for high standards.

3.6.5 Coding, error detection and correction of the general questionnaire

The process of error detection and correction involves a wide range of procedures (Jooste, *et al.*, 1988). These procedures were also applied to this study. The various phases involved were carried out by other members of the team.

Questionnaire and result sheets were developed in accordance with the guidelines and coding standards of the Scientific Computer Unit of the MRC (Gargan, 1987).

Error detection during data collection and coding

Data editing commenced in the field by supervisors who were responsible for controlling the information on the cover-page as well as for completeness of the questionnaire and blood samples.

At the office, questionnaires were controlled for coding or miscoded errors and returned to the fieldworkers within 24 hours for correction. By following this procedure, accuracy and reliability of the data was enhanced.

All data except the 24-hour dietary recall were entered into the computer directly from the questionnaires and original blood analysis printouts, in order to minimize transcribing errors.

Error detection after computerisation

Once computerised, data were scrutinized to detect obvious errors that indicated incorrect coding or encoding. A printed version of the data, using various procedures of the Statistical Analyses System (SAS) programme (SAS Institute, 1989), facilitated this step. Identity (ID) and card numbers were checked for duplicated, mismatched or missing values. Area codes were checked against the sampling realisation. Incorrect or missing values were rectified where possible by referring to the interview date and the name of the fieldworker. All addresses on the questionnaires were marked on an area map and checked against the coded and encoded numbers. However, the actual home address was not available in many cases. These methods of error detection proved to be very time consuming.

Once all the identification codes and cards were corrected, the different data sets were merged into three final sets. These included 425 children below 15 years of age, 102 adults above 64 years, and 986 adults aged 15 - 64 years (Appendix **B**).

Using descriptive analyses for quantitative variables, outlying values were detected and compared with the original data. Inconsistencies in discrete and continuous variables were detected by cross validation, e.g. smoking status versus duration of smoking in years. Similarly unreasonable transformations of a ratio for two variables were detected e.g. incorrect height or weight measurements used to obtain the body mass index.

Error correction

All errors were checked against the original questionnaires or analysis sheets and corrections recorded onto coding sheets along with the appropriate card and ID numbers. These were encoded into the computer and the data set updated by using the specific update procedure in SAS.

Main errors that occurred in the data sets were incorrect area codes, and duplication of ID numbers. Very few errors were detected among the other variables (about 230 in all). Documentation of all error corrections were kept as well as electronic archives of each data set during the different editing stages for reference purposes.

3.7 ANTHROPOMETRIC METHODS

Since the fieldworkers were required to walk some considerable distances into squatter areas all equipment had to be portable. For example, in the case of body mass assessments, beam balance scales could not be used. Consequently, emphasis had to be placed on the utilisation of portable instruments of good quality, e.g. high quality, robust bathroom scales were purchased. Training also included fieldworkers to be standardised in the measurement procedures.

3.7.1 Measurements taken and procedures followed

The measurements that were included in the study were:

- height in centimetres
- body mass in kg.

Height, without shoes was measured to the nearest 0,5 cm using a metal measuring tape against a wall, and a flat headboard at right angles to the wall to ensure correct reading. The precise procedure followed is described in the training manual, which appears in Appendix G.

Mass was determined on a good quality bathroom scale with the subject in light clothing and without shoes. The bathroom scales were standardised weekly against a beam balance to determine the zero setting. Thereafter, in the field, the fieldworker's own weight was used as a reference before weighing each participant.

Two phases of training took place: the first introductory training prior to the intensive training week, and the second phase during the following week was used to consolidate and refine procedures. During the week of training, the fieldworkers' methods were standardised by comparing measurements thereby identifying those who may have tended to over- or underestimate measurements.

3.8 BLOOD SAMPLING AND PROCESSING PROCEDURES

Blood samples were collected (according to a standard procedure) with minimum stasis from the anterior cubital vein, and were analysed for serum and red blood cell folate, and serum vitamin B_{12} (CT 302, dual radio assay kit, Amersham International, Amersham UK); erythrocyte transketolase activity and thiamin pyrophosphate effect (Schouten, *et al.*, 1964); erythrocyte riboflavin coefficient (Nichoals, 1974); whole blood nicotinamide (Clark, *et al.*, 1975); plasma and vitamin C (Denson & Bowers, 1961); vitamin A and E (Catignani & Bieri, 1983); pyridoxal-5-phosphate (Chabner & Livingston, 1970); and retinol binding protein (Partigen^{R} immunodiffusion plates, Behring Institute Hoechst Pharmaceuticals, Marburg FRB).

3.9 FEEDBACK TO THE COMMUNITY

Throughout the contact-making phase, assurances had to be provided that ways would be sought to give feedback to the areas surveyed and to the African population as a whole. There were many conflicting opinions as to how this should be done, especially when the issue of confidentiality arose. Furthermore, practical considerations had to be taken into account. For example, those residing in squatter camps frequently had no formal addresses. Finally, it was left to individual respondents to respond to the offer of feedback by providing addresses of friends, relatives or employers, to whom results could be posted.

After completing the data capturing and cleaning on computer, the first priority was to give feedback to respondents in various ways. A result sheet was developed by the Institute for Biostatistics. A letter explaining the results was drawn up and translated into Xhosa, as well as an information sheet on a healthy lifestyle to protect against heart disease (Appendix I). An address list was computerised and merged with the result by ID number. A student was appointed to assist with these tasks.

Of the 779 result sheets sent out, about 130 were returned by post due to unknown addresses. The BRISK study however, received publicity via Radio Xhosa and respondents who had not received their results were given a contact number that could be used to request them.

3.10 STATISTICAL ANALYSES

Basic descriptive univariate statistical analyses were performed in the exploratory stage of the data analysis. These usually took the forms of means and/or medians and standard deviations. (See subsection 3.5.9).

Further bivariate analyses of dietary variables against various socio-demographic variables also took place. These bivariate analyses were usually additionally stratified by age and gender. Significance testing was performed between different groups.

Predictive models of dietary consumption against socio-demographic and other variables potentially influencing the reporting of dietary intake was performed by multiple linear regression.

Correspondence analysis was also used to elucidate the multivariate relation between various dietary, socio-demographic and degenerative disease risk factor variables.

The BMDP and SAS statistical packages were used for the analyses in most cases. Anthropometric data were calculated according to the Centers for Disease Control/World Health Organisation Anthro' package, which is regarded as the standard program for such analysis. Analysis relating to calculation of dietary data utilizing the MRC food tables were done on a set of programs developed by the Institute of Biostatistics (IB) for the RIND. These programmes are summarised in a report by Langenhoven, *et al.* (1989).

The detailed discussion of the implementation of these techniques appear in the appropriate sections of Chapters 4 and 5.

3.11 ETHICAL APPROVAL

Ethical approval for the study was given by the Ethics Committee of the Medical Faculty of the University of Cape Town.

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CHAPTER 4 RESULTS AND DISCUSSION OF THE NUTRITIONAL ASSESSMENT OF THE AFRICAN POPULATION IN CAPE TOWN

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CHAPTER 4

RESULTS AND DISCUSSION OF THE NUTRITIONAL ASSESSMENT OF THE AFRICAN POPULATION IN CAPE TOWN

The dietary results of the three age categories (3 - 6; 15 - 18; 19 - 44 years) under investigation will be presented separately, followed by anthropometric (and where available supportive biochemical) data.

Within each dietary section of the results, nutrient data will be presented first, followed by food group and meal pattern data. The anthropometric data will be reported to provide further insight into the nutritional status of this population. The discussion section of each category will highlight the salient points pertinent to that age group. This will be followed by a section investigating the quality of the dietary data, including biochemical data and investigations into reported energy intakes. In a brief, final, overall discussion these major age categories will be compared with a view to the provision of both age-specific and population-based recommendations, which will appear in Chapter 6.

In the evaluation of dietary intakes within each age category reference will be made to the 'traditional' and 'western' aspects of the structure of diets. Characteristics of each dietary pattern are depicted below. It must be noted, however, that there is a continuum between the two major categories of the diet, and this paradigm does not necessarily fit all population groups. It is the result of the distillation of a body of literature from western and developing country sources (from African data in particular), and is derived from the unifying threads that emerged.

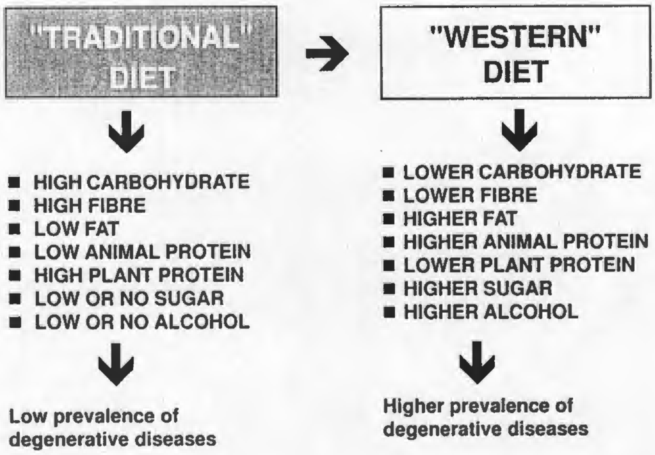

Figure 4.1: Simplified schematic diagram depicting features of traditional and western diets

4.1 NUTRITIONAL STATUS OF THE 3 - 6-YEAR-OLDS (PRESCHOOLERS)

Mean and median daily energy, macronutrient and cholesterol intakes are presented in Table 4.1; vitamin and mineral intakes appear in Tables 4.2 and 4.3 respectively. It can be noted that the standard deviations of most nutrients are large, reflecting substantive variability in intakes.

Table 4.1: Mean and median daily energy macronutrient and cholesterol intakes in children aged 3 - 6-years (N=163)

Nutrient	Mean	Standard deviation	Median
Energy (kcal)	1244	383	1193
Energy (MJ)	5.2	1.6	5.0
Total protein (g)	41	16	38
Animal protein (g)	21	14	18
Plant protein (g)	20	9	18
Total fat (g)	40	21	37
Saturated fat (g)	14	8	13
Mono-unsaturated fat (g)	15	9	13
Polyunsaturated fat (g)	9	5	8
Cholesterol (mg)	144	128	96
Carbohydrate (g)	181	55	176
Dietary fibre (g)	13	6	12
Added sugar (g)	36	22	33

Table 4.2: Mean daily intakes of vitamins in children aged 3 - 6-years (N=163)

Nutrient	Mean	Standard deviation	Median
Vitamin A (RE)	402	613	244
Thiamin (mg)	0.70	0.31	0.60
Thiamin (mg/4.2MJ)	0.60	0.24	0.53
Riboflavin (mg)	0.80	0.63	0.65
Niacin (mg)	7.82	3.94	7.00
Niacin (mg/4.2MJ)	6.66	3.70	5.70
Vitamin B_6 (mg)	0.69	0.40	0.64
Folic Acid (µg)	120	67	101
Vitamin B_{12} (µg)	2.43	5.23	1.60
Ascorbic acid (mg)	54	129	13.0

RE: Retinol equivalents

Table 4.3: Mean daily intakes of minerals in children aged 3 - 6-years (N=163)

Nutrient	Mean	Standard deviation	Median
Calcium (mg)	355	200	327
Iron (mg)	5.2	2.4	4.8
Magnesium (mg)	179	67	166
Phosphorus (mg)	641	222	628
Potassium (mg)	1349	505	1297
Sodium (mg)	1098	771	851
Zinc (mg)	5.8	3.5	4.8
Copper(mg)	0.7	0.3	0.7

The percentages of children falling below 67% and above 120% of the recommended dietary allowances (RDA) (Food and Nutrition Board, 1990) are depicted in Table 4.4, below.

Table 4.4: Mean percentage of children aged 3 - 6-years (N=163) with energy and nutrient intakes less than 67% RDA and more than 120% RDA

Nutrient	% Children <67% RDA	% Children >120% RDA
Energy (kcal)	39	3
Energy (MJ)	39	3
Total protein (g)	3	86
Vitamin A (RE)	64	15
Thiamin (mg)	41	14
Riboflavin (mg)	52	12
Niacin (mg)	53	9
Vitamin B_6 (mg)	58	6
Folic Acid (µg)	8	68
Vitamin B_{12} (µg)	26	63
Ascorbic acid (mg)	76	12
Calcium (mg)	80	1
Iron (mg)	77	1
Magnesium (mg)	2	73
Phosphorus (mg)	33	10
Zinc (mg)	77	8
Copper(mg)	62	5

RE: Retinol equivalents

High percentages of children fell below 67% of the RDA for most nutrients with the exceptions of protein and folic acid and magnesium, thus reflecting a micronutrient depleted diet. More than half the children were deficient in vitamin A, riboflavin, niacin, vitamin B_6, ascorbic acid, calcium, iron, zinc and copper. Approximately a third or more preschoolers fell below the RDAs for energy, thiamin, vitamin B_{12} and phosphorus. Conversely, large proportions of preschoolers exceeded the RDAs by 20% for protein (86%), folic acid and vitamin B_{12} (68% and 63% respectively) and for magnesium intakes (73%).

Macronutrient and cholesterol intake are given in Table 4.5, together with the guidelines of the local recommendations of the Diet Consensus Panel (1989), which are in line with those of the American Heart Association (AHA) (1988). Comparisons of these data reveal that the diets of these children met prudent dietary guidelines.

Table 4.5: Mean energy distribution of macronutrient and cholesterol intake in the diets of 3 - 6-year-old urban African children resident in the Cape Peninsula, 1990 (N=163)

Variable	Mean	SD	Median	AHA	South African Diet Consensus Panel
Total protein as %E	13.2	3.3	12.3	< 15	-
Animal protein as% of plant protein	6.6	4.0	6.4	-	-
Plant protein%E	6.5	1.9	6.3	-	-
Total fat as %E	28.1	8.3	28.2	< 30	< 30
Saturated fat as %E	9.5	3.2	9.2	< 10	< 10
Monounsaturated fat as %E	10.2	3.9	10.5	< 10	< 10
Polyunsaturated fat as %E	6.1	2.8	5.6	< 10	< 10
Diet P/S	0.71	0.43	0.62	1	-
Cholesterol (mg)	144	128	96	<300	<300
Total carbohydrate as %E	63.7	10.6	70.0	≥ 50	-
Sugar as %E	11.8	6.2	11.1	-	-

SD: Standard deviation
AHA: American Heart Association guidelines
%E: % of total energy intake
P/S: Polyunsaturated/saturated fatty acid ratio

In Table 4.6 the contributions of the five food groups to macronutrient intake, including fibre and sugar are presented. Meat was a major contributor to total fat (24%), cholesterol (56%) and protein intakes (39%), although more saturated fat was derived from milk (27% as opposed to 23% from meat). However, the 'added' fats provided 36% and 32% of total and saturated fats respectively. Evidence of a cereal-based diet is supplied by the high proportion of energy (40%), protein (38%) and fibre (57%) provided by cereals.

Table 4.6: Contribution of the Five Food Groups and 'non basic foods' to macronutrient, etc. intakes in African children (aged 3 - 6 years) resident in the Cape Peninsula (N=163 boys and girls)

		PERCENTAGE CONTRIBUTION							
Food Group		Energy	Total Protein	Total Fat	Saturated Fat	Cholesterol	Total Carbohydrate	Fibre	Sugar
Milk Group	Mean	8.6	14.9	16.4	26.5	26.6	4.6	0.03	0.3
	SD	9.0	14.6	18.5	25.0	30.9	5.0	0.3	1.7
Meat Group	Mean	16.4	38.9	24.3	23.4	55.8	4.5	15.3	1.2
	SD	11.4	21.7	18.0	19.6	36.9	8.2	22.6	8.2
Fruit & Vegetable Group	Mean	10.0	4.8	6.2	5.0	1.2	12.2	25.7	5.7
	SD	9.6	4.8	11.1	9.6	3.6	11.9	21.6	17.8
Cereal Group	Mean	40.7	38.4	11.7	6.3	2.0	57.2	56.8	0.4
	SD	13.1	16.7	10.6	6.7	10.2	14.8	21.8	1.9
Fat Group	Mean	10.4	0.3	36.4	31.5	12.8	0.1	0.1	0.0
	SD	6.9	0.9	21.6	22.6	25.0	0.2	1.4	0.1
'Non basic' Group*	Mean	12.9	2.4	3.3	4.3	1.3	20.4	1.8	92.0
	SD	8.8	5.4	8.3	9.8	6.1	11.4	4.1	19.5

SD: Standard deviation

* The 'non basic' food group is constituted of foods not falling into the Five Food Groups (Langenhoven, *et al.*, 1989).

A clearer picture of the diet as a whole emerges from the data set out in Table 4.7, which also presents a comparison with local dietary guidelines in terms of food groups (Dept. of Health Services and Welfare, 1990). Milk consumption was markedly inadequate, with a median intake of half a portion compared to the recommended two to three portions. Cheese intake was negligible. Only meat and cereal intakes met the requirements. Unfortunately most of the cereals were refined. Less than half of the recommended four portions of vegetables and fruits were consumed, which together with the extremely inadequate milk intake, explains the very low vitamin and mineral intakes. As noted in the methods section, the total fat intake cannot be evaluated from the 'fat group' *per se* since it includes only added fats and not fat incorporated into recipes, during food preparation.

Table 4.7: Mean and median number of portions consumed daily by African 3 - 6-year-old children in the Cape Peninsula (N=163 boys and girls)

Foods	Mean number of portions	SD	Median number of portions	DNHPD Guidelines	% Consumers overall
Milk Group	0.7	0.7	0.5	2 - 3	75
Milk	0.7	0.7	0.5		74
Cheese	0.03	0.2	0.0		3
Meat Group	2.6	2.1	2.1	2 or more	88
Red meat	0.7	1.5	0.0		28
White meat	0.7	1.3	0.0		49
Eggs	0.3	0.6	0.0		25
Legumes	0.3	0.5	0.0		36
Fruit & Vegetable Group	1.6	1.4	1.3	4 or more	79
Ascorbic acid-rich veg/fruit	0.2	0.5	0.0		31
Carotene-rich veg/fruit	0.1	0.3	0.0		23
Potato, sweet potato	0.6	0.8	0.3		53
Other veg/fruit	0.6	0.9	0.2		52
Cereal Group	7.0	3.0	6.6	4 or more	100
Unrefined	1.6	2.0	0.9		58
Refined	5.4	3.2	4.9		99
Fat Group	3.1	2.5	2.5	4 or more	92
Dripping, 'saturated animal fat'	0.6	1.4	0.0		27
Brick margarine	2.2	2.2	1.8		78
Oil, tub margarine	0.3	0.8	0.0		28

SD: Standard deviation
DNHPD: Department of National Health and Population Development

With regard to meal frequency, less than half (45%) of the children had only two meals exceeding 600 kJ, while 9% consumed only one meal (see Table 4.8). Similarly, less than half (45%) had three meals during the period of recall. It was encouraging to note that 83% of children consumed breakfast, although only 58% had lunch. However, it was noted in reviewing the data that 'snacking' contributed a wide range of nutrients of the order of approximately one-third or more of energy intake (Table 4.9). Consequently it appears that little 'nutrient empty' food was consumed between meals.

Table 4.8: Meal frequency and specific meals consumed on the day of recall for African children resident in the Cape Peninsula, 1990, aged 3 - 6 years (N=163)

		Number of children	%
Number of meals	0	2	1.2
	1	15	9.2
	2	73	44.8
	3	73	44.8
Meals	Breakfast	136	83.4
	Lunch	95	58.3
	Supper	149	91.4

Table 4.9: Percentage contribution from each of three meal periods and from snacking to total energy and nutrient intake for 3 - 6-year-old urban Africans (BRISK) (boys N=93 and girls N=70 combined)

	Breakfast			Lunch			Supper			Snacking		
	Median	Q_1	Q_3	Median	Q_1	Q_3	Median	Q_1	Q_3	Median	Q_1	Q_3
Energy	23	17	31	25	14	34	30	22	39	29	13	43
Total protein	17	11	25	22	14	40	39	27	51	26	7	39
Animal protein	9	0	22	17	0	48	42	14	71	1	0	37
Total fat	16	6	26	24	8	45	31	18	48	29	8	51
Saturated fat	15	8	28	22	8	41	35	20	50	27	6	46
Polyunsaturated fat	13	6	29	23	5	46	25	15	45	28	8	57
Cholesterol	6	0	19	18	0	43	45	14	78	0	0	37
Total carbohydrate	28	21	37	24	14	31	25	17	36	32	17	43
Dietary fibre	16	9	28	25	14	41	26	15	44	31	16	51
Added sugar	47	26	66	2	0	37	0	0	4	31	0	60
Calcium	25	11	43	18	10	40	20	10	48	22	7	42
Iron	16	9	28	24	16	41	32	19	48	25	12	40
Vitamin A	11	3	31	18	4	43	25	9	55	26	4	52
Thiamin	24	16	33	21	12	40	34	21	48	23	10	39
Vitamin B_6	12	7	22	23	9	49	37	20	57	21	9	36
Ascorbic acid	0	0	3	8	0	53	27	1	73	10	0	54
Vitamin B_{12}	10	0	33	19	0	51	28	2	56	0	0	39

Q_1 = First quartile
Q_3 = Third quartile
For 50% of respondents the percentile contribution is contained in the interquartile range

The results of the anthropometric analysis (Table 4.10) support the fact that the diet was generally inadequate. Over a quarter of the children were 'stunted' in terms of the NCHS reference values, with 27.6% (Z-score <-2 height-for-age). Fewer children were 'underweight', with 7.7% (Z-score <-2 weight-for-age), and similarly 7.9% were 'wasted' (Z-score <-2 weight-for-height). On the other hand, 20.1% reflected a Z-score >+2 for weight-for-height, reflecting a substantial proportion of obese children.

Table 4.10: Percentages and mean of 3 - 6-year-old urban African children falling within certain Z-score and percentile categories (N=163)

	Z-score				Percentile		
	% < -3	% < -2	Mean	% > +2	% < 3rd	% < 5th	% > 95th
Weight-for-age	3.5	7.7	-0.8	9.0	9.1	12.7	10.7
Height-for-age	10.2	27.6	-0.8	8.9	29.8	37.4	12.1
Weight-for-height	4.8	7.9	1.1	20.1	8.5	9.0	25.0*

* Four children were omitted because of extreme outlying values.

Discussion

These results should cause concern about the diets of young African children in the Cape Peninsula. They reveal a refined, cereal-based diet that is particularly deficient in dairy products, vegetables and fruits. This pattern has been shown elsewhere in Africa, for example in Nigeria (Ajayi, 1984) and Tanzania (Kreysler and Mndeme, 1975). A somewhat erratic meal pattern is evident. Most of the children consume breakfast and supper, about half have lunch, and many consume the remainder of the intake (approximately one third of all nutrients) in small amounts throughout the day. This pattern is probably determined by the presence of adults (notably the mother), who in many cases is only at home in the early morning and evenings. It must be noted, however, that two meals a day was the norm of African populations in the past (Coetzee, 1982), and may account in part for the meal pattern observed in the study population.

Although there was variation in foods constituting the meals, a 'typical' breakfast included soft porridge with much sugar (often without milk) and tea. Foods eaten during the day and at lunch were usually based on bread, with various spreads. The evening meal was typically a cooked meal with a maize-staple, for example: meat stew with stiff maize porridge, or samp and beans.

In terms of the NCHS standards (Hamill, *et al.*, 1977), a large proportion (29.8%) of the children were stunted, which is consistent with other work on black children (Pinstrup-Anderson, *et al.*, 1993) and compares well with earlier work in the Cape Peninsula. In the Philani (Le Roux and le Roux, 1991) and SHAWCO (Hugo-Hamman, *et al.*,1987) surveys conducted in Khayelitsha, Cape Town, during the late 1980s, 23.5% and 29.6% of 3 - 5-year-olds were found to be under the 3rd percentile height-for-age respectively. Similarly, in the national RHOSA (Dept. of Health Services and Welfare, 1990) study among rural African preschoolers, stunting was observed in 24.5% of the population. At 9.1%, the percentage of children under the 3rd percentile of weight-for-age in the present study is similar to the figure reflected in the RHOSA study (8.4%) (Dept. of Health Services and Welfare, 1990) and the SHAWCO survey (10.3%) (Hugo-Hamman, *et al.*,1987), and is not as high as in the Philani survey (16.8%) (Le Roux and le Roux, 1991). However, the proportion of wasted children in the present study (8.5% below the 3rd percentile of weight-for-height) exceeds that in all three surveys [RHOSA 1.8% (Dept. of Health Services and Welfare, 1991), Philani 2.5% (Le Roux and le Roux, 1991) and SHAWCO 2.8% (Hugo-Hamman, *et al.*,1987)]. The present figure is similar to the 6.9% below the 3rd percentile found by Richardson, *et al.* (1991) in the Transvaal, and the 15.5% below the 5th percentile in Bloemfontein (Househam and Elliot, 1987) (12.7% below the 5th percentile in the present study).

Interestingly, in their review of data from 31 countries, Carlson and Wardlaw (1990) found the prevalence of stunting in rural areas to be 1.5 times the urban prevalence, while wasting showed a different pattern, with almost one-third of the countries having a higher prevalence in urban areas. The pattern of between one-quarter and one-third of preschoolers being stunted (below -2 SD height-for-age) and one-tenth being wasted (below -2 SD weight-for-height) has been observed fairly consistently elsewhere in Africa - in Sierra Leone, Togo, Burkino Faso, Botswana, Zaire, Kenya and Namibia (Keller and Fillmore, 1983; Katjuanjo, *et al.*, 1993). According to the WHO definition, this is indicative of a moderate prevalence of malnutrition (WHO, 1986). While the anthropometric data from all these studies suggest that the dietary intakes of many of the children are inadequate to support optimal growth, no dietary evaluations were included. It was therefore not possible to identify problem areas in their diets. The paradoxical evidence of obesity observed in this sample does not seem to be reported elsewhere, apart from having been noted in urban children in Bulawayo, Zimbabwe (Mathe, *et al.*, 1985). However, an emphasis in research on examining the problem of undernutrition may well have led to potential obesity not specifically being investigated in young children. The increasing prevalence of obesity among adults in developing countries is, nevertheless, widely documented (Kumanyika, 1987). South Africa is no exception in this regard, with a prevalence of 7.9% among African men and 34.1% among women (body mass index $\geq$ 30) in the Cape Peninsula (Steyn, *et al.*, 1991). The early onset of obesity therefore raises many concerns, and requires further investigation.

The paucity of dietary data on young African children in South Africa makes comparisons difficult and perhaps even spurious. Nevertheless, the other studies are useful as a yardstick. Steyn, *et al.* (1989), who used similar methodology in their study of rural preschoolers in Lebowa, also found cereal and meat intakes to be adequate, but those of milk, vegetables and fruit extremely low. The Lebowa children consumed a mean of 0.27 portions (Steyn, *et al.*, 1989) from the milk group, compared to a mean of 0.74 in the Cape Peninsula children. Conversely, the Lebowa preschoolers reflected a mean intake of 1.52 portions of fruit and vegetables, whereas in our study the mean intake from this food group was 1.32. Interestingly, the rural preschoolers (Steyn, *et al.*, 1989) consumed far less added fat (mean 0.53 portions) than this urban group, who had a mean added fat intake of 3.12 portions. This can be attributed to the move away from the traditional low fat diet to a more western diet, a phenomenon recorded by many researchers (Den Hartog and van Staveren, 1985). In similar vein, the rural group had a more predominantly cereal-based diet with a mean intake of 9.57 portions (Steyn, *et al.*, 1989), as opposed to the mean of 7.0 portions in this urban group (Table 4.7). Richardson, *et al.* (1991), who looked at urban (Soweto) and rural (Gelukspan) black 4- and 5-year-olds, found that the urban dwellers consumed almost double the total fat of the rural children. The urban children also consumed more carbohydrate in absolute terms than those in the rural areas, although in the urban group proportionally more of it was refined. The mean energy intake of the rural children in the Richardson, *et al.* (1991) report, at 4574 kJ, is very similar to that found by Steyn, *et al.* (1989) (4541 kJ). However, the mean of 6400 kJ for the urban African children in the Richardson, *et al.* (1991) study is markedly higher than that of 5200 kJ in this Cape Town study (Table 4.1).

In respect of the macronutrient energy distributions, the profile of the Lebowa (Steyn, *et al.*, 1992) children is even more conservative, when compared to prudent dietary guidelines, than those of the Cape Town children. Surprisingly, however, total protein constituted 15% of energy (15%E) in the more impoverished Lebowa (Steyn, *et al.*, 1992) preschoolers compared to the 13%E in this study; nevertheless, the Cape Town children consumed less plant protein (6.5%E) than their rural counterparts (9%E) whose plant protein intake was almost double that of animal protein (5%E). In the Richardson, *et al.* (1991) urban/rural comparison a similar trend was evident with plant protein predominating over animal among the rural children, and with the converse occurring among the urban group. Total fat contributed 30%E of the urban group compared to 23%E in the rural children (Richardson, *et al.*, 1991). The Lebowa (Steyn, *et al.*, 1992) children had particularly low fat intakes contributing 19%E. The fat intake of the Sowetan (Richardson, *et al.*, 1991) children reflected the highest intakes (30%E) followed closely by the Cape Town children (28%E), both urban groups being close to the prudent dietary cut-off point. This suggests that further increases in fat intake may lead to an atherogenic diet. The Gelukspan (Richardson, *et al.*, 1991) children fell into a range intermediate (23%E) to the above. Carbohydrate intakes show the same traditional to Western gradation: Lebowa (Steyn, *et al.*, 1992) (68%E obtained from carbohydrates) had the highest proportion followed by Gelukspan (Richardson, *et al.*, 1991) (65%E) and Cape Town (64%E), with Sowetan (Richardson, *et al.*, 1991) 5-year-olds having the lowest percentage (57%E). It can be concluded that the urban children are consuming a progressively Western diet (in respect of the macronutrient profile) and that, as rural children are increasingly exposed to Western influences, they are gradually following suit. The increasing prevalence of dental caries among urban compared to rural children is further evidence of this urban deterioration of the childrens' diets (Richardson, *et al.*, 1991).

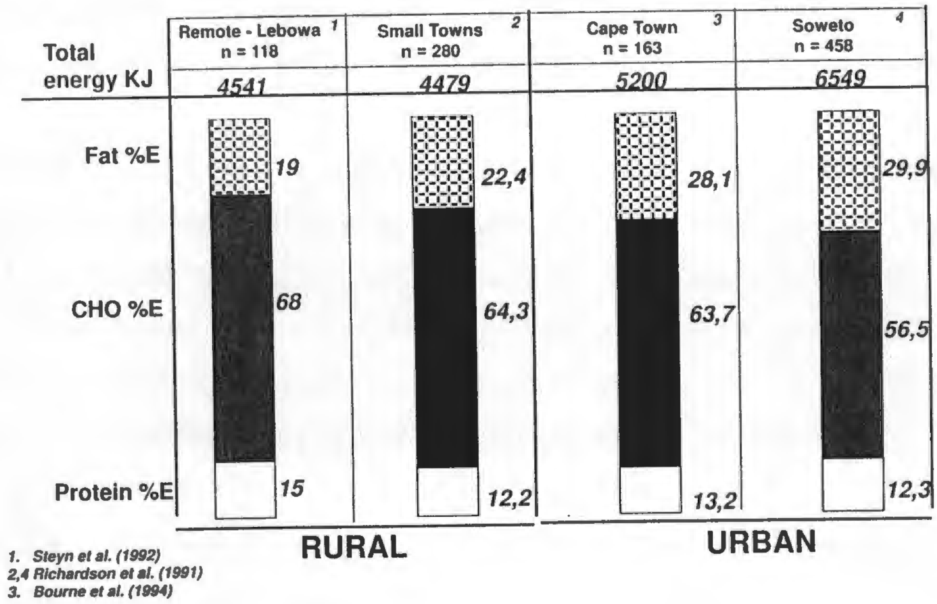

Figure 4.2: Gradient of macronutrient distribution in African preschoolers with increasing urbanisation

The interpretation of vitamin and mineral intakes is not as clear-cut. Certainly in terms of the RDAs African children have exceptionally low intakes, as evidenced in the various study areas mentioned above (Richardson, *et al.*, 1991; Steyn, *et al.*, 1992) and reported elsewhere in Africa (Levin, *et al.*, 1993). It should be stressed that there is little evidence of clinical stigmata of vitamin and mineral deficiencies in this population [Personal communication, local health authorities]. However, DeMaeyer and Adiels-Tegman (1985) report a prevalence of anaemia of about 50% in African children. Comparisons of vitamin and mineral intakes of these Cape Town children with those of preschoolers resident in Edinburgh, Scotland (seven-day inventory method) (Payne and Belton, 1992) reveal similar mean intakes of vitamin A, thiamin, folic acid, vitamin B_{12} and ascorbic acid, but not the particularly low intakes of riboflavin, niacin and vitamin B_6 found in our study. Payne and Belton (1992) reported no overt symptoms of vitamin deficiency or growth retardation but do, however, speculate that the children with low intakes had subclinical vitamin and mineral deficiencies. Since the prevalence of diseases associated with poverty (such as tuberculosis) are apparently on the increase (DNHPD, 1993) among young urban Africans, the authors can think of no alternative but to strongly advocate the importance of an adequate diet. Adequate consumption of micronutrients through food is the best way of preventing micronutrient deficiencies (Hussey and Klein, 1990). In squatter areas in Brazil it was found that 50% of the children were consuming only five food types, although 26 were available in the same price range (Reichenheim and Ebrahim, 1986). The authors concluded that choice of foods could be improved even in poor urban families (Reichenheim and Ebrahim, 1986). In the present study sample, fruit, vegetable and milk intakes should be addressed. Micronutrient enrichment of basic staples such as maize and bread should also be a priority in health policy formulation.

In many studies among African preschool children stunting (low height-for-age) has been found to be about 30% or above, while the percentage of underweight children is usually less than 15% (Steyn, *et al.*, 1989). This study falls within this pattern in those respects, and can be interpreted as evidence of chronic undernutrition caused by a diet low in energy and essential nutrients over a long period of time, leading to suboptimal growth. However, of particular concern is the 8.5% of children falling below the 3rd percentile of weight-for-height (wasting). This percentage far exceeds the 2.5% and 2.8% in studies found in other parts of Cape Town (Hugo-Hamman, *et al.*,1987; Le Roux and le Roux, 1991) where the proportion of new arrivals from rural areas would probably have been higher, since these studies had study populations drawn mainly from squatter areas. It, therefore, appears that there is evidence of acute undernutrition as well as of chronic undernutrition, contrasting with emerging obesity in urban African preschoolers.

4.2 NUTRITIONAL ASSESSMENT OF THE 15 - 18-YEAR-OLDS (ADOLESCENTS)

Mean and median nutrient intakes for young men and women are presented in Tables 4.11, 4.12 and 4.13. Macronutrient intakes together with fibre, sugar and cholesterol appear in Table 4.11, while vitamin and mineral intakes are tabulated in Tables 4.12 and 4.13.

Table 4.11: Mean and median daily energy, macronutrient, cholesterol and fibre intakes in men (N=58) and women (N=61) aged 15 - 18 years

Nutrients	Men			Women		
	Mean	Standard deviation	Median	Mean	Standard deviation	Median
Energy (kcal)	2035	833	1858	1525	690	1431
Energy (MJ)	8.5	3.5	7.8	6.4	2.9	6.0
Protein (g)	70	38	63	49	36	45
Plant protein (g)	36	18	32	24	14	21
Animal protein (g)	34	31	27	25	23	20
Fat (g)	65	41	60	51	39	41
Saturated fat (g)	22	14	18	15	12	12
Monounsaturated fat (g)	24	17	20	18	15	14
Polyunsaturated fat (g)	14	10	11	13	12	9
Cholesterol (mg)	262	312	156	245	268	152
Carbohydrate (g)	298	129	274	219	91	210
Dietary fibre (g)	21	12	18	17	11	13
Sugar (g)	52	49	46	51	40	45

From the above Table it is clear that adolescent males consume more food than their feminine counterparts, as is evidenced by the considerably higher energy intake in the men (2035 kcal) as opposed to the women (1525 kcal).

Table 4.12: Mean daily intake of vitamins in men (N=58) and women (N=61) aged 15 - 18 years

Vitamins	Men				Women			
	Mean	Standard deviation	Median	Q_3-Q_1	Mean	Standard deviation	Median	Q_3-Q_1
Vitamin A (RE)	373	399	264	296	452	948	231	197
Thiamin (mg)	1.09	0.57	0.96		0.83	0.53	0.67	
Thiamin (mg/4.2 MJ)	0.64	0.22	0.53		0.62	0.34	0.53	
Riboflavin (mg)	1.06	0.80	0.88		0.86	0.68	0.68	
Niacin (mg)	12.95	8.10	11.80		9.35	5.64	8.40	
Niacin (mg/4.2 MJ)	6.43	3.42	5.94		6.32	3.33	5.93	
Vitamin B_6 (mg)	1.00	0.64	0.89		0.91	0.70	0.70	
Vitamin B_6 mg/tot prot (g)	0.02	0.01	0.02		0.02	0.02	0.01	
Folic Acid (µg)	193	136	148		150	106	118	
Vitamin B_{12} (µg)	3.4	4.7	2.3	3.4	3.2	9.5	1.5	2.0
Ascorbic Acid (mg)	61	150	17	26	53	108	20	35

Median and interquartile range (Q_3-Q_1) provided because of particularly large standard deviations
RE: Retinol equivalents

Table 4.13: Mean and median daily intakes of minerals in men (N=58) and women (N=61) aged 15 - 18 years

Minerals (mg)	Men			Women		
	Mean	Standard deviation	Median	Mean	Standard deviation	Median
Calcium	570	457	435	335	223	284
Iron	8.8	4.4	8.1	7.0	3.7	6.5
Magnesium	287	145	243	199	94	186
Phosphorus	1051	541	982	693	319	668
Potassium	2044	976	1910	1682	766	1644
Sodium	2025	1431	1572	1286	940	1164
Zinc	9.9	6.9	7.6	6.8	5.1	5.5
Copper	1.2	0.7	1.1	1.0	0.5	0.9

With the exception of vitamin A, male intakes exceeded those in women (Tables 4.12 and 4.13). However, the gender disparities in thiamin and niacin are not evident when expressed per 4.2 MJ (thiamin 0.6 vs. 0.6 and niacin 6.4 vs. 6.3 for men and women respectively). This suggests that women consumed diets of higher micronutrient density than men (and was additionally supported by further analyses for other nutrients - data not presented.)

A more accurate reflection of nutrient adequacy is reported in Table 4.14 where percentages of male and female adolescents that fell below 67% and above 120% of the RDA are given. The high percentages of men and women falling below two thirds of the RDA, in most cases more than half the sample (with the exceptions of protein and vitamin B_{12} and folic acid in men), reflects an adolescent group consuming a nutrient depleted diet. Of particular concern were the high percentages of women with inadequate calcium and iron intakes (96% and 81% <67% RDA respectively).

Table 4.14: Mean percentage of men (N=58) and women (N=61) aged 15 - 18 years with energy and nutrient intakes less than 67% recommended dietary allowances (RDA) and more than 120% RDA

	Men		Women	
Nutrients % RDA*	<67%	>120%	<67%	>120%
Energy (kcal)	56	6	59	8
Protein (g)	24	40	20	40
Calcium (mg)	77	8	96	0
Iron (mg)	51	10	81	0
Magnesium (mg)	55	14	62	5
Phosphorus (mg)	42	22	69	4
Zinc (mg)	66	14	72	7
Copper (mg)	75	3	84	0
Vitamin A (RE)	89	4	81	9
Thiamin (mg)	53	8	53	12
Riboflavin (mg)	66	11	68	11
Niacin (mg)	62	10	66	9
Vitamin B_6 (mg)	77	5	64	13
Folic Acid (μg)	47	30	53	26
Vitamin B_{12} (μg)	39	47	48	28
Ascorbic Acid (mg)	81	12	70	14

* Recommended dietary allowances, 1990. When more than 25% of subjects have an intake below 75% RDA for a specific nutrient, that nutrient deserves attention in that population (Garry *et al.*, 1982).

Macronutrient energy distributions are given in Table 4.15 together with energy contributions from sugar and alcohol, presented with local (Diet Consensus Panel, 1989) and American (AHA, 1988) prudent dietary guidelines. Comparisons of these data reveal that the diets of these adolescents fall within both sets of recommendations, with only marginal differences between the genders. More than half of the total protein was consumed from plant sources (58% for men and 56% for women) and the proportions of energy derived from carbohydrate exceeded 60%. These figures reflect traditional features to the structure of the diet.

Table 4.15: Mean and median daily energy distributions, nutrient ratios and cholesterol intake in men (N=58) and women (N=61) aged 15 - 18 years

	Men			Women				
Nutrients	Mean	SD	Median	Mean	SD	Median	AHA	SA
Total protein as %E	13.6	4.3	12.1	13.1	5.0	11.9	< 15	-
Animal protein as % of total protein	42	24	44	44	26	45	-	-
Total fat as %E	27.4	11.0	27.9	28.3	10.0	27.6	< 30	< 30
Saturated fat as %E	9.1	3.7	9.2	8.5	3.3	8.3	< 10	< 10
Monounsaturated fat as %E	9.9	5.1	9.5	10.1	4.4	10.3	< 10	< 10
Polyunsaturated fat as %E	6.0	3.8	5.1	7.2	4.1	6.8	< 10	< 10
Diet P/S	0.7	0.5	0.6	0.9	0.6	0.8	1	-
Cholesterol (mg)	262	312	156	245	268	152	<300	<300
Total carbohydrate as %E	64.3	14.1	65.3	63.7	12.3	62.5	≥ 50	-
Sugar as %E	10.7	8.5	9.2	14.6	11.0	13.4	-	-
Sugar as % total carbohydrate	18.0	13.0	18.0	24.0	16.0	23.0	-	-
Alcohol intake as %E	0	0	0	0	0	0	-	-

SD: Standard deviation
AHA: American Heart Association guidelines
SA: South African Diet Consensus Panel
%E: Values expressed as percentage of total daily energy intake
P/S: Polyunsaturated/saturated fatty acid ratio

Tables 4.16 and 4.17 include breakdowns of food group contributions to macronutrient fibre and sugar intakes. Table 4.16 illustrates that the meat group was the most important source of cholesterol and the second highest contributor to total fat and saturated fat, after the fat group itself. In men and women a substantial proportion of total protein was derived from the cereal group. The cereal group was the most important source of energy in men (45.5%) and in women, although to a lesser extent (34.1%). The nutrient-empty 'non basic' food group provided more than 10% of energy, while the contributions from the nutrient-rich milk and fruit and vegetable groups were very low. In Table 4.17 it can be seen that the cereal group was the main source of carbohydrate and fibre, while the non basic group was the primary source of sugar intake.

NB

Table 4.16: Contribution of the Five Food Groups and 'non basic foods' to total energy, fat, cholesterol and protein intake for the Cape Peninsula African population aged 15 - 18 years (N=58 men and 61 women)

FOOD GROUP		PERCENTAGE CONTRIBUTION									
		Energy		Total Fat		Saturated Fat		Cholesterol		Total Protein	
		Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Milk Group	Mean	6.7	4.0	13.7	9.1	21.2	14.1	21.7	16.1	11.0	7.6
	SD	8.4	6.5	19.6	17.6	26.9	22.4	33.6	30.0	13.9	13.1
Meat Group	Mean	18.4	20.4	28.4	26.5	28.3	29.0	54.1	61.8	38.3	47.0
	SD	14.6	13.0	24.3	19.7	25.1	23.0	39.4	36.0	24.3	23.8
Fruit & Vegetable	Mean	8.2	14.2	5.3	8.6	5.0	7.6	1.7	1.8	4.1	6.8
Group	SD	9.4	14.1	10.5	12.1	11.7	11.6	7.2	4.7	5.4	7.7
Cereal Group	Mean	45.5	34.1	15.8	12.8	8.9	7.9	5.5	6.5	43.7	35.2
	SD	14.6	14.7	14.3	14.0	10.4	9.7	18.1	17.6	18.2	18.5
Fat Group	Mean	9.0	10.6	32.9	36.8	31.0	33.1	14.1	10.9	0.4	0.2
	SD	6.9	7.9	24.2	24.6	26.1	25.1	29.4	22.8	1.4	0.4
Non basic Group	Mean	10.7	13.9	3.4	3.8	3.6	4.9	3.6	1.7	2.3	2.3
	SD	10.7	12.1	12.6	10.1	12.9	12.6	15.7	8.2	6.1	4.0

SD: Standard deviation

Table 4.17: Contribution of cereals, vegetables & fruit and 'non basic foods' to the carbohydrate, fibre and sugar intake of the 15 - 18-year-old Africans in the Cape Peninsula (N=58 men and 61 women)

FOOD GROUP		PERCENTAGE CONTRIBUTION					
		Carbohydrate		Fibre		Sugar	
		Men	Women	Men	Women	Men	Women
Fruit & Vegetable Group	Mean	9.9	17.9	20.1	28.2	7.1	9.2
	SD	10.9	19.0	20.6	25.7	19.9	26.1
Cereal Group	Mean	62.4	46.8	66.1	48.8	1.9	0.0
	SD	17.1	18.1	25.0	27.1	13.7	0.2
Non basic Group	Mean	16.7	21.2	0.9	1.8	92.0	88.9
	SD	13.7	16.9	3.8	3.6	19.5	26.8

SD: Standard deviation

The analysis expressed in terms of the number of food portions of the five food groups as described in subsection 3.5.9 of the Methods, and their breakdowns are tabulated in Table 4.18. As a means of comparison, the local Department of Health guidelines are included in the Table.

Recommendations for only the cereal and fat groups were met, while those for cereals were exceeded. Although this is indicative of a traditional dietary pattern, mean intakes of refined cereals (9.5 portions) exceeded those of unrefined cereals (3.0 portions) by far. The breakdown of the mean intakes of the meat group suggests that preferences for the subgroups are approximately in line with each other. The fact that these young women consumed marginally more eggs than men implies that the taboo on egg intake in women (childbearing age) has fallen away. The medians of both the meat and fruit and vegetable groups indicate that at least half the sample consumed marginal amounts of the components of these groups. Intakes from the fat group indicate a marked preference for brick margarine.

Table 4.18: Mean and median number of portions for African 15 - 18-year-olds for the Five Basic Food Groups and the percentage consumers for each group

FOODS	Men (N=58)			Women (N=61)			DNHPD Guidelines	% Consumers overall N=119
	Mean	SD	Median	Mean	SD	Median		
Milk Group	1.0	1.4	0.3	0.4	0.7	0.2	1.6	58
Milk	1.0	1.4	0.2	0.4	0.7	0.1		55
Cheese	0.1	0.3	0	0.0	0.2	0		5
Meat Group	1.9	1.8	1.4	1.8	1.5	1.4	2	91
Red meat	0.4	1.0	0	0.3	0.8	0		25
White meat	0.4	0.8	0	0.3	0.5	0		33
Eggs	0.4	1.2	0	0.5	1.0	0		21
Legumes	0.3	0.7	0	0.3	0.7	0	---	17
Vegetable & Fruit Group	2.0	2.4	1.4	2.6	2.6	2.2	4 or more	71
Vitamin C-rich veg/fruit	0.3	0.8	0	0.2	0.6	0		20
Carotene-rich veg/fruit	0.1	0.3	0	0.1	0.3	0		12
Potato, sweet potato	1.0	1.6	0	1.0	1.5	0		44
Other veg/fruit	0.7	1.1	0	1.2	2.1	0		57
Cereal Group	12.6	6.7	10.8	7.2	4.3	6.2	4 or more	99
Unrefined cereals	3.0	4.3	0.6	1.5	2.3	0		47
Refined cereals	9.5	7.4	8.1	5.8	4.3	4.9		96
Fat Group	4.0	3.4	3.3	3.9	3.8	3.3	3 - 8 teaspoons	81
Butter, saturated fats	0.7	1.5	0	0.2	0.6	0		23
Brick margarine	2.9	2.9	2.3	3.2	3.5	2.5		78
Oil, tub margarine	0.4	1.1	0	0.5	1.0	0		25

SD: Standard deviation
DNHPD: Department of National Health and Population Development

With respect to salt intake among the 15 - 18-year-olds, 42% liked their meals 'well salted', although 62% preferred to 'taste first' and then add salt. Sixty percent of these adolescents reported consuming salty snacks more than three times per week.

In Tables 4.19 and 4.20 for men and women respectively, the distributions of nutrient intake throughout the day are presented. Intakes during the breakfast period were generally lower than other times of the day, while reported consumption during the supper period suggests that this was the main meal of the day for both young men and women. Interestingly, the between-meal or 'snacking' periods were times during the day when a considerable proportion of a variety of nutrients were consumed. The lunch period appears to have been of lesser importance than the collective contribution of the snacking times to total intake. These figures imply that food intake was a function of activities during the day.

Table 4.19: Percentage contribution from each of three meal periods and from snacking to total energy and nutrient intake for 15 - 18-year-old urban African (BRISK) men (N=58)

	Breakfast			Lunch			Supper			Snacking		
	Median	Q_1	Q_3	Median	Q_1	Q_3	Median	Q_1	Q_3	Median	Q_1	Q_3
Energy	23	16	32	26	19	33	40	33	47	37	15	55
Total protein	16	7	30	23	8	28	50	38	59	28	15	51
Animal protein	1	0	10	15	0	26	61	12	84	17	0	46
Total fat	13	4	35	26	6	45	34	24	54	40	16	62
Saturated fat	17	2	33	20	4	43	44	24	57	41	18	53
Polyunsaturated fat	11	4	38	30	13	57	28	12	48	43	12	66
Cholesterol	0	0	5	11	0	43	60	23	86	23	0	59
Total carbohydrate	30	19	37	26	13	36	35	28	44	37	19	57
Dietary fibre	19	9	36	29	15	39	37	19	50	36	11	65
Added sugar	29	13	59	13	0	43	0	0	44	29	0	63
Calcium	23	3	38	17	7	46	33	22	58	29	13	59
Iron	18	8	32	22	11	35	41	26	58	31	16	56
Vitamin A	8	0	42	28	0	52	27	2	57	35	3	71
Thiamin	20	10	37	21	13	31	40	29	58	33	15	63
Vitamin B_6	10	5	31	15	5	33	46	28	63	33	9	54
Ascorbic acid	0	0	0	4	0	43	67	4	100	8	0	47
Vitamin B_{12}	0	0	11	9	0	45	36	0	87	22	0	53

Q_1 = First quartile
Q_3 = Third quartile
For 50% of respondents the percentile contribution is contained in the interquartile range

Table 4.20: Percentage contribution from each of three meal periods and from snacking to total energy and nutrient intake for 15 - 18-year-old urban African (BRISK) women (N=61)

	Breakfast			Lunch			Supper			Snacking		
	Median	Q_1	Q_3	Median	Q_1	Q_3	Median	Q_1	Q_3	Median	Q_1	Q_3
Energy	19	11	29	32	17	40	36	27	49	36	17	49
Total protein	16	5	28	25	10	39	48	36	61	22	9	42
Animal protein	0	0	21	18	0	48	49	0	84	8	0	41
Total fat	15	3	30	28	8	50	37	23	49	44	17	53
Saturated fat	19	3	31	25	8	45	40	23	50	38	19	53
Polyunsaturated fat	12	2	28	29	11	42	32	14	53	40	8	68
Cholesterol	0	0	19	13	0	59	42	11	80	6	0	50
Total carbohydrate	21	11	30	30	17	41	32	24	44	36	22	56
Dietary fibre	14	0	30	21	11	37	37	26	52	36	11	55
Added sugar	33	9	52	22	0	53	0	0	26	41	0	68
Calcium	19	1	32	24	11	39	34	21	53	28	10	51
Iron	12	6	27	25	16	41	43	30	55	29	12	55
Vitamin A	14	0	39	36	7	49	18	1	45	51	8	74
Thiamin	13	5	27	25	14	36	45	29	56	33	10	55
Vitamin B_6	8	2	25	21	13	39	45	26	68	24	14	55
Ascorbic acid	0	0	0	1	0	63	26	1	99	0	0	70
Vitamin B_{12}	0	0	25	25	0	69	18	0	65	17	0	86

Q_1 = First quartile
Q_3 = Third quartile
For 50% of respondents the percentile contribution is contained in the interquartile range

Small percentages of young adolescents consumed no meals (< 600 kJ or 143 kcal) on the day of recall, with the majority of the sample having had two meals. In over 80% of respondents one of the meals was 'supper' with approximately half of more having reported eating 'breakfast' and/or 'lunch'.

Table 4.21: Meal frequency and specific meals taken on the day of recall for urban Africans aged 15 - 18 years (N=163)

		% Men (N=58)	% Women (N=61)
Number of meals	0	3.4	1.6
	1	20.7	26.2
	2	48.3	41.0
	3	27.6	31.1
Meals	Breakfast	64	56
	Lunch	43	57
	Supper	86	89

A meal was defined as an intake of 600 kJ or more per meal period

Anthropometric data

Anthropometric data for the adolescents are depicted in Tables 4.22 and 4.23. Standard deviations were small, with medians being very similar to the means. The same could be said for men with respect to weight, while in the case of women mean weights were approximately 3 kg in excess of the medians.

The distribution of BMI categories (Table 4.23) shows marked disparities between men and women. Although the highest percentage of both men and women fell within the 'normal' BMI category, considerably more men than women were classified as 'underweight' (39.7 vs. 4.8% respectively). Almost one third of the female adolescents were 'overweight' as opposed to 1 in 10 young men.

Table 4.22: Mean and median heights and weights and BMI distributions for African 15 - 18-year-old men and women

		Men	Women
Height (cm)	Mean	165.33	156.65
	Standard deviation	6.31	7.59
Weight (kg)	Mean	57.93	58.06
	Standard deviation	9.89	10.39
BMI (kg/m^2)	Mean	21.16	23.68
	Standard deviation	3.24	3.99

Table 4.23: BMI (kg/m^2) distributions in terms of Bray's classification for 15 - 18-year-olds

BMI categories	Men	Men %	Women	Women %
Underweight	<20	39.7	<19	4.8
Normal weight	20 – ≤25	48.2	19 – ≤24	56.5
Overweight	>25 – ≤30	10.4	>24 – ≤30	30.6
Obese	>30	1.7	>30	8.1
		100.0		100.0

Discussion

The major observations in this study of African adolescents are that the subjects consumed a diet meeting prudent dietary recommendations, but reflecting low micronutrient status.

Unfortunately, there are no local population-based nutrient data of African adolescents, other than that reported in this thesis. Consequently, few local comparisons are possible, since only two other studies from the Western Cape have investigated dietary intakes among older adolescents (all using the 24-hour recall method in population-based samples). A study on rural white teenagers (aged 15 - 19 years) resulted in the publication of macronutrient data (Wolmarans, *et al.*, 1988), but did not include figures on micronutrient intakes. However, another large study among urban low income coloured adolescents (15 - 19 years of age) included comprehensive nutrient data (Langenhoven, *et al.*, 1988). In both studies a typical western dietary pattern was reported.

Comparisons between young African men and local (Cape Town) coloured males (Langenhoven, *et al.*, 1988), revealed some striking differences. For example, Africans reported far lower absolute intakes of animal protein (34 g vs. 52 g), total fat (65 g vs. 108 g), and sugar (52 g vs. 109 g). Similar differences were noted between the two groups of women. Energy intakes for both men and women are also compared between the two groups. African men had a mean energy intake of 2035 kcal vs. 2543 kcal in coloureds, while African women reported a mean of 1525 kcal vs. 2243 kcal in young coloured women. These energy differences cannot easily be explained especially since the same methodology was used in both studies (24-hour recall). Since almost a third of the young women were overweight, it is possible that some degree of underreporting occurred among the females. This phenomenon of underreporting intake has been noted in the United States (Kumanyika, 1987; Braitman, *et al.*, 1985).

Because of the strictures imposed on various ethnic groups during the apartheid years, many researchers regard race classification as a proxy for SES (Yach, 1995). According to this view the downward gradient of SES would be white, coloured and African, which would imply that whites consume more westernised diets than coloureds and in turn Africans. However, in certain respects, macronutrient distributions of low income coloureds indicate that the structure of adolescent diets either mirror that of whites or exceed prudent guidelines to a greater extent. In both men and women percentages of energy from total protein intake were similar (13 - 14% in whites and coloureds) with African adolescent men and women falling within this range. The energy contribution of total fat in white and coloured men was 34.6% and 37.7% respectively (African men 27.4%E from total fat). This shows that the generally poorer coloureds had higher energy contributions from fat, which can be attributed in part to the higher proportions of polyunsaturated fat in coloured diets (10.3% and 9.8% in men and women) than in whites (6.6% and 7.0% for men and women respectively). In line with this, the P/S ratios for coloureds were high (1.00 and 0.85 for young men and women) as opposed to whites (0.57 and 0.59). The percentages of energy from carbohydrate were higher in whites (51.5% and 49.9%) than in coloureds (48.7% and 47.3%) for men and women respectively. Thus, it can be seen that in several respects both whites and coloureds consumed westernised diets, with certain anomalies relating to SES. When these figures are compared with Africans (Table 4.15) the evidence of a traditional basis to the African diet is notable.

For the purposes of international comparison, data from Non-Hispanic blacks in NHANES III Phase I, 1988 - 1991, (McDowell, *et al.*, 1994) are more in line with local whites and coloureds (exceeding prudent dietary guidelines in every respect) than with the African adolescents depicted in this thesis. The proportions of energy derived from total protein, fat and carbohydrate in 16 - 19-year-old Non-Hispanic blacks of both genders were 14.1%, 36.5% and 50.1% respectively.

As far as local micronutrient intakes are concerned, the teenagers in the coloured population have a marginally higher micronutrient status than African adolescents. In the coloured study (Langenhoven, *et al.*, 1988) the 1980 RDAs were used for comparison (Food and Nutrition Board, 1979) and lower intakes expressed as <75% of RDA, as opposed to the lower cut-off value (<67% RDA [1990]) utilised in this thesis. In the coloured study more than 50% of teenagers fell below the above cut-off value for calcium, iron, magnesium, zinc, copper, vitamins A, B_6 and folic acid for both genders. More than half African adolescents also had low intakes of these particular nutrients, but additionally for thiamin, riboflavin, niacin and ascorbic acid. Without exception mean intakes of micronutrients among blacks NHANES III (Alaimo, *et al.*, 1994) were strikingly higher than the means reported in Tables 4.11 and 4.12.

Comparisons of anthropometric data from this study with other local groups in a similar age category suggest that female African adolescents had a higher mean BMI (Table 4.22) than urban coloureds (22.6 in 19 - 24-year-olds, Steyn, *et al.*, 1990), urban whites (21.0 in 15 - 19-year-olds, Vorster, *et al.*, 1995) and rural whites (22.8 in 19 - 24-year-olds, Jooste, *et al.*, 1988) while mean BMIs for young men indicated that rural white males have the highest BMI (22.9, Jooste, *et al.*, 1988) followed by urban whites (22.4, Vorster, *et al.*, 1995) Africans (21.7) and coloureds (20.9, Steyn, *et al.*, 1990). However, as can be noted by the various age categorisations the African group is the youngest of all.

In spite of this youthful bias, the African women (Table 4.23) reflected the highest percentage of overweight (BMI >24 - ≤30, Bray, 1978) (30.6%) compared to coloureds (24.3%) and whites (23.1%), and obesity (BMI >30) at 8.1%, with coloured and white young females at 6.8% and 4.6% respectively. This reflects the current oft-reported emergence of obesity in women in developing countries. Obesity is increasing in all populations, developed and developing; the increase being more marked in women and particularly rapid in adolescents (Walker, 1995; Kumanyika, 1987). Cross-sectional data in the USA indicate that there was a 58% increase in the prevalence of obesity among 12 - 17-year-old adolescent girls between 1963 - 1965, and 1976 - 1980. For black teenagers there was a 96% increase in prevalence (Mc Anarney and Stevens-Simon, 1993). Data derived from the National Health and Nutrition Examination Surveys I, II and III have revealed that between 1976 and 1980, and 1988 and 1991, mean BMIs rose from 24.3 to 26.3; this approximates an average gain of 7 kg (Kuezmarski, *et al.*, 1994).

In contrast only 12.1% of the male African adolescents were overweight or obese (Table 4.23). Although this figure is considerably higher than that for coloured males (7.4%) (Steyn, *et al.*, 1990) a far higher proportion of rural white adults reflected excessive body weight (26.7%) (Jooste, *et al.*, 1988). However, in this Cape Town study it can be seen that anthropometric under- and overnutrition co-exist in 15 - 18-year-olds in the context of a diet low in micronutrient quality.

4.3 NUTRITIONAL ASSESSMENT OF THE 19 - 44-YEAR-OLDS

Mean and median intakes of macronutrients, sugar and cholesterol are depicted in Tables 4.24, while vitamin and mineral intakes are presented in Tables 4.25 and 4.26 for both genders.

Notable differences exist between intakes of men and women possibly because of the tradition of men being served first and receiving the 'lions share' of available food.

of men being served first and receiving the 'lions share' of available food.

Table 4.24: Mean and median daily energy, macronutrient and cholesterol intakes in men (N=285) and women (N=364) aged 19 - 44 years

	Men			Women		
Nutrients	Mean	Standard deviation	Median	Mean	Standard deviation	Median
Energy (kcal)	2020	874	1431	1534	667	828
Energy (MJ)	8.5	3.7	6.0	6.4	2.8	8.0
Protein (g)	77	44	45	56	33	69
Plant protein (g)	34	21	21	23	14	30
Animal protein (g)	42	40	20	33	30	35
Fat (g)	60	43	41	49	33	51
Saturated fat (g)	20	17	12	16	12	17
Monounsaturated fat (g)	21	17	14	17	14	16
Polyunsaturated fat (g)	13	10	9	11	9	11
Cholesterol (mg)	265	288	152	213	226	173
Carbohydrate (g)	282	128	210	214	95	263
Dietary fibre (g)	21	15	13	16	11	19
Sugar (g)	50	44	45	47	34	40

Table 4.25: Mean daily intake of vitamins in men (N=285) and women (N=364) aged 19 - 44 years

	Men				Women			
Vitamins	Mean	Standard deviation	Median	Q_3-Q_1	Mean	Standard deviation	Median	Q_3-Q_1
Vitamin A (RE)	724	2829	257	343	558	1141	244	329
Thiamin (mg)	1.11	0.63	1.01		0.85	0.53	0.75	
Thiamin (mg/4.2 MJ)	0.63	0.34	0.52		0.64	0.33	0.53	
Riboflavin (mg)	1.17	1.33	0.94		0.84	0.57	0.73	
Niacin (mg)	16.10	11.62	13.99		12.21	7.97	11.10	
Niacin (mg/4.2 MJ)	8.05	4.51	7.52		7.91	3.83	7.32	
Vitamin B_6 (mg)	1.15	0.82	1.00		0.92	0.62	0.81	
Folic Acid (µg)	218	175	169		155	131	117	
Vitamin B_{12} (µg)	6.9	29.3	2.3	4.1	3.6	8.7	1.6	2.9
Ascorbic Acid (mg)	54	151	16	30	42	84	18	34

Median and interquartile range (Q_3-Q_1) provided because of particularly large standard deviations
RE Retinol equivalents

Table 4.26: Mean and median daily intakes of minerals in men (N=285) and women (N=364) aged 19 - 44 years

	Men			Women		
Minerals (mg)	Mean	Standard deviation	Median	Mean	Standard deviation	Median
Calcium	526	484	372	337	221	290
Iron	10	6	9	7	4	4
Magnesium	337	840	274	206	99	98
Phosphorus	1111	641	998	752	356	719
Potassium	2212	1082	2068	1757	833	1664
Sodium	1583	1147	1373	1102	831	948
Zinc	10.6	8.4	8.7	7.7	6.2	6.2
Copper	1.4	1.7	1.2	1.0	0.5	0.9

Although absolute intakes in men are higher than those in women, there is evidence suggesting that women consume diets of higher nutrient density than men, particularly as illustrated in the cases of thiamin and niacin when intakes are expressed per 1000 kcal (Table 4.25). Additional data (not presented) showed that this was the case for most micronutrients.

Percentages of respondents falling below the cut-off values of 67% and above 120% of the RDAs are given in Table 4.27. An average of 53% of respondents had energy intakes <67% RDA. In contrast about 40% of subjects reported protein intakes >120% RDA. Calcium intakes for men and women were low - 71% of men and 84% of women reflected intakes <67% RDA. Iron intake was also very low in women, with 80% having intakes <67% RDA. For men where the RDA for iron is lower, only 32% fell below 67% RDA. Profiles of the trace elements, magnesium, zinc and copper reflect low intakes, particularly in women.

Vitamin intakes also tended to be low, with approximately 50% of subjects having mean intakes <67% RDA for thiamin, riboflavin, niacin, folic acid and vitamin B_{12}. Particularly low intakes were noted for vitamins A, B_6 and C, with two thirds or more respondents who reported intakes <67% RDA.

Table 4.27: Mean percentage of men (N=285) and women (N=364) aged 19 - 44 years with energy and nutrient intakes less than 67% RDA and more than 120% RDA

	Men		Women	
Nutrients % RDA*	<67%	>120%	<67%	>120%
Energy (kcal)	53	6	52	7
Protein (g)	17	43	20	39
Calcium (mg)	71	13	84	1
Iron (mg)	32	28	80	2
Magnesium (mg)	34	16	48	9
Phosphorus (mg)	18	41	39	18
Zinc (mg)	60	12	67	8
Copper (mg)	70	4	87	1
Vitamin A (RE)	83	9	78	14
Thiamin (mg)	49	11	47	15
Riboflavin (mg)	62	10	61	9
Niacin (mg)	45	19	43	19
Vitamin B_6 (mg)	70	6	66	6
Folic Acid (µg)	34	32	54	20
Vitamin B_{12} (µg)	36	47	44	35
Ascorbic Acid (mg)	79	13	75	12

* Recommended dietary allowances, 1990. When more than 25% of subjects have an intake below 75% RDA for a specific nutrient, that nutrient deserves attention in that population (Garry *et al.*, 1982).

Mean and median energy distributions are depicted in Table 4.28 and reflect an essentially prudent diet in this adult population. Dietary protein represented approximately 14% of food energy intake, with plant protein being almost equal to animal protein. Total fat contributed 26.5% to total food energy intake, with saturated fatty acids contributing an overall average of 8.7%E, polyunsaturated fatty acids 6.0%E and monounsaturated fatty acids 9.2%E. The P/S ratio of the diet was relatively high at 0.8 and 0.9 for men and women respectively. Mean cholesterol intake averaged at a moderate 239 mg.

Table 4.28: Mean and median daily energy distributions, nutrient ratios and cholesterol intake in men (N=285) and women (N=364) aged 19 - 44 years

Nutrients	Men Mean	Men SD	Men Median	Women Mean	Women SD	Women Median	AHA	SA
Total protein as %E	15.1	4.8	14.4	14.5	4.8	14.2	< 15	-
Animal protein as % of total protein	49	28	56	51.2	27	47	-	-
Total fat as %E	25.9	11.8	24.3	27.0	11.2	26.5	< 30	< 30
Saturated fat as %E	8.6	4.4	8.4	8.8	4.3	8.8	< 10	< 10
Monounsaturated fat as %E	9.0	5.2	8.7	9.4	5.0	8.8	< 10	< 10
Polyunsaturated fat as %E	5.7	3.7	5.0	6.3	3.9	5.4	< 10	< 10
Diet P/S	0.8	0.7	0.7	0.9	0.8	0.7	1	-
Cholesterol (mg)	265	288	152	213	226	173	< 300	< 300
Total carbohydrate as %E	61.3	16.3	61.7	62.0	15.3	63.1	≥ 50	-
Sugar as %E	11.0	9.6	9.5	13.6	11.1	11.6	-	-
Sugar as % total carbohydrate	19	16	16	23	16	21	-	-
Alcohol intake as %E	2.4	8.2	0	0.9	5.5	0	-	-

SD: Standard deviation
AHA: American Heart Association guidelines
SA: South African Diet Consensus Panel
%E: Values expressed as percentage of total daily energy intake
P/S: Polyunsaturated/saturated fatty acid ratio

Total available carbohydrate represented a mean of 62% of total energy intake, which is characteristic of a cereal-based African diet. Sugar intake contributed 11.0% and 13.6% to total energy intake in men and women respectively. The mean dietary fibre intake was 21 g in men and 16 g in women.

Tables 4.29 and 4.30 outline how the various food groups contributed to total macronutrient intakes, while in Table 4.31 the mean and median number of portions consumed from the Five Basic Food Groups are presented.

Table 4.29: Contribution of the Five Food Groups and 'non basic foods' to total energy, fat, cholesterol and protein intake for the Cape Peninsula African population aged 19 - 44 years (N=285 men and 364 women)

FOOD GROUP		Energy Men	Energy Women	Total Fat Men	Total Fat Women	Saturated Fat Men	Saturated Fat Women	Cholesterol Men	Cholesterol Women	Total Protein Men	Total Protein Women
Milk Group	Mean	6.1	5.1	13.6	10.2	20.4	16.4	19.3	18.2	9.6	8.5
	SD	9.1	8.0	22.0	16.3	28.5	22.8	31.3	30.0	14.4	13.0
Meat Group	Mean	24.3	23.0	37.6	36.1	37.0	36.3	64.4	64.3	49.6	50.3
	SD	17.9	15.7	28.2	27.0	29.4	28.4	38.6	38.1	27.1	25.4
Fruit & Vegetable Group	Mean	9.0	12.9	6.7	9.4	5.8	7.4	0.9	1.2	6.3	6.7
	SD	10.4	13.8	12.2	16.1	11.5	13.8	3.1	6.2	9.0	12.2
Cereal Group	Mean	38.2	34.9	12.7	11.0	7.9	6.8	1.0	2.5	34.1	31.4
	SD	18.7	16.4	15.2	12.9	12.9	9.6	8.0	11.9	21.3	18.8
Fat Group	Mean	7.7	8.4	27.6	30.4	26.0	26.0	13.0	12.4	0.2	0.2
	SD	7.8	7.6	25.4	25.3	26.5	0.0	26.3	25.4	0.6	0.7
Non basic Group	Mean	15.2	15.7	1.1	2.0	1.4	2.3	1.3	1.4	2.7	3.3
	SD	14.0	13.8	5.7	9.1	6.9	10.2	9.4	8.8	5.2	10.4

SD: Standard deviation

Table 4.30: Contribution of cereals, vegetables & fruit and 'non basic foods' to the carbohydrate, fibre and sugar intake of the 19 - 44-year-old Africans in the Cape Peninsula (N=285 men and 364 women)

FOOD GROUP		PERCENTAGE CONTRIBUTION					
		Carbohydrate		Fibre		Sugar	
		Men	Women	Men	Women	Men	Women
Fruit & Vegetable Group	Mean	11.7	15.8	23.8	33.2	5.8	3.6
	SD	14.5	17.3	25.8	28.8	19.6	14.1
Cereal Group	Mean	54.6	50.4	54.8	48.2	0.5	0.6
	SD	21.2	21.0	31.0	28.3	6.3	6.0
Non basic Group	Mean	22.6	24.8	0.7	2.1	93.5	94.0
	SD	18.5	17.2	2.8	10.7	21.5	18.1

SD: Standard deviation

Milk intake was low, contributing only 5.1% to 6.1% to total energy intake (Table 4.29). Less than half the recommended two portions for milk per day were consumed (Table 4.31). Cheese intake was neglible. As much as 44% of the study population did not report consuming any dairy products during the 24-hour recall period.

The meat group was the highest contributor to total fat (about 37%), saturated fat (approximately 37%), cholesterol (64%) and total protein (50%) intakes, and the second highest contributor to total energy intakes (24.3% and 23.0% of total E; Table 4.29). Since components of this group are relatively expensive, this is perhaps surprising in face of the poverty endemic in this population. Although 89% of the sample consumed items from this group on the day of recall, full requirements for women were not met, while those for men were exceeded (Table 4.31).

Table 4.31: Mean and median number of portions for African 19 - 44-year-olds for the Five Basic Food Groups and the percentage consumers for each group

FOODS	Men (N=285) Mean	SD	Median	Women (N=364) Mean	SD	Median	DNHPD Guidelines	% Consumers overall N=649
Milk Group	0.9	1.4	0.2	0.5	0.8	0.2	1.6	56
Milk	0.9	1.4	0.1	0.5	0.7	0.2		54
Cheese	0.0	0.1	0	0.0	0.2	0		4
Meat Group	2.7	2.2	2.2	1.2	1.7	1.6	2	89
Red meat	0.7	1.5	0	0.5	1.1	0		30
White meat	0.7	1.0	0	0.6	0.9	0		43
Eggs	0.4	1.0	0	0.3	0.8	0		16
Legumes	0.6	1.3	0	0.4	0.9	0		22
Vegetable & Fruit Group	2.2	2.4	1.9	2.6	2.8	1.9	4 or more	73
Vitamin C-rich veg/fruit	0.2	0.6	0	0.2	0.6	0		23
Carotene-rich veg/fruit	0.1	0.5	0	0.3	0.6	0		18
Potato, sweet potato	1.0	1.4	0	1.0	1.6	0		46
Other veg/fruit	0.7	1.5	0	1.1	1.9	0.2		48
Cereal Group	10.9	7.1	9.5	7.6	4.8	6.8	4 or more	97
Unrefined cereals	2.0	3.6	0	1.1	2.1	0		36
Refined cereals	8.9	7.2	7.4	6.4	5.0	5.5		92
Fat Group	3.6	4.0	2.3	3.1	3.2	2.4	3 - 8 teaspoons	77
Butter, saturated fats	0.8	2.4	0	0.8	1.8	0		26
Brick margarine	2.1	3.1	0.6	1.8	2.3	0.8		56
Oil, tub margarine	0.6	1.5	0	0.6	1.4	0		32

SD: Standard deviation
DNHPD: Department of National Health and Population Development

Only about half the recommended four portions of fruits and vegetables was consumed by 50% of the study population, with 27% of respondents not reporting any (Table 4.31). This food group contributed 9% and 13% of total energy for men and women respectively (Table 4.29), and 24% and 33% of fibre for men and women (Table 4.30). Interestingly, women consumed notably more fruits and vegetables than men.

Evidence of a traditional cereal basis to the diet was revealed by the intake from the cereal group (Table 4.31). Much of the cereal intake consisted of bread, white bread being marginally favoured over brown bread. Twenty percent of white bread was home-made (data not in tables). Men and women consumed 11 and 8 portions respectively of the cereal group, thereby exceeding the recommended minimum of four portions (Table 4.31) and contributing an average of 37% of total energy in the diet (Table 4.29). However, the impact of westernisation is shown by the fact that the intake of refined cereals was substantially higher than unrefined cereals. When expressed in terms of the percentage of consumers, more than twice as much refined as unrefined cereals were consumed (Table 4.31). The cereal group was also an important source of protein (Table 4.29), yielding approximately one third of total protein and about half the dietary fibre (Table 4.30). If mean daily cereal intake of this study sample is expressed in ratios, the ratio of maize : bread : rice was 4 : 2 : 1 (data not shown).

The 'added' fat consumption did not exceed the recommended number of portions (Table 4.31). The fat group itself was only the second largest contributor to total fat and saturated fat (Table 4.29). However, calculations for this group do not represent total fat intake, as was described under Methods (Chapter 3, section 3.5.9). The Five Basic Food Groups thus contributed 85% of total energy (Table 4.29) and approximately 15% came from 'non-basic' food sources.

The distributions of nutrient intakes throughout are presented in Tables 4.32 and 4.33 for men and women respectively.

Table 4.32: Percentage contribution from each of three meal periods and from snacking to total energy and nutrient intake for 19 - 44-year-old urban African (BRISK) men (N=285)

	Breakfast			Lunch			Supper			Snacking		
	Median	Q_1	Q_3	Median	Q_1	Q_3	Median	Q_1	Q_3	Median	Q_1	Q_3
Energy	20	7	33	28	15	41	37	28	50	32	15	48
Total protein	13	1	31	26	4	48	43	29	62	29	4	47
Animal protein	1	0	23	14	0	58	43	0	78	10	0	48
Total fat	11	2	36	26	2	47	41	23	62	26	2	54
Saturated fat	14	2	38	24	1	46	42	24	62	22	1	52
Polyunsaturated fat	8	0	39	27	2	47	36	17	60	25	1	59
Cholesterol	0	0	16	17	0	51	46	13	79	8	0	50
Total carbohydrate	21	10	36	28	17	40	35	25	45	35	16	50
Dietary fibre	10	0	33	24	0	44	39	22	61	31	3	53
Added sugar	33	15	58	16	0	48	0	0	28	32	0	57
Calcium	22	3	41	23	9	42	32	16	52	30	10	59
Iron	13	3	36	24	7	41	41	25	58	30	8	50
Vitamin A	4	0	40	14	0	45	27	4	63	24	0	61
Thiamin	16	0	33	26	6	43	43	29	57	31	4	48
Vitamin B_6	9	0	27	22	6	44	48	24	67	26	9	49
Ascorbic acid	0	0	2	0	0	45	41	0	96	0	0	50
Vitamin B_{12}	0	0	29	13	0	57	29	0	71	12	0	66

Q_1 = First quartile
Q_3 = Third quartile
For 50% of respondents the percentile contribution is contained in the interquartile range

Table 4.33: Percentage contribution from each of three meal periods and from snacking to total energy and nutrient intake for 19 - 44-year-old urban African (BRISK) women (N=364)

	Breakfast			Lunch			Supper			Snacking		
	Median	Q_1	Q_3	Median	Q_1	Q_3	Median	Q_1	Q_3	Median	Q_1	Q_3
Energy	21	8	34	31	18	44	40	32	51	27	6	46
Total protein	12	2	27	29	8	45	51	33	67	18	1	41
Animal protein	2	0	15	6	0	55	49	0	85	0	0	40
Total fat	11	3	31	28	6	55	40	22	60	18	0	47
Saturated fat	13	2	29	26	5	54	41	24	65	16	0	48
Polyunsaturated fat	10	1	34	25	7	55	35	18	61	17	0	54
Cholesterol	1	0	14	13	0	57	46	16	86	1	0	44
Total carbohydrate	24	12	37	29	18	40	37	26	47	28	10	47
Dietary fibre	14	0	31	30	13	52	40	23	60	21	0	50
Added sugar	39	19	61	1	0	42	1	0	32	34	0	56
Calcium	19	4	41	23	11	42	36	19	57	20	3	50
Iron	13	3	28	29	13	47	44	29	61	18	4	45
Vitamin A	7	0	38	21	2	58	33	2	70	8	0	50
Thiamin	15	2	31	25	14	46	45	31	62	20	0	47
Vitamin B_6	8	1	20	31	11	55	46	26	70	17	0	46
Ascorbic acid	0	0	1	17	0	77	38	0	93	0	0	49
Vitamin B_{12}	0	0	25	13	0	59	29	0	78	3	0	47

Q_1 = First quartile
Q_3 = Third quartile
For 50% of respondents the percentile contribution is contained in the interquartile range

In both men and women, the 'supper' period was the time during which the largest proportion of nutrients was consumed, while the 'breakfast' meal appeared to be the smallest meal, contributing a fifth of total energy and small proportions of other nutrients. The additive contribution of the snacking periods is more notable in men than in women, but in both groups substantive amounts of protein and micronutrients including calcium, iron, thiamin, vitamin B_6 and in the case of men, vitamin B_{12} were consumed as snacks.

The meal frequencies are reported in Table 4.34. More women (33%) than men (24%) consumed three meals (i.e. more than 600 kJ per mealtime) during the 24-hour recall period. Men consumed fewer 'meals' than women possibly because of time constraints imposed by employment (men having higher employment rates than women). However, as was illustrated in Table 4.32 men consume more during 'snacking' periods. In both men and women 'supper' was consumed by the large majority of respondents (88% and 87% respectively).

Table 4.34: Meal frequency and specific meals taken on the day of recall for urban Africans aged 19 - 44 years

		% Men (N=285)	% Women (N=364)
Number of meals	0	2.5	3.3
	1	27.4	22.5
	2	46.0	41.5
	3	24.2	32.7
Meals	Breakfast	53	57
	Lunch	51	60
	Supper	88	87

A meal was defined as an intake of 600 kJ or more per meal period

Among the men and women of this age category 49% reported a preference for their meals being 'well salted', while half enjoyed their meals 'lightly salted'. However, 61% stated that they would taste the food first before adding salt as opposed to 4% who habitually added salt before tasting. Thirty seven percent reported consuming 'salty snacks' more than three times per week.

Anthropometric data for men and women from this age category are presented in Tables 4.35 and 4.36. Mean and median heights, weights and BMIs are presented in Table 4.35, while distributions of BMI are tabulated in Table 4.36.

In Table 4.35 mean and median figures were similar. Women were approximately 10 cm shorter than men (1.59 m vs. 1.69 m) but heavier, with median BMIs of 26.8 in women and 22.2 in men.

Table 4.35: Mean and median heights and weights and BMI distributions for African 19 - 44-year-old men and women

		Men	Women
Height (cm)	Mean	168.99	158.76
	Standard deviation	6.83	6.86
	Median	168.65	159.00
Weight (kg)	Mean	66.16	70.29
	Standard deviation	11.11	16.19
	Median	64.25	67.00
BMI (kg/m^2)	Mean	23.18	27.87
	Standard deviation	3.76	6.15
	Median	22.21	26.77

A high proportion of women were 'obese' (BMI >30; Table 4.36), with only 5.6% of men being classified as obese. In contrast 17.1% of men were 'underweight' (BMI <20), while only 3.6% of women fell in this category.

Table 4.36: BMI (kg/m^2) distributions in terms of Bray's classification for 19 - 44-year-olds

BMI categories	Men	Men %	Women	Women %
Underweight	<20	17.1	<19	3.6
Normal weight	20 – ≤25	57.7	19 – ≤24	33.7
Overweight	>25 – ≤30	19.6	>24 – ≤30	31.5
Obese	>30	5.6	>30	31.2
		100.0		100.0

Discussion

The mean energy intakes in African 19 - 44-year-old men and women compare well with those found in other local and overseas studies utilizing the 24-hour recall (U.S. Dept. of Health and Human Services, 1983; Wolmarans, *et al.*, 1988; Langenhoven, *et al.*, 1988). This is illustrated in Fig. 4.3 (subsection 4.4.2), which features womens' energy intakes from this study as well as the CORIS, CRISIC and NHANES II studies. (Similar, albeit more irregular trends were evident from the comparisons of male data from these studies.) Energy intakes were low in all these studies compared to the RDA. As mentioned in Table 2.3 of the Literature Review, underreporting of intake is a problem potentially inherent with the 24-hour recall method (Bingham, 1987). Furthermore, a method based on one day's food intake is likely to yield a higher percentage of individuals below a fixed cut-off point such as the RDA, than a method including several day's consumption per individual (Hegsted, 1972). The ratios of protein, fat and carbohydrate to total energy in this study sample, compare well with other recent studies on urban Africans reported in the literature (Gericke, *et al.*, 1989; Albertse, *et al.*, 1990). Nonetheless, it is possible that systematic underreporting did take place in which case the assumption is made that it was manifest equally across all food groups, and that the true structure of the diet of the study population is reflected by this data. Although an apparent anomaly exists between the low mean energy intakes among women on the one hand, and the high prevalence of obesity on the other (31.2% having BMI >30), it can be argued that this prevalence of obesity contributed to the low reported mean energy intake, since several studies reveal low reported energy intakes by obese women (Braitman, *et al.*, 1985; Kumanyika, 1987; Bray, *et al.*, 1987).

In studies on American blacks the finding of low energy intakes coupled with obesity have led to the hypothesis that blacks have lower caloric requirements and more efficient energy utilization than whites of the same body weight (Kumanyika, 1987). The 'thrifty genotype' hypothesis (Neel, 1962; Knowler, *et al.*, 1983) holds that populations exposed to inadequate or fluctuating food supplies are genetically selected for a high level of efficiency in caloric utilisation or fat storage. This efficiency predisposes to an explosion of obesity and/or diabetes as food supplies increase. Rapidly increasing, high prevalences of both obesity and diabetes have been reported in several economically developing populations both within and outside the United States and including blacks (Walker and Segal, 1980; Richards and de Casseres, 1974).

Mean total fat consumption, at 26.5%E, fell within the AHA's (1988) recommendation of <30%E. However, this is much higher than the 17%E contribution of total fat intake found in 1953 by Batson (1955) (food purchasing habits), the 13.4%E and 16.6%E among rural lactating mothers (24-hour recall and diet history respectively) (Langenhoven, *et al.*, 1988) and the 16%E reported by Jooste, *et al.* (1990) from a study on institutionalized African migrant labourers (weighed portions). Manning, *et al.* (1974) (modified diet history) showed that fat intakes ranged from 21 - 30%E in urban Africans - the more well off families consuming the greater proportion of fats.

The proportion of fat in the diet among urban Africans, in comparison with the Manning, *et al.* (1974) study, has not increased over the past two decades. This is possibly because of the spiralling cost of food relative to minimum wage levels, though a higher fat intake than is traditionally consumed in the rural areas has been maintained. Nevertheless, fat intake still falls below current figures for local whites at 35%E (Wolmarans, *et al.*, 1988) and coloureds at 37%E (Langenhoven, *et al.*, 1988), both studies having used the 24-hour recall methodology.

The high carbohydrate intake, which is characteristic of a cereal-based diet, met the AHA dietary guideline of 50 - 60%E 'or more', and is similar to the reported 62 - 70%E range in the Manning, *et al.* (1974) study. As expected, the figure for Africans is higher than current figures for the western-oriented local whites at 44 - 51%E (Wolmarans, *et al.*, 1988) and the average 46%E for adult coloureds (Langenhoven, *et al.*, 1988). Absolute intakes of fibre in men were markedly lower than the 48 g reported by Jooste, *et al.* (1990), where institutionalised men were served a traditional diet. Figures for fibre intake for both men and women approximated those for whites (ranges 18 - 19 g and 13 - 14 g for men and women) and were markedly higher than figures derived for coloureds (13 - 17 g and 10 - 14 g for men and women respectively). Calculations derived per unit energy revealed that fibre intakes for Africans were somewhat better than those for whites (ranging from 6.6 - 7.4 g/4.2 MJ in men and from 8.5 - 9.1 g/4.2 MJ in women). Nevertheless, for a high carbohydrate dietary profile, the higher intake of refined over unrefined cereals represents a shift away from the traditional eating pattern.

The apparent contradiction of relatively high protein intakes, as reflected by the high percentage of subjects >120% RDA, compared well with other local studies on predominantly low socioeconomic groups (Langenhoven, *et al.*, 1988; Steyn, *et al.*, 1989). The equal distribution of plant versus animal protein reflects in part the traditional use of legumes, and possibly also economic constraints. The potential adequacy of the amino acid profile is further supported by the fact that legumes are traditionally consumed with a maize staple.

Reported cholesterol intakes in the sample were also lower at an overall mean of 236 mg compared with the 380 mg found for whites (Wolmarans, *et al.*, 1988) and 313 mg for coloureds (Langenhoven, *et al.*, 1988) but more than double the 115 mg reported by De Villiers (1988) in her study on rural Zulu women. This figure falls below the AHA dietary guideline of <300 mg/day.

The relatively high P/S ratios of 0.8 and 0.9 (in men and women respectively) compared well with that of coloureds (0.78 - 1.00) as opposed to the low figures for whites (0.48 - 0.59). However, in Africans the relatively high range was a reflection of a comparatively low saturated fat intake (8.6%E and 8.8%E in males and females) which met the AHA recommendation of <10%E, whereas in the coloured study population, the high P/S ratio reflected their frequent use of sunflower oil in food preparation.

The mean intakes of vitamins and minerals reflected a micronutrient depleted diet. These low intakes and the consequences thereof, were supported by biochemical vitamin status analyses, and show a significantly high prevalence of inadequate vitamin status (see subsection 4.4.1). Clinical examinations were not performed in this study. Nevertheless, no evidence of clinical stigmata of vitamin deficiencies is known to exist in this adult population (Personal communication - local health authorities). Interpretation of analyses of blood samples (drawn from this study population) by means of multiple parameter criteria has revealed a prevalence of iron deficiency anaemia in 20.8% of women and 6.3% in men (Nesamvuni, 1993). The higher prevalence in women than in men reflects the pattern of lower iron intakes in women than in men, and in particular the relatively higher proportion of women below the RDA, exacerbated by blood loss in women during their menses, as well as the high parity of this group.

A rather erratic meal pattern emerged, with between one fifth of the sample having consumed only one meal (Table 4.34) and almost a half having eaten only two meals during the 24-hour recall period (a meal being defined as intake per mealtime >600 kJ). Two meals a day was the norm in African populations in the past (Coetzee, 1982). As Manning, *et al.* (1974) found in their Guguletu study conducted some twenty years previously, the only certainties seem to be that most individuals (in this case 88% of men and 87% of women) consume supper and that 'snacking' contributes considerably to total daily intake.

The inadequate milk consumption was reflected by low calcium and riboflavin intakes in the diet, and low levels of riboflavin in the blood (see subsection 4.4.1). Soured milk potentially presents fewer storage problems than fresh milk and is part of the traditional eating pattern of some African populations (Coetzee, 1982). The inadequate milk consumption found in this study, thus represents a shift from tradition. This is supported by market research conducted in 1985 by the Bureau of Market Research, where Martin (1991) reports a mean daily milk consumption of 58 ml milk and 23 ml maas (soured milk) in urban Africans. However, the figures of our study sample are somewhat higher - 70 ml milk and 77 ml maas. Interestingly, in 1985, Martin (1989) found that metropolitan Africans spent 5.8% of their food budget on dairy products, whereas the more economically disadvantaged rural Africans spent 7.0%. Furthermore, the total expenditure of urban Africans on dairy products fell between 1975 and 1985, despite increases in metropolitan populations.

Conversely, the expenditure by urban Africans on meat and meat products is threefold higher (325.2%) than by rural Africans, whereas the expenditure of urban Africans on cereals and cereal products exceeds that of rural Africans by 35.2% (Martin, 1989). Thus, it may be predicted that as long as the socioeconomic status of Africans increases, we can expect higher expenditures on meat than on cereal products, which is further evidence of a transition towards a more western diet.

Meat consumption is, however, already adequate, men having higher intakes than women, possibly because they are traditionally served before women and children during meals. Manning, *et al.* (1974) refer to the preference for fatty meat. Nevertheless, meat intake was lower than in the coloured population (Langenhoven, *et al.*, 1988), particularly for red meats where both coloured men and women consumed approximately twice as much red meat (means of 1.4 and 0.8 portions per day respectively) as Africans (means being 0.7 and 0.5 portions for men and women - Table 4.31). The 'egg taboo'* among women discussed by Manning, *et al.* (1974) appears to have fallen away with women consuming almost as many eggs as men.

Legume intake at a mean of 0.6 portions for men and 0.4 for women was very similar to figures for the coloured population (Langenhoven, *et al.*, 1988), who consumed means of 0.4 and 0.3 portions by men and women respectively, despite legumes being a dominant feature of the traditional African diet.

The low intakes of fruits and vegetables were reflected in the low vitamin intakes as well as in blood vitamin analyses (see subsection 4.4.1). Table 4.31 reveals poor intakes of carotene and vitamin C rich fruits and vegetables and Tables 4.32 and 4.33 indicate that most vitamin C is consumed with the evening meal, when vegetables tend to be consumed. Manning, *et al.* (1974) commented on inadequate vegetable intakes, twenty years previously and market research (Martin, 1989) showed decreases in the market share of vegetable expenditure between 1975 and 1985 for all population groups. Subsequently, the drought, which has forced vegetable prices even higher, has in all likelihood exacerbated this situation. The World Health Organisation has recommended the consumption of 400 g vegetables (including legumes) and fruit daily (WHO, 1990). The mean daily intake of this study sample is 245 g. In England in 1990, the per capita intake was 340 g (Gregory, *et al.*, 1990). Yet in the MONICA project in Glasgow, approximately half of the households consumed less than 200 g per day (Wrieden, *et al.*, 1993). Similarly, very few individuals in the United States even approached their recommended five or more servings of fruit and vegetables daily. In the U.S. (NHANES II data) only 10% consumed the recommended five servings. Thus, clearly, inadequate fruit and vegetable intakes are also commonly observed in the more industrialised nations.

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* 'Eggs are forbidden to women because it is believed that they render them wanton' (Jackson, 1952).

The cereal group was the major contributor of energy and fibre. Although much of it is refined, since the mealie meal staple is a refined product, white bread preference is not extreme. The more expensive white bread was reported 54% of the time, compared to cheaper brown bread at 46%. Price does undoubtedly play a role in the choice, but it must be borne in mind that home baked white bread is perceived to be cheaper than commercial brown bread. Rice is also a popular cereal choice. Anecdotal evidence has revealed that bread being 'instant', and rice, which has a fairly short cooking time, are often used in preference to maize staples because of the longer cooking period required for maize products (personal observation).

The consumption of 'added' fats was within recommendations. However, it is interesting that this was also the case in the CORIS (Wolmarans, *et al.*, 1989) rural white population with its western diet. Anecdotal evidence from the past suggests that little salt was consumed:

"The Mpondo at any rate do not appear to be fond of salt, though there are fairly well-marked individual exceptions. Traders say that they do not sell nearly so much per family as would be used by Europeans e.g. a cupful might be expected to last a family for two weeks, though more would be used when vegetables are scarce. Salt is seldom or never added to a dish at a meal and the cook would be guided in the amount she used by the taste of the head of the kraal."
*Fox, F.W. (1939). Some Bantu recipes from the Eastern Cape Province. Bantu Studies **13:** 66-74.*

Added fats contributed about 28% to total fat intake, the main source of fat being brick margarine (Table 4.29). The addition of saturated animal fats, such as dripping, to maize dishes and its use in the preparation of stews, was reflected in the mean numbers of portions (Table 4.31). Animal fats are used more frequently than sunflower oil in food preparation. Interestingly, market research findings show increases in expenditure on fats among Africans, but decreases among other sectors of the population between 1975 and 1985 (Martin, 1989).

Anthropometry

In order to contextualise the anthropometric data reported in the results, the comparative tables, which also appear in the literature review, are repeated below. These tables have been constructed in chronological sequence in order to facilitate interpretation over time.

Mean heights are similar to those found in studies of groups of African origin elsewhere (Ostwald and Gebre-Medhin, 1978; Wing, *et al.*, 1989) depicted in Tables 4.37 and 4.38.

Table 4.37: A comparison of the mean heights of male respondents in the present survey with those of other surveys

Survey	Year	Area	Ethnic group	Age	Mean Height (cm)	SD
Present survey	**1990**	**Urban Cape Town**	**African**	**19 - 44**	**169.0**	**6.8**
Slome, *et al.*	1960	Urban Durban	African	20 -50+	165.5	6.1
O'Keefe, *et al.*	1983	Urban Durban	African	42 (16)	171.0	8.0
O'Keefe, *et al.*	1985	Rural Kwazulu	African	37 (17)	165.0	7.0
Ndaba & O'Keefe	1985	Rural Kwazulu	African	41 (19)	166.0	7.0
Ostwald & Gebre-Medhin	1978	Addis Ababa	African	20 - 30	168.0	6.3

Table 4.38: A comparison of the mean heights of female respondents in the present survey with those of other surveys

Survey	Year	Area	Ethnic group	Age	Mean Height (cm)	SD
Present survey	**1990**	**Urban Cape Town**	**African**	**19 - 44**	**158.8**	**6.9**
Slome, *et al.*	1960	Urban Durban	African	20 -50+	155.3	5.8
O'Keefe, *et al.* (patients)	1983	Urban Durban	African	41 (19)	161.0	7.0
O'Keefe, *et al.*	1985	Rural Kwazulu	African	45 (15)	156.0	6.0
Ndaba & O'Keefe	1985	Rural Kwazulu	African	44 (18)	158.0	7.2
De Villiers	1987	Rural Kwazulu	African	24 - 46	158.0	6.0
Wing, *et al.*	1989	USA Urban Pittsburgh	Black	42 - 50	162.4	6.3

Male/female comparisons of mean BMIs (depicted in Table 4.39) show that African men fell within the 'normal' range, as did local coloured men (mean BMI 23.5; Steyn, *et al.*,1988). Rural white men, however, had a mean BMI of 26.2 falling in the overweight category. Without exception, African women fell into the overweight range, whereas rural white women had a borderline mean BMI of 24.5. The figure for whites compares well with older women (35 - 40 years) in Italy (Verona, 24.1), Poland (23.9), Netherlands (23.3). However, African women had a similar mean BMI to Italian women in Naples (27.8) (Seidell, *et al.*, 1989).

Table 4.39: Comparison of the mean BMIs of male and female respondents in the present survey with those of other surveys

Survey	Year	Area	Ethnic group	Age	Mean BMI (Kg/m²)	
					Men	Women
Present survey	**1990**	**Urban Cape Town**	**African**	**19 - 44**	**23.2**	**27.9**
Seftel	1978	Rural Johannesburg	African	20 - 39	22.3	26.1
Steyn, *et al.*	1982	Urban Cape Town	Coloured	25 -44	23.5	26.3
O'Keefe & Ndaba	1985	Rural Kwazulu	African	20 - 54	21.4	25.5
De Villiers	1988	Rural Kwazulu	African	24 - 46	-	28.0
Jooste, *et al.*	1988	Rural Western Cape	White	25 -44	26.2	24.5
Mollentze, *et al.*	1990	Urban Mangaung	African	25 -44	23.2	28.4
Mollentze, *et al.*	1990	Rural QwaQwa	African	25 -44	24.4	28.1

Percentages of men and women with BMIs >30 from various study samples show consistently that obesity prevalence in African women is considerably higher than that in men (Table 4.40) and more common in African females than in rural whites, the male/female dichotomy is not marked (13.8% vs. 13.2%) with male obesity being marginally more evident in men. Afro-American women have even higher prevalences than local women, with men also being at risk (16%). An anomaly with local data emerges from rural QwaQwa, where African men reflecting a prevalence of 15.6%, which almost parallels that of Afro-American men.

Table 4.40: Comparison of BMIs >30 of male and female respondents in the present survey with those of other surveys

Survey	Year	Area	Ethnic group	Age	% Men	%Women
Present survey	**1990**	**Urban Cape Town**	**African**	**19 - 44**	**5.6**	**31.2**
Steyn, *et al.*	1982	Urban Cape Town	Coloured	25 -44	3.5	18.9
Garrow	1983	USA	Black	'Adults'	16.0	40 - 50
Jooste, *et al.*	1988	Rural Western Cape	White	25 - 44	13.8	13.2
Mollentze, *et al.*	1990	Rural QwaQwa	African	25 - 44	15.6	33.8
Mollentze, *et al.*	1990	Rural Kwazulu	African	25 - 44	7.8	37.5
Seedat, *et al.*	1990	Urban Durban	Indian	25 - 44	2.7	17.0

In U.S. adults, the apparent marked excess of obesity among black women (Van Itallie, 1985; NCHS, 1985) has been of particular interest, because it parallels the marked black female excess of several obesity-related health outcomes. Along with obesity, elevated blood pressure and mortality due to heart disease, stroke and diabetes occur a rates that are 1.5 to 2.5 times the rates in white women.

Among local Africans, particularly those with high urban exposure, hypertension is already common and severe, particularly in obese women (Seftel, *et al.*, 1980; Seedat, *et al.*, 1982).

Similarly the 8% age-adjusted rate of non-insulin dependent diabetes mellitus (NIDDM) found in urban Africans (Cape Town) was associated with increases in BMI and upper-segment fat distribution as well as urban exposure (Levitt, *et al.*, 1993). However, IHD is still a rare condition in urban Africans in South Africa (Steyn, *et al.*, 1991).

4.4 INVESTIGATIONS INTO THE QUALITY OF THE DIETARY DATA

4.4.1 Substantiation of dietary intake by biochemical indicators of vitamin status

The objectives of the investigation of the blood vitamin indicators were:

(i) to provide supportive evidence for the quality of the 24-hour recall data;

(ii) to further evaluate the vitamin status of the adult sample.

Because of competing demands for blood from research projects associated with the BRISK study, unequal quantities of blood from male and female subjects were available for the analyses reported below. Consequently 1 in 6 sequential sample was submitted for biochemical vitamin analysis. This included 125 women and 44 men aged 15 - 64 years (N = 169).

Blood samples were collected according to a standard procedure, with minimum stasis from the anterior cubital vein, and were analysed for serum and red blood cell folate and serum vitamin B_{12} (CT 302, dual radio assay kit, Amersham International, Amersham UK); erythrocyte transketolase activity and thiamin pyrophosphate effect (Schouten, *et al.*, 1964); erythrocyte riboflavin coefficient (Nichoals, 1974); whole blood nicotinamide (Clark, *et al.*, 1975); plasma and vitamin C (Denson and Bowers, 1961); vitamin A and E (Catignani and Bieri, 1983); pyridoxal-5-phosphate (Chabner and Livingston, 1970); and retinol binding protein (Partigen^R immunodiffusion plates, Behring Institute Hoechst Pharmaceuticals, Marburg FRB).

Descriptive statistics were calculated such as the means and standard deviations, including the percentages of subjects with subnormal values. Spearman correlations were performed between biochemical indicators and the respective vitamins from the reported dietary data. This was done for the combined sample of both genders, and for women only (because of the small sample size of men).

Results

The results depicting normal ranges and the distributions of the biochemical data are presented in separate Tables for men and women (Tables 4. 41 and 4.42) respectively.

Table 4.41: Distribution of blood vitamin values for men aged 15 - 64 years - the BRISK study (N=44)

Biochemical indicator	Trans-ketolase activity	Thiamin pyrophosphate effect	Riboflavin	Vitamin C	Vitamin B_6 Pyridoxal-5-P	Vitamin A	Vitamin E	Vitamin B_{12}	Serum folate	Red blood cell folate	Retinol binding protein
Units	U/L	%	coefficient	mg/dl	ng/ml	μg/dl	mg/L	Pg/ml	ng/ml	ng/ml	mg/100ml
Normal range	30 - 50	< 25	< 1.15	0.25 - 1.20	6 - 20	> 20	> 6	180 - 710	> 2.5	235 - 612	3 - 6
Cut-off point	< 30	≥ 25	≥ 1.15	< 0.25	< 6	≤ 20	≤ 6	< 180	≤ 2.5	< 235	< 3
Number	44	44	44	44	44	44	44	44	44	44	44
Mean	40.4	24.1	1.25	0.38	4.8	54.0	6.8	537	4.5	466	3.8
SD*	94.2	7.8	0.27	0.34	2.2	22.7	2.1	166	2.9	160	1.3
Minimum	25.1	11.5	0.84	0.05	1.5	17.8	2.9	290	1.7	173	1.8
Maximum	66.5	46.0	2.00	1.45	12.2	110.0	10.8	890	19.0	794	8.5
% *below/above* cut-off point	11.4	36.3	52.3	47.7	72.7	2.3	38.6	0	18.2	4.5	15.9

* Standard deviation

Table 4.42: Distribution of blood vitamin values for women aged 15 - 64 years - the BRISK study (N=125)

Biochemical indicator	Trans-ketolase activity	Thiamin pyrophosphate effect	Riboflavin	Vitamin C	Vitamin B_6 Pyridoxal-5-P	Vitamin A	Vitamin E	Vitamin B_{12}	Serum folate	Red blood cell folate	Retinol binding protein
Units	U/L	%	coefficient	mg/dl	ng/ml	μg/dl	mg/L	Pg/ml	ng/ml	ng/ml	mg/100ml
Normal range	30 - 50	< 25	< 1.15	0.25 - 1.20	6 - 20	> 20	> 6	180 - 710	> 2.5	235 - 612	3 - 6
Cut-off point	< 30	≥ 25	≥ 1.15	< 0.25	< 6	≤ 20	≤ 6	< 180	≤ 2.5	< 235	< 3
N	121	121	121	125	125	125	125	125	125	124	125
Mean	40.5	26.0	1.32	0.49	5.1	48	7.7	514	4.3	433	3.4
SD*	12.1	12.4	0.34	0.30	2.7	17	3.3	214	1.9	160	1.0
Minimum	18.0	6.4	0.78	0.08	1.4	13	1.8	70	1.2	104	0.6
Maximum	85.0	72.1	2.55	1.45	14.2	103	23.6	1200	11.5	1121	7.6
% *below/above* cut-off point	15.7	41.3	70.3	21.6	67.2	1.6	32.8	2.4	12.9	7.4	37.6

* Standard deviation

Approximately 40% of men and women had an inadequate thiamin status (TPP effect); inadequate vitamin C status was present in 22% of women and 48% of men. The highest prevalence of inadequate status both in women and men was for vitamin B_6 and riboflavin. With respect to folic acid status, approximately 1 in 10 women (12.9%) had low concentrations of serum folate, while 7.4% of reflected low blood status with respect to red blood cell folate. Among the men a higher percentage (18.2%) than women had low serum folate, while only 4.5% had low red blood cell folate concentrations. None of the men and only 2.4% of women had marginal vitamin B_{12} status.

By contrast, marginal status for fat soluble vitamins were rather uncommon with only 1.6% and 2.3% of men and women having low vitamin A concentrations. Interestingly, however, one third or more individuals of both genders had low plasma vitamin E concentrations.

Weak correlations between blood vitamin status and 24-hour recall intake for men and women combined, were seen. In the combined sample, the strongest correlations were for riboflavin ($r = 0.15$; P 0.05), vitamin C ($r = 0.20$; $P < 0.01$), vitamin B_6 ($r = 0.25$; $P < 0.001$) and vitamin B_{12} ($r = 0.32$; $P < 0.001$). Among the women alone, these correlations were: riboflavin ($r = 0.21$; $P < 0.05$), vitamin C ($r = 0.24$; $P < 0.01$), vitamin B_6 ($r = 0.32$; $P < 0.01$) and for vitamin B_{12} ($r = 0.36$; $P < 0.001$).

Discussion

A picture of poor vitamin nutriture emerged both for reported dietary intakes, and biochemical values. At the biochemical level, marginal vitamin status was found for vitamin B_6, riboflavin, vitamin E and vitamin C in large proportions of both men and women. This was reflected in reported dietary intakes (see Tables 4.14 and 4.27).

Since milk is the primary source of riboflavin in this population, the low reported milk intakes referred to in Tables 4.18 and 4.31 are supported by the biochemical data. With respect to vitamin B_6, since this is found in a variety of food sources, it is difficult to comment on this in terms of foods. Nevertheless, the fact that approximately 70% of men and over 60% of women reported intakes < 67% RDA (Tables 4.14 and 4.27) is reflected at the biochemical level. Similarly, the plasma vitamin C data is mirrored by the low reported intakes (70 - 80% of both men and women had intakes < 67% RDA) in both adolescent and adult age categories. Values from both sets of data (i.e. dietary and biochemical) for these three vitamins are further corroborated by the correlations.

Since 7.4% of women and only 4.5% of men presented with low concentrations of red blood cell folate, this suggests that the folate status of women is compromised to a greater extent than men. Certainly from the dietary intake data, intakes of women were lower than those of men. Because this biochemical indicator shows evidence of chronicity, it would appear that women may be compromised in this respect in the long term. These low folic acid intakes have implications for the prevalence of neural tube defects, as well as the presence of anaemia.

The approximately 1 in 3 prevalence of low plasma vitamin E concentrations, raises a concern about the possible lack of its protective role in heart disease in a large proportion of this population. This together with low intakes of β-carotene, and vitamin C place urban Africans at risk of degenerative disease in general and heart disease in particular (Reimersma, 1990; Diplock, 1991).

Data on the vitamin status of Africans are very limited, with isolated studies indicating low dietary intakes of vitamins A, C, B_6, B_{12}, riboflavin and folate (see section 2.3 of Literature Review). The interpretation of the low reported intakes has, however, been hampered by the lack of concomitant biochemical data on vitamin status. When the latter were reported among adults in rural Venda for instance, it was found that blood levels of vitamin A, α-tocopherol, vitamin B_{12} and folate were mostly within normal limits, despite a relatively small variety of foods eaten and a low animal protein intake (Vorster, *et al.*, 1994).

Since the intakes of young children are frequently largely determined by adults, a brief comment on paediatric studies is appropriate. Studies on children have reflected micronutrient inadequacies at the biochemical level. For example, niacin status was found to be inadequate in 28% of African children in a rural village (Soldenhoff and van der Westhuyzen, 1988), while folate and vitamin B_{12} status were reported to be inadequate in 30% and 8% of African preschoolers in the Northern Transvaal respectively.

To summarise, there is evidence of low vitamin nutriture among adults aged 15 - 64 years in this study both from the perspective of dietary and biochemical supportive data. The extremely scanty data reported from isolated studies provides some back-up information regarding low vitamin status in Africans (with the exception of the study of rural adults in Venda (Vorster, *et al.*, 1994)). The implications of low vitamin nutriture in the urban adults investigated in this Cape Town study are complex, particularly in view of the rapidly changing quality of the diet. Relationships between SES proxies and vitamin intakes will be explored in Chapter 5.

4.4.2 An examination of reported energy intakes in adults aged 15 - 64 years

In the light of the low 24-hour reported energy intakes (in comparison with RDAs) and in particular with respect to adult women (who exhibited high prevalences of overweight/obesity), several investigations were made:

(i) Reported energy intakes from the large survey were stratified by interviewer to ascertain whether particular fieldworkers displayed a tendency to under- or overreport. This examination of inter-fieldworker variation showed no meaningful inter-observer discrepancies reflecting a marked consistency of recording data. Intra-fieldworker variation was also studied, comparing energy intakes from the second week of data collection to the penultimate week of the survey. Again a notable consistency of reporting in terms of energy intake was found.

(ii) Energy intakes of women from two local studies, which had used the 24-hour recall method: CORIS (Wolmarans, *et al.*, 1988) and CRISIC (Langenhoven, *et al.*, 1988) were plotted against the BRISK data. Also included were the NHANES II data for women (1983). For reference purposes, the RDA (1989) for energy was also depicted. These appear on Fig. 4.3 below.

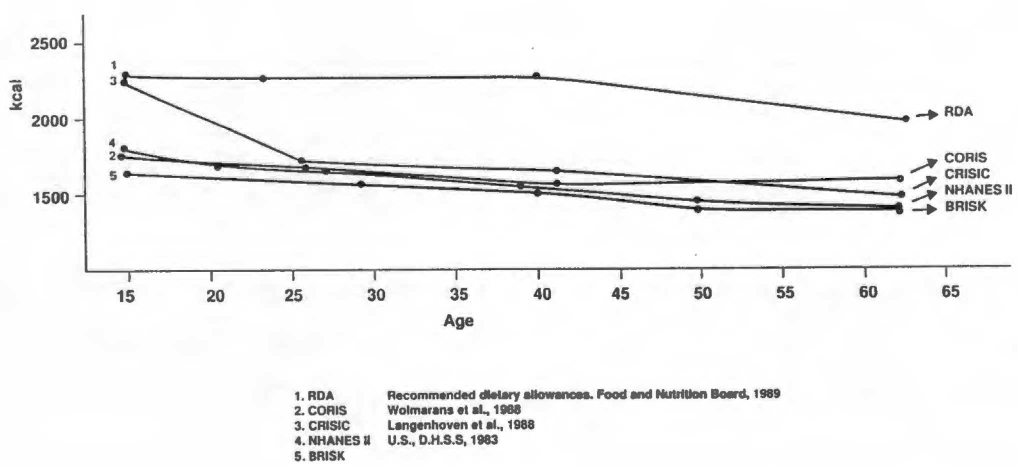

Figure 4.3: Comparison of mean energy intakes (24-hour recall) of adult females from various studies

As can be seen, the energy data from the studies fell below RDAs to a great extent, but did not differ much from each other (with the exception of 15 - 25-year-olds from the CRISIC study).

(iii) In order to investigate whether underreporting occurred among obese women, ratios of $\frac{\text{observed energy intakes (24-hour recall)}}{\text{expected energy intakes (Bray formula)}}$

were calculated for women of normal weight (BMI 19 - ≤24) and obese women (BMI >30). For expected energy intake the very conservative Bray formula (1989) for resting metabolic rate (RMR) was used, since the data on activity levels in women were considered to be unreliable for this purpose.

The Bray formula used was:

Table 4.43: Estimating energy needs

Daily energy requirement (kcal/day) = resting metabolic rate (RMR in kcal/day)	
RMR in kcal/day	
Men	900 + (10 x weight (kg))
Women	800 + (7 x weight (kg))

Another approach, also using BMR, is discussed by Black, *et al.* (1991).

The ratios are presented below in Table 4.44.

Table 4.44: Ratios of observed : expected energy intakes in women

	Body Mass Index	
	19 - ≤24	>30
N	139	187
Mean	1.06	0.84
Standard deviation	0.45	0.38

Significance was reached at $P < 0.05$ for the two groups of women, suggesting underreporting of intake by the obese. Among men, however, there was no significant difference between men with BMIs 20 - ≤25 and those with BMIs >30. This could partially be attributed to the small sample size of obese men (N=35).

(iv) For the purposes of comparing energy reporting in women and men, a scattergram for reported energy intake for the genders was produced.

The scattergram presented below (Fig. 4.4) features reported 24-hour energy intakes for men and women, in terms of body weight (kg) together with plots of the mean values of men and women as a function of body weight. Also included, are the mean intakes for both genders. Among men, mean intake falls beyond 90 kg, suggesting underreporting in obese male respondents. In women mean energy intake is quite consistent for all body weights, also implying underreporting (<1 500 kcal) as weight in kg increases. Interestingly, most of the outliers (>3 000 kcal) are women across the range of body weights.

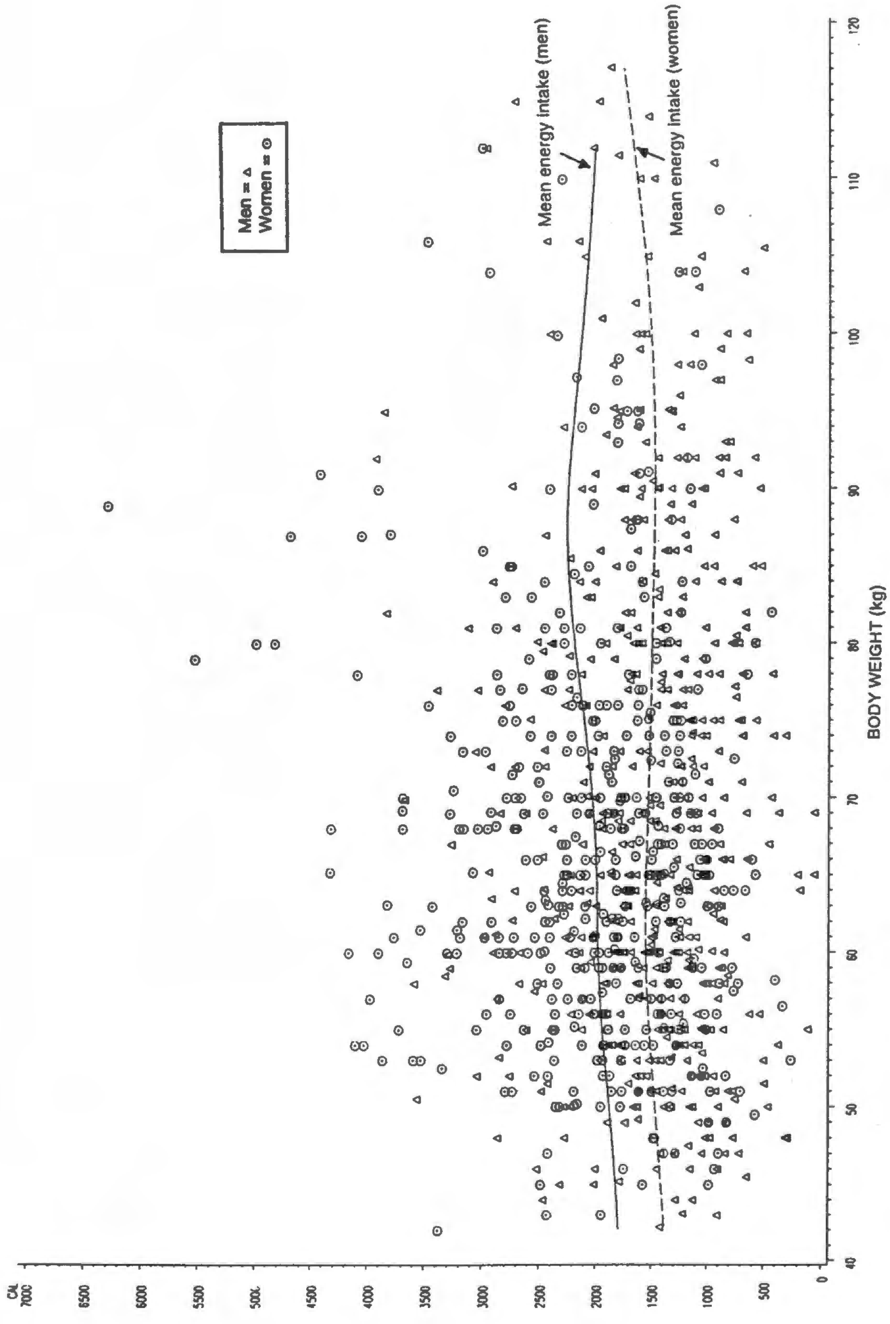

Figure 4.4: Scattergram of energy intakes (kcal) for men and women by body weight (kg)

(v) Scattergrams were also produced for men and women separately, with body weight (kg) on the y-axis. The points were plotted with the following symbols denoting reported activity level ascertained from the questionnaire (low ⊙, med ▵ and high activity levels). Superimposed on this is a graph of RMR (Bray, 1989). This serves to illustrate the extent to which men and women reported below minimum energy requirements, and how this related to body weight.

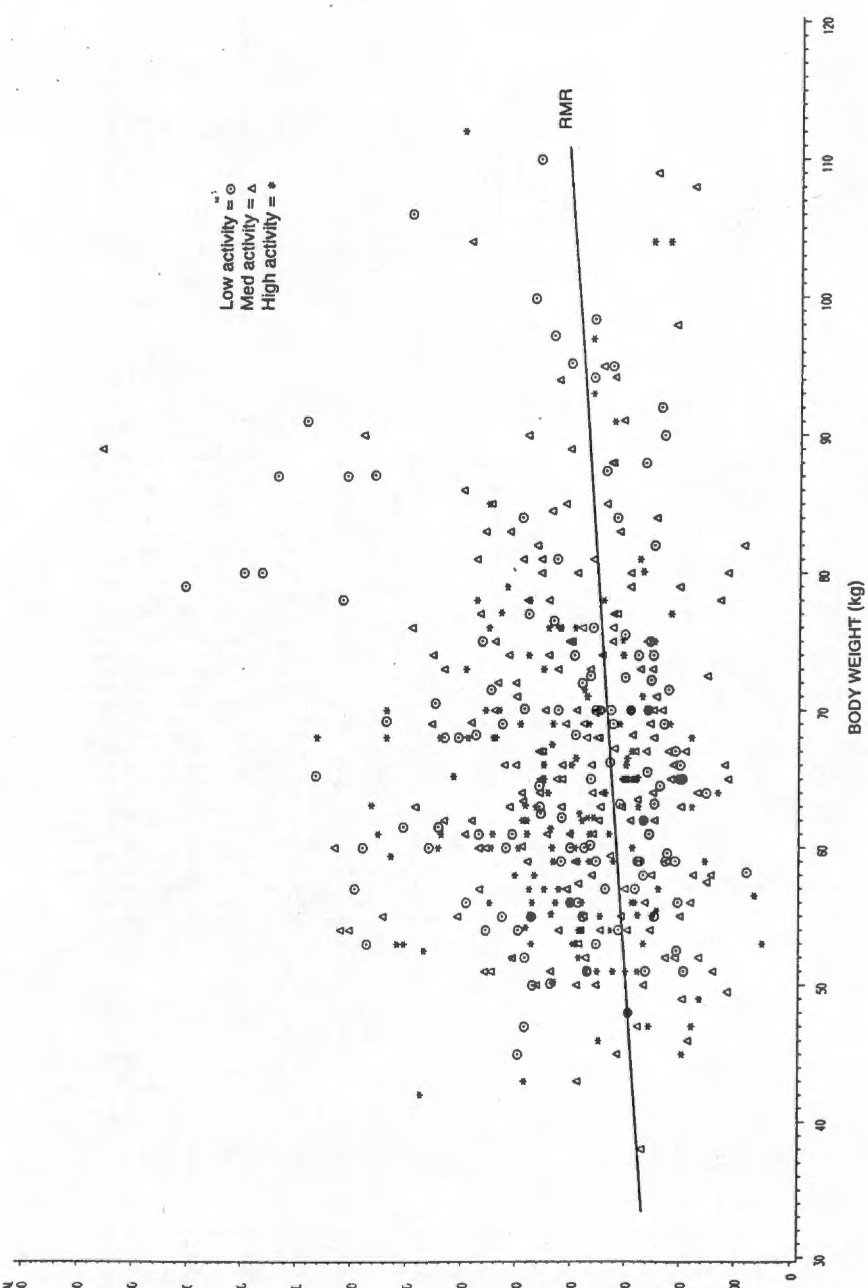

Figure 4.5: Scatter plot of energy intakes (kcal) by body weight (kg) for different activity levels in men

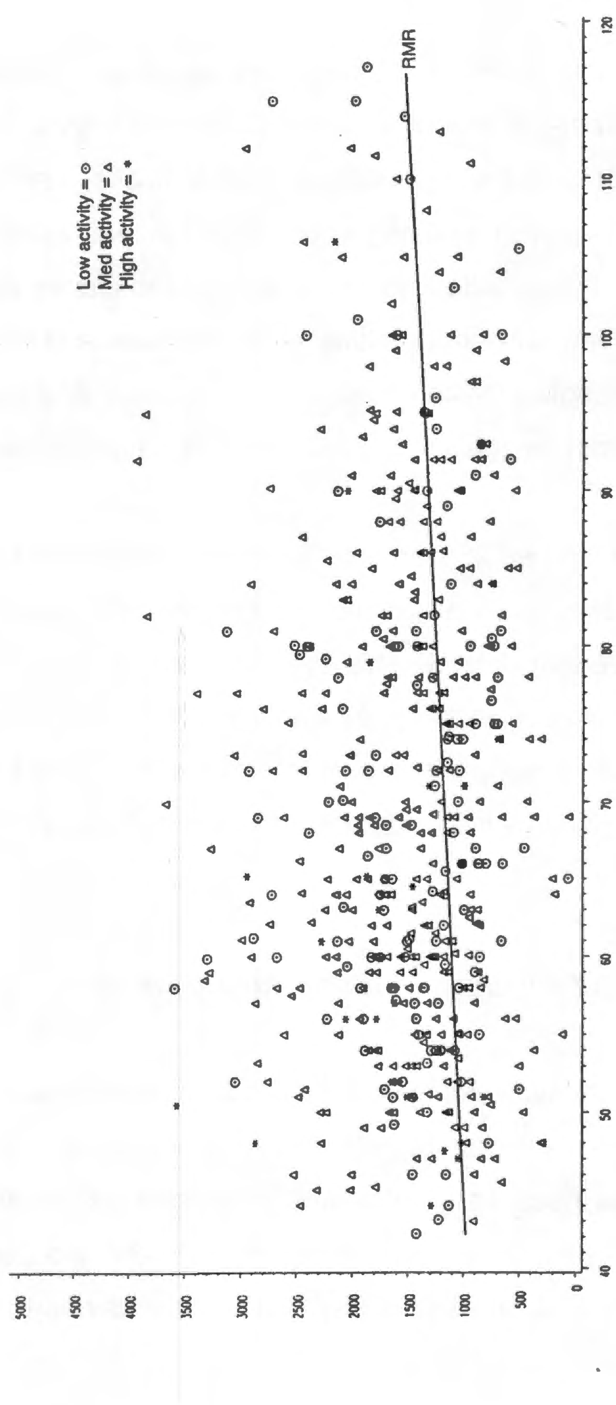

Figure 4.6: Scatter plot of energy intakes (kcal) by body weight (kg) for different activity levels in women

These scattergrams illustrate that there were no marked patterns of energy reporting with respect to activity level.

(vi) ***Supplementary sub-study on energy intake***

Finally, a small supplementary in-depth study was carried out so as to investigate reported intakes more extensively.

This study was conducted by a trained and supervised fieldworker (i.e. not a nursing sister) for the purpose of investigating the effect on energy intake of the 24-hour recalls, including in-depth probes about additional nibbling habits. The interviewer spent an hour or more with each subject, ensuring that the interview was conducted under very relaxed circumstances. This made it possible for respondents to search their memories for 'forgotten' food items and for the fieldworker to observe the respondents' behaviour in the course of household activities. Both the fieldworker and respondents were chosen independently from the main study, but using the same sampling frame.

The sample size included 25 men and 25 women (N=50) in the age range 19 - 44 years. The energy intake data were combined for men and women in order to produce a combined mean energy intake. This, in turn, was compared with the combined mean of both genders from the main study. The additional sub-study showed an increase of only 7.4% in the mean energy intake over the main study. This finding suggested that the quality of dietary energy intake data was not sacrificed by the full procedures executed in the main study.

Concluding summary of investigations into dietary quality

It is well known from the literature that there is no dietary intake method which accurately reflects energy intake. Furthermore, a one day intake cannot be expected to reflect the energy intake of individuals or groups because of intra- and inter-individual variation. The 24-hour recall method in particular is associated with underreporting (Briefel and Sempos, 1992). It has also been established in several studies that obese individuals underreport food intake (Braitman, *et al.*, 1985; Kumanyika, 1987).

The above investigations show that although a measure of underreporting may have occurred irrespective of reported activity level, (for the previous day's intake), the results are, nevertheless, comparable with other studies utilising the 24-hour recall method. An interesting observation was that obese women in particular underreported energy intake, which is in line with findings elsewhere. Since the presence of obesity has been shown in a qualitative study to be associated with a 'state of happiness' in this society (Zodumo Mvo, personal communication) this is a surprising finding. This suggests that a knowledge of health risks related to overconsumption exists. Finally, the supplementary study showed that the underreporting of energy intake in the main study was not associated with the heavier respondent burden, nor with the potential bias introduced by the choice of nursing sisters as fieldworkers.

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CHAPTER 5 RESULTS AND DISCUSSION RELATING TO THE NUTRITION TRANSITION

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CHAPTER 5

RESULTS AND DISCUSSION RELATING TO THE NUTRITION TRANSITION

Introduction

For the purposes of interpretation of the data presented in this section, the schematic model presented previously in Chapter 4, still applies and is shown again in Fig. 5.1. In the urban context the 'traditional' diet is usually associated with lower SES, while the 'western' diet is linked to higher SES. This model (shown below) largely refers to macronutrient intakes. However, one of the objectives of the following analyses was also to examine micronutrient intakes. In other words, dietary intake as a whole was investigated.

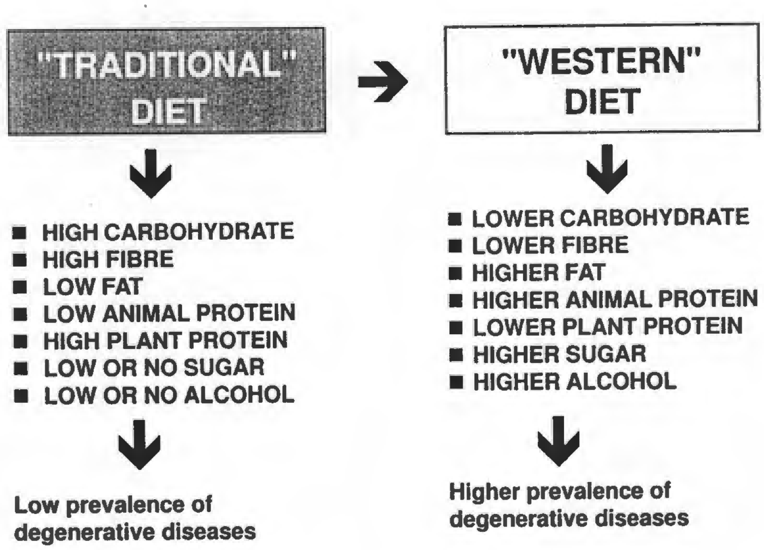

Figure 5.1: Simplified schematic diagram depicting features of traditional and western diets

5.1 AN EXPLORATORY EXAMINATION OF SOME DETERMINANTS OF DIETARY INTAKE (BIVARIATE ANALYSES)

This section describes a broad exploratory analysis on specific proxies for SES, and urban exposure, on dietary intake variables. Since exhaustive bivariate analyses were not appropriate, because of the probable effects of confounders, the analyses are based on selected proxies for SES namely, housing as well as electricity/gas used for food preparation, and ownership of a refrigerator used for storage of food, (the latter two variables being directly food-related). The effect of urban exposure on dietary intake was also explored.

5.1.1 The effect of selected household proxies for socio-economic status on dietary intake

The SES variables were used dichotomously in the Kruskal-Wallis test on mean nutrient intakes for the three targeted age categories. In other words, housing was categorised as formal vs. informal, while electricity/gas and refrigerator ownership were classified as 'with' or 'without'. The effect of urban exposure was investigated on an ordinal scale, since the objective was to examine *dietary shifts* with increasing urbanisation. Urban exposure was ascertained by mean of a migration history to determine the number of years spent in a city. From this an index of exposure was calculated, whereby

$$100 \times \frac{\text{years spent in a city}}{\text{age in years}} = \text{\% life spent in a city.}$$

A summary table (Table 5.1) provides an overview of Tables 5.2 - 5.10. This will be presented first with the series of tables within each age category to follow. Table 5.1 summarises the results of the statistical analysis and, thereby, reflects the nutrients for which significant relationships were reached, and at which level this occurred. The Table is presented below utilising variables denoting higher SES (*viz.* those living in formal housing, individuals using electricity/gas for cooking, and those with access to refrigeration facilities).

Table 5.1: Absolute intakes of macronutrients, energy, fibre and micronutrients and relative intakes of macronutrients

		3 - 6 Years N=163			15 - 18 Years N=118			19 - 44 Years N=285					
		Formal housing N=99	Elec/Gas N=87	Fridge N=55	Formal housing N=82	Elec/Gas N=76	Fridge N=50	Formal housing M N=151	Formal housing F N=211	Elec/Gas M N=147	Elec/Gas F N=190	Fridge M N=99	Fridge F N=108
ABSOLUTE INTAKES OF MACRONUTRIENTS, ENERGY & FIBRE	Energy (KJ)							-					
	Total protein (g)												
	Animal protein (g)												
	Plant protein (g)												
	Total fat (g)								+			++	++
	Saturated fat (g)												
	Monounsaturated fat (g)												
	Polyunsaturated fat (g)												
	Carbohydrate (g)							---	---			--	--
	Fibre (g)												
ABSOLUTE INTAKES OF MICRONUTRIENTS	Vitamin A (RE)	+++	+++	+++		++	++	++	++	+++	+++	+++	+++
	Thiamin (mg)							--	--				
	Riboflavin (mg)	+	+	+									+
	Niacin (mg)	+++	+++	+++									
	Vitamin B_6 (mg)	+++	+++	+++		+			++		+		++
	Folic Acid (mg)			+									
	Vitamin B_{12} (µg)	++	++	+++							+		+++
	Ascorbic acid (mg)	+	++						+		--		+
	Calcium (mg)												
	Iron (mg)	+	++	+++									
RELATIVE INTAKES OF MACRONUTRIENTS	% E Total protein								++				+
	% E Animal protein			+					+++		++		+++
	% E Plant protein		-	---					---		--		---
	% E Total fat	+++	+++	+++	+	+++	+++	+++	+++	+++	+++	+++	+++
	% E Saturated fat	+++	+	+++	+	+	++	++	++	+++	+	++	+++
	% E Monounsaturated fat	+++	+++	+++	++	+++	+++	+++	+++	+++	+++	+++	+++
	% E Polyunsaturated fat	+++	++	+++		+	+	+++	++	+++		+++	
	% E Carbohydrate							---	---			--	---
	P/S Ratio												
	Keys score	++		+++				+	+	+	+		+++

P < 0.05: + and - ; *P* < 0.01: ++ and --; *P* < 0.001: +++ and ---

Key to Table 5.1

The signs of the table are positive if the nutrients listed in the left column increase significantly with the attributes listed at the top of the table (i.e. formal housing, presence or use of electricity/gas in cooking and ownership of a refrigerator). If they decrease, then the signs are negative. The levels of significance are listed by: *P* <0.05 one symbol; *P* <0.01 two symbols and *P* <0.001 three symbols.

In this section, reference will be made to the summary table (Table 5.1) as well as the detailed tables, which include the data for each age category (Tables 5.2 - 5.13).

An overall interpretation of Table 5.1 illustrates subtleties in the macronutrient composition of the diet when expressed as percentages of energy, while this is not mirrored to the same extent in the mean absolute intakes. However, absolute intakes of micronutrients (expressed in their respective units) show striking patterns with respect to the three age categories with the preschooler group largely reflecting the adult group, while in the adolescent age category a different pattern emerged.

A more detailed examination of absolute intakes in Table 5.1 as well as Tables 5.2 - 5.7 on male and female subjects aged 19 - 44 years, shows the following: Energy intake was significantly lower only in men aged 19 - 44 years living in formal housing as opposed to informal housing (8117 kcal vs. 9013 kcal; $P < 0.05$, Table 5.2). Total fat intake (expressed in grams) was increased for several adult sub groups, women in formal housing ($P < 0.05$, Table 5.3) and both men and women who had access to refrigeration ($P < 0.01$, Tables 5.4 and 5.5). Conversely, carbohydrate intake expressed in grams was significantly lower in both men and women in formal housing ($P < 0.001$) and with access to a refrigerator ($P < 0.01$).

Table 5.2: Mean nutrient intake in men aged 19 - 44 years (N=237) in formal and informal housing

Nutrient	*P* value*	Mean intake N=151 Formal housing	N=86 Informal housing
	***P* < 0.05**		
Energy (kJ)†		8117	9013
Calcium (mg)†		407	627
Keys score		31.1	28.2
	***P* < 0.01**		
Vitamin A (RE)		822	717
Thiamin (mg)†		1.01	1.22
Saturated fat as % Energy		9	8
	***P* < 0.001**		
Total fat as % Energy		28.8	22.3
Polyunsaturated fat as % Energy		6.4	4.9
Monounsaturated fat as % Energy		10.5	7.6
Total carbohydrate (g)†		253	320
Carbohydrate as % Energy †		58.0	64.6

* Kruskal-Wallis test
† Nutrients with significantly higher reported intakes in ***Informal housing***
RE: Retinol equivalents

Table 5.3: Mean nutrient intake in women aged 19 - 44 years (N=336) in formal and informal housing

Nutrient	*P* value*	Mean intake N=211 Formal housing	Mean intake N=125 Informal housing
	***P* < 0.05**		
Ascorbic acid (mg)		44	36
Total fat (g)		52	44
Keys score		31.4	27.5
	***P* < 0.01**		
Thiamin (mg)†		0.78	0.93
Vitamin A (RE)		648	445
Vitamin B_6 (mg)		0.98	0.82
Calcium (mg)†		315	362
Protein as % Energy		15.0	13.7
Saturated fat as % Energy		9.4	7.6
Polyunsaturated fat as % Energy		6.9	5.6
	***P* < 0.001**		
Animal protein as % Energy		9.1	6.9
Plant protein as % Energy†		5.8	6.7
Total fat as % Energy		29.7	23.2
Monounsaturated fat as % Energy		10.7	7.6
Carbohydrate (g)†		196	239
Carbohydrate as % Energy †		58.6	66.2

* Kruskal-Wallis test
† Nutrients with significantly higher intakes in ***informal housing***
RE: Retinol equivalents

Table 5.4: Mean nutrient intake in men aged 19 - 44 years (N=285) with or without refrigeration

Nutrient	*P* value*	Mean intake N=99 Refrigeration	Mean intake N=187 No refrigeration
	***P* < 0.01**		
Total carbohydrate (g)†		248	297
Carbohydrate as % Energy†		57.4	63.2
Total fat (g)		67	56
Saturated fat as % Energy		10	8
	***P* < 0.001**		
Vitamin A (RE)		1081	553
Total fat as % Energy		30.6	23.6
Polyunsaturated fat as % Energy		6.7	5.2
Monounsaturated fat as % Energy		11.2	8.0

* Kruskal-Wallis test
† Nutrients with significantly higher intakes among men ***without refrigeration***
RE: Retinol equivalents

Table 5.5: Mean nutrient intake in women aged 19 - 44 years (N=364) with or without refrigeration

Nutrient	*P* value*	Mean intake N=108 Refrigeration	Mean intake N=256 No refrigeration
	***P* < 0.05**		
Ascorbic acid (mg)		40	43
Riboflavin (mg)		0.95	0.8
Protein as % Energy		15.1	14.1
	***P* < 0.01**		
Vitamin B_6 (mg)		1.06	0.86
Total carbohydrate (g)		248	297
Total fat (g)		67	56
	***P* < 0.001**		
Vitamin A (RE)		831	439
Vitamin B_{12} (μg)		4.56	3.22
Carbohydrate as % Energy		56.0	64.5
Animal protein as % Energy		10.1	7.4
Plant protein as % Energy		5.0	6.7
Total fat as % Energy		31.5	25.0
Saturated fat as % Energy		10.2	8.2
Monounsaturated fat as % Energy		11.4	8.6
Keys score		34.7	27.6

* Kruskal-Wallis test
RE: Retinol equivalents

When macronutrients are expressed as percentages of energy for 19 - 44-year-olds, significant associations for all three SES indicators were found for most macronutrients. Significance was reached at P <0.001 for increased %E total fat and %E monounsaturated fat for both men and women (Tables 5.6 and 5.7 below) and for %E saturated fat for both genders with higher SES. Gender disparities for significant associations in all three SES attributes occurred for %E animal protein (women only), %E polyunsaturated fat (mainly men only), whereby increases occurred with higher SES, and %E plant protein (women only) significantly decreased with higher SES. Percentage energy from carbohydrate was also significantly decreased for those in formal housing and those with refrigeration facilities (both genders). The Keys score used as an overall indicator of atherogenicity was significantly higher for both men and women in formal housing, with electricity/gas and for women only with a fridge.

Table 5.6: Mean nutrient intake in men aged 19 - 44 years (N=285) with or without electricity or gas

Nutrient	*P* value*	Mean intake	
		N=147 Electricity/gas	N=139 Without
	***P* < 0.05**		
Calcium (mg)†		432	605
Keys score		31.6	28.5
	***P* < 0.001**		
Vitamin A (RE)		1004	457
Total fat as % Energy		28.6	23.2
Saturated fat as % Energy		9.1	8.2
Polyunsaturated fat as % Energy		6.3	5.2
Monounsaturated fat as % Energy		10.4	7.7

* Kruskal-Wallis test
† Nutrients with significantly higher intakes among men *without electricity/gas*
RE: Retinol equivalents

Table 5.7: Mean nutrient intake in women aged 19 - 44 years (N=364) with or without electricity or gas

Nutrient	*P* value*	Mean intake	
		N=190 Electricity/gas	N=174 Without
	***P* < 0.05**		
Calcium (mg)†		326	349
Vitamin B_6 (mg)		0.98	0.86
Vitamin B_{12} (μg)		3.7	3.55
Saturated fat as % Energy		9.4	8.1
Keys score		32	28
	***P* < 0.01**		
Ascorbic acid (mg)†		44	51
Animal protein as % Energy		9.0	7.3
Plant protein as % Energy†		5.7	6.6
	***P* < 0.001**		
Vitamin A (RE)		681	420
Total fat as % Energy		29.4	24.3
Monounsaturated fat as % Energy		10.6	8.2

* Kruskal-Wallis test
† Nutrients with significantly higher intakes among women *without electricity/gas*
RE: Retinol equivalents

These associations of relative (%E) intakes of macronutrients are largely mirrored in the 3 - 6-year-old age category, especially with respect to the significantly increased fat intakes, to a lesser extent in terms of the decreased plant protein consumption. Significance was also reached for an increased Keys score among those in formal housing, and those with access to refrigeration (see Table 5.1, as well as Tables 5.8 - 5.10).

Table 5.8: Mean nutrient intake in children aged 3 - 6 years (N=163) living in formal and informal housing (boys and girls combined)

Nutrient	*P* value*	Mean intake	
		N=99 Formal housing	N=54 Informal housing
	***P* < 0.05**		
Iron (mg)		5.5	4.6
Ascorbic acid (mg)		78	20
Riboflavin (mg)		0.88	0.67
	***P* < 0.01**		
Vitamin B_{12} (μg)		3.02	1.58
Keys score		33	28
Plant protein as % Energy		6.3	6.9
	***P* < 0.001**		
Vitamin A (RE)		518	243
Vitamin B_6 (mg)		0.79	0.53
Niacin (mg)		8.79	6.16
Total fat as % Energy		30.8	23.8
Saturated fat as % Energy		10.1	8.3
Polyunsaturated fat as % Energy		6.7	5.3
Monounsaturated fat as % Energy		11.5	8.3

* Kruskal-Wallis test
RE: Retinol equivalent

Table 5.9: Mean nutrient intake in children aged 3 - 6 years (N=163) with household refrigeration and without refrigeration (boys and girls combined)

Nutrient	*P* value *	Mean intake	
		N=55 Refrigeration	N=108 No refrigeration
	***P* < 0.05**		
Riboflavin (mg)		1.05	0.7
Folic acid (μg)		136	113
Animal protein as % Energy		7.3	6.4
	***P* < 0.001**		
Iron (mg)		6.1	4.8
Vitamin A (RE)		623	315
Vitamin B_6 (mg)		0.99	0.58
Vitamin B_{12} (μg)		4.32	1.69
Niacin (mg)		10.26	6.87
Plant protein as % Energy		5.8	6.8
Total fat as % Energy		33.1	26.1
Saturated fat as % Energy		10.8	8.9
Polyunsaturated fat as % Energy		7.0	5.7
Monounsaturated fat as % Energy		12.6	9.3
Keys score**		34.8	29.3

* Kruskal-Wallis test
RE: Retinol equivalent
** Using the Keys dietary score formula and the prudent guidelines, an ideal prudent dietary score of 28 can be calculated (where S = 10%E, P = 10%E and dietary cholesterol = 300 mg/11.3 MJ). A high Keys score is an indication of a high saturated fat and cholesterol intake and a relatively low polyunsaturated fat intake

Table 5.10: Mean nutrient intake in children aged 3 - 6 years (N=163) with electricity or gas and without (boys and girls combined)

Nutrient	*P* value *	Mean intake N=87 Electricity/gas	Mean intake N=76 Without
	***P* < 0.05**		
Riboflavin (mg)		0.9	0.7
Saturated fat as % Energy		10.0	8.9
Plant protein as % Energy		6.2	6.9
	***P* < 0.01**		
Iron (mg)		5.6	4.8
Ascorbic acid (mg)		90.0	16.2
Vitamin B_{12} (μg)		3.24	1.59
Polyunsaturated fat as % Energy		6.6	5.2
	***P* < 0.001**		
Vitamin A (RE)		517	282
Vitamin B_6 (mg)		0.81	0.57
Niacin (mg)		9.04	6.56
Total fat as % Energy		30.5	25.6
Monounsaturated fat as % Energy		10.0	8.9

* Kruskal-Wallis test
RE: Retinol equivalents

The adolescent age category could not be divided into male and female subcategories because of the small sample sizes, so combined genders were used for the analyses. An inspection of Table 5.1 shows that the pattern of nutrients for which significance was reached largely differs from the youngest age group, and the older age category (19 - 44 years) especially with respect to micronutrient intakes. Nevertheless, there are great similarities among all age groups for fat intakes. Significantly higher fat intakes can be noted for total fat and saturated, monounsaturated and polyunsaturated fats (see Tables 5.11, 5.12 and 5.13).

Table 5.11: Mean nutrient intake in adolescents aged 15 - 18 years (N=118) in formal and informal housing (men and women combined)

Nutrient	*P* value *	Mean intake N=82 Formal housing	Mean intake N=26 Informal housing
	***P* < 0.05**		
Total fat as % Energy		29.9	24.6
Saturated fat as % Energy		9.2	8.0
	***P* < 0.01**		
Plant protein as % Energy		6.3	7.8
Monounsaturated fat as % Energy		11.0	8.1

* Kruskal-Wallis test
RE: Retinol equivalent

Table 5.12: Mean nutrient intake in adolescents aged 15 - 18 years (N=118) with electricity or gas or without (men and women combined)

Nutrient	*P* value*	Mean intake	
		N=76 Electricity/gas	N=42 Without
	***P* < 0.05**		
Vitamin B_6 (mg)		1.06	0.79
Saturated fat as % Energy		9.2	8.2
Polyunsaturated fat as % Energy		7.2	5.6
	***P* < 0.01**		
Vitamin A (RE)		498	265
	***P* < 0.001**		
Plant protein as % Energy		6.3	7.8
Total fat as % Energy		30.3	23.8
Monounsaturated fat as % Energy		11.2	7.9

* Kruskal-Wallis test
RE: Retinol equivalent

Table 5.13: Mean nutrient intake in adolescents aged 15 - 18 years (N=118) with household refrigeration and without refrigeration (men and women combined)

Nutrient	*P* value*	Mean intake	
		N=50 Refrigeration	N=68 No refrigeration
	***P* < 0.05**		
Polyunsaturated fat as % Energy		7.3	6.1
	***P* < 0.01**		
Vitamin A (RE)		485	362
Saturated fat as % Energy		9.8	8.2
	***P* < 0.001**		
Plant protein as % Energy		5.9	7.5
Total fat as % Energy		30.2	24.9
Monounsaturated fat as % Energy		12.3	8.4

* Kruskal-Wallis test
RE: Retinol equivalent

Turning to absolute intakes of micronutrients (shown in Tables 5.1 - 5.13), significance was reached in all age categories for only vitamins A and B_6 for the majority of SES variables. The adolescent group stands out as being markedly different to the preschool and adult groups, as these are the only micronutrients for which significance was attained. Within the preschool group, significance was reached for vitamins A, niacin, vitamin B_6, vitamin B_{12}, ascorbic acid and iron, depending on the SES variables, while to a lesser extent ($P < 0.05$) for riboflavin and folic acid (see summary Table 5.1). Among the adults significantly lower intakes are reflected for thiamin in men and women ($P < 0.01$) in formal housing, in women where electricity/gas were utilised ($P < 0.01$) and for both genders for calcium with respect to formal housing and electricity/gas.

These data show that a more 'western' orientation to dietary composition is associated with certain proxies for higher SES. In turn, higher SES is associated with better dietary quality with respect to specific intakes of micronutrients especially in preschoolers and to a lesser extent in adults. Furthermore, the profile of nutrient intakes in preschoolers, which reached significance for the three attributes of higher SES, not only mirrors that of adults in particular, but that of adult women specifically. This implies that women as caregivers influence the diets of young children. Finally, adolescent diets appear to be least affected by SES with the exception of fat intakes and vitamin A.

5.1.2 The effect of urban exposure on dietary intake

The map presented below illustrates the migration of Africans from the rural then independent states to the cities of East London, Port Elizabeth and Cape Town. The shift to Cape Town, in spite of the distance involved, has been marked particularly since 1986. It must be reiterated however, that this migration is not unidirectional, but is cyclical in nature with constant movement between rural and urban bases (Ramphele & Heap, 1991; Dewar, *et al.*, 1991).

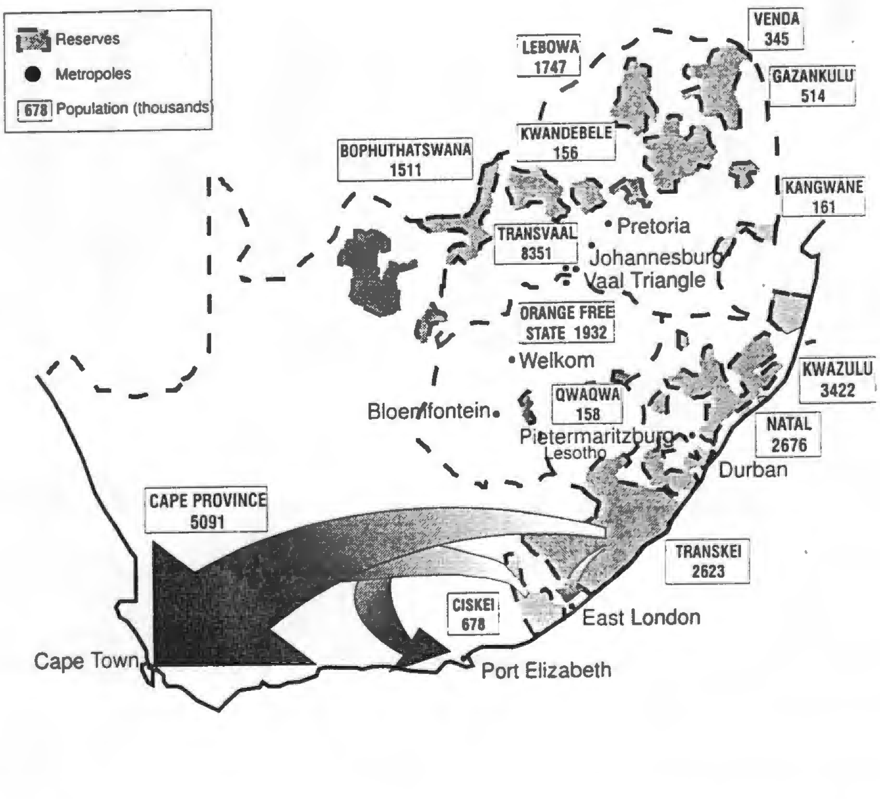

Figure 5.2: South Africa: African population density in previously designated TBVC National Independent States illustrating migration to Cape Province metropoles at the time of the study (1990)

Figures 5.3 and 5.4 show the proportion of life in the city in different age groups for men and women respectively from this study. The 15 - 29-year-old males and females have a similar U-shaped pattern with the highest proportion having spent 80 - 100% of their lives in the city. These are the city bred youth.

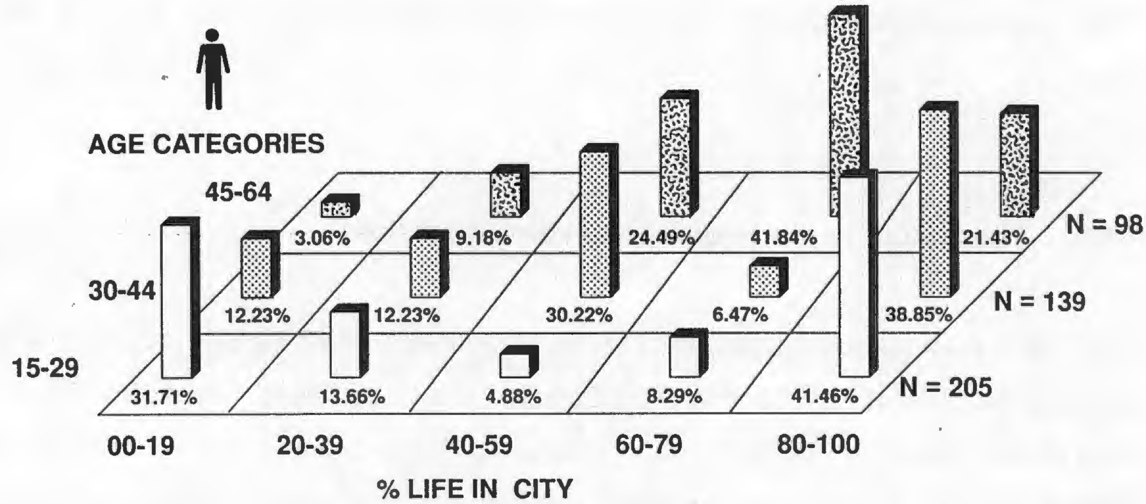

Figure 5.3: The proportion of life spent in the city for men aged 15 - 64 years (N=442)

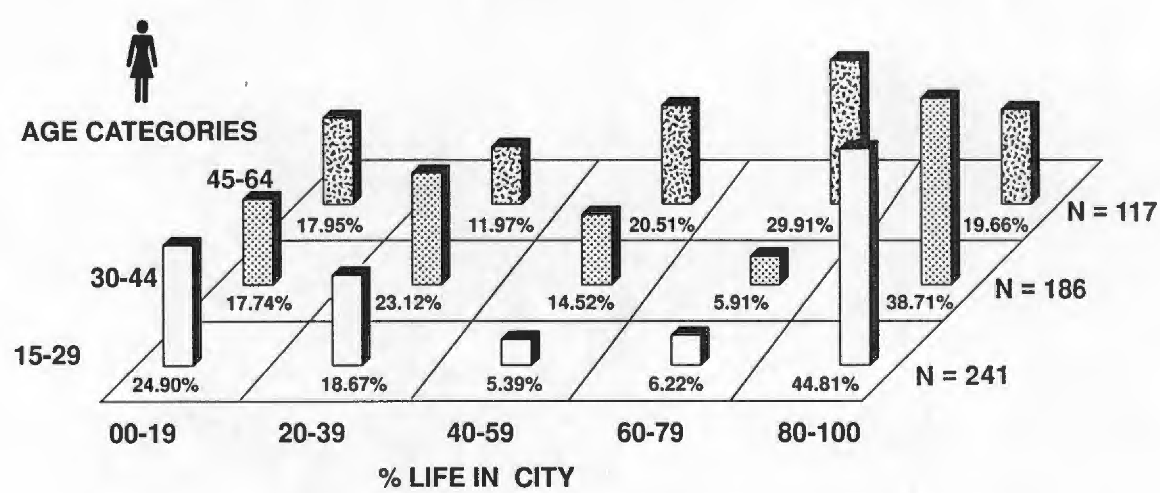

Figure 5.4 The proportion of life spent in the city for women aged 15 - 64 years (N=544)

Sixty three percent of the oldest male age group (45 - 64 years) had spent greater than 60% of their lives and 88% of this group greater than 40% of their lives in the city. This group had the lowest proportion of city-bred people (80 - 100% of life). The females in this age group had a similar distribution, except for the substantially greater proportion of newcomers to the city compared to the males (18% vs. 3%).

The index of urban exposure (% life spent in the city) used in this study has been described in Chapter 3 (Methods, section 3.8.2: (iii) Demographic and urbanisation information). Since it was considered not meaningful to examine urban exposure in 3 - 6-year-olds, this group was omitted. It was also not possible to examine 15 - 18-year-olds as a separate group, because of small sample sizes at different levels of urban exposure, therefore the younger adult category was extended to include 15 - 24-year-olds. Data on this age group will be presented first, stratified by urban exposure, followed by data on 19 - 44-year-olds. Data on both age categories initially will be expressed as nutrient intakes stratified by urban exposure, and subsequently on food group intake by urban exposure. Certain dietary variables have been omitted because no clear-cut upward or downward shifts emerged. Consequently, the data presented represents selected nutrients with clear upward or downward movements when stratified by the urbanisation index. Those which reached significance will be highlighted.

In the sections which follow, Tables 5.14 - 5.21 (15 - 24-year-olds), a significant shift (at the appropriate level) is indicated if the confidence intervals around the mean value of the 0 - 20% 'Life spent in city' category does not overlap the confidence intervals of the 70 - 100% 'Life spent in city' category. In Tables 5.22 - 5.30 (19 - 44-year-olds) the same criteria apply, except that the appropriate upper category is 80 - 100% 'Life spent in city'. The graphical presentations reflect the means and ± 95% confidence intervals.

(a) 15 - 24-year-olds

(i) Energy intake

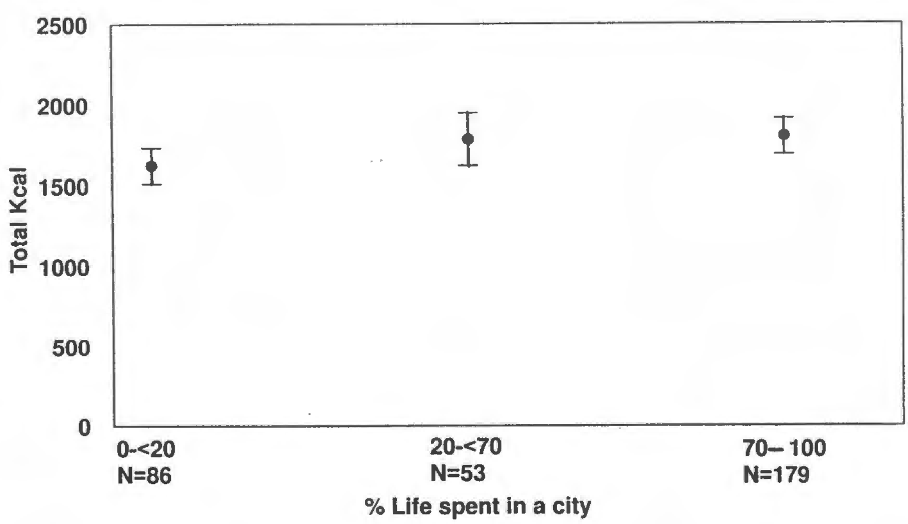

Figure 5.5: The effect of urban exposure on reported energy intake (kcal) in 15 - 24-year-olds

Table 5.14: **Reported energy intakes stratified by urban exposure for 15 - 24-year-olds**

% Life spent in a city		Kcal		
	N	Mean	SD	± 95% CI
0 - <20	86	1623	527	111.4
20 - <70	53	1786	607	163.4
70 - 100	179	1802	767	112.2

An increase in energy intake with increasing urban exposure can be noted. However, this did not reach significance.

(ii) Macronutrient intakes expressed in grams

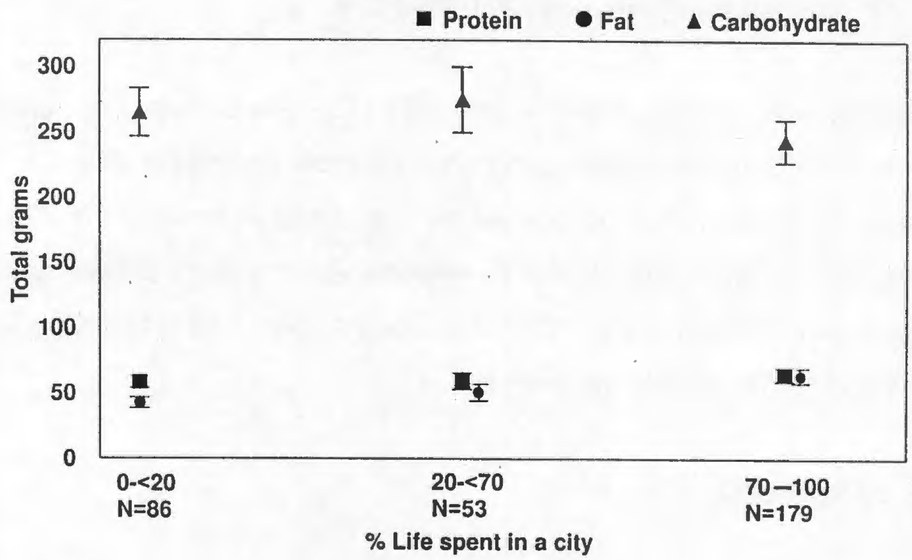

Figure 5.6: The effect of urban exposure on reported intakes of protein, fat and carbohydrate expressed in grams in 15 - 24-year-olds

Table 5.15: Reported gram intakes of protein, carbohydrate and fat stratified by urban exposure among 15 - 24-year-olds

% Life spent in a city		Protein (g)			Carbohydrate (g)			Total Fat (g)		
	N	Mean	SD	± 95% CI	Mean	SD	± 95% CI	Mean	SD	± 95% CI
0 - <20	86	57.9	21.4	4.52	265	87.4	18.5	42.2	19.0	4.01
20 - <70	53	59.1	23.5	6.32	275	92.8	25.0	50.9	24.2	6.51
70 - 100	179	64.4	36.2	5.30	244	113	16.5	63.9	40.4	5.91

Increases in protein and fat intakes are illustrated above, while absolute intake in carbohydrate intakes decrease. Only the upward shift in fat intake reached significance, (*P* <0.01).

(iii) Macronutrient intakes expressed as percentages of energy

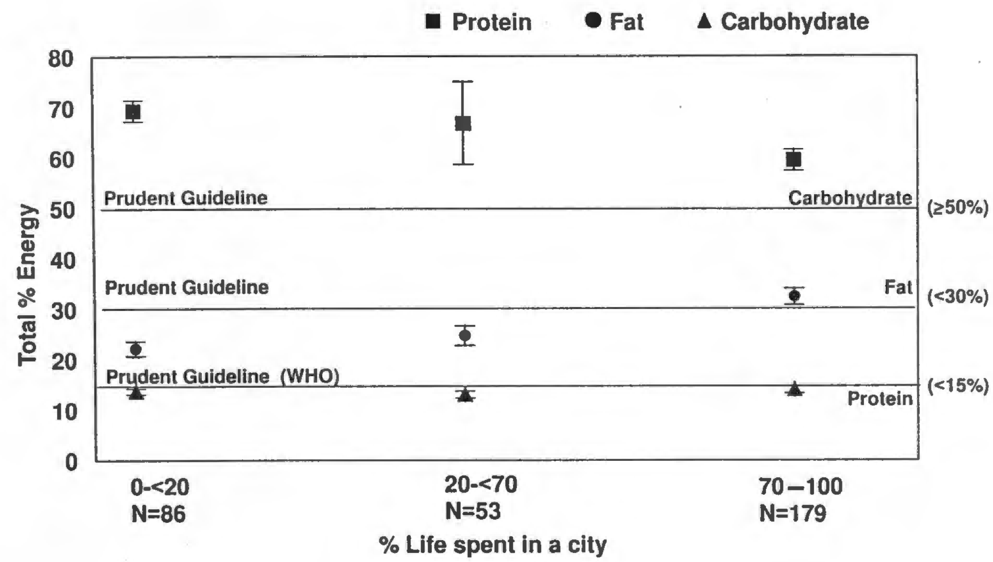

Figure 5.7: The effect of urban exposure on intakes of protein, fat and carbohydrate, expressed as % Energy in 15 - 24-year-olds

Table 5.16: Intakes of % Energy of protein, fat and carbohydrate stratified by urban exposure in 15 - 24-year-olds

% Life spent in a city		%E Protein		%E Total Fat		%E Carbohydrate	
	N	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI
0 - <20	86	13.7 (2.7)	.57	22.2 (6.84)	1.45	69.4 (9.9)	2.09
20 - <70	53	13.0 (2.6)	.70	24.7 (7.12)	1.92	66.8 (30.7)	8.26
70 - 100	179	14.0 (5.1)	.75	32.4 (11.0)	1.61	59.4 (14.1)	2.11

When macronutrient intakes are expressed as percentages of energy the upward shift in %E total fat again reached significance (*P* <0.01), while the decrease in the proportion of carbohydrate was also significant (*P* <0.01). There was no distinct shift with respect to protein intake.

(iv) Fat intakes expressed as percentages of energy

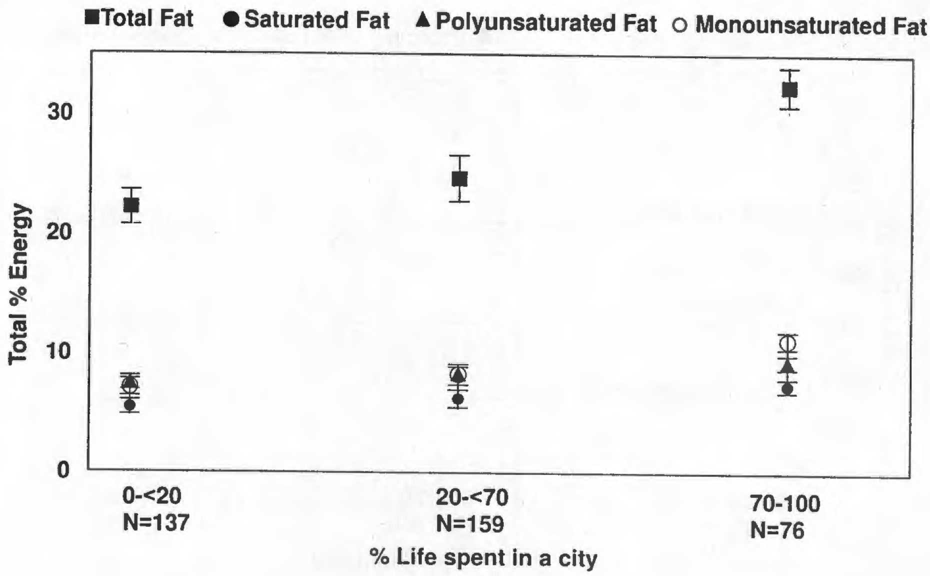

Figure 5.8: The effect of urban exposure on total, saturated, polyunsaturated and monounsaturated fats in 15 - 24-year-olds

Table 5.17: Percentages of energy derived from total, saturated, polyunsaturated and monounsaturated fats stratified by urban exposure for the 15 - 24-year-olds

% Life spent in a city		%E Total Fat		%E Saturated Fat		%E Polyunsaturated Fat		%E Monounsaturated Fat	
	N	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI
0 - <20	86	22.2 (6.84)	1.45	7.49 (2.8)	.59	5.43 (2.9)	.61	7.10 (3.4)	.72
20 - <70	53	24.7 (7.12)	1.92	8.13 (2.8)	.75	6.21 (2.8)	.75	8.25 (3.2)	.86
70 - 100	179	32.4 (11.0)	1.61	9.34 (4.0)	.58	7.38 (3.8)	.56	11.20 (4.9)	.72

The above figure and graph illustrate that intakes of total fat and the three subcategories of fats increased significantly with urban exposure. Significance was reached for each variable at the P <0.01 level.

(v) *Protein intakes expressed as percentages of energy*

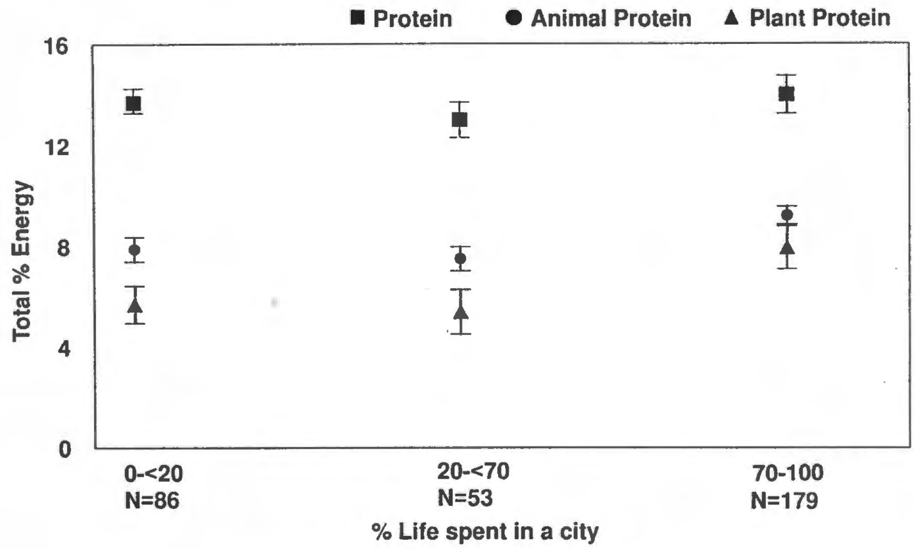

Figure 5.9: The effect of urban exposure on total protein as well as animal and plant protein in 15 - 24-year-olds

Table 5.18: Intakes of total, animal and plant protein (%E) stratified by urban exposure in 15 - 24-year-olds

% Life spent in a city		Protein as %E		Animal Protein as %E		Plant Protein as %E	
	N	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI
0 - <20	86	13.7 (2.7)	.57	5.70 (3.5)	.74	7.88 (2.3)	.49
20 - <70	53	13.0 (2.6)	.70	5.39 (3.3)	.89	7.49 (1.8)	.48
70 - 100	179	14.0 (5.1)	.75	7.95 (5.8)	.85	9.22 (2.4)	.35

The data presented above show significant upward shifts for both animal and plant protein intakes at the *P* <0.01 level, while the upward shift proportion of total protein was not significant.

(vi) Fibre intakes expressed in grams

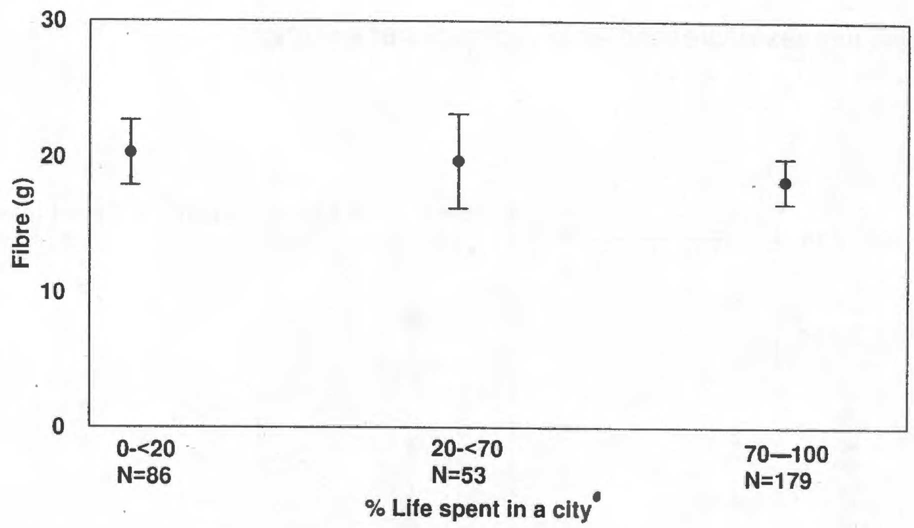

Figure 5.10: The effect of urban exposure on fibre intakes among 15 - 24-year-olds

Table 5.19: Fibre intake (g) stratified by urban exposure in 15 - 24-year-olds

% Life spent in a city		Fibre (g)	
	N	Mean (SD)	± 95% CI
0 - <20	86	20.3 (11.1)	2.39
20 - <70	53	19.7 (13.4)	3.47
70 - 100	179	18.3 (10.4)	1.66

There were no significant changes in fibre intake with increasing urban exposure.

(vii) Keys score

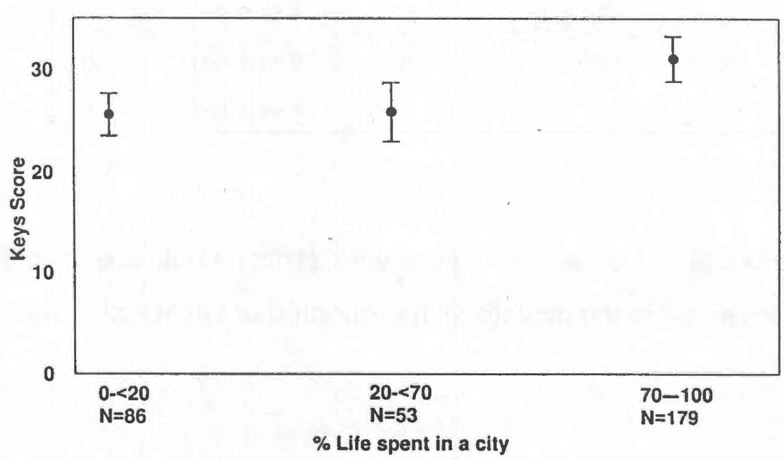

Figure 5.11: The effect of urban exposure on the Keys score in 15 - 24-year-olds

Table 5.20: The Keys score stratified by urban exposure in 15 - 24-year-olds

% Life spent in a city		Keys Score	
	N	Mean (SD)	± 95% CI
0 - <20	86	25.6 (9.8)	2.07
20 - <70	53	25.9 (10.7)	2.88
70 - 100	179	31.1 (15.0)	2.19

The Keys score as an overall indicator of dietary atherogenicity increased significantly with increasing urban exposure (P <0.05).

(viii) Sugar intake expressed as percentages of energy

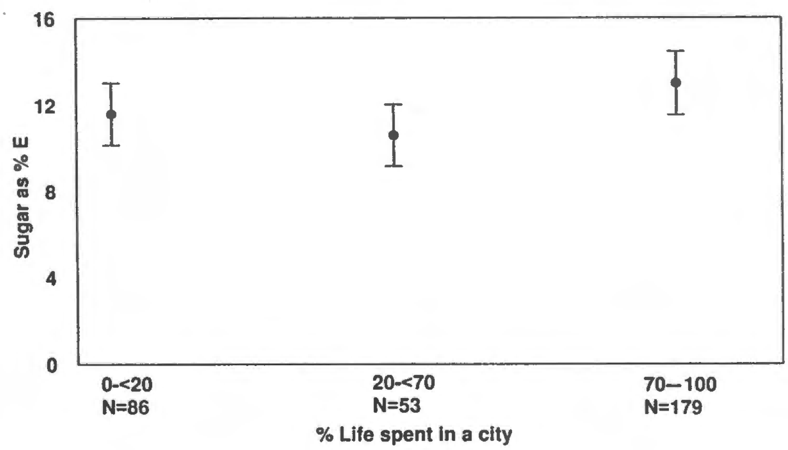

Figure 5.12: The effect of urban exposure on sugar expressed as % Energy in 15 - 24-year-olds

Table 5.21: Percentage energy from sugar stratified by urban exposure in 15 - 24-year-olds

% Life spent in a city		Sugar as %E	
	N	Mean (SD)	± 95% CI
0 - <20	86	11.6 (6.8)	1.44
20 - <70	53	10.6 (5.3)	1.43
70 - 100	179	13.0 (10.1)	1.47

Sugar intake (as %E) did not increase significantly with urban exposure.

When alcohol intake was expressed as %E, the means were extremely low (<2%) and the standard deviations very large, indicating great variability. Reporting of alcohol intakes are notoriously suspect.

There were no noteworthy directional shifts by urban exposure for micronutrient intakes.

To sum up, in the 15 - 24-year-old age group intakes of following nutrients were significantly increased at the P <0.01 level with increasing urban exposure: total fat in grams, %E total fat, saturated fat, polyunsaturated and monounsaturated fats in addition to %E animal and plant proteins. There was a negative association with increasing urban exposure and %E carbohydrate (P <0.01). As an overall index of atherogenicity, the Keys score also rose significantly (P <0.05). These data reflect a shift in the structure of the diet towards a western diet with increasing urban exposure.

(b) 19 - 44-year-olds

In this section the analyses follow similar lines to those performed in the previous section. However, the larger number of persons in this category permitted examination of four categories of urban exposure.

(i) Energy intake

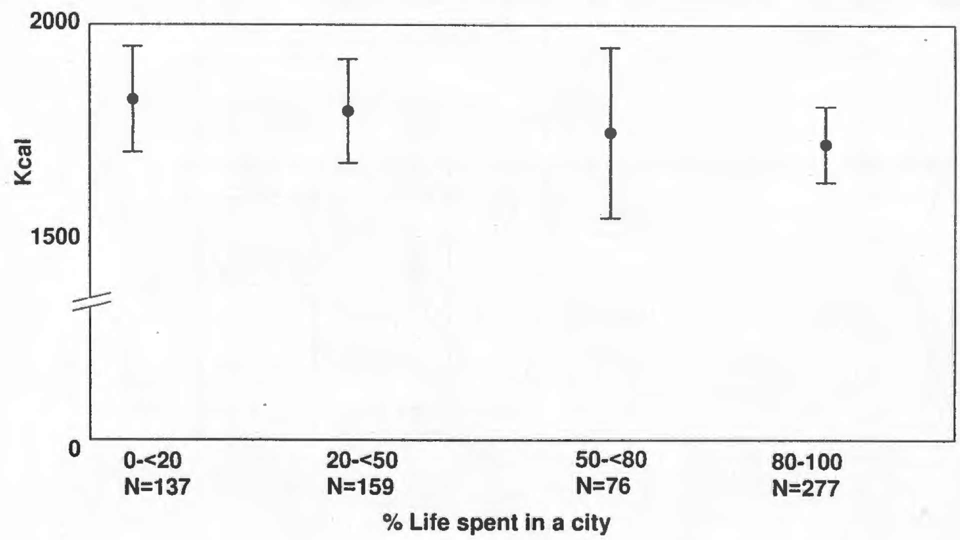

Figure 5.13: The effect of urban exposure on reported energy intake (kcal) in 19 - 44-year-olds

Table 5.22: Reported energy intakes stratified by urban exposure for 19 - 44-year-olds

% Life spent in a city		Energy Kcal	
	N	Mean (SD)	± 95% CI
0 - <20	137	1822 (811)	126.8
20 - <50	159	1794 (802)	124.6
50 - <80	76	1743 (908)	204.1
80 - 100	277	1715 (773)	90.9

In the Figure and Table given above, a downward shift of energy intake can be noted. This, however, did not reach significance.

(ii) Macronutrient intakes expressed in grams

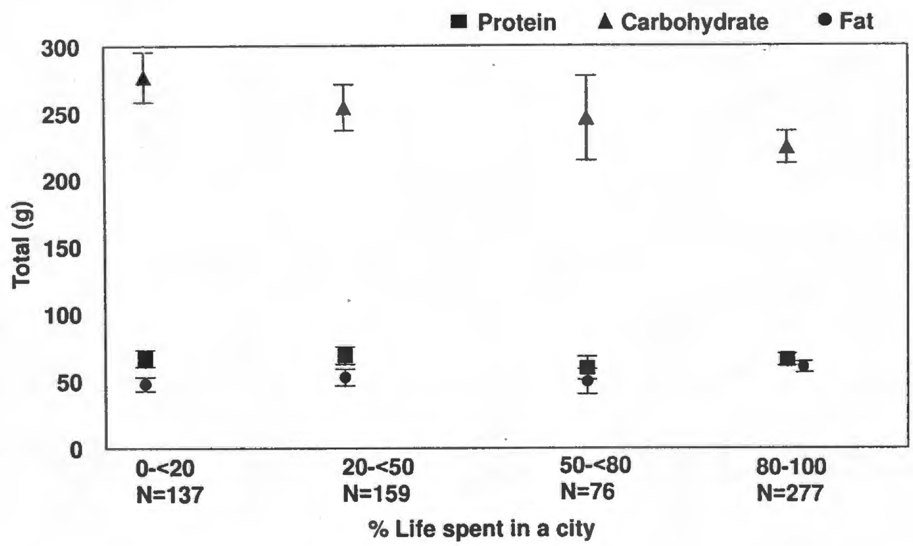

Figure 5.14: The effect of urban exposure on reported intakes of protein, carbohydrate and fat expressed in grams in 19 - 44-year-olds

Table 5.23: Reported gram intakes of protein, carbohydrate and fat stratified by urban exposure among 19 - 44-year-olds

% Life spent in a city		Total Protein (g)		Total Carbohydrate (g)		Total Fat (g)	
	N	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI
0 - <20	137	66.9 (40)	6.26	277 (119)	18.62	47.8 (33)	5.16
20 - <50	159	68.9 (42)	6.53	254 (111)	17.25	52.7 (40)	6.22
50 - <80	76	59.6 (38)	8.54	246 (141)	31.70	49.6 (42)	9.44
80 - 100	277	65.6 (39)	4.59	224 (104)	12.24	60.0 (38)	4.47

No particular significant shift emerged for protein with increased urban exposure, while in the case of total fat and carbohydrate intakes, significance was reached for the upward (P <0.05) and downward (P <0.01) shifts for the respective macronutrients.

(iii) Macronutrient intakes expressed as percentages of energy

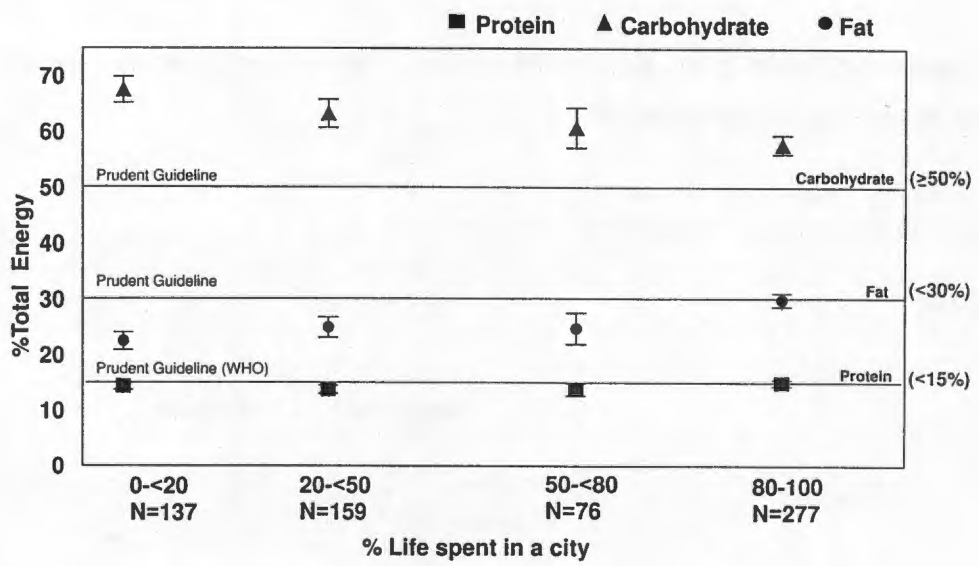

Figure 5.15: The effect of urban exposure on intakes of protein, fat and carbohydrate, expressed as % Energy in 19 - 44-year-olds

Table 5.24: Intakes of % Energy of protein, fat and carbohydrate stratified by urban exposure in 19 - 44-year-olds

% Life spent in a city		Total Protein as %E		Total fat as %E		Total Carbohydrate as %E	
	N	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI
0 - <20	137	14.4 (4.1)	.641	22.5 (10.3)	1.61	67.6 (14.9)	2.33
20 - <50	159	13.8 (5.0)	.745	25.0 (12.0)	1.86	63.3 (16.4)	2.55
50 - <80	76	13.8 (5.0)	1.124	24.8 (12.6)	2.83	60.8 (16.0)	3.60
80 - 100	277	15.0 (4.9)	.576	30.0 (10.3)	1.21	57.8 (14.5)	1.71

When total intakes of macronutrients are expressed as percentages of energy, fat increased significantly (P <0.01), carbohydrate decreased significantly (P <0.01), while significance was not reached for protein. This pattern reflects that of absolute intakes of these macronutrients.

(iv) Fat intakes expressed as percentages of energy

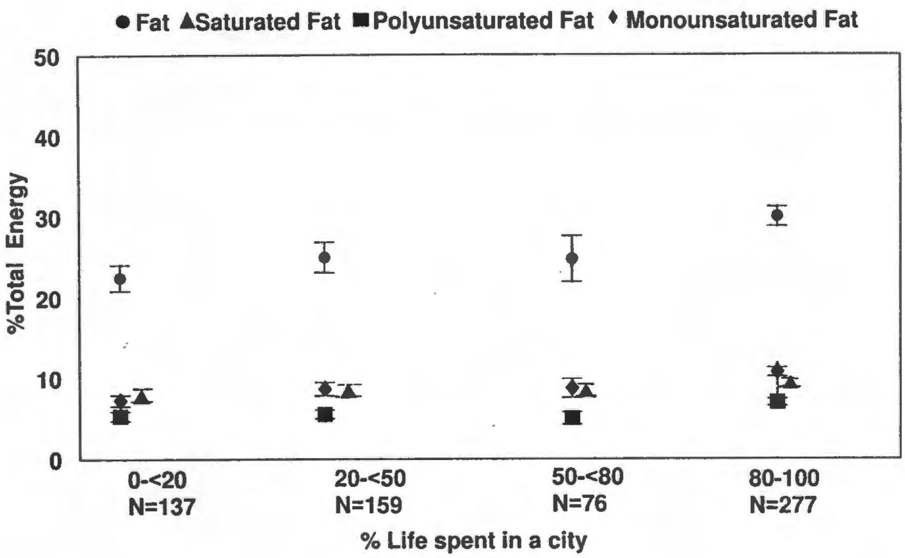

Figure 5.16: The effect of urban exposure on total, saturated, polyunsaturated and monounsaturated fats in 19 - 44-year-olds

Table 5.25: Percentages of energy derived from total, saturated, polyunsaturated and monounsaturated fats stratified by urban exposure for the 19 - 44-year-olds

% Life spent in a city		Fat as %E		Saturated fat as %E		Polyunsaturated fat as %E		Monounsaturated fat as %E	
	N	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI
0 - <20	137	22.5 (10.3)	1.61	7.74 (4.0)	.63	5.31 (3.7)	.58	7.25 (4.4)	.69
20 - <50	159	25.0 (12.0)	1.86	8.48 (4.8)	.74	5.53 (3.5)	.54	8.65 (5.4)	.84
50 - <80	76	24.8 (12.6)	2.83	8.48 (4.8)	1.08	5.03 (3.4)	.76	8.73 (5.2)	1.17
80 - 100	277	30.0 (10.3)	1.21	9.43 (3.9)	.46	6.97 (3.9)	.46	10.75 (4.8)	.56

Significance was reached for increases in total fat and the three subgroups of fats with increased urban exposure, all at the (*P* <0.01) level.

(v) Protein intakes expressed as percentages of energy

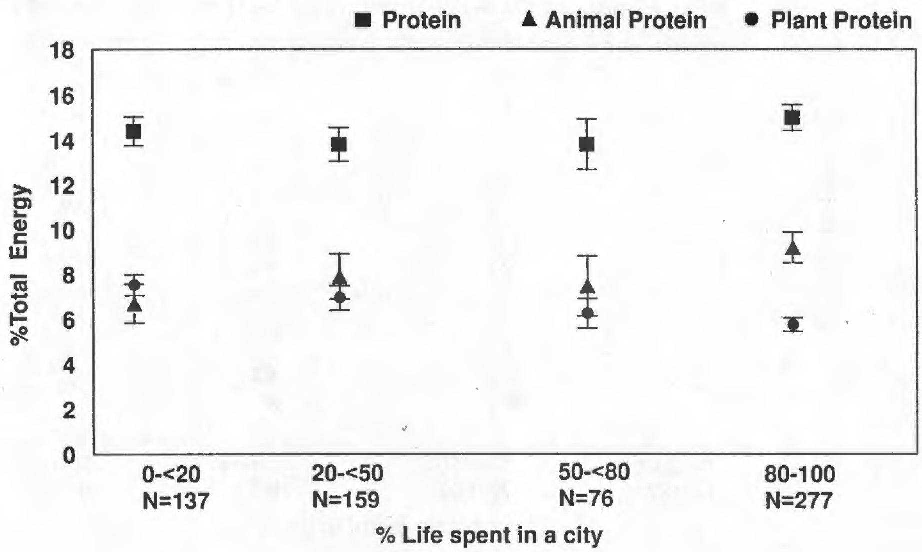

Figure 5.17: The effect of urban exposure on total protein as well as animal and plant protein in 19 - 44-year-olds

Table 5.26: Intakes of total, animal and plant protein (%E) stratified by urban exposure in 19 - 44-year-olds

% Life spent in a city		Protein as %E		Animal protein as %E		Plant protein as %E	
	N	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI
0 - <20	137	14.4 (4.1)	.641	6.70 (5.5)	.86	7.53 (2.9)	.454
20 - <50	159	13.8 (5.0)	.745	7.89 (6.5)	1.01	6.95 (3.5)	.544
50 - <80	76	13.8 (5.0)	1.124	7.48 (5.9)	1.33	6.26 (2.9)	.652
80 - 100	277	15.0 (4.9)	.576	9.20 (5.9)	.69	5.77 (2.5)	.294

There was no marked shift for %E total protein. However, animal protein increased significantly (*P* <0.01), while %E plant protein decreased significantly (*P* <0.01).

(vi) Keys score

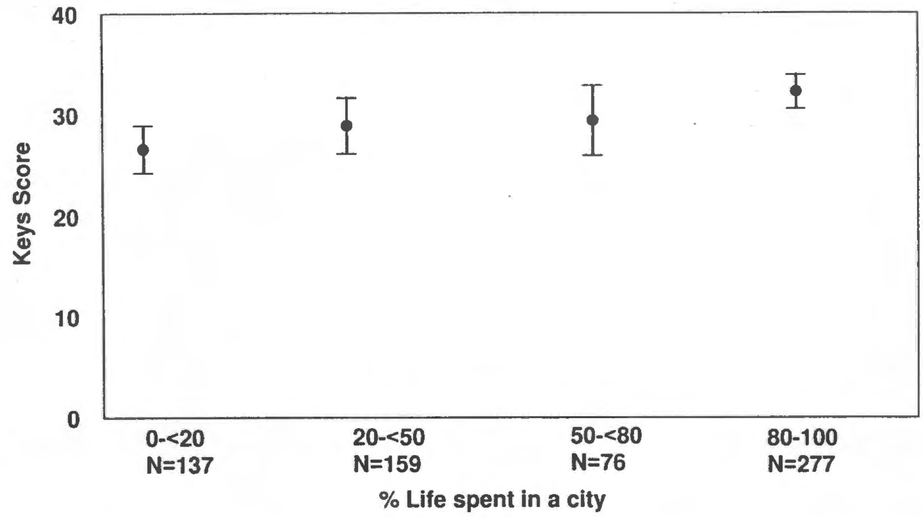

Figure 5.18: The effect of urban exposure on the Keys score in 19 - 44-year-olds

Table 5.27: The Keys score stratified by urban exposure in 19 - 44-year-olds

% Life spent in a city		Keys score	
	N	Mean (SD)	± 95% CI
0 - <20	137	26.6 (14.9)	2.33
20 - <50	159	28.9 (17.7)	2.75
50 - <80	76	29.4 (15.3)	3.44
80 - 100	277	32.2 (14.3)	1.68

Significantly increased Keys scores reflect a significant upward shift in dietary atherogenicity with increased urban exposure (P <0.01).

(vii) Sugar as % Energy

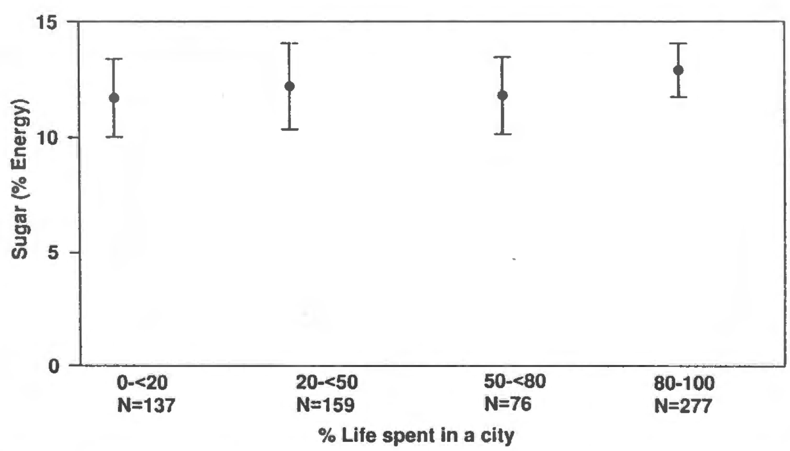

Figure 5.19: The effect of urban exposure on sugar expressed as % Energy in 19 - 44-year-olds

Table 5.28: Percentage energy from sugar stratified by urban exposure in 19 - 44-year-olds

% Life spent in a city		Sugar as % Energy	
	N	Mean (SD)	± 95% CI
0 - <20	137	11.7 (10.1)	1.69
20 - <50	159	12.2 (12.0)	1.86
50 - <80	76	11.8 (11.0)	2.47
80 - 100	277	12.9 (9.8)	1.16

There was no shift with changes in urban exposure with respect to sugar intake.

(viii) Fibre intake

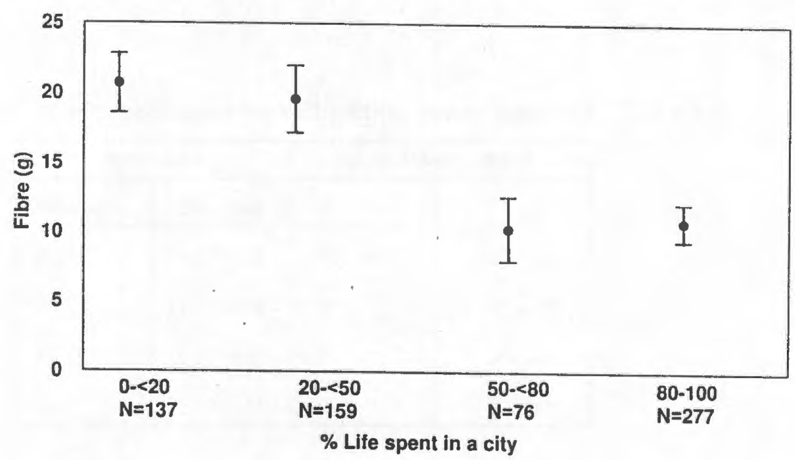

Figure 5.20: The effect of urban exposure on fibre intakes among 19 - 44-year-olds

Table 5.29: Fibre intake (g) stratified by urban exposure in 19 - 44-year-olds

% Life spent in a city		Fibre (g)	
	N	Mean (SD)	± 95% CI
0 - <20	137	20.7 (13.0)	2.10
20 - <50	159	19.6 (15.2)	2.39
50 - <80	76	14.5 (10.3)	2.34
80 - 100	277	16.7 (10.8)	1.35

A marked downward shift in fibre intake is illustrated above. This reached significance at the P <0.01 level.

(ix) Vitamin intakes

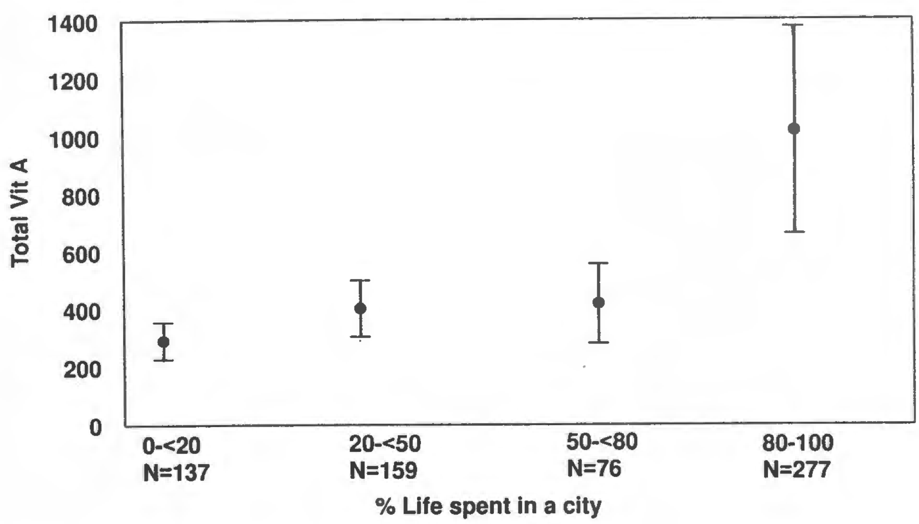

Figure 5.21: The effect of urban exposure on vitamin A intakes in 19 - 44-year-olds

Table 5.30: Vitamin intakes stratified by urban exposure in 19 - 44-year-olds

% Life spent in a city		Vitamin A (RE)		Ascorbic acid (mg)		Thiamin (mg)		Folic acid (μg)	
	N	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI	Mean (SD)	± 95% CI
0 - <20	137	291 (406)	63.5	39.5 (96)	13.01	1.08 (0.61)	.095	207 (160)	25.02
20 - <50	159	402 (631)	98.1	36.4 (87)	13.52	1.01 (0.65)	.101	187 (163)	25.33
50 - <80	76	418 (706)	138.7	58.2 (195)	43.83	0.95 (0.63)	.142	171 (138)	31.02
80 - 100	277	1018 (3036)	357.3	55.0 (116)	13.65	0.90 (0.52)	.061	174 (152)	17.89

The upward shift for vitamin A was significant at the P <0.01 level. Upward shifts were also noted for ascorbic acid, but did not reach significance, while downward shifts in thiamin and folic acid were also not significant. No overall shifts existed for any of the other micronutrients.

For both age categories (15 - 24- and 19-44-year-olds) the significant upward shifts in fat intakes (absolute intakes and %E contribution of total fat and its components) and the significant decreases in carbohydrate signify a shift towards a western diet with urbanisation. The significantly decreased plant protein (in the case of the 19 - 44-year-olds) and increased animal protein intakes (in both age categories) lend further support to this. The Keys score, used as an index of dietary atherogenicity reflected overall significant upward shifts by urban exposure in both age categories. No particular significant shifts emerged for vitamin intake, with the exception of vitamin A, which increased significantly with urbanisation.

An examination of the underlying shifts in food intakes (as opposed to nutrients) is presented below, expressed in terms of food groups (Table 5.31) and stratified by the percentage life spent in a city for the 19 - 44-year-old men and women. (Sample sizes were too small for the investigation of the 15 - 24-year-olds.) Notable increases in intakes of the meat, fat and vegetable groups are shown, while decreases in the dairy and cereal groups are depicted. This suggests that the upward shift in animal protein is derived from increases in meat intake, while the meat group also being a primary source of fat together with the fat group itself, account for the upward shift in fat intakes previously observed. The 26.6% downward shift in the cereal group accounts to great extent for decreases in carbohydrate intake. The striking 57.3% increase in fruits and vegetables is one positive feature of increasing urban exposure.

Table 5.31: The influence of increasing urban exposure on %E contribution of the Five Basic Food Groups (and the 'non-basic' foods) in adults aged 19 - 44 years (N=649)

	% LIFE SPENT IN A CITY				
Mean%E from Food Groups	0 - <20 N=137	20 - <50 N=159	50 - <80 N=76	80 - 100 N=277	% Change between extremes
Dairy group	6.53	6.02	6.80	4.50	⇓ 31.1
Meat group	20.63	24.25	21.54	25.32	⇑ 22.7
Fruit & Vegetable Group	9.06	7.89	11.22	14.26	⇑ 57.3
Cereal group	43.10	38.95	34.25	31.65	⇓ 26.6
Fat group	7.75	7.93	6.84	9.03	⇑ 16.5
'Non basic' foods*	12.96	15.00	19.44	14.92	⇑ 15.1

* See Chapter 3, section 3.5.9

A breakdown of the Five Food Groups appears in Table 5.32 below, which also depicts the percentage change between relative newcomers to the city (0 - <20% life spent in the city and those who have spent all or most of their lives as city dwellers (80 - 100% life spent in the city).

Table 5.32: The influence of increasing urban exposure on %E contribution of Food Groups in adults aged 19 - 44 years (N=649)

Food categories	% Life spent in a city		% Change between extremes	
	0 - < 20	80 - 100		
%E from Food Groups				
Milk Group				
Milk	6.53	4.25	⇓	34.9
Meat Group				
Red meat	4.69	7.95	⇑	69.5
White meat	6.18	8.99	⇑	45.5
Eggs	1.14	1.90	⇑	66.6
Legumes	4.04	2.19	⇓	45.8
Fruit & Vegetable Group				
Vitamin C-rich veg/fruit	1.00	1.35	⇑	35.0
Carotene-rich veg/fruit	0.38	0.83	⇑	118.4
Potato, sweet potato	4.77	7.27	⇑	52.4
Other veg/fruit	2.80	4.75	⇑	69.6
Cereal Group				
Unrefined cereals	7.45	7.35	⇓	8.0
Refined cereals	35.77	24.36	⇓	31.9
Fat Group				
Butter, saturated fats	1.95	1.73	⇓	11.3
Brick margarine	4.46	5.45	⇑	22.2
Oil, tub margarine	1.35	1.80	⇑	33.3

The breakdown of the components of the meat group show overall increases in the sources of animal protein, with legumes, the main source of plant protein decreasing by 45.8%. Decreases in milk intake (34.9%) and both refined and unrefined cereals are illustrated. The fall in cereals suggests an overall shift away from a starch staple. In the fat group, added saturated fat decreased, while brick margarine (the main source of monounsaturated fat), sunflower oil and tub margarine (the primary sources of polyunsaturated fats) increased by 22.2%, 33.3% and 33.3% respectively. In general, food group intake reflected the shift towards a 'western' diet, with evidence of dairy products decreasing with urban exposure. The positive association of fruits and vegetables with increasing urban exposure is particularly striking.

Although these bivariate analyses are instructive it was important to conduct multivariate analyses to determine if relationships persisted once the influence of confounding variables had been controlled for. It was also possible to include other indicators of SES as well as other potential predictors for dietary intake.

5.2 IDENTIFICATION OF DETERMINANTS OF DIETARY INTAKE (MULTIVARIATE ANALYSES)

Since no statistical method can be relied on to identify the 'true' underlying model of the relationships between the predictor and outcome variables, two independent multivariate methods have been used in this section. These are namely multiple linear regression and correspondence analysis. The results of the multiple linear regression will be presented first (5.2.1), followed at a later stage by the correspondence analysis (5.2.2).

5.2.1 The effects of selected variables on dietary intake (multiple linear regression)

Listings of predictor and outcome variables are presented below. As can be seen, the predictor variables were both of continuous and dichotomous categorical types (Kahn and Sempos, 1989). Cut-off values are provided for the dichotomous categorical variables.

Table 5.33: List of predictor variables

a) List of categorical predictor variables used in multiple linear regression with their respective cut-off points		
Gender	0 = male	1 = female
Housing	0 = formal	1 = informal
No water supply	0 = tap in home	1 = no tap in home
No fridge	0 = fridge	1 = no fridge
Employment for money	0 = no	1 = yes
Unemployed (excludes looking for work)	0 = no	1 = yes
Education - medium (Std 5 - 7)*	0 = no	1 = yes
Education - high (Std 8 - 10)**	0 = no	1 = yes
Electricity/gas	0 = no	1 = yes
Urban exposure medium (≥50% <80% life in city)	0 = no	1 = yes
Urban exposure high (≥80% life in city)	0 = no	1 = yes
Exercise - medium	0 = no	1 = yes
Exercise - high	0 = no	1 = yes
b) List of continuous predictor variables used in multiple linear regression		
Age		
% Life spent in a city		
Body mass index (BMI)		

* 7 - 9 years completed schooling
** 10 - 12 years completed schooling

Table 5.34: List of nutrient outcome variables

Macronutrients	Units	% Energy (%E)
Energy	Kcal	kJ MJ
Protein (total)	g	%E
Animal protein	g	%E
Plant protein	g	%E
Fat (total)	g	%E
Saturated fat	g	%E
Polyunsaturated fat	g	%E
Monounsaturated fat	g	%E
Carbohydrate	g	%E
Fibre	g	
Sugar	-	%E
Alcohol	-	%E
P/S ratio	$= \frac{\text{Polyunsaturated fat g}}{\text{Saturated fat g}}$	
Keys dietary score $= 1.26\,(2S-P)+1.5\,\sqrt{1000\,C/E}$ where S = saturated and P = polyunsaturated fatty acids as a percentage of total energy; C = dietary cholesterol in milligrams per day; E = daily energy intake in kilocalories		
Micronutrients (selected) Vitamins	Units	
A	RE	
C	mg	
B_1	mg	
B_2	mg	
B_6	mg	
Folic acid	μg	
B_{12}	μg	
Minerals		
Calcium	mg	
Iron	mg	
Mean adequacy ratio (MAR) score* $= \frac{\text{sum of NARs for nutrients}}{\text{number of nutrients}}$ whereby NAR $= \frac{\text{daily intake of nutrient}}{\text{RDA for that nutrient}}$		

To improve the accuracy of the modelling, the transformations listed in Table 5.35 below were carried out. These had the effect of normalising the distributions of the outcome variables.

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* Guthrie, H.A. & Scheer, J.C. (1981). Validity of a dietary score for assessing nutrient adequacy. *J. Am. Diet. Assoc.* **78:** 240-245.

Table 5.35: Transformations of outcome variables to improve regression modelling

Square root transformation:	
Macronutrients, fibre, energy	Micronutrients
Total fat	Vitamin A
Saturated fat	Vitamin C
Polyunsaturated fat	Thiamin
Monounsaturated fat	Riboflavin
Total carbohydrate	Vitamin B_6
Total protein	Folic acid
Animal protein	Vitamin B_{12}
Plant protein	Calcium
Fibre	Iron
Kilocalories	
Arc sin transformation, followed by square root transformation:	
MAR (mean adequacy ratio)	

Computer algorithms used for linear regression

The SAS statistical package was used for the analyses.

The Maximum R^2 Improvement (MAX R) algorithm was used. "The maximum R^2 improvement does not settle on a single model. Instead it tries to find the 'best' one variable model, the 'best' two variable model and so forth, although it is not guaranteed to find the largest R^2 for each size [i.e. pertaining to the number of variables]. After comparing all possible switches, MAX R makes the switch that produces the largest in R^2 [where R^2 indicates the proportion of variance explained by the model]. Comparisons begin again, and the process continues until MAX R finds that no switch would increase R^2. Thus, the two-variable model achieved is considered the 'best' two-variable model the technique can find. Another variable is then added to the model, and the comparing-and-switching process is repeated to find the 'best' three-variable model, and so forth." (SAS Institute, 1989).

Since there is no guarantee that the MAX R algorithm will find the model with the largest R^2, further confirmatory analysis was done using the R^2 selection algorithm, which examines all possible subsets of the predictor variables, using untransformed values. This exploratory analysis confirmed the robustness of the choice of variables using the MAX R algorithm. However, the results of this 'all possible subsets' analysis is not reported here.

The models presented are those for which all the selected variables were significantly associated with the nutrient variable (P <0.05).

Table 5.36: Coefficients for multiple linear regression for macronutrient intakes in children aged 3 - 6 years

VARIABLES	COEFFICIENT ESTIMATES		SE	P-VALUE	R^2
Total Fat as %E	Intercept	27.85	2.75	0.0001	0.21
Age		1.35	0.58		
No fridge		- 5.68	1.47		
No water supply		- 3.98	1.41		
Saturated Fat as %E	Intercept	10.99	0.44	0.001	0.10
No fridge		- 1.32	0.58		
No water supply		- 1.32	0.56		
Polyunsaturated Fat as %E	Intercept	4.36	0.93	0.0001	0.11
Age		0.63	0.20		
No fridge		- 1.48	0.47		
Monounsaturated Fat as %E	Intercept	9.87	1.28	0.0001	0.22
Age		0.69	0.27		
No fridge		- 2.69	0.68		
No water supply		- 1.85	0.66		
Carbohydrate as %E	Intercept	57.97	1.42	0.0001	0.15
No fridge		5.45	0.29		
Informal housing		5.42	0.68		
Animal Protein as %E	Intercept	10.38	1.34	0.01	0.06
Age		- 0.74	0.29		
Informal housing		- 1.42	0.68		
Plant Protein as %E	Intercept	5.76	0.27	0.01	0.06
No fridge		1.05	0.33		

Results and discussion of multiple linear regression in 3 - 6-year-olds

According to the criteria specified in the previous section, the models included three or less significant predictors. The level of prediction for preschoolers was generally low, with the % R^2 exceeding 20% for two nutrient outcomes (i.e. total fat and monounsaturated fat).

Access to refrigeration and age were the two most important predictors followed by lack of a tap in the house and informal housing. The data support the model (in Fig. 5.1) in so far as the indicators of low SES are associated with downward shifts of total, saturated, polyunsaturated and monounsaturated fats, including also % energy from animal protein. Conversely, the low SES variables are related to upward shifts in carbohydrate and plant protein.

These results suggest that increases in aspects of SES have a positive association with dietary atherogenicity even in very young children.

No meaningful results emerged for the micronutrient analyses in the 3 - 6-year-olds.

Results and discussion of multiple linear regression in 15 - 64-year-olds

For the purposes of these analyses, the entire adult range from 15 - 64 was considered in order to maximise sample sizes.

The results are set out as follows:

(i) Tables 5.37 and 5.38 represent the signs of the coefficients in the regression, whereby the '+' signs depict upward shifts in nutrients and '-' signs downward shifts. The variables associated with these signs appear at the top of the Tables.

(ii) Tables 5.39, 5.40 and 5.41 reflect the predictor variables for the 'best model' for each nutrient together with the coefficient estimates, the value of the intercept (and the relevant standard errors).

In the reporting of the results age and gender will be examined firstly, followed by the interpretation of nutrient variables with reference to the model in Fig. 5.1.

Table 5.37: Signs of the coefficients for macronutrient intakes in adults aged 15 - 64 years (N=983)

% ENERGY	Age	Male gender	Female gender	Informal housing	No water supply	No electricity/gas	No fridge	Unemployed	Employed	Medium education	High education	Urban medium	Urban high	Life percent	Moderate exercise	High exercise	Body mass index	% R^2
E Total fat				-			-		+	+	+		+					15
E Saturated fat				-			-		+	+	+							9
E Pufat	-		+			-								+				8
E Mufat					-		-		+	+	+		+					16
E Carbohydrate					+	+			-	-	-			-				14
E Protein	+	+			-			-		+	+							5
E Animal protein	+				-				+	+	+			+				10
E Plant protein	-	+					+		-	-	-			-				12
ABSOLUTE VALUES																		
Total fat	-	+					-		+	+			+					10
Saturated fat		+					-		+	+	+		+					7
Polyunsaturated fat	-	+																8
Monounsaturated fat	-	+				-	-		+	+			+					10
Calories		+			+							-						12
Total carbohydrate	-	+			+						-			-				15
Protein		+							+	+		+					+	11
Animal protein		+					-		+	+	+			+				9
Plant protein		+		+	+				+		-				-			15
Fibre	-	+			+									-	-			10
Keys score	+					-	-		+		+							8

Table 5.38: Signs of the coefficients for micronutrient intakes in adults aged 15 - 64 years (N=983)

	Age	Male gender	Female gender	Informal housing	No water supply	No electricity/gas	No fridge	Unemployed	Employed	Medium education	High education	Urban medium	Urban high	Life percent	Moderate exercise	High exercise	Body mass index	% R^2
MAR		+					-					+						3
Folic Acid		+								+				+		+		7
Calcium		+			+				+					-				8
Vitamin B_1	-	+			+						-				-			10
Vitamin A				+		-	-	-					+			+		6
Ascorbic acid					-						+		+		+	+		4
Riboflavin		+			-			-								+		6
Vitamin B_{12}		+					+	-		+	+							5

Increasing age was associated mainly with decreased absolute intakes of macronutrients. In other words, for those individuals of greater age, lower intakes of macronutrients were reflected (Table 5.37) namely, the fats (excluding saturated fats, carbohydrate and plant protein). Percentages of energy derived from polyunsaturated fat, and plant protein also showed decreases, while total protein and animal protein increased with age. As a measure of atherogenicity the Keys score increased, suggesting that although absolute intakes may be negatively associated with age, the structure of the diet becomes more atherogenic. The level of prediction for most nutrients was below 15% (%R^2) with the exception of total carbohydrate (g) and grams of plant protein.

With respect to gender, men reflected higher absolute intakes of macronutrients, as expected in the light of their higher intakes of food (see Chapter 4, sections 4.2 and 4.3). By virtue of this, higher intakes of folic acid, thiamin, riboflavin, vitamin B_{12} and calcium were also reflected in men. However, the % R^2 were extremely low for all these micronutrients, including the MAR score whereby only 3% of the variation was explained.

Turning to the composition of the diet (i.e. proportions of protein, fat and carbohydrate) in relation to the SES variables, certain patterns emerge. Percentages of energy from total, saturated and monounsaturated fats share the same predictors, which yield a positive association: employment for money, and medium and high education. Conversely, these fats are negatively associated with the lack of a fridge (with implications for storage of fats and SES). The predictors for polyunsaturated fats are different and not easily explained (this will be dealt with at a later stage). The percentage of energy from animal protein are also positively associated with employment, medium and high education, as well as increasing urban exposure (i.e. a profile of higher SES). Conversely, % energy from plant protein is negatively associated with these same variables (i.e. a profile of lower SES). Similarly, the proportion of energy from carbohydrate is negatively associated with these variables (also a profile of low SES) and positively linked with plant protein and lack of a fridge. Simply put, higher plant protein and carbohydrate intakes are associated with lower SES, while fat and animal protein intakes are associated with upward social mobility. Polyunsaturated fat appears as an anomaly, most probably since its usage is dependent of SES and specifically does not require refrigeration, which the other fats do.

Absolute intakes of macronutrients (expressed in grams) broadly reflect the same pattern reported above, especially with respect to animal protein, total fat, saturated and monounsaturated fats being positively associated with higher levels of education, employment and fridge ownership. Conversely, the nutrients, higher intakes of which are associated with the traditional diet such as carbohydrate, plant protein and fibre are increased, among those with no water supply and by default, low education. Carbohydrate and fibre intakes decreased with high urban exposure.

The models were not successful in predicting reported vitamin intake. This is shown by the particularly low % R^2 ($\leq$10%).

Table 5.39: List of models for absolute macronutrient intakes in 15 - 64-year-olds

VARIABLES	COEFFICIENT ESTIMATES		SE	R^2
Kcal	Intercept	43.83	0.52	0.12
Female gender		- 6.08	0.57	
No water supply		1.36	0.57	
Urban (medium)		- 1.83	0.71	
Protein	Intercept	7.4	0.30	0.11
Female gender		- 1.40	0.15	
Education (medium)		0.32	0.13	
Formal employment		0.35	0.14	
BMI		0.03	0.03	
Urban (medium)		- 0.41	0.17	
Animal Protein	Intercept	3.85	0.46	0.09
Female gender		- 0.94	0.19	
No fridge		- 0.46	0.20	
Education (high)		0.69	0.24	
Education (medium)		0.88	0.21	
Formal employment		0.66	0.18	
% Life spent in city		0.01	0.002	
BMI		0.04	0.02	
Plant Protein	Intercept	6.39	0.20	0.15
Age		- 0.02	0.004	
Female gender		- 0.75	0.10	
No water supply		0.36	0.10	
Education (high)		- 0.48	0.13	
Education (medium)		- 0.32	0.12	
Exercise (moderate)		- 0.22	0.10	
% Life spent in city		- 0.00	0.001	
Total Fat	Intercept	7.67	0.29	0.10
Age		- 0.02	0.006	
Female gender		- 0.74	0.15	
No fridge		- 0.64	0.17	
Education (medium)		0.42	0.15	
Formal employment		0.48	0.15	
Urban (high)		0.54	0.17	
Saturated Fat	Intercept	4.01	0.14	0.07
Female gender		- 0.53	0.09	
No fridge		- 0.36	0.10	
Education (high)		0.30	0.13	
Education (medium)		0.40	0.11	
Formal employment		0.30	0.09	
Polyunsaturated Fat	Intercept	3.11	0.14	0.08
Age		- 0.01	0.003	
Female gender		- 0.17	0.08	
Education (high)		0.32	0.11	
Education (medium)		0.34	0.09	
Urban (high)		0.38	0.09	
Monounsaturated Fat	Intercept	4.41	0.22	0.10
Age		- 0.01	0.004	
Female gender		- 0.45	0.10	
Use of electricity/gas		0.25	0.12	
No fridge		- 0.35	0.13	
Education (medium)		0.26	0.09	
Formal employment		0.33	0.10	
Urban (high)		0.34	0.11	
Total Carbohydrate	Intercept	17.2	0.40	0.15
Age		- 0.03	0.01	
Female gender		- 2.05	0.21	
No water supply		0.98	0.22	
Education (high)		- 0.48	0.24	
% Life spent in city		- 0.01	0.003	
Fibre	Intercept	4.87	0.16	0.10
Age		- 0.01	0.003	
Female gender		- 0.52	0.09	
No water supply		0.29	0.09	
Exercise (moderate)		- 0.31	0.09	
% Life spent in city		- 0.01	0.001	
Keys Score	Intercept	25.92	1.92	0.08
Age		0.09	0.04	
No fridge		- 5.62	1.02	
Education (high)		4.27	1.34	
Education (medium)		4.70	1.17	
Formal employment		3.70	0.98	

Table 5.40: List of models for macronutrients expressed as %E in 15 - 64-year-olds

VARIABLES	COEFFICIENT ESTIMATE		SE	R^2
Protein as % Energy	Intercept	13.27	0.59	0.05
Age		0.05	0.01	
Female gender		- 0.81	0.30	
No water supply		- 0.79	0.31	
Education (high)		1.01	0.42	
Education (medium)		1.17	0.36	
Unemployment		- 0.93	0.33	
Animal Protein as % Energy	Intercept	3.27	0.75	0.10
Age		0.06	0.01	
No water supply		- 1.11	0.39	
Education (high)		2.00	0.51	
Education (medium)		2.08	0.44	
Formal employment		1.49	0.37	
% Life spent in city		0.02	0.01	
Plant Protein as % Energy	Intercept	8.47	0.40	0.12
Age		- 0.02	0.01	
Female gender		- 0.03	0.17	
No fridge		0.77	0.20	
Education (high)		- 1.02	0.25	
Education (medium)		- 0.93	0.21	
Formal employment		- 0.55	0.18	
% Life spent in city		- 0.01	0.003	
Total Fat as % Energy	Intercept	24.53	1.36	0.15
No fridge		- 3.93	0.81	
Informal housing		- 1.92	0.83	
Education (high)		4.16	0.93	
Education (medium)		4.30	0.81	
Formal employment		2.18	0.66	
Urban (high)		3.03	0.77	
Saturated Fat as % Energy	Intercept	8.6	0.48	0.09
No fridge		- 1.50	0.30	
Informal housing		- 0.63	0.32	
Education (high)		1.22	0.35	
Education (medium)		1.30	0.31	
Formal employment		1.14	0.26	
Polyunsaturated Fat as % Energy	Intercept	5.88	0.39	0.08
Age		- 0.04	0.01	
Female gender		0.78	0.23	
Use of electricity/gas		0.52	0.25	
% Life spent in city		0.02	0.004	
Monounsaturated Fat as % Energy	Intercept	8.84	0.45	0.16
No fridge		- 1.85	0.36	
No water supply		- 1.12	0.34	
Education (high)		1.62	0.41	
Education (medium)		1.76	0.36	
Formal employment		0.98	0.29	
Urban (high)		1.34	0.34	
Carbohydrate as % Energy	Intercept	68.12	1.64	0.14
No fridge		3.00	1.10	
No water supply		3.00	1.04	
Education (high)		- 4.32	1.25	
Education (medium)		- 4.81	1.09	
Formal employment		- 5.21	0.90	
Urban (high)		- 0.06	0.01	

Table 5.41: List of models for micronutrient intakes in 15 - 64-year-olds

VARIABLES	COEFFICIENT ESTIMATE		SE	R^2
Vitamin A	Intercept	15.23	2.87	0.06
Use of electricity/gas		3.72	1.56	
No fridge		- 4.31	1.59	
Informal housing		3.18	1.55	
Exercise (high)		4.47	1.58	
Unemployed		- 3.20	1.27	
Urban (high)		4.70	1.35	
Vitamin C	Intercept	3.69	0.26	0.04
Education (high)		0.58	0.29	
Exercise (high)		1.73	0.39	
Exercise (moderate)		0.62	0.29	
Urban (high)		0.82	0.27	
Vitamin B_2	Intercept	1.02	0.02	0.06
Female gender		- 0.11	0.02	
Exercise (high)		0.06	0.03	
Unemployed		- 0.07	0.02	
Vitamin B_{12}	Intercept	1.34	0.11	0.05
Female gender		- 0.33	0.09	
Education (high)		0.31	0.12	
Education (medium)		0.35	0.11	
Unemployed		- 0.32	0.09	
% Life spent in city		0.003	0.001	
Vitamin B_1	Intercept	1.15	0.03	0.10
Age		- 0.002	0.001	
Female gender		- 0.14	0.02	
No water supply		0.06	0.02	
Education (high)		- 0.05	0.02	
Exercise (moderate)		- 0.05	0.02	
Calcium	Intercept	20.70	0.68	0.08
Female gender		- 3.41	0.46	
No water supply		- 1.44	0.49	
Formal employment		1.04	0.46	
% Life spent in city		- 0.02	0.01	
Folic acid	Intercept	10.68	0.32	0.07
Female gender		- 1.55	0.27	
Education (medium)		0.66	0.25	
Exercise (high)		1.01	0.35	
% Life spent in city		0.01	0.004	
MAR*	Intercept	0.93	0.01	0.03
Female gender		- 0.06	0.01	
No fridge		- 0.04	0.01	
Urban (low)		0.03	0.02	

* Mean adequacy ratio

In broad terms, indicators of high SES, particularly employment and educational status, are associated with increased intakes of nutrients linked to the western diet. Conversely, proxies for ***low*** SES are either negatively associated with these nutrients (i.e. fats and animal protein) or positively associated with nutrients pertaining to the traditional diet (i.e. carbohydrate, plant protein and fibre). To sum up, the data are consistent with the model (Fig. 5.1). The relatively low R^2 are consistent with other studies investigating nutritional status (e.g. Smith, *et al.*, 1983). This implies that as one would expect, there are many other factors which influence dietary intake.

APPENDIX D

DESCRIPTION OF THE DIETARY KIT

Equipment used and procedures followed

It was essential that each interviewer be equipped with whatever would be necessary to enable her to describe the dimensions of any possible food item. Additionally the requirements for such a kit were:

- that it should be small (i.e. not bulky), simple and practical
- it had to be lightweight
- and resilient (i.e. not easily broken or destroyed)
- it should represent foods, and especially food portion sizes, commonly consumed by the population under investigation
- it had to be subject to meaningful interpretation by both fieldworker and respondent

The contents of the dietary kit had thus to be developed and evolved in tandem with the questionnaire and its application, and actual food practices.

Three main categories of items were thus identified:

- food models of typical food portions
- measuring equipment to measure any possible set of dimensions
- receptacles (crockery) to accommodate food models and/or real foods

The Food Models

The use of food models has long been advocated in the literature (Moore, *et al.*, 19??refs) to reduce the frustration of respondents in their attempts to describe the dimensions of food items, and to ease the burden of interviewers. Furthermore, such models have permitted various degrees of standardization.

It was decided to use high density sponge at a very early stage in the refinement of the methodology. Ultimately three sizes of wedges representing `small', `medium' and `large' slices of pot bread, were included. An elliptically-shaped slice of foam was added, which could represent either a slice of pot bread (cut horizontally) or a piece of meat or fish. The smallest piece of foam represented 30g meat such as could be present in a stew. The five food models were numbered so that fieldworkers could identify them by just using a single number.

The sponge models were thus in a sense `closed-ended' and standardised, but consequently could potentially introduce bias (as people would tend to choose one of the sizes present). An `open ended' model in the form of a bag of popcorn was also included, as this very clearly resembled samp or crumbly mealie meal when heaped on to a plate. Since it was up to the respondent to heap the popcorn to represent a serving, the heap could be of any size. The fieldworker then recorded the volume of the heap using the measuring jug – later to be translated into gram weights in the coding phase.

For very similar reasons a bag of raw oats was also included to simulate items, which did not heap as much, for example rice. Versatile but meaningful usage of these food models was encouraged in combination with the measuring equipment (see below). All of them were lightweight and proved to

APPENDIX C

HANDOUT BEARING THE MRC AND UCT LOGOS

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Department of Community Health

Medical School
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MEDICAL RESEARCH COUNCIL
MEDIESE NAVORSINGSRAAD

MNR
MRC

When people who live in rural areas come to the cities they often get diseases of the cities. Their diet also changes. The result is that the blood pressure of people becomes raised, many more people smoke and fats in their blood increase. These conditions could lead to heart and other diseases in later years.

The University of Cape Town (and Medical Research Council) are concerned about these changes and want to study the black people of Cape Town to see to what extent these changes have occurred. This will enable us to plan ways to reduce these problems in Cape Town's black people.

About 1000 people will be chosen in a very scientific way from all the black people to take part in the study. If you are chosen, the nursing sister who is visiting you in your home will ask you questions on your background, diet and habits. She will weigh you, measure your height and blood pressure and take some blood samples. She will tell you if your blood pressure is raised. We will send you the results of you blood test (if you are willing to give your address).

~~~~~~

Xa abantu beshiya ubomi basezilalini besiza kuhlala ezidolophini baye bafumane izifo ezinxulumene nentlalo yasedolophini. Nendlela abatya ngaye ithi yahluke. Oku kubangela ukuba abantu bafumane izifo ezinjenge-high blood pressure ("i-high high") kuze neqondo lamafutha egazini lithi linyuke. Ezi meko zikhokelela ekubeni umntu afumane isifo sentliziyo nezinye izifo ezikwanjalo.

Iyunivesiti yaseKapa, isebenzisana nequmrhu eliphanda ngezempilo, iceba ukwenza uphando malunga nezinguquko zenzeka kubantu abantsundu abahlala kwisixeko saseKapa. Oku kuya kusinceda xa siceba iindlela zokunciphisa ezingxaka zabantu abantsundu besixeko saseKapa.

Malunga newaka labantu liya kukhethwa ngendlela engakhethe bani ukuze wonke abenake ukuthatha inxaxheba. Ukuba uye wakhethwa, lo sister ukundwendweleyo uza kukubuza malunga nentlalo yakho kunye nendlela otya ngayo. Uya kuthi athathe ubunzima bakho, abude kunye ne-blood pressure. Uya kuthi athathe nomlinganiselo ongephi wegazi lakho. Uya kuthi akwazise zangaba i-blood pressure yakho inyukile ukuze ubenakho ukuba ungafumana unyango. Siya kuthi sikwazise ngeziphume zovavanyo lwegazi (ukuba uyakuvama ukusinika i-address yakho).
~~~~~~

Table B2. The planned (*) and realised sample (**): number of women in different areas

	AGE GROUPS IN YEARS																
	< 19		19-22		23-24		25-34		35-44		45-50		51-54		55-64		Total
AREA	*	**	*	**	*	**	*	**	*	**	*	**	*	**	*	**	**
Guguletu houses	21	21	23	23	12	10	38	39	24	24	13	15	6	9	31	30	171
Guguletu hostels	2	2	1	1	1	0	6	0	1	2	1	1	0	0	0	0	6
Langa houses	7	6	10	8	4	3	16	14	13	10	6	5	2	2	7	4	52
Langa converted hostels	2	2	1	1	1	1	2	2	2	2	1	1	0	0	1	0	9
Langa hostels	2	2	2	2	0	0	2	2	2	2	1	1	0	0	1	1	10
Nyanga houses	3	5	4	7	1	2	7	5	3	8	1	1	1	2	3	4	34
Nyanga converted hostels	1	0	1	3	1	1	3	4	2	5	1	1	0	0	0	0	14
Nyanga shacks	1	1	1	2	0	4	2	12	1	5	0	0	0	0	0	1	25
Nyanga-west houses	2	1	2	1	0	0	2	3	1	1	1	2	0	0	0	0	8
KTC	1	1	1	1	1	2	2	2	2	2	1	1	0	0	1	1	10
Old Crossroads	4	2	4	4	2	0	10	5	7	9	2	3	1	1	2	3	27
Khayelitsha:																	
Village 1-4	12	12	11	8	8	7	29	24	18	19	5	6	1	0	2	5	81
Site C	8	5	8	10	5	2	20	25	11	12	5	10	1	0	1	1	65
Village 3,4 shacks	2	0	2	0	2	0	5	3	3	3	1	2	0	0	1	1	9
Greenpoint	4	2	5	5	1	1	11	7	7	5	2	1	0	0	1	2	23
Total	72	62	75	76	39	33	155	147	98	109	41	50	12	14	51	53	544

Table B3. Sample requirements (*) and realisation (**) of the sample age range 3 - 14 years

	AGE GROUPS IN YEARS													
	3 - 4				5 - 6		7 - 10		11 - 14				Total	
	Males		Females		Combined		Combined		Males		Females		Males	Females
AREA	*	**	*	**	*	**	*	**	*	**	*	**	**	**
Guguletu houses	13	14	11	13	15	19	37	36	17	20	19	22	59	65
Guguletu hostels	1	0	3	3	2	2	4	4	1	1	1	1	5	6
Langa houses	5	3	5	7	8	7	13	8	7	5	8	8	15	23
Langa converted hostels	1	1	1	0	1	0	1	1	1	0	0	1	2	1
Langa hostels	1	0	0	1	1	0	1	1	1	1	0	0	2	1
Nyanga houses	2	4	1	0	3	2	7	10	3	4	4	3	13	10
Nyanga converted hostels	1	1	1	1	1	2	4	4	1	1	1	0	3	6
Nyanga shacks	1	5	1	1	1	3	2	5	1	1	1	3	11	7
Nyanga-west houses	1	0	0	1	2	3	3	2	2	2	1	2	5	5
KTC	1	2	1	0	1	1	3	2	1	2	2	1	6	2
Old Crossroads	4	1	5	3	5	3	10	7	4	4	3	2	8	12
Khayelitsha:														
Village 1-4	8	7	11	7	15	16	28	24	12	12	12	12	38	40
Site C	8	7	7	4	8	8	18	19	8	5	8	8	25	26
Village 3,4 shacks	2	2	1	0	3	1	4	5	1	1	2	2	5	6
Greenpoint	3	2	6	2	6	4	12	6	6	3	3	1	10	8
Total	52	49	54	43	72	72	147	134	66	62	65	65	207	218 (425)

B.2 SAMPLE REALISATION AND WEIGHTING*

B.2.1. Sample realisation

The requirements of age cut-off points of the dietary survey made it necessary to have a minimum of 50 subjects in each of the age and gender strata. The *required* samples for men and women are given in Tables B1 and B2 respectively.

The *realised* samples for men and women in all the strata are also presented in Tables B3 and B4. From these Tables it can be seen that the Nyanga area was over-sampled by 71% according to the design, whereas the formal areas of Khayelitsha were under-sampled by 22%.

Table B1. The planned (*) and realised sample (**): number of men in different areas

	AGE GROUPS IN YEARS																
	< 19		19-22		23-24		25-34		35-44		45-50		51-54		55-64		Total
AREA	*	**	*	**	*	**	*	**	*	**	*	**	*	**	*	**	**
Guguletu houses	21	20	20	19	9	9	40	39	20	20	6	5	5	7	22	21	140
Guguletu hostels	1	1	2	3	1	0	6	8	8	8	4	2	1	1	5	4	27
Langa houses	7	5	7	6	4	2	14	10	8	8	3	3	1	1	3	1	36
Langa converted hostels	1	1	1	1	1	1	3	3	3	2	2	2	1	1	2	3	14
Langa hostels	1	1	2	2	1	4	4	2	3	3	2	2	2	2	3	2	18
Nyanga houses	4	3	4	3	1	4	4	5	5	5	2	3	1	0	4	3	26
Nyanga converted hostels	1	1	1	3	1	0	2	4	1	4	0	2	0	0	1	0	14
Nyanga shacks	1	1	1	3	0	1	2	4	1	2	1	2	0	1	1	2	16
Nyanga-west houses	1	1	1	0	0	0	1	1	2	1	1	0	0	0	1	0	3
KTC	1	0	1	1	1	1	1	3	1	1	1	1	0	0	0	0	7
Old Crossroads	5	3	3	5	2	2	6	2	8	7	3	6	1	0	2	1	26
Khayelitsha:																	
Village 1-4	12	10	9	6	6	3	21	9	17	10	6	5	2	3	4	4	52
Site C	8	5	6	6	2	4	14	12	11	10	4	2	2	1	1	1	41
Village 3,4 shacks	2	2	1	0	0	0	3	1	3	2	1	2	0	0	1	0	7
Greenpoint	4	4	4	2	1	1	7	5	7	1	3	1	2	1	1	0	15
Total	70	58	63	60	30	32	128	110	98	84	39	38	18	18	51	42	442

*Adapted from: Steyn, K. & Fourie, J. (Eds.) (1991). BRISK Study Methodology. Technical Report No. 1. Parowvallei, Medical Research Council.

APPENDIX B

TECHNICAL DETAILS OF SAMPLING

B.1 QUOTA LIST

An example of the quota list used in sampling is given below in Fig. B1

FIELDWORKER - 08

NAME : Sr. L. Bakana.

AREA : GUGULETU SECTION 1

BLOCKS : 1, 3, 5, ~~7~~, ~~21~~

TOTAL RESPONDENTS : 29

AGES OF RESPONDENTS IN SAMPLE

AGE	SEX	TOTAL	RECORD
3 - 4	Male	1	✓
3 - 4	Female	1	✓
5 - 6	Male or female	1	✓
7 - 10	Male ✓ or female ✓	2	✓ ✓
11 - 14	Male	1	✓
11 - 14	Female	1	✓
15 - 18	Male	1	✓
15 - 18	Female	2	✓ ✓
19 - 22	Male	1	✓
19 - 22	Female	1	✓
23 - 24	Male	1	✓
23 - 24	Female	1	✓
25 - 34	Male	2	✓ ✓
25 - 34	Female	3	✓ ✓ ✓
35 - 44	Male	1	✓
35 - 44	Female	1	✓
45 - 50	Female	1	✓
45 - 50	Male	1	✓
55 - 64	Male	1	[illegible]
55 - 64	Female	2	✓ ✓ ✓ Extra
65 +	Male	2	✓ ✓
65 +	Female	1	✓

TOTAAL 29 will do 30 Short of One

Figure B1: Quota list

Poster presentations at Scientific Meetings

1. Badenhorst, C.J., Steyn, K., Fourie, J.M., Jooste, P.L., Lombard, C.J. & Bourne, L.T. The haematology of urban adult Africans residing the Cape Peninsula, compared to standard reference values. ESSA Congress. Durban, 18-20 August 1993.

2. Katzenellenbogen, J., Steyn, K., Lombard, C.J., Bourne, L.T., Jooste, P. & Badenhorst, C.J. Urbanisation as a determinant of major risk factors for ischemic disease (IHD): The BRISK Study. ESSA Congress. Durban, 18-20 August 1993.

3. Nesamvuni, A.E., Badenhorst, C.J., Bourne, L.T., Kruger, M., Steyn, N.P., Lombard, C.J., Laubscher, J.A., Marais, M., Steyn, K. & Jooste, P.L. Iron status and dietary intake of adult blacks aged 15-64 years residing in the Cape Peninsula (BRISK Study, 1990). Southern Africa Nutrition Congress. Durban, 22-26 August 1994.

4. Bourne, L.T., Langenhoven, M.L., Höll, M.E., Steyn, K., Jooste, P.L., Fourie, J.M. & Truter, H. Food choices and macro-nutrient intake in an urban black population. Congress of the Nutrition Society of Southern Africa. Pretoria, 7-11 April 1992.

5. Langenhoven, M.L., Bourne, L.T., Steyn, K. & Jooste, P.L. The development of methodology for the BRISK study. Congress of the Nutrition Society of Southern Africa. Pretoria, 7-11 April 1992.

6. Badenhorst, C.J., Slazus, W., Steyn, K., Jooste, P.L., Lombard, C.J., Oelofse, A., Truter, H., Fourie, J.M. & Bourne, L.T. Prevalence of anaemia of urban adult black residents in the Cape Peninsula. Congress of the Nutrition Society of Southern Africa. Pretoria, 7-11 April 1992.

7. Bourne, L.T., Langenhoven, M., Steyn, K., Katzenellenbogen, J., Jooste, P., Lombard, C. & Badenhorst, C.J. Urbanisation and diet - an atherogenic transition. The BRISK Study. ESSA Congress. Durban, 18-20 August 1993.

8. Lombard, C.J., Badenhorst, C.J., Steyn, K., Fourie, J.M., Jooste, P.L., Bourne, L.T., & Nesamvuni, E. Percentile ranges for the haematology of urban adult Africans in the Cape Peninsula. ESSA Congress. Durban, 18-20 August 1993.

9. Badenhorst, C.J., Steyn, K., Fourie, J.M., Jooste, P.L., Lombard, C.J., Bourne, L.T. & Woodroof, C.W. The haematology of urban adult Africans in the Cape Peninsula, compared to Standard Reference Values. 15th African Health Sciences Congress. Nairobi, Kenya, 7-11 February 1994.

10. Vorster, H.H., Jerling, J.C., Steyn, K., Badenhorst, C.J., Bourne, L.T. & Jooste, P.L. Implications of plasma fibrinogen levels for coronary heart disease and stroke in the black population of the Cape Peninsula. LASSA Congress. Wildernis, 21-25 March 1994.

11. Nesamvuni, A.E., Badenhorst, C.J., Bourne, L.T., Kruger, M., Steyn, N.P., Lombard, C.J., Laubscher, J.A., Marais, M., Steyn, K. & Jooste, P.L. Iron status and dietary intake of adult blacks aged 15-64 years residing in the Cape Peninsula (BRISK Study, 1990). SASPEN Congress. Durban, July 1994.

12. Bourne, L.T., Langenhoven, M., Steyn, K., Katzenellenbogen, J., Jooste, P., Lombard, C. & Badenhorst, C.J. Urbanisation and diet - an atherogenic transition. The BRISK Study. Southern Africa Nutrition Congress. Durban, 22-26 August 1994.

13. Steyn, K., Bourne, L.T., Jooste, P.L., Fourie, J.M., Lombard, C.J. & Yach, D. Smoking in the African community of the Cape Peninsula, South Africa. 9th World Conference of Tobacco and Health. Paris, 10-14 October 1994.

14. Bourne, L. Over- and undernutrition in South Africa. Workshop on Urban Health Policy for Developing Countries. Johannesburg, 29-30 March 1995.

15. Bourne, L. The Nutrition Transition in a black South African Community. South African Sugar Association Nutrition in Transition Symposium. Midrand, 18-19 May 1995.

16. Nesamvuni, A.E., Badenhorst, C.J., Bourne, L.T., Kruger, M., Steyn, N.P., Lombard, C.J., Laubscher, J.A., Marais, M., Steyn, K. & Jooste, P.L. Iron overload in adult black men aged 15-64 years residing in the Cape Peninsula: Is it a problem? (The BRISK Study). 'Hands on' Nutrition Congress South Africa. 31 March - 4 April 1996, Stellenbosch.

17. Bourne, L.T., Badenhorst, C.J., Steyn, K., Langenhoven, M., Jooste, P.L. & Lombard, C.J. Anthropometry and related factors in the black population of the Cape Peninsula. 'Hands on' Nutrition Congress South Africa. 31 March - 4 April 1996, Stellenbosch.

APPENDIX A

BRISK PUBLICATIONS

1. Steyn, K., Jooste, P.L., Bourne, L., Fourie, J.M., Badenhorst, C.J., Bourne, D.E., Langenhoven, M.L., Lombard, C.J., Truter, H., Katzenellenbogen, J., Marais, M. & Oelofse, A. (1991). Risk factors for coronary heart disease in the black population of the Cape Peninsula. The BRISK Study. *S. Afr. Med. J.* **79:** 480-485.

2. Bourne L.T., Langenhoven, M.L., Steyn, K., Jooste, P.L., Laubscher, J.A. & Van der Vyver, E. (1993). Nutrient intake patterns in the urban African population of the Cape Peninsula. The BRISK Study. *Central Afr. J. Med.*, **39:** 238-248.

3. Bourne, L.T., Langenhoven, M.L., Steyn, K., Jooste, P.L., Nesamvuni, A.E. & Laubscher, J.A. (1994). The food and meal pattern in the urban African population of the Cape Peninsula, South Africa: the BRISK Study. *Central Afr. J. Med.* 1994, **40:** 140-148.

4. Bourne, L.T., Langenhoven, M.L., Steyn, K., Jooste, P.L., Laubscher, J.A. & Bourne, D.E. (1994). Nutritional status of 3 - 6-year-old African children in the Cape Peninsula. The BRISK Study. *East Afr. J. Med.* **71:** 695-702.

5. Steyn, K., Bourne, L.T., Jooste, P.L., Fourie, J.M., Lombard, C.J. & Yach, D. (1994.) Smoking in the black community of the Cape Peninsula, South Africa. *East Afr. J. Med.*, **71:** 784-789.

6. Sparling, P.B., Noakes, T.D., Steyn, K., Jordaan, E., Jooste, P.L., Bourne, L.T., Badenhorst, C.J. (1994). Physical activity patterns of black South African men in Cape Town. The BRISK Study. *Med. Sci. Sprt. Exerc.* **26:** 896-902.

7. Badenhorst, C.J., Fourie, J.M., Steyn, K., Jooste, P.L. Bourne, L.T., Kruger, M. & Slazus, W. (1995). The haematological profile of urban Africans aged 15 - 64 years in the Cape Peninsula (The BRISK Study). *East Afr. J. Med.* **72:** 19-24.

8. Oelofse, A., Jooste, P.L., Steyn, K., Badenhorst, C.J., Bourne, L.T.& Fourie, J. (1996). The lipid and lipoprotein profile of the urban black South African Community of the Cape Peninsula - the BRISK Study. *S. Afr. Med. J.* **86:** 166-169.

BRISK PRESENTATIONS

Papers presented at Scientific Meetings

1. Steyn, K., Jooste, P., Bourne, L.T. & Fourie, J.M. The risk factors of ischaemic heart disease in the black population of the Cape Peninsula - the BRISK study. The Seventh Congress of the Southern African Hypertension Society. Johannesburg, 24-26 April 1991.

2. Steyn, K., Jooste, P.L., Bourne, L.T. & Fourie, J.M. The risk factors of ischaemic heart disease in the black population of the Cape Peninsula: The BRISK Study. The Tenth Epidemiological Conference of the Epidemiological Society of Southern Africa. Cape Town, 7-11 July 1991.

3. Badenhorst, C.J., Steyn, K., Jooste, P.L. & Bourne, L.T. Haematological values and prevalence of anaemia in a randomised sample of urban adult black residents in the Cape Peninsula. The Tenth Epidemiological Conference of the Epidemiological Society of Southern Africa. Cape Town, 7-11 July 1991.

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since such subsidies can distort market forces in unexpected ways.

The urban context explored in this study provides certain opportunities for specific nutrition interventions. For example, the central processing of food items such as bread lends itself to fortification, the sale of street foods by hawkers creates the possibility of introducing healthier food options, and access to bulk purchasing at food markets could lead to coordinated efforts to make fruits and vegetables available at low cost.

The relatively low level of prediction of nutrient outcomes by the SES and demographic proxies investigated in this thesis, suggest that food choice is affected by many other variables not included in this study. The SES proxies are, for example, particularly crude as indicators of short term control over cashflow or short term income. Ethnographic research is, therefore, called for to investigate other underlying factors that may influence food choice and intra-household distribution. These may provide insights into other issues that operate around food, which may assist in the design of targeted strategies. This study by nature of its cross-sectional design, could not establish causal relationships between risk factors and outcomes. Neither could patterning of behaviours be investigated. This could be addressed by a series of studies over time, analysed in a similar way to the approach used by Patterson, *et al.* (1994).

The coexistence of under- and overnutrition and possible linkages between them have not been explained. An understanding of this may lead to ways of tackling these nutritional states jointly. Consequently, future research should be directed at this apparent paradox. Barker, *et al.* (1990) have advanced the hypothesis that poor maternal nutrition may result in low birth weight, and in turn the propensity to a variety of degenerative diseases in adult life, such as hypertension and cardiovascular disease (Barker, *et al.*, 1989), ischaemic heart disease (Barker, *et al.*, 1989; Barker, *et al.*, 1993) and diabetes (Barker, *et al.*, 1992). The poor nutritional status of women reported in this study and the approximate 10% prevalence of low birth weight observed in Africans (Chapter 2, subsection 2.5.1), suggest that local research investigating this hypothesis would be worthy of attention. Furthermore, nutritional surveillance now being planned should include an examination of both anthropometric extremes so that this can be monitored.

South Africa is experiencing a protracted transition with coexistences of infectious and chronic diseases, and under- and overnutrition. This has profound implications for the future patterns of morbidity and mortality that the country will experience. A knowledge of these expected trends will facilitate the planning of appropriate health care delivery.

It can be argued that nutrition education *per se* has little impact on food choices, since despite the many different approaches utilised in the past, these have met with little success in altering food habits among the poor. However, the great marketing successes in promoting nutrition-empty foods hold many lessons for health educationalists. For example, targeting the needs of individuals for status, power, strength and glamour are important tools in commercial advertising. Although there will always be budgetary constraints for health education, innovative, cost effective approaches should be sought. It may well be possible to seek collaboration with the food industry in the realm of 'social marketing' of legumes, fruits and vegetables, dairy products and cereals. Ethnographic research to supplement ongoing market research into food choice and behaviour may well provide useful insights into the way these healthy messages may be angled and targeted at risk groups, such as adolescents. This subgroup in particular, are subject to peer group pressure and are attracted to foods with contemporary appeal. Even very young children can be encouraged to 'take home' healthy eating messages in song or verse via, for example, the school feeding schemes now operating. In a recent national cross-sectional study of 2000 South African adults, 88% of respondents considered that knowledge of healthy eating should be attained during childhood, both at primary school and at home (Langenhoven, *et al.*, 1995).

It has been shown that despite evidence of low micronutrient intakes, there is little indication of clinical stigmata in this population. It is, therefore, debatable whether there are subclinical deficiencies (as suggested by the blood vitamin analyses) or wether even <67% RDA may be too high for certain micronutrients. These questions will remain, until appropriate prospective studies are undertaken.

Nevertheless, the very low micronutrient status reflected in all age groups examined in this study, highlights the possible need to address deficiencies in ways other than by encouraging dietary diversity, which may not address the extent of the problem. Consequently, the prospect of fortification of basic foods is being investigated by the Department of Health, in order to target the very low income groups. In turn, options are being sought regarding suitable food carriers, appropriate levels of nutrients and indeed which nutrients should be included. Currently vitamin A, iron, iodine and folic acid are receiving attention, in line with local research and international priorities. Such initiatives in collaboration with the food industry may make a partial contribution to improving micronutrient insufficiency in very impoverished subgroups.

The subsidization of dietary staples, such as bread has been advocated to alleviate the economic burden on the poor (Walker, *et al.*, 1995). However, this may not be appropriate (Bayley, 1995)

6.4 RECOMMENDATIONS

The health policy currently being developed, recognises the coexistence of undernutrition and 'diseases of lifestyle' linked to 'obesity-related diseases' (Department of Health, 1995). There is also a specific focus on maternal (including adolescent mothers) and child health. Consequently, there is a framework for policies and programmes to be designed from national down to district level, to address issues of at-risk groups raised in this study.

However, the design of appropriately targeted programmes and policies to tackle the problems of under- and overnutrition jointly presents a pressing challenge. The problem related to undernutrition may also prove to be somewhat easier to address, since there are well established strategies to combat these in the Primary Health Care approach embodied in the health policy. It can, however, be argued that the need for policies and programmes addressing adverse dietary shifts related to development require more innovative planning, since the issue of development-related disease control in situations of poverty essentially constitutes a recent phenomenon, not previously fully recognised. This applies not only to South Africa, but to developing countries worldwide. This is borne out in the recent WHO announcement, which has emphasised the global lack of attention paid to the prevention of such non-communicable diseases (NCDs) in developing countries, highlighting the human suffering and disablement induced by NCDs before they kill (WHO, 1996).

Clearly, therefore, there is a need to promote healthy eating patterns and healthy lifestyles. Nutrition education messages are required to address both deficit and excess, and there is an important requirement to do so in the context of poverty. Even in a western country such as Britain, the need for a policy on diet and low income has recently been highlighted (Martell, 1996). Although income was not ascertained in this study, in research conducted on squatters at Bester (in Durban), the average income of a family was given as R500 a month (Coutsoudis, *et al.*, 1994). This implied that for a family of five only about R300 a month would be available for food. Consequently, dietary guidelines need to set out, given available resources and local food preferences. Ways combining the type of information embodied in the prudent dietary guidelines, and RDA-based food group approaches need to be sought so as to produce a single dietary guideline. Given the fact that 'traditional' recipes still form part of the diet, the benefits of such can be emphasised, while simultaneously demonstrating healthy western type dishes and food choices. Several workers have argued that to improve compliance, dietary advice to the public should be scientifically sound, affordable, credible, realistic, practical, and culturally sensitive, with clear, simple, focussed, and moreover, positive messages (Harper, 1978; Harper, 1991; Black, 1987; Goldberg, 1992).

The quality of mortality data for the African population is poor, with severe underreporting, particularly in rural areas (Botha and Bradshaw, 1985). Consequently, only percentages of total deaths are provided for the country as a whole.

6.3 CONCLUSIONS

The dietary intake of urban Africans in Cape Town, while being micronutrient-deficient, is shifting from a prudent macronutrient profile with features of the traditional diet, towards an atherogenic western diet with only marginally improved micronutrient status. The literature from both developed and developing countries suggests that this is unlikely to reverse, and that diet will continue to contribute, together with other aspects of an urban lifestyle, to increased risk from degenerative diseases. Moreover, data from this study suggest that these dietary changes occur within a lifetime, and in view of recent changes introduced by the new government and the policies embodied in the Reconstruction and Development Programme (RDP), may well accelerate.

While this dietary pattern is increasingly conducive to chronic disease risk, it possibly also compromises immunity to infections. In the light of the poverty endemic in this population, the micronutrient inadequacies reported in this study may well persist for some time. Furthermore, the data point to increases in meat and fat intake beyond requirements with increasing urban exposure, and while fruit and vegetable consumption may increase (as suggested by the data), it is unlikely to more than double, to meet requirements in the near future. The fall-off in dairy intake, already inadequate, also raises concerns.

The complex picture of coexisting under- and overnutrition in preschoolers and adults respectively, presented by the anthropometric data, is consistent with international literature in developing countries.

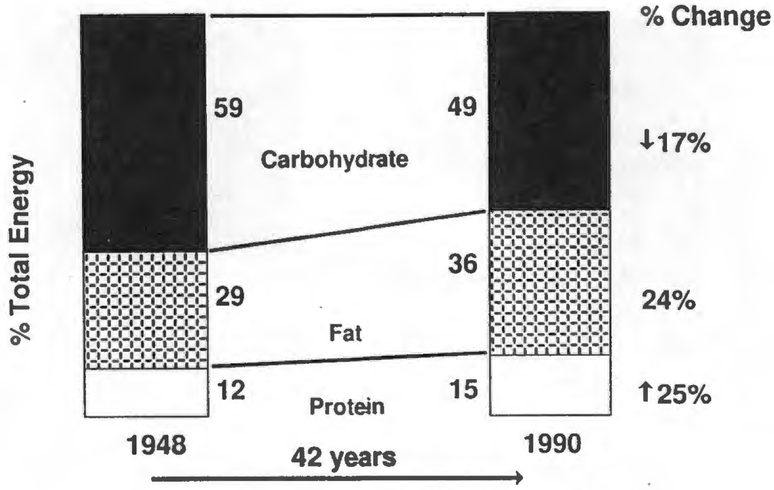

Fig 6.3: Changes in mean macronutrient profiles in Ireland, 1948 - 1990 (Department of Health, Ireland, 1990)

Concomitant with the changes depicted in Fig. 6.1, the literature has reflected increases in degenerative diseases associated with diet (Chapter 2, subsection 2.3.6.) In that section, increases in prevalence of hypertension, diabetes, cancers and lipid disorders among Africans were reported, and associated with urbanisation, industrialisation, 'western' lifestyles and increasingly atherogenic diets as well as low intakes of anti-oxidant micronutrients. Furthermore, certain chronic disease risk factors were noted even among young adults, thereby suggesting that these were not merely phenomena of the aging process.

In general, the African population in South Africa has displayed a trend in mortality indicative of the epidemiologic transition, with declining rates due to infectious diseases, and increasing rates of chronic diseases and in particular circulatory diseases. This is shown in Table 6.1 below.

Table 6.1: Mortality trends due to infectious and circulatory diseases in Africans, South Africa, 1951 - 1990

Year	% deaths from infectious diseases	% deaths from circulatory diseases
1951	22[illegible]	6.6
1970	13[illegible]	12.1
1990	11[illegible]	12.8

Data prior to 1951 were not available. (Sources: Bourne and Dick, 1979; Central Statistical Services, 1992)

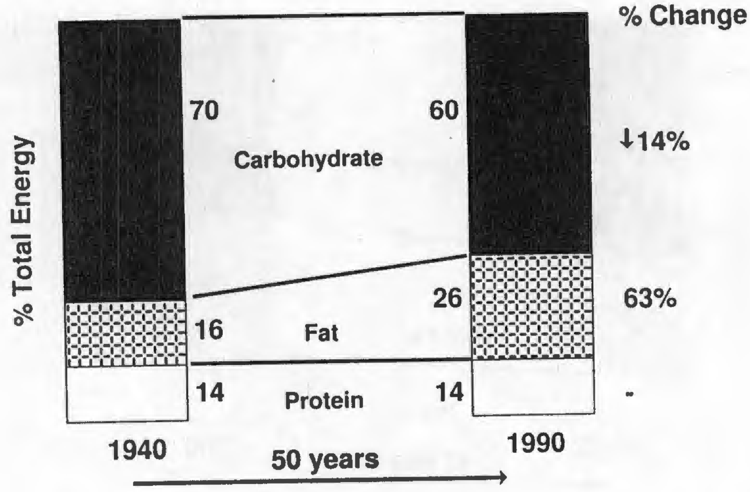

Fig 6.1: Change in mean macronutrient profiles in urban Africans 1940 - 1990

As can be seen, mean %E fat intake had increased by 63%, while carbohydrate intake had decreased by 14%, across a period of 50 years.

In contrast, the historical shift depicted below, in currently developed countries, has been observed from a base, which approximates that currently observed in the African population in Cape Town (see Figs. 6.2 and 6.3 depicting the U.S.A. and Ireland respectively). In these countries, these changes were accompanied by rapid industrialisation and economic growth (particularly in the U.S.A.). It would be reasonable to expect that with improvements in SES the negative changes in dietary intake in urban Africans will continue. However, the pace at which this may occur will be determined by the rate of economic development, and the success or otherwise of attempts by policies and programmes to address this transition.

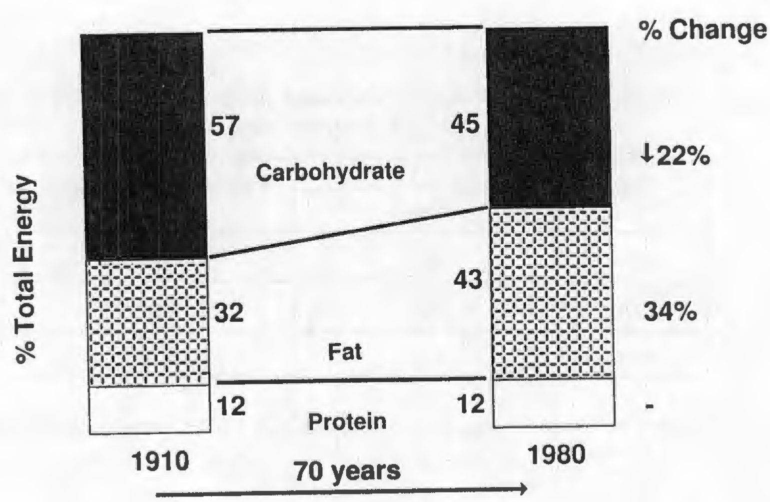

Fig 6.2: Changes in mean macronutrient profiles in the U.S.A., 1910 - 1980 (Danforth, 1985)

elucidated the important variables affecting dietary intake, the relatively low R^2 values did not permit the accurate modelling of dietary intake. In addition, this study did not examine the underlying behavioural mechanisms of dietary intake. The final multivariate procedure (correspondence analysis) placed levels of dietary atherogenicity in context with other risk factors for degenerative disease, assessed in the adult sample aged 15 - 64 years old. This again also reflected an association of high urban exposure and formal housing with higher dietary atherogenicity, while the more prudent scores were associated with low urban exposure, low educational status and informal housing. While men were associated with risk factors such as smoking and alcohol intake, they also reflected an absence of obesity and a relatively high level of physical activity. Women were associated with the presence of obesity and the reported absence of a smoking habit. Hypertension was associated with increased age.

6.2 DISCUSSION

The shift from a traditional to a western diet has been documented in developing countries worldwide, as has the coexistence of anthropometric under- and overnutrition (Popkin, 1994). This suggests that it is independent of culture and is a function of industrialisation, urbanisation and degrees of socio-economic development. Monteiro, *et al.* (1995) have linked these changes to the attainment of dietary sufficiency of energy and protein at a national level, after which rapid shifts in dietary composition occur. South Africa with its complex historical background and distorted demographic patterns, particularly affecting Africans, has unique features in terms of transition theory. Furthermore, it is not possible to demonstrate a period of 'national dietary adequacy'.

Nevertheless, there has been a transition in nutritional status. The frank deficiency stigmata and acute manifestations of marasmus, kwashiorkor, pellagra and ariboflavinosis documented in the Literature Review (Chapter 2, section 2.3) in the past have virtually been eradicated. Shifts in anthropometric status over time proved to be difficult to track, due to inadequate data, although there is evidence of increasing prevalence of obesity among African women to levels exceeding those in Western populations (Walker, 1995). Fig. 2.4 (Chapter 2) depicts fairly consistent changes in the structure of the diet in the direction of atherogenicity in urban Africans from a series of studies dating from 1940 (Fox, 1940), when nutrient data first became available. For purposes of contrast, a comparison of the 1940 study with that of the mean macronutrient profiles of 15 - 64-year-olds in the present study is illustrated below.

young children and women of childbearing age are profoundly influenced by their circumstances, unlike adolescents and adult men, who possibly exhibit greater independence in food choice and procurement when they are outside the home.

A negative aspect of higher SES (in terms of the above proxies), however, was the finding that diets were shown to be significantly more atherogenic than was the case in the lower SES subgroups. Percentages of energy (%E) derived from fats were significantly higher in all age categories of higher SES, while %E carbohydrate, and plant protein were significantly lower in certain subgroups. The Keys score was also significantly higher in preschoolers and adults, who were associated with the proxies for higher income.

Also consistent with the literature, were the findings that when dietary intakes were stratified by urban exposure in 15 - 24 and 19 - 44-year-old age categories, significant shifts in the composition of the diet were noted. The significant upward directions in fat intakes and downward movements in carbohydrates and fibre signify a shift towards a western diet with increasing urbanisation. This was also shown by significant increases in the Keys score with urban exposure. Sugar intake did not increase significantly, and reported alcohol intakes (%E) were too low to identify shifts. With respect to micronutrients, significance was only reached for vitamin A, which was positively associated with urban exposure.

Food group intake, as opposed to nutrient intake was also stratified by urban exposure (among 19 - 44-year-olds), in order to determine underlying shifts in food consumption patterns. As expected, there was an overall increase in intakes from the meat and fat groups and a downward shift in consumption from the cereal group. There was a disconcerting downward movement in dairy intake, which decreased by approximately 30%. However, fruit and vegetable intake increased strikingly by more than 50% with increasing urban exposure, indicating greater dietary diversity in this respect. A closer examination of the breakdowns of food groups reflected a downward shift in legume consumption. Furthermore, in the fat group increases in brick margarine (the main source of monounsaturated fat in this population), as well as oil and tub margarine were noted.

Multiple linear regressions (on 3 - 6-year-olds and adults aged 15 - 64 years) incorporating additional SES proxies, such as the presence or otherwise of a water supply, employment and educational status, further corroborated these shifts, thereby adding evidence of the movement towards a western diet from a traditional dietary pattern. While these regression analyses the RDA for many micronutrients, and even more so, the potential demands of pregnancy and lactation. In view of the relatively high teenage pregnancy rate (Chapter 2, subsection 2.5.2) and the high total fertility rate of 3.9 among African women, (Kaiser Foundation, 1991) women of childbearing age represent a specific at-risk group.

Comparisons of food group data with generally accepted requirements pointed to inadequate intakes of dairy products (≤0.5 portions) and fruits and vegetables (≤2 portions) in particular, in all age categories. Distributions of nutrient intakes throughout the day revealed that during 'snacking' periods, a considerable proportion of nutrients were consumed, particularly in the case of adolescents. The evening meal ('supper'), emerged as the main meal of the day in all age categories. A particularly disturbing finding was that on the day of recall, only 45% of preschoolers consumed three meals.

A complex picture of coexisting under- and overnutrition emerged from examinations of anthropometric data among 3 - 6-year-olds:

27.6% were 'stunted' (z-score <-2 height-for-age)
7.7% were 'underweight' (z-score <-2 weight-for-age)
7.9% were 'wasted' (z-score <-2 weight-for-height).

Somewhat paradoxically, 20.1% reflected a z-score >+2 for weight-for-height, reflecting a substantial proportion of obese children.

The presence of coexisting under- and overnutrition was also evident in the older age groups. Gender disparities in anthropometric status were apparent in 15 - 18-year-old adolescents. In young men, 39.7% were underweight (vs. 4.8% in women), while 30.6% of female adolescents were overweight (vs. 10.4% in men). However, anthropometric differences between the genders were particularly striking in older men and women (aged 19 - 44 years), whereby 31.2% of women were obese (BMI >30) as opposed to only 5.6% of men.

Bivariate analyses of selected proxies for higher SES (i.e. formal housing, gas/electricity used in cooking and presence of a refrigerator) were positively associated with higher intakes of micronutrients, especially with respect to vitamin A. The better micronutrient quality of diets were particularly influenced by these SES variables in the preschooler age group, and in women aged 19 - 44 years. Conversely, in adolescents of higher SES, micronutrient dietary quality was not significantly higher than those of lower SES. These data suggest that the quality of diets in very

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

This cross-sectional analytic study was designed to evaluate dietary intake and nutritional status in an urban African population. The interrelationships of dietary intake with SES and demographic indicators as well as measures of urban exposure were also examined. A further aim was to determine the extent to which this rapidly urbanising population is shifting from a traditional dietary pattern towards a western atherogenic diet.

6.1 SUMMARY OF FINDINGS

The results of this dietary study based on the 24-hour recall method reflect an urban population consuming a micronutrient-deficient, but essentially prudent diet, in the three age categories investigated (i.e. 3 - 6-year-olds, 15 - 18-year-olds and 19 - 44-year-olds). Mean macronutrient intakes of each age/gender category fell within prudent dietary guidelines. However, high percentages of subjects (i.e. > 25%) reported intakes < 67% RDA for a range of vitamins (i.e. vitamin A, thiamin, riboflavin, niacin, vitamin B_6, folic acid, vitamin B_{12} and ascorbic acid) in all age categories. Among adults aged 15 - 64 years old these 24-hour recall data were supported by biochemical analyses of blood samples for selected vitamins namely: thiamin, riboflavin, ascorbic acid, vitamin B_6 and vitamin E. Furthermore, for a range of micronutrients, approximately 50% or more respondents fell below two thirds of the RDAs in *all* age categories. These micronutrients were *viz.:* vitamin A, thiamin, riboflavin, niacin, vitamin B_6, ascorbic acid, calcium, iron, zinc and copper. However, there is no evidence of clinical micronutrient stigmata in this population.

Of the three age categories, the preschoolers were the least deficient, while the adolescent group (15 - 18-year-olds) reflected the highest proportion of individuals reporting micronutrient-deficient diets. In the case of the 3 - 6-year-olds, 39% fell below 67% RDA for energy, which together with low micronutrient intakes, suggested diets that were inadequate to support optimal growth. This was indeed shown by their anthropometric status. On the other hand, both female adolescents and adult women of childbearing age reported diets that were insufficient to meet two thirds of

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on Figs. 5.22, 5.23 and 5.24.

In addition, correspondence analyses were attempted with the above variables and individual nutrients. The same main clusters remained, however, no striking findings were made with respect to a particular nutrient.

5.3 OVERALL DISCUSSION OF MULTIVARIATE ANALYSES

In this section, bivariate analyses have demonstrated a positive association between higher SES and micronutrient quality. On the other hand, the higher SES subgroups consumed diets that were significantly more atherogenic and 'western oriented' than the lower SES counterparts. Dietary intake when stratified by '% life spent in a city', becomes increasingly atherogenic with increasing urban exposure. These shifts were apparent in both 15 - 24, and 19 - 44-year age categories and strongly suggest that westernisation of the diet occurs within a lifetime and is currently in a very dynamic phase of change. This becomes more evident when compared with shifts over the previous 50 years.

In multiple regression models the directions of change in macronutrient intakes were consistent with the bivariate data and the simplified 'traditional ➡ western' schematic model. Micronutrient data were more difficult to interpret and a low percentage of the variation was explained by the respective models. This can partially be attributed to the fact that micronutrients are derived across the food group spectrum. Conversely, macronutrient intakes (particularly when expressed as % energy) relate to the composition of the diet and it is this structure which is primarily subject to transition and, in turn, a shift towards greater degenerative disease risk.

The final correspondence analysis placed dietary atherogenicity in context with other risk factors for degenerative disease in this African population, also demonstrating that dietary status i.e. 'prudent traditional' or 'atherogenic western' is associated with other aspects of lifestyle, which contribute to degenerative disease risk. These findings are consistent with the fairly broad range of literature covered.

Dimension 1 determines the highest component of the chi-square information at 14.01% (from Table 5.44) and can be considered to represent a gender/education axis. (From Table 5.43 the coefficients of gender, smoking, alcohol intake and education had the greatest dispersion in dimension 1. Gender and education can reasonably be considered to be the best underlying descriptor of that dimension.)

Dimension 2 (12.58%) reveals an age axis, while dimension 3 (10.23%) can be considered to be an urbanisation and housing axis. The three axes, thus, collectively represent 36.82% of the chi-square information of the data.

As with the multiple regression analysis, this technique only again explains a relatively low proportion of the chi-square information.

Discussion of correspondence analysis

The interpretation of correspondence analysis is essentially a graphical one. A three-dimensional representation has resulted from the analysis. This is displayed in Figs. 5.22, 5.23 and 5.24 as the projection of the three dimensional space (of dimensions 1, 2 and 3 above) on to three two-dimensional plots. It should be noted that all the representation of the information is contained in any two of the three, two-dimensional plots. However, the representation of clustering is sometimes clearer in a particular pair of two-dimensional projections. Hence all three of the two-dimensional projections are included.

The highest quality indices were found for the variables age, gender and blood pressure, followed by smoking, housing and obesity.

The following association clusters were detected:

(i) Formal housing, 'western' diet and highly urbanised.
(ii) Informal housing, 'prudent' diet, low urban exposure, low education.
(iii) Male, no obesity, high exercise, alcohol consumption, smoking.
(iv) High blood pressure, higher age.
(v) Obesity, women, no smoking.

Because of the very low quality (0.01) of the MAR index, this variable was not included in the clusters identified above. These clusters are identified with the same roman numerals as above,

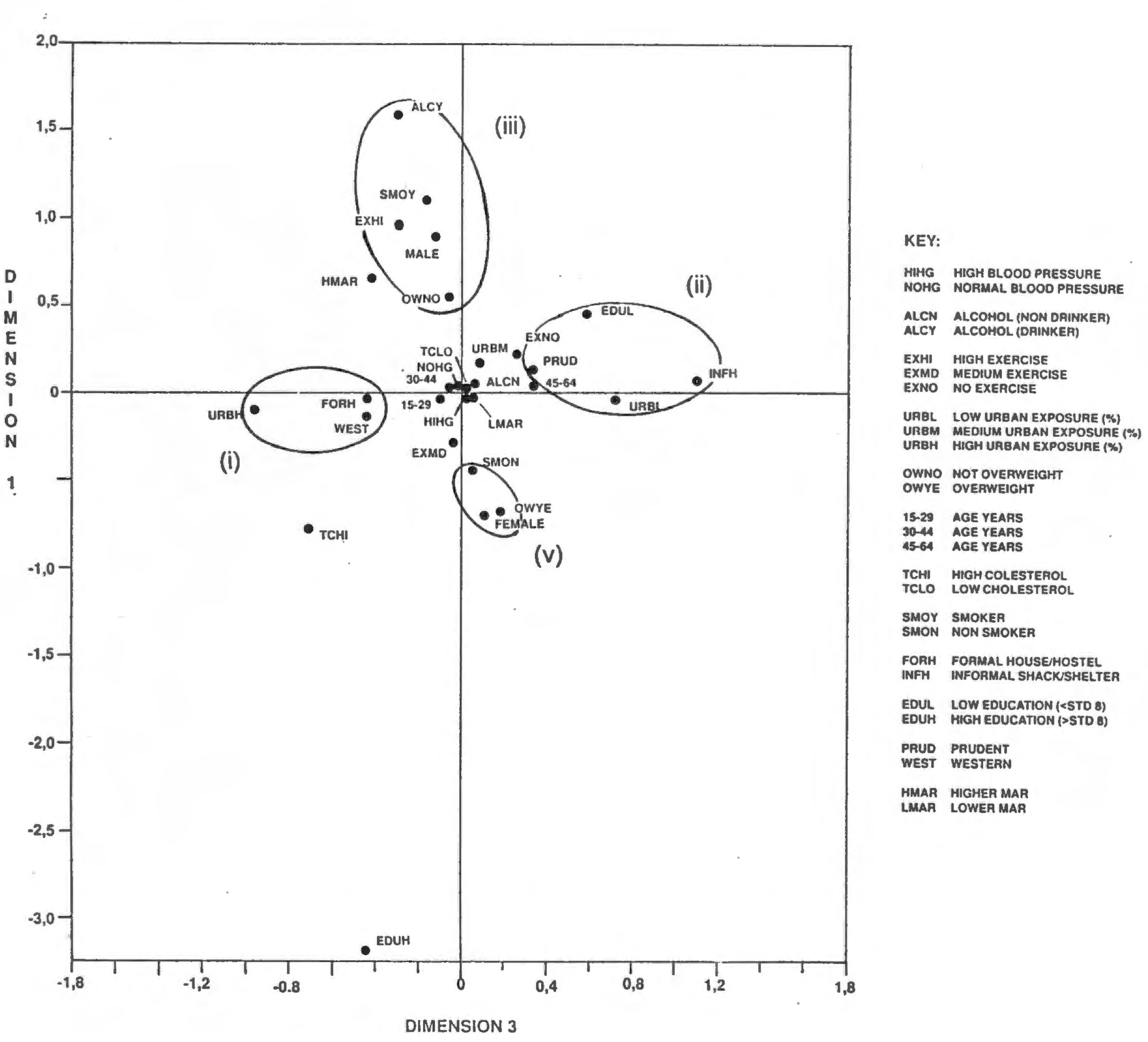


Figure 5.24: Graphical plot of correspondence analysis for 15 - 64-year-olds - Dimensions 1 and 3

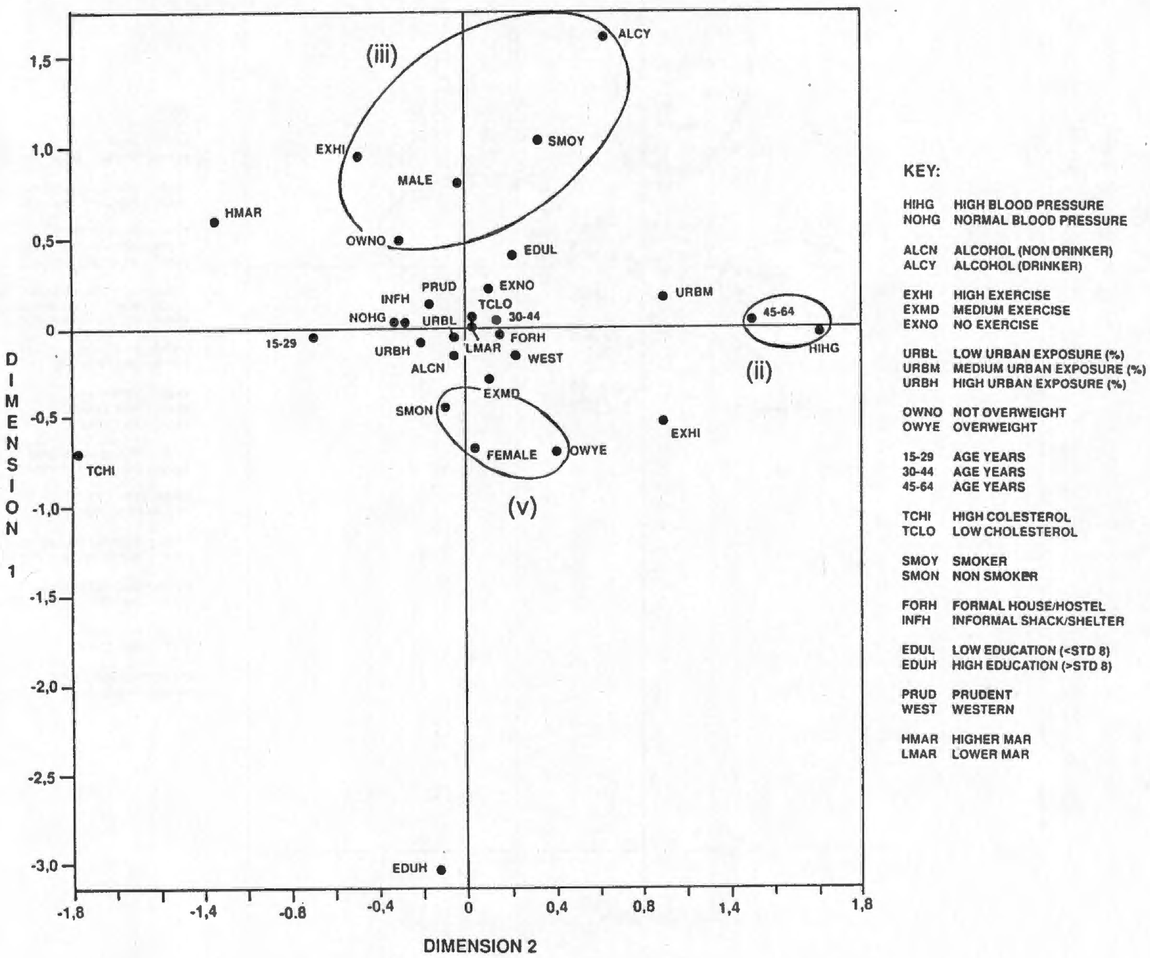


Figure 5.23: Graphical plot of correspondence analysis for 15 - 64-year-olds - Dimensions 1 and 2

Table 5.44: Chi-square decomposition of correspondence analysis

Dimension	χ^2	% χ^2
1	1615	14.01
2	1450	12.58
3	1180	10.23
4	842	7.30
5	776	6.73
6	735	6.38
Residual	4932	42.77
Total	11532	100.00

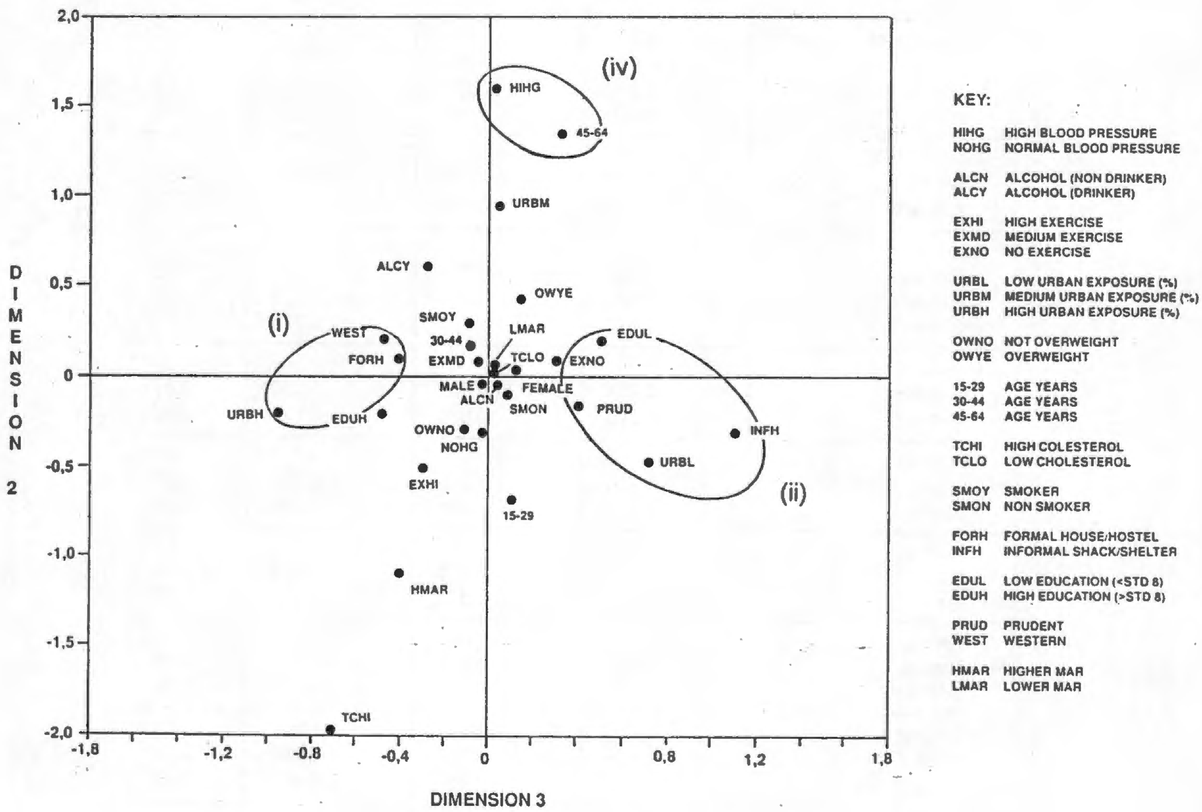


Figure 5.22: Graphical plot of correspondence analysis for 15 - 64-year-olds - Dimensions 2 and 3

The main results of the multiple correspondence analysis for 15 - 64-year-olds are presented in Tables 5.43 and 5.44 and Figures 5.22, 5.23 and 5.24. An interpretation of association can be made if points are found in approximately the same direction from the origin and approximately the same region of space. (Those points clustering around the point of origin have not been resolved in the analysis.) A three-dimensional space is used to represent the associative structure in the\data. The column quality in Table 5.43 represents the quality of the points representation on a scale of 0 - 1 (SAS Institute, 1989).

Table 5.43: Column coordinates and quality in correspondence analysis

Variable	Dimension 1	Dimension 2	Dimension 3	Quality Index
Blood pressure				
High	- 0.027	1.631	0.045	0.63
Normal	0.005	-0.325	- 0.009	0.63
Alcohol				
No	- 0.167	- 0.064	0.030	0.35
Yes	1.615	0.623	- 0.289	0.35
Exercise				
High	0.973	- 0.536	- 0.323	0.32
Medium	- 0.331	0.084	- 0.042	0.27
None	0.204	0.097	0.257	0.06
% Life spent in a city				
0 - 39	- 0.033	- 0.487	0.751	0.54
40 - 79	0.197	0.959	0.071	0.35
80 - 99	- 0.118	- 0.193	- 0.942	0.49
Obese (BMI)				
No <30	0.566	- 0.325	- 0.127	0.57
Yes ≥30	- 0.731	0.420	0.165	0.57
Age				
15 - 29	- 0.020	- 0.761	- 0.113	0.62
30 - 44	0.022	0.154	- 0.099	0.52
45 - 64	0.012	1.365	0.376	0.73
Gender				
Women	- 0.724	0.032	0.110	0.67
Men	0.895	- 0.039	- 0.163	0.67
Cholesterol				
High	- 0.796	- 1.948	- 0.703	0.27
Low	0.009	0.021	0.008	0.27
Smoking				
No	- 0.462	- 0.125	0.067	0.59
Yes	1.103	0.300	- 0.159	0.59
Housing				
Formal	- 0.028	0.155	- 0.460	0.58
Informal	0.066	- 0.371	1.100	0.58
Education				
< Std 8	0.425	0.201	0.599	0.46
≥ Std 8	- 3.339	- 0.160	- 0.477	0.46
Diet type*				
Prudent	0.132	- 0.183	0.384	0.34
Western	- 0.167	0.232	- 0.486	0.34
Diet quality				
Good (MAR)	0.668	- 1.156	- 0.420	0.01
Poor (MAR)	- 0.002	0.004	0.002	0.01

* Prudent = Keys score ≤ 28
Western = Keys score > 28

Results

In this study the multivariate indicator matrix used for the correspondence analysis consists of the 29 rows and 29 columns defined by the categories of the survey variables listed in the first column of Table 5.43.

Table 5.42: Variables used in correspondence analysis

Variable	Categories	Cut-off values	Description	Descriptive abbreviation
Blood pressure	High Normal	≥160/95 mmHg <140/90 mmHg	Hypertension Normotension	HIHG NOHG
Alcohol	No Yes		Non drinkers Drinkers	ALCN ALCY
Exercise	High Medium None		Strenuous exercise at work and in sport Non-strenuous exercise at work and in sport Sedentary	EXHI EXMD EXNO
Urbanisation	Low Medium High	0 - 39 40 - 79 80 - 100	Low urban exposure Medium urban exposure High urban exposure	URBL URBM URBH
Obesity	Yes No	BMI >27 M; >25 F BMI ≤27 M; ≤25 F	Overweight Not overweight	OWYES OWNO
Age	Years	15 - 29 30 - 44 45 - 64		15 - 29 30 - 44 45 - 64
Gender	Male Female		Male Female	MALE FEMALE
Cholesterol	High Low	High risk category†† No risk	'High' total cholesterol 'Low' total cholesterol	TCHI TCLO
Smoking	Yes No		Smokers Non-smokers	SMOY SMON
Housing	Formal Informal		Formal housing/hostels Informal shacks/shelters	FORH INFH
Education	Low High	< Std 8 (10 years schooling) >Std 8 (10 years schooling)	Low education High education	EDUL EDUH
Diet type*	'Prudent' 'Western'	Keys score ≤ 28††† Keys score >28	Lower Keys score Higher Keys score	PRUD WEST
MAR quality**	Higher Lower	≥67% RDA for 9 nutrients*** <67% RDA for 9 nutrients	Above median Below median	HMAR LMAR

* Assessment of atherogenicity (Keys score, Shekelle, *et al.*, 1981)
** Mean adequacy ratio (Guthrie and Scheer, 1981)
*** The 9 nutrients were: vitamins A, C, B_1, B_2, B_6, B_{12}, and folic acid as well as minerals, calcium and iron

†† Rossouw, J.E. *et al.* (1988). Action limits for serum total cholesterol: a statement for the medical profession by an *ad hoc* committee of the Heart Foundation of Southern Africa. *S. Afr. Med. J.* **73:** 693-700.

††† Using the Keys dietary score formula and the prudent guidelines, an 'ideal' prudent dietary score of 28 can be calculated (where S = 10%E, P = 10%E and dietary cholesterol = 300 mg/11.3 MJ. A high Keys score is an indication of a high saturated fat and cholesterol intake and a relatively low polyunsaturated fat intake.

5.2.2 Interrelationships of overall determinants of dietary intake, risk factors for degenerative disease, and nutrition-related outcomes (correspondence analysis)

Introduction

In correspondence analysis (Greenacre, 1984) an attempt is made to find a low dimensional graphical representation of the association between the rows and columns of a contingency table. It is an exploratory multivariate technique that converts frequency table data into graphical displays in which rows and columns are depicted as points.

Much of the value of correspondence analysis relates to its multivariate treatment of the data through the simultaneous consideration of multiple categorical variables. The multivariate nature of correspondence analysis can reveal relationships that would not be detected in a series of pairwise comparisons of variables. Correspondence analysis also helps to show how variables are related, not just that a relationship exists. The graphical display obtained from a correspondence analysis can help in detecting structural relationships among the variable categories (Hoffman and Frank, 1986).

Correspondence analysis also reduces the number of coordinates used to describe the data. These coordinates are calculated so that each successive coordinate axis accounts for a decreasing portion of the total association between the rows and columns as given by the chi-squared statistic. The first coordinate accounts for the largest part of the total associate, the second for the next largest part and so on. These correspondence analysis coordinates are similar to the principal components in a principal components analysis that partitions the total variance instead of the total chi-square (Dixon, 1988).

The results of correspondence analysis are usually displayed on a two- or three-dimensional graphical representation. To use correspondence analyses for the results of a survey such as the BRISK study, a multivariate indicator matrix had to be constructed for the survey variables of interest, and was analysed using multiple correspondence analyses. In order to establish categories for the variables used, the relevant technically defined cut-off values were taken into consideration, but the ultimate decision was based on the distributions of these variables.
The SAS statistical package was used for the analysis (SAS Institute, 1989). The data entered were in the categories of the variables listed in Table 5.42.

be very resilient.

The Measuring Equipment
These included:

- *A Ruler*: This was used to measure the diameter and thickness of round or cylindrical items or the length, width and thickness of other shaped items of other shaped items. Fieldworkers could use the ruler to ascertain the dimensions of items not conforming to the size of the models. For example if a piece of fish had been consumed which was `nearly' the size of the sponge slice, the subject could use the slice to indicate how small in comparison the item had been. The interviewer could then measure those dimensions. Thus the model in combination with the ruler could be used to determine `relative' size.

- *A Calibrated Measuring Jug*: This was used to measure the volumes of glasses, mugs and cups (using water) and to determine the volumes of `servings' of oats and popcorn.

- *A Ladle*: This was engraved with a graduated scale of volumes. Since almost every home possessed a ladle, this was used a great deal in assessing serving sizes.

Crockery Included
Essentially these items were added to the kit to initiate the process of recreating meals and to help ease any mess involved. Interviewers then invited respondents to bring forward their own crockery after demonstrating how they would be used. It was important for example, that the plate actually used by the subject be produced, as many individuals have a mental picture of a portion relative to the size of the plate. Clearly volumes of glasses and mugs could also be more accurately measured, using the actual ones used by the respondent.

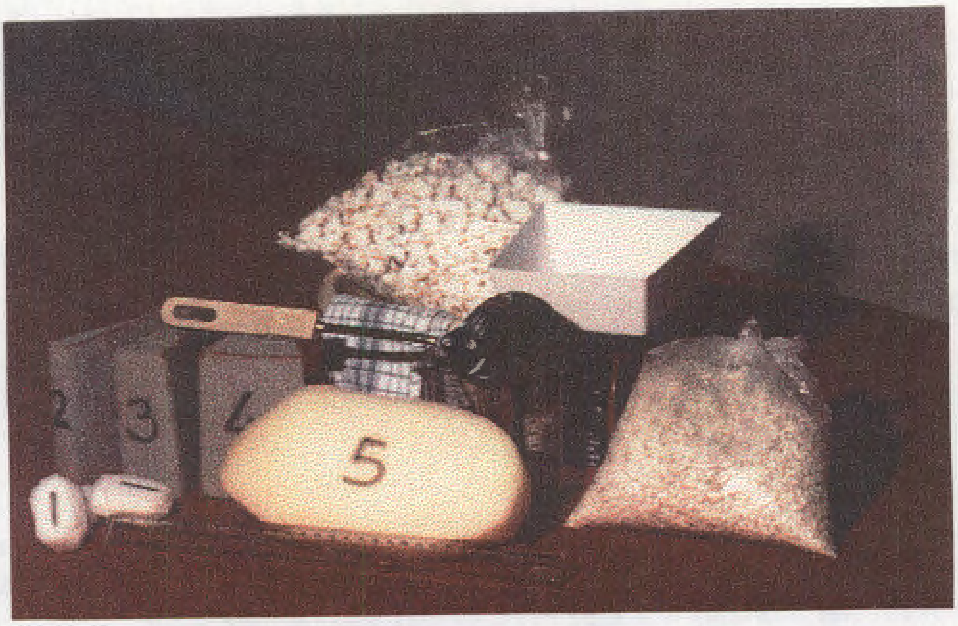
A plate and a 'typical' mug were included in the kit to serve as back-up equipment in the event of no crockery being available at the time. Since fieldwork was conducted in the evenings when supper was being prepared and served, this situation did arise.

IN SUMMARY THE COMPLETE DIETARY KIT COMPRISED:

5 numbered sponge models of various sizes (to simulate pot bread, pieces of meat, fish etc.)
1 pack of popcorn (to simulate servings of samp and beans, mealie meal etc.)
1 pack of oats (to stimulate servings of rice, soft mealie meal etc.)
1 ruler
1 calibrated measuring jug (250 ml)
1 ladle engraved with a graduated scale of volumes
1 small scale calibrated up to 2 kg
1 plate (to act as a receptacle for spooned servings)
1 bowl
1 mug
1 tea towel

The fieldworkers had to carry this kit together with a bag containing other equipment, stationery and questionnaires.

A photograph of the dietary kit appears below, together with a separate photograph illustrating how the kit was used to depict real foods and/or measure dimensions of foods.



APPENDIX E

MEAL SIMULATION EXERCISE

A discussion group was convened by the author prior to the survey for a practical exercise on portion size and meal simulation. The group consisted of nutrition researchers (3 including the author), community nutritionists (2), and 3 Xhosa-speaking lay 'nutrition advisers', who lived and worked in the African residential areas. Additionally two African women (both mothers of several children) were invited to provide input. This group therefore represented a cross-section of researchers, nutritionists actively working in low income areas, nutrition-oriented community workers and independent members of the African community. A larger group could have proved unwieldy for focused discussions and could not have been accommodated within the time and physical constraints.

The aims of this exercise were:

(i) to supplement the information gleaned from attending meals in various homes
(ii) to discuss 'typical' foods consumed in various contexts and to ascertain how the context determined portion sizes
(iii) to gain insights into methods of preparation and recipes utilised, particularly with respect to traditionally oriented foods
(iv) to identify appropriate food codes for various items and to create new codes where necessary
(v) to have visual images and measurements of food items constituting meals to assist in the development of appropriate food models
(vi) to identify areas of bias with respect to status, and possible sources of under- and over reporting.

Twenty food items were identified, which members of this group prepared freshly and brought to a central venue. The foods that are normally eaten hot were heated so that they resembled the foods as they are consumed. Sufficient quantities were prepared to make it possible for portion sizes of 'family members' to be dished out and weighed.

The sequence of 'meals' or periods during the day when food is typically consumed was followed. Consequently the concept of 'breakfast' or the first meal period of the day was the point of departure, ending with the last structured meal ('supper'). All comments and opinions were noted and summarised in a report. This report consequently consists of observations made within this group. It was subsequently noted that these observations were remarkably consistent with those gleaned in individual homes supporting the anecdotal and scientific evidence that low income African families consume a relatively narrow range of foods (Richardson, *et al.*,1982), on a repetitive basis depending on cash flow circumstances.

For the portion size determinations a reference family was taken as :

Mother
Father
Son (14 - 16 years)
Daughter (10 - 12 years)

1. BREAKFAST

It was estimated that most of the people *did not* eat breakfast. These were mainly working people, but many were also school children. Most individuals, however, had tea or coffee on rising, prepared with fresh milk or creamer and sugar. Those people who *did* eat breakfast (mainly women and small children):

— *Bread* was commonly eaten
— *'Vetkoek'* (deep fried balls of refined flour and water raised with yeast) was a popular choice. Unfortunately 'vetkoek' was not included in this exercise, however, see attached report.
— Of the porridges, thin maize meal porridges (*'Isidudu'*) was the most popular, with *oats* being a second choice

1.1 Bread

Most people in Guguletu, Nyanga and Khayelitsha make their own bread — very often it is steamed (pot bread), but is sometimes baked in the homes, which have ovens. It was estimated that most people in Langa buy bread. However, it must be noted that a large proportion of Langa's residents live in hostels with limited cooking facilities.

1.1.1 *Pot bread (made in 22 cm diameter pot)*

Mother:	2 slices @ 92 g each Margarine 10 g each Jam 13 g each
Father:	2 slices @ 118 g each Margarine 12 g each Jam 20 g each
Son:	2 slices @ 140 g each Margarine 26 g each Jam 28 g each
Daughter:	2 slices @ 127 g each Margarine 14 g each Jam 25 g each

1.1.2 *Shop bread (purchased whole, not sliced)*

Mother:	2 slices @ 64 g each Margarine 7 g each Jam 5 g each
Father:	2 slices @ 62 g each Margarine 16 g each Jam 5 g each
Son:	2 slices @ 106 g each Margarine 17 g each Jam 19 g each
Daughter:	2 slices @ 46 g each Margarine 9 g each Jam 4 g each

1.1.3 *Soft maize meal porridge ('Isidudu')*

Mother:	344 g porridge 12,5 ml sugar 25 ml milk
Father and Son:	740 g porridge 12,5 - 37,5 ml sugar 25 ml milk
Daughter:	240 g porridge 12,5 ml sugar 25 ml milk

2. LUNCH

This is usually bread or 'vetkoek' if the person is *away* from home. Those who *remain at home* may also eat bread or 'vetkoek' but very often eat the left-overs from supper, such as stiff maize meal, samp and beans, rice, etc. These may be accompanied by meat, mince or eggs if available.

One dish *only* eaten as a lunch dish is '*Isigwampa*' (maize meal with greens). It is not traditionally considered suitable for the evening since it is considered to be 'female' food. Spinach is most commonly used as the green component in the urban areas, as it is not feasible to scour the veld for '*imifino*' (greens).

Four varying proportions of maize meal to spinach were prepared. Each adviser independently chose the 4 : 1 (4 cups raw spinach to 1 cup maize meal) as the most likely combination, but stated that an even higher proportion of greens is preferred. Though not strictly traditional, ingredients such as stock cubes, Aromat, Holsum or margarine are usually included. Sometimes mealie rice is added to the mixture. This dish is consumed *communally*, i.e. each person present would eat from one container or plate and hands would be used for eating (i.e. no utensils). However, a 'typical' amount eaten would be in the region of 320 g.

Note: Apparently some men do eat '*Isigwampa*', but would never admit this to friends and therefore perhaps not to an interviewer.

3. SUPPER

3.1 '*Umqa wethanga*' (stiff maize meal and pumpkin)

There were reports of this being a lunch dish only, but subsequently it appeared that this could be eaten as a supper dish as well. Traditionally it was considered also to be a 'female' dish, but it has now gained acceptance among men. Of the ratios of maize meal to pumpkin available the advisers independently chose the one with the highest proportion of pumpkin (2 cups pumpkin : 1 cup maize meal). However, they stated that an even higher proportion of pumpkin would be preferential; as high as 6-8 : 1. It seems as though this dish would not be prepared if there was insufficient pumpkin — if there was too little pumpkin it would be served as a separate vegetable.

Usually a little salt is added, and only enough sugar 'to make it tasty', not sweet. If '*Umqa wethanga*' is eaten on its own, since the consistency is soft, it may be served out and eaten with a spoon. A likely portion size for an adult woman would be 400 g with more for males and less for female offspring.

3.2 **Samp '*Umnqgisho*'**

This is a popular supper dish, which can be served with fresh milk, *amasi* (soured milk) or meat and vegetables. If eaten with milk, the portion sizes would be as those listed for '*Umphokogo*' (see 3.6 below). If eaten with meat and vegetables, portion sizes would depend to some extent on the amounts of meat and vegetables available, but would be of the same order of magnitude as listed above. However, the samp, if eaten in this way, would be 'softer' than when eaten with milk and may include spices (monosodium glutamate [MSG], curry powder) or fats (oil, Holsum [a marine and vegetable oil based solid cooking fat], margarine).

3.3 **'*Umnqgusho*' (samp only or samp and beans)**

There was confusion as to the use of the above term, since the same word was used to specify samp only or samp and beans. Strictly speaking '*Umnqgisho namboytji*' signifies samp and beans, but colloquially the first word '*Umnqgisho*' is used for both dishes.

Comment: Interviewers should probe to determine exactly what was consumed.

Differing proportions of samp to beans were prepared, and the ratio independently chosen by the advisers to be representative was the 1 : 1 ratio ('many' beans). However, they did point out that many people bought the commercially packaged mix, which has a ratio of 1 part beans : 5 parts samp (few or 'little' beans).

Many people add stock, MSG, curry powder, oil, Holsum or margarine to the mixture thereby elevating sodium and fat contents to this dish.

3.3.1 *'Umnqgusho' (samp and beans) only*

The following portion sizes were indicated if this dish was eaten on its own:

Mother:	580 g
Father:	750 g
Son:	740 g
Daughter:	485 g

3.3.2 *'Umnqgisho' (samp and beans) as a side dish (served with meat and carrots and/or cabbage*

Mother:	220 g
Father:	330 g
Son:	400 g
Daughter:	250 g

3.4 **'*Umqa*' (stiff maize meal)**

This may be eaten on its own or with vegetables, or if possible with meat, fish or offal and vegetables.

'Umqa' as the main dish

Mother:	410 g
Father:	540 g
Son:	700 g
Daughter:	220 g

'*Umqa*' is perceived by some (especially when it is consumed on its own) as a symbol of abject of poverty. Sensitive probing is required.

3.5 **Meat**

	Meat portion (with bone)	*Potato*	*Gravy*
Mother:	90 g	80 g	+ 15 ml
Father:	170 g	65 g	+ 15 ml
Son:	130 g	45 g	+ 15 ml
Daughter:	100 g	60 g	+ 10 ml

Comment: Meat, fish and chicken are seldom eaten during the week by the middle and lower income families, so interviewers should be aware of this status bias.

3.6 ***'Umphokoqo'* (crumbly maize meal porridge)**
This can be eaten as a lunch or supper dish but is more frequently eaten in the evening. Because it is eaten cold with fresh or sour milk it tends to be eaten only when the weather is hot.

	'Umphokoqo'	*'Amasi' (sour milk)*
Mother:	430 g	700 ml
Father:	630 g	520 ml
Son:	680 g	±1000 ml (1 litre)
Daughter:	380 g	380-450 ml

3.7 ***'Isophu'***
A meal of soup and bread would be a popular choice for a winter supper. The composition of the soup would vary widely depending on whatever is available. Samp, vegetables, 'soup' bones, stock cubes are commonly added.

It would be served in mugs in the following volumes:

Mother:	2 x 350 ml
Father:	3 x 350 ml
Son:	3-4 x 350 ml
Daughter:	1 x 350 ml

The standard enamel mug commonly used, holds a volume of 350 ml (400 ml when filled to the brim).

4. MISCELLANEOUS DISHES

4.1 **Mealie rice** is not eaten as such, but is used as an ingredient (e.g. in '*Isiggwampa*' and '*Isophu*').

4.2 **Stamped wheat** is not commonly consumed.

4.3 ***'Amarewu'* (fermented maize meal drink)**
All members of the family drink this at any time of the day on any day. It is also a *must* for a funeral.

4.4 ***'Iinkobe'* (boiled whole mealie kernels)**
This is eaten only at funerals and is a traditional 'must' . It is eaten by the handful i.e. ± 15 g per handful.

5. SNACKS' AND 'MEALTIMES'

It was of interest to note that there is no direct translation of the word 'snacks', which suggests that the concept as we know it does not exist among the urban Xhosa. In fact, in the urban context, the concepts of 'breakfast' and 'lunch' are also unclear, because individuals in a household may have widely differing routines, and tend to eat when it is convenient and if/when food is available. Certainly an effort is made to serve an evening meal to the whole family, and a great effort is made to serve meat (mainly chicken) with a large meal on a Sunday.

However, additional foods eaten during the day are:

sweets
fizzy drinks
cordials
sandwiches
'vetkoek'
chicken feet
peanuts
polony
beer (commercial and home-brewed)
spirits

Concluding remark: Interviewers should therefore structure the day with respondents, linking intake to activities rather than to 'meals'. Definitions should be determined for the times of the day on the questionnaires.

REFERENCE:

Richardson, B.D., Sinwell, R.E. & Rantsho, J.M. (1982). The variety of food items consumed by different child populations in South Africa. *Ecol. Food Nutr.* **12:** 29-32.

APPENDIX F

COPY OF THE DIETARY QUESTIONNAIRE

Office No.

IV. DIETARY INFORMATION

| | | | | | | | 6

| 0 | 5 |

Interviewer: | | |

Sequence number | | | | | | | | | | 13

Date:

We now change to questions on food.

1. Do you eat your food:

well salted?	1
OR lightly salted?	2
OR not salted?	3

2. Do you add EXTRA SALT OR AROMAT/FONDOR to your serving of food?

No, I never add extra salt/Aromat	1
Yes, but TASTE FIRST and then add	2
Yes, even BEFORE having tasted the food	3

3. Do you eat salty snacks more often than three times per week (i.e. luxuries such as chips, niknaks, salted peanuts, salty biscuits, biltong, dried sausage)

Yes=1	No=2		16

4. How many eggs do you usually eat per week (7 days)?

Do not eat eggs = | 0 | 0 | | | | 18

5. How are these eggs usually prepared, and at what meal are they usually eaten?

	N/A	Break-fast	Lunch	Evening meal	Between meals		
Fried in oil	0	1	2	3	4		19
Fried in margarine	0	1	2	3	4		
Fried in dripping/butter	0	1	2	3	4		
Boiled	0	1	2	3	4		
Scrambled	0	1	2	3	4		
Egg dish (eg omelette, specify: ....)	0	1	2	3	4		24

6. Do you usually eat the fat on meat? (Do not mention the options)

Yes=1	No=2

Eat only lean meat | 3

Do not eat meat | 4 |

7. Do you eat the skin of chicken (all poultry, duck, turkey)?

Yes=1	No=2

Do not eat poultry = 3		26

8. How often did you eat the following during the last week? (7 days)

Cheese 27
Fish (fresh and tinned) ....
Chicken (excluding chicken feet) ....
Beef, mutton, pork (including mince, sausage) ....
Liver, kidney, brains ....
Offal (including tripe, pootjies) ....
Cold meats (polony, viennas) ....
Peanut butter ....
Dried beans, peas, lentils (excluding soup mix) ....
Nuts (eg peanuts) 36

9. What fat is used mainly for:
Please tick appropriate column and supply brand name.

NO FAT = 0

	Butter (Brick)	Marg. (Brick)	Marg. (Tub)	Marg. (Tub) (Med.fat)	White Marg. (Holsum)	Oil	Lard Drip-ping		
Frying	1	2	3	4	5	6	7		37
Roasting and stewing	1	2	3	4	5	6	7		
Making cake and bread	1	2	3	4	5	6	7		
As spread	1	2	3	4	5	6	7		
In gravies	1	2	3	4	5	6	7		
With cooked vegetables	1	2	3	4	5	6	7		42

If in doubt, please comment ....
....
....

24 HOUR - RECALL - BRISK 1989

Person number

0	6

Record all food items consumed yesterday in ml or household measures accurately, and as neatly as possible
Use a new line for each item.

Yesterday was ....day

Time of day	Food Item	Amount	Preparation: Homemade, commercial, raw, canned, boiled, fried, baked	Home (H) or Away (A)
From waking up till ± 9 o'clock				
Midmorning (9-12)				
Lunch (± 12-2)				

APPENDIX G

FIELDWORKER TRAINING MANUAL

1

BRISK FIELDWORKER MANUAL

INTRODUCTION

This manual is to help you (the BRISK fieldworker) both during the training and while you are in the field.

Your work as a fieldworker will involve the following tasks:

(1) Finding specific sites (plots) in the townships which have been chosen for the study.

(2) Selecting people for the study from the site once you have found it.

(3) Asking these people questions from the questionnaire.

(4) Drawing blood samples from the participants.

(5) Taking measurements from the participants. These will include mass, height, mid-arm circumference and blood pressure.

This manual is a guide to the methods and rules you will use for all these tasks except that of administering the questionnaire. You will be given a separate manual for this.

SAMPLING INSTRUCTIONS

Selecting specific sites and people for the study in the correct way is just as important as asking questions and taking measurements and blood correctly. The process of selecting people for a study is known as sampling.

WHAT IS SAMPLING?

When we do research we want to find out information about a specific group of people. We call this group the study population. In the BRISK study, the study population is all the people who live in the black townships of Cape Town (about half a million people).

We want to find out as much about the study population as possible regarding the subject we are researching. One way of doing this would be to interview every person in that population. In the BRISK study this would mean interviewing everyone in the black townships of Cape Town! Obviously this would be impossible as it would be very difficult to find everybody and would take too much time and money.

A more practical way to get information is to select people from a population who best represent that population as a whole. This is called sampling and can be just as good as using the whole population if done correctly. The group of people chosen for the study is called the sample.

Different methods can be used to select a sample from a population. The methods used depend on many things such as the size of the population and the subject being researched.

THE BRISK SAMPLE

The sample for BRISK has already been selected. There are about 1 500 people in the sample.

The sample has been selected so that the people to be interviewed are spread out evenly over the townships.

The sample has also been chosen so that a specific number of men and women of different ages is included. The numbers of men and women in each age category are called quotas. You will read more about quotas later in the manual.

The sampling has been designed in theory but the fieldworkers will make sure it is carried out in practice. The methods and rules in this manual have been worked out to help you to do this. Following these methods and rules may at times seem difficult and unnecessary, but the success of the study depends on it.

SAMPLING METHODS AND RULES

We will now discuss how you will go about sampling.

Sampling will involve: (1) Finding a marked site in the township.

(2) Selecting people from the site.

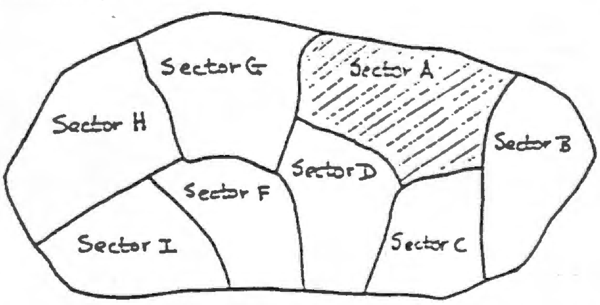
(1) Finding a site

The sites are plots which have been chosen for the study and have been marked on housing maps of the townships. They are mainly township houses. However you will also be visiting some hostels, converted hostels, shacks and squatter areas. The instructions below are for the housing areas. We will discuss methods for the other areas later.

This is how the sites for the study have been marked on the map. You will need to understand what we mean by the words sector, block and site. The drawings below will help you with this.

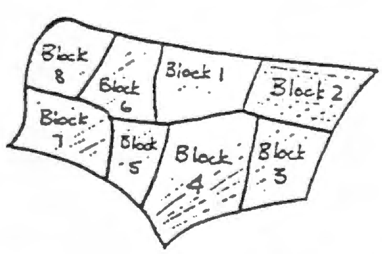
(1) Each township eg Guguletu, has been divided on the map into a number of sectors:

Guguletu:



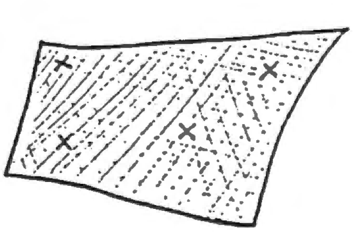
(2) Each sector contains a number of blocks:

eg Sector A:



(3) Four sites have been selected and marked in each block:

eg Block 2:



<u>This is how you will work:</u>

You will work in teams of four fieldworkers and each team will have the use of a car.

Each team will work on one sector at a time.

The team will drive to the sector and then to one of the blocks in that sector.

Each team member will then visit one of the four marked sites in the block. These sites will be the starting points from which you will look for people for the study. When the interviews for the block have been done, the team will move on to the next block in the sector and so on until all the blocks in the sector are completed.The team will then be given a new sector to work on.

The field organisers will be responsible for making sure that you are able to find the sites on the maps.

(2) <u>What to do when you have reached the site.</u>

You must now choose people for the study from those living on the site. If there are many people living on the site this may require a number of steps which are listed below. However, in many cases there will only be one household living on the site - if so, you can go straight to step 3.

<u>Step 1: Choosing a main dwelling</u>

A main dwelling is a formally constructed house, not a shack. If there is more than one main dwelling on the site it means that the plot has been subdivided. You must then choose one main dwelling at random using the random number tables.(You will learn how to use these in the training.)

<u>Step 2: Choosing a household</u>

Enter the house and introduce yourself. Speak to a responsible person and find out if there is more than one household living on the site. A household is defined as a group of people who eat together. Also ask who is at home. If there is more than one household with people at home, pick a household from these at random and proceed.

<u>Step 3: Choosing people from the household</u>

For this step you will need to look at your quota list. For each sector that you work on you will be given a new quota list by the field organiser. Please look at the example of a quota list on the next page and then read on.

You can see that the quota list is divided into 3 main age categories (marked A,B, and C).

Each main age category is again divided by age and sex into age/sex cells (cell means the same as group). For each sector you will have to interview a certain number of people fitting into these age/sex cells.

On the right hand side of the list there is a space for you to keep track of how many people you have already interviewed in each cell. Each time you complete an interview you must make a x in the this column next to the relevant cell. When you count the x's you will be able to see how many people you have already interviewed for a particular age/sex cell.

You will have to find people in the household who can be used to help fill up your quota list. When you start on a sector this will be easy but as your quota is filled this will become more difficult as you will only be looking for people to fill certain cells.

The numbers in this column tell you how many people you must interview for each age/sex cell.

This is an Age/Sex Cell. ie 3 to 4 yr old males.

Guguletu Sector A		Team member: No 2	
Age (yrs)	Sex	Number	Interview Record
3 - 4	M	2	x x
	F	1	x
5 - 6	M & F	3	
7 - 10	M & F	5	x x x x x
11 - 14	M	4	
	F	3	
15 - 22	M	1	
	F	2	
23 - 24	M	4	
	F	3	
25 - 34	M	1	
	F	3	
35 - 44	M	3	
	F	2	
45 - 54	M	1	
	F	2	
55 - 64	M	2	
	F	4	
65 and over	M	3	
	F	2	

This column is for recording how many interviews you have done in each age/sex cell. Make a cross here each time you complete an interview

Age Category A (3 - 15yrs)

Age Category B (15 - 64 yrs)

Age Category C (65yrs and over)

Age Categories: There are different rules for selecting people for these categories. See next page.

The rules for choosing people from a household are slightly different for the broad age categories A, B, and C and are listed below:

CATEGORY A (3-14 year olds)

For children younger than 10 years you must make sure there is a parent or childminder to help with the dietary recall - otherwise you will no be able to get accurate information.

In selecting a child to interview, please ensure that dietary information could be obtained i.e. if the child has consumed food away from home, eg at a registered crèche or nearby child minder, that the name of the crèche can be recorded or the childminder be contacted. After the interview, contact the childminder to obtain missing information. (Alternative arrangements are being made to obtain data from registered crèches).

You must not interview more than one child per site or starting point.

CATEGORY B (15-64 year olds)

You must not interview more than one person per site from this broad age category. If there is more than one in the household who fits your quota, choose one at random.

CATEGORY C (over 64 year olds)

You must interview all the old people available on the site. There are not many old people living in the townships and you may have difficulty filling the quota if you only choose one per site.

EXCLUSION RULES

There are also certain exclusion rules for choosing people for the study. These rules are listed below. This means that if a person has any of the problems below, he or she must not be included in the study.

1. Pregnant women.
2. Lactating women (until breastfeeding has ended)
3. Mentally retarded people
4. Bedridden people
5. People under treatment for a major illness (stroke, TB, cancer), or recovering from major illness ie illness less than 3 months ago.
6. People who have been hospitalised in the previous week.
7. Temporary visitors from elsewhere during first month stay.
8. Drunk Person

HOW TO FILL IN THE QUOTA LIST

You must interview at least one person per site or starting point: First one person must be selected from category B, who fits your quota and had none of the problems listed in the exclusion rules. This person must be selected at random from all qualifying persons (i.e. persons from age category B fitting your quota) on the site. All households on the site should be considered for this selection. If you cannot find any qualifying person on the selected site (starting point site) you have to go to the adjacent site always moving in the same direction around the street blocks. If there is more than one person in category B choose one at random (that person with birthday closest to date of interview). If there are people in categories A and C available in the ~~household~~ site given that you have already been able to choose one in category B - you must interview not more than one in each of category A and category C (if necessary choose one person at random - closest birthday - in each category). The rule is you must interview in each ~~household~~ site chosen one person from category B and if available one from categories A and/or C.

When you have almost finished working on a sector, you may find that your quota list is full. You may then help your fellow team members to fill in their quota lists.

RULE FOR MOVING TO AN ADJACENT SITE

The rule for moving to an adjacent site is that you will go to the house which is on you left as you leave the first site. Remember that you will only move to an adjacent site if there is no one suitable for interview on the first site.

SAMPLING METHODS FOR HOSTELS, CONVERTED HOSTELS, SHACKS AND SQUATTER AREAS

The methods and rules you will use in these areas are basically the same as for the housing areas. The difference lies in how you will find the starting points (called sites in the housing areas). The rules for selecting people from the starting point are then the same as for the housing areas.

HOSTELS AND CONVERTED HOSTELS

The hostel buildings that you must visit are marked on the map. You will be instructed to choose a certain number of rooms (sites) in each building. A household is the group of people who occupy the room and cook and eat together. You will choose the rooms as randomly as possible from those in the hostel building, making sure that you do not only choose those in one area of the building. (Your field supervisor will supply you with further details)

You will then go to each room (site) you have selected and proceed as you would at sites in the housing areas.

SHACKS AND SQUATTER AREAS

You will visit certain shack and squatter areas which have been marked on the map. You will have to select a certain number of dwellings from each area. You will do this as randomly as possible, making sure that you choose the dwellings from all over the area. You must choose dwellings from the central parts of the area as well as from the edges.

You will then go to each dwelling that you have selected and proceed as you would at sites in the housing areas.

FOOTNOTE FOR FIELD SUPERVISORS

[INSTRUCTIONS TO FIELD SUPERVISORS ON CHOOSING ROOMS IN HOSTELS AND CONVERTED HOSTELS.

You will choose the rooms systematically, for example:-

If there are 30 rooms in the building and you have to select 4, divide 30 by 4 (=7½). Thus selection interval length is 7 (the largest integer less than or equal to the division result). Start with a random number between 1 and 7 (eg 2). Start thus with the second room and thereafter every 7th room until you have covered four rooms. Use your own system of numbering of the rooms if necessary, starting at one point of the building, until you have moved through the building.]

BRISK - PROCEDURES FOR BLOOD SAMPLING

Blood samples will be drawn from all adults in the study. The blood sample will be taken first, before the questionnaire is filled in. If the person refuses to give blood, she or he cannot be included in the study.

You will use a butterfly apparatus, 3 syringes and ~~5~~ 6 test tubes for each person (adult).

1) Use the anterior cubital vein (at elbow). If possible use the left arm. (You will be using the right arm for BP measurement.)

2) Feel for the vein. If needed, inflate a BP cuff on the arm to make the vein stand out. Once you can feel the vein, release the cuff immediately - do not leave the cuff on the arm for a long time as this may affect the blood sample.

3) Clean the skin over the vein. Bend the butterfly needle (with its plastic cover still on) slightly upwards with the opening facing downwards. This will prevent the needle opening sucking on to the wall of the vein when you are drawing blood.

4) Stretch the skin in front of the vein and insert the needle directly into the vein with one movement. Tape the apparatus to the arm so that the needle is securely fixed in the vein

5) Attach the 10ml syringe (which already has 1ml clear citrate solution in it). Draw EXACTLY enough blood to reach the 10ml mark of the syringe. Remove the syringe and set aside.

6) Now attach the 20ml syringe. Draw at least 20ml blood into the syringe and set aside. Now fill the other 10ml syringe. Take the needle out of the vein .

7) Now put the blood from the 3 syringes into the tubes according to the instructions given on the next page.

8) Label all the tubes with the persons name and number, and the date and time of the blood sampling.

FIELDWORKER INSTRUCTIONS FOR THE QUESTIONNAIRE

The BRISK questionnaire is subdivided into six parts, i.e. the

- The COVER PAGE
- I. GENERAL INFORMATION
- II. DEMOGRAPHIC AND URBANIZATION INFORMATION
- III. RISK FACTOR INFORMATION
- MEASUREMENTS
- IV. DIETARY INFORMATION

These various parts should be completed in the sequence they appear in the questionnaire.

In response to the questionnaire questions, please:

(i) give written information where necessary

(ii) circle the answer options and then transfer this information to the coding blocks on the right side of the page. Only information which needs to be computerized should be coded on the right side of the vertical line on the questionnaire pages.

Any additional information or explanatory notes can be written on the left side of the page.

NB Only 5% of the questions require written information and 95% involve circling and transferring codes.

COVER PAGE

The BRISK SAMPLING INSTRUCTIONS explains how to find the specific site and select the study participant. Following this procedure will enable fieldworkers to complete the cover page. Please leave the first 6 coding blocks blank for the office number which will be entered at the Institute.

I. GENERAL INFORMATION

The serial or office number will be coded at the Institute. Each interviewer will receive a number which should be coded in the appropriate blocks.

Q1. The index person number (5 blocks on right side of the margin) will consist of:-

(i) the 2 digits of the interviewer number
(ii) a 3 digit sequential number of each respondent.

For example, the person number of the 7th person studied by interviewer 3 will read: 03007

This number should be repeated on other sections of the
(a) questionnaire as well as on
(b) the blood test tubes

Please ensure that the person number is transcribed correctly.

Q2. Respondents are under no obligation to provide their names and address but if they would like to receive their results, the correct name and address is necessary. Also, for HSRC controlling purposes, the home and work telephone number is required if available.

Q3 and 4. Information about the dwelling should be indicated by circling the correct answer option and transferring the circled information to the coding block on the right side of the page. The same applies to the other questions in this section.

Q5. This is self explanatory.

Q's 7-12 are self explanatory.

II. DEMOGRAPHIC AND URBANIZATION INFORMATION

Q1. This is self explanatory.

Q2. Record the date of birth at question 2 and enter the correct age (at last birthday) in the coding block. Also indicate whether the age is accurate or an approximation.

NB. To establish how long a person has been exposed to an urban environment, Q's 3-6 must be completed accurately.

Q3. The main aim of this question is to categorize people in broad categories as regards birthplace

(i) rural;
(ii) semi rural;
(iii) urban

Sufficient information about the place of birth like the town, district and homeland, eg Transkei, Venda etc should be given to allow office staff to code the information at question 3 correctly.

Q3.1 Self explanatory.

Q4. Discuss the mid-point issue with the trainer.

Q5. For people who have stayed in the city for more than a year only the year of arrival (or birth) needs to be entered at question 5. However, for new arrivals

(=people who have stayed in the city for less than a year) the month of arrival should be coded (eg January = 01, June = 06 etc).

Q6. We also need to know for how long each participant has lived in the city and therefore we must establish the total time the participant spent away from the city in question 6.

Q7. Is self explanatory.

Q8. We will attempt to obtain information about the employment status of the participant. Please give sufficient details about the job to allow the office staff to enter the correct codes. A description of the job is needed, as well as the type of workplace, eg clerical work at the rent office or checking clothing in a factory.

Q9. The highest school and post school qualification is required at question 9. In cases of unfamiliar qualifications try to establish the equivalent standard given in the list and write the qualification next to the standard. When in doubt about post school qualifications give full particulars under "other" or give explanatory notes in the left hand margin.

III. RISK FACTOR INFORMATION

Q1. Physical Activity

The aim of these questions is to determine energy expenditure

(i) during working hours and
(ii) after hours

Q 1.1 Deals with exercise during working hours subdivided into subcategories:-

(a) If a person does clerical or administrative work, he falls in the first subcategory.

(b) A person who does a lot of walking, like a nurse, housewife, and a postman, falls in the second subcategory.

(c) A person who does hard physical labour, like refuse cleaning, falls in the third subcategory.

When in doubt, make notes on the left side of the page.
Please mark only one category under 1.1

Q 1.2 Deals with exercise after working hours

In the second main physical activity category we would like to know whether a person does regular exercise (more than twice a week) outside working hours. If so, the exercise needs to be classified into either a light or strenuous category. Examples of light and strenuous activities are given on the questionnaire. Again, if there is doubt, please make notes on the left side of the page. It is possible for a person to be involved in exercise in both categories B and C, as long as it is performed more than twice a week.

2. Tobacco use

In this section we would like to distinguish between smokers, non-smokers and exsmokers. A person who has stopped smoking less than a month ago is considered to be a smoker. Question 2c should be completed for all the index persons, whether he/she smokes or not.

3. Alcohol

First distinguish between drinkers and non-drinkers and then establish the drinking pattern separately for the week and week-end. A week-end starts on Friday afternoon after work until Sunday night. Communal drinking is seen as a drinking session where more than one drinker shares a drink in a container, which is passed around. Only one of the answer options, which reflects the usual drinking pattern, should be marked.

Q 4. Medical history

Q 4.1 Personal

(a) Please probe.

(b) If a person takes medication try to confirm it by asking to see the pills or the prescription or in any other way.

Q 4.2 Family

A medical history of a close relative refers only to own close family members as specified. Don't allow people to speak for too long.

Q 5. Self explanatory.

Q 6. Self explanatory.

BRISK STUDY MEASUREMENTS

MID-ARM CIRCUMFERENCE (MAC)

A measurement of mid-arm circumference is needed for the purposes of the study. You will also need this measurement to decide which size cuff to use when you take the blood pressure of the person.

How to measure mid-arm circumference:

1. Remove clothing from the upper part of the right arm.
2. Find the point on the upper arm which is midway between the bony point of the outer shoulder and the bony point of the elbow. Use your hands to do this, as shown in the training. Mark the point.
3. Wrap the MAC tape around the arm at the marked point. Thread the tape through itself so that it forms a loop.
4. Pull the tape so that it is firmly wound around the arm. Make sure it is not too tight - it must not cut into the flesh or leave a mark behind when removed.
5. Take the measurement using the arrow on the tape.

Rule for choosing blood pressure cuffs:

MAC $\leqslant$ 33cm - use small cuff

MAC > 33cm - use large cuff

HEIGHT

You will need a straight wall on an even surface for height measurement. If there is no wall available (eg in sqatter areas), use the nearest flat upright surface.

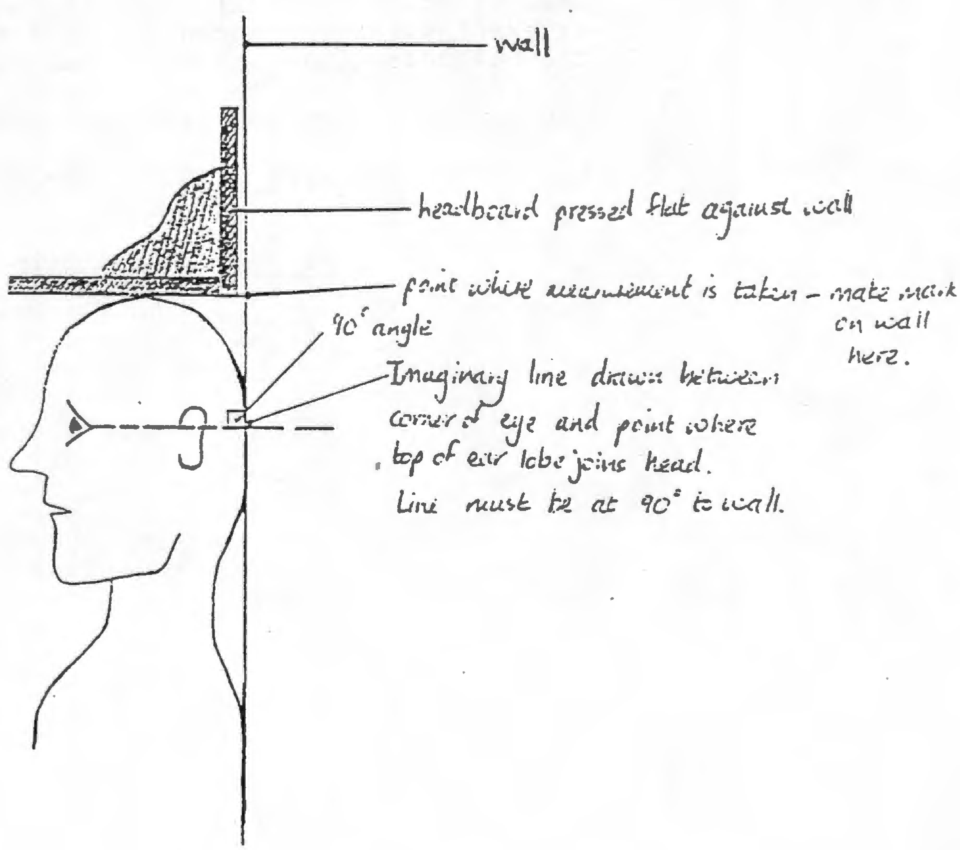
1. The person must stand, barefoot, with his/her back against the wall. The feet must be together and the heels must be firmly on the ground and as close to the wall as possible. The legs and back must be straight and the back of the head must rest against the wall.

2. Now straighten the head with your hands so that a line drawn between the corner of the eye and the point where the top of the ear joins the head, would be at right angles to the upright wall.(see diagram)

3. Place the headboard so that the horizontal part rests firmly on top of the head and is at right angles to the wall. The vertical part of the headboard must be flat against the wall.(see diagram)

4. Now make a mark on the wall where the horizontal part of the headboard meets the wall. Once you have made this mark, ask the person to move away.

5. Take the tape measure and measure the distance between the floor and the mark on the wall. Do this by anchoring the tape on the floor with your toe (directly below the mark) and extending the tape upwards.



MASS

You will be using bathroom scales to measure mass.

How to measure mass:

1. Put the scale on a firm, flat surface.

2. The person being weighed must be barefoot and lightly clothed.

3. Get the person to stand on the scale and take the reading to 1 figure after the decimal point eg 63.7 kg.

STANDARDISING THE SCALE

You will have to standardise the scale regularly to make sure it is measuring accurately.

The scale will be standardised against a beam balance at the MRC once a week. This means that the scale will be adjusted so that it measures exactly the same weights as the beam balance.

How to standardise the scale against the beam balance:

1. Weigh yourself on the beam balance and record the mass.

2. Now weigh yourself on the bathroom scale. Adjust the zero point on the scale so that it measures your mass as exactly that measured on the beam balance.(eg if the bathroom scale measures your mass as 60.0 kg and the beam balance measures it as 60.7 kg you must adjust the zero point of the bathroom scale to 0.7 kg.)

3. Record the new zero point of the bathroom scale.

CHECKING THE SCALE IN THE FIELD

1. Each day before you go into the field, adjust the zero point of the scale to the point recorded from standardisation with the beam balance.

2. Now weigh yourself and record the mass.

3. During the fieldwork that day, you must check the scale each time before you measure a person's mass. You will do this by measuring your own mass and making sure it is the same as that measured at the beginning of the day.

BRISK STUDY - RULES FOR BLOOD PRESSURE MEASUREMENT

1) The person must be seated for at least 5 minutes before you take the first reading.

2) The person must be relaxed and sit with uncrossed legs. Explain that you will be taking 3 readings.

3) Measure the mid-arm circumference using the tape provided. Choose the large blood pressure cuff if the measurement is over 33cm.

4) Use the right arm. Put the cuff on at least 2,5 cm above the ante cubital fossa (the elbow).

5) Check that the mercury level on the baubonometer is at 0 mm. If it is not, tilt the baubonometer sideways to set the level at 0 mm.

6) Feel the radial pulse and pump up the cuff until the pulse disappears. This is a rough estimate of systolic pressure.

7) Now you can take the first reading. Pump up the cuff to a reading to a level about 30 mm higher than the estimated systolic pressure.

8) Deflate the cuff slowly while listening at the elbow with the bell of the stethoscope (part with rubber) and watching the baubonometer scale.

9) The systolic reading will be taken as the level at which 2 consecutive, clear beats are heard.

10) The diastolic reading will be taken as the level at which all the sounds disappear.

11) Once you have read the diastolic pressure, deflate the cuff rapidly.

12) You will take 3 readings. Wait at least 1 minute between the readings.

13) Do not round off the readings.

IV. DIETARY INFORMATION

Fill in the person number. Point out that you are now changing to questions on food. If possible suggest moving to the kitchen.

Q1-Q3 It is not possible to measure salt intake accurately, therefore with these questions we try to group people in "heavy salters" and "the rest".

Q2 "Extra" salt refers to salt/Aromat added in addition to what was added in the cooking process. "Your serving of food" refers to an individual's helping/portion/plate of food.

Q3 The number of times per week is important - it does not matter whether these foods are eaten with/as a meal, or as between-meal snacking.

Q4 The 'usual' intake of eggs is important. If it is 16 in one week and no eggs for several weeks thereafter, determine the average over the last 4 weeks: eg 16 ÷ 0 + 0 + 0 = 4 per week every week.

Fill in the number of eggs

1 egg =	0	1
7 eggs =	0	7
12 eggs =	1	2

Q5 We are interested in usual intake -

therefore in most cases only one option will be recorded (but two are possible). - all the other options must be filled in as NA (= 0)

Example: The respondent usually eats 4 eggs per week (from question 4). Most often he eats fried eggs over weekends for breakfast. (Fried in oil).

Fill in as follows: circle code 1 under the breakfast column to coincide with "fried in oil".

Q6 The usual intake of fat is important. When a person removes the fat from meat, either before or after cooking the answer is

NO $\boxed{2}$

If the person eats <u>some</u> of the fat, the answer is

YES $\boxed{1}$

'Eat only lean meat', means NEVER eating any fat on meat.

Q7 To simplify, the question reads "chicken", but in fact refers to <u>all poultry</u>. If the answer is "sometimes", or "not always" please fill in

YES = $\boxed{1}$

Q8 The <u>number of times</u> each specific food was eaten <u>during the last seven days</u>, is to be filled in. If a food was not eaten in the last 7 days, fill in $\boxed{0}$.

If a food was eaten MORE THAN 9 times in the last seven days, write down the actual number of times next to the food, but fill in 9 in the space provided in the right hand margin $\boxed{9}$.

Please take note of the detail in brackets with each item.

Q9 The important word is MAINLY. Only one fat can be coded eg for frying. Should more than one fat be mentioned, check which one was used <u>most frequently</u> and code that one.
Ask for the BRAND NAME of the margarine or, best, <u>ask them to show you the container</u>. You may even write down the name of the margarine.

Butter: only real dairy BUTTER (eg Dairy Belle, Erica, Bonnita)

Brick margarine: wrapped in foil (eg Rama, Blossom, Sunshine Stork, etc)
Tub margarine and medium fat spread: please differentiate.

White margarine (eg Holsum)

Oil (Sunflower oil, noname brand, "fish" oil, olive oil)

Lard, dripping: any left-over cooking fat, beef, mutton, pork or chicken, used in cooking.

Frying: As for eggs, fish, onions, potatoes (chips), vetkoek, stir-fry vegetables

Roasting and stewing eg. meat and vegetables

Making cake and bread: as ingredient eg in baking.

As spread on bread, etc: also on scones, biscuits.

In gravies: meat gravies.

With cooked vegetables: eg when preparing pumpkin or mashed potato, or when serving gem squash.

THE 24-HOUR RECALL

We would like to know what the person's food and liquid intake was during the whole of the day before the interview. That is, you have to write down everything the person ate and drank "yesterday", from rising in the morning until going to bed, at mealtimes and in between. We need to know the following: what food was eaten, how much of it, how was it prepared, and was it eaten at home or away from home. First let the person tell you exactly what he/she, or the child she is answering for, has eaten, while you fill in the questionnaire. If you suspect that everything was not mentioned, remind the person of certain specific foods, but be careful that the person does not give incorrect information to please you. The quantity EATEN (NB not the quantity served) is then written down. The definitions for indicating the time of the day are as follows:

From waking up till ± 9 o'clock - anything eaten or drunk since waking up till 9 o'clock.

Midmorning - anything eaten or drunk between ± 9 o'clock and 12 o'clock

Lunch - the meal between about ±12 - 2 pm.

Afternoon - anything eaten or drunk between 2 pm and just before evening meal.

Evening meal - (ie supper) the meal after 5 o'clock in the afternoon, irrespective of how late it was eaten.

After the evening meal and during the night - anything eaten or drunk after supper and during the night.

Extras - anything eaten or drunk that was not already mentioned, or did not fall into any specific other period.

NB FOR SHIFT-WORKERS

Do not try to force intake into the questionnaire's time slots. RATHER delete the left hand side column headings, and fill in actual times of intake.

NB FOR CHILDREN ATTENDING A CRèCHE

Please make sure that the name and address of the creche is filled in on the questionnaire

One's food intake is often influenced by what one was doing. Therefore, try to link "yesterday's" food intake with "yesterday's" activities.

How to fill in the quantity eaten:

1. Please ONLY use the measures that we have standardised on: eg using the models or by interpreting whatever quantity was eaten into number of spoon- or ladlefuls, or in ml. If more than one person shared food from one communal basin, please quantify the respondent's share by guiding the respondent to describe his own consumption in terms of spoonfuls or in ml.

2. In the case of commercial products, use brand names eg Blossom margarine, Nespray (milkpowder), Bar-One (sweet), Coke, etc.

3. For some items, ask to see the container to check the label, eg Rama (is it tub, brick or medium fat spread); cold drink (is it artificially sweetened).

Should you have an unforeseen problem, do not hesitate, contact L. Bourne or M Langenhoven immediately.

1. DRINKS

Please quantify in ml.

1. Using your measuring cup, please determine the volume of the cup/mug/glass the respondent used yesterday. Write it down in the left hand margin.

2. Ask: Please show me how much. What did you put in first, (the tea/coffee or the milk?) Allow the respondent to pour water into the cup/mug/glass to resemble yesterday's intake, and measure the "tea"/ "coffee" and "milk" separately.

<u>Say</u>: then you added .... - how much of it, please show me with the water (and measure that).

(a) Tea and coffee

- how much was taken
- milk added? yes or no
  - if yes, what type of milk
  - quantity of milk
- sugar added,
  - how many spoonfuls, size of the spoon, level or heaped.

    Use the following abbreviations:

	level	heaped
teaspoon	-tsp	^tsp
sugarspoon	-ss	^ss
desert spoon	-ds	^ds
tablespoon	-tbs	^tbs

(b) Types of milk and milk substitutes

Fresh full cream milk	FC milk
2% milk	2% milk
Skimmed milk	Skim milk
Powdered WHOLE milk - please use brand name	Nespray, Klim, Everyday
Powdered SKIM milk - use brand name	Protea, Elite, Farmers' Pride
Milk blends (dairy and plant fat blend)	Carnation Blend, Molico, Sunblest, Make-a-litre
Numel (dairy only blend)	
Creamers	Cremora, Ellis Brown, Coffee mate, Kreem mee, Weigh less
Condensed milk - full cream	Gold Cross (Carton 325 g)
Condensed milk - skim milk	Gold Medal
Evaporated milk - full cream	Carnation, Ideal
Evaporated milk - skim	Slender
Amasi/Maas: bought or homemade	
Drinking Yoghurt (sweetened)	Yogi-sip, Yo-flo, Jolly Jo, Yog-nog
Drinking Yoghurt (unsweetened)	
Buttermilk	

Flavoured milk (sweetened)   Steri-milk

(c) Drinks made with milk eg Nesquick, Milo, Cocoa, Horlicks, ovaltine

- How much was taken (respondent demonstrates with water)

- How much milk was added (respondent demonstrates)
- What type of milk
- Was sugar added? How much?

(d) Cold drinks and fruit juices

(i) Fizzy drinks: - how much: <u>cans</u>: 200 ml, 340 ml
<u>bottles</u>: 175 ml, 200 ml, 300 ml , 500 ml, 1 L 1,5 L and 2 L;
<u>homemade</u> (soda stream, mix a drink) was it artificially sweetened (AS)

(ii) Cordials: Oros, Kool Aid, Esto, Citro, Trix, Shani, Quin
- how much concentrate/or powder
- how much water
- was it artificially sweetened (AS)

(iii) Other fruit juices: carton, plastic bottles, fruit tree
- type (brand name, check container)
- how much
- was it artificially sweetened (AS)

(iv) Pure fruit juice: liquifruit, fresh up, appletizer, grapetizer, monis

(e) Dairy mixes: Frulati, Fiesta, Tropica

(f) Alcoholic drinks

- type of alcoholic beverage, give brandname (beer, spirits, wine, concoction, sherry)
- quantity
- mixed with cold drink?
- how much

Beer: <u>bought</u> beer: 340 ml can, 340 ml bottle (dumpy) 375 ml bottle (pint), 450 ml man-can, long Tom; 750 ml bottle (quart), 2 L draught beer, bought sorghum beer: 1 L carton;
<u>homebrewed</u>: how much, what was in the mixture.
(home brew kit for 22 L)

white foam glass - ± 200 ml

Spirits: Brandy, whisky, cane, gin, vodka
one tot (bar tot) = 25 ml
one double tot = 50 ml; miniature = 50 ml
nippy = 200 ml
bottle = 750 ml
half-jack = 375 ml; 1 L, 2 L

Wine: semi-sweet and dry wines, white, red and pint (stein, grand cru, etc) per glass ±120 ml flavoured wines; (per glass ±150 ml), fortified wines: hanepoot, muscadel, sherry, jerepigo (per glass 60 ml).
nippy = 200 ml
dinky = 250 ml
½ bottle = 375 ml
Drostdy hof - 340 ml
Bottle = 750 ml
Flagons: 1,5 L, 2 L, 4,5 L
6-shooter 4,5 L
Vats: 2 L, 5 L
Boda-bag: 3 L

Esprit (flavoured wines): 340 ml cans
750 ml bottles

Concoctions: Please try to find out what it was made of, how much the respondent drank, whether any coke, other cold drink or water was added.

2. BREAD

(a) Type of bread: white, brown, mealie bread? Homemade or bought/commercial

(b) What size slice: shop bought bread (B) size is standard, indicate thickness and number of slices, OR state "shop sliced" (SS).

Homemade bread: if bread is available, please ask person to cut one slice equivalent to the size of yesterday's slice, and weigh on your scale. If bread is not available, use the foam models and record the letter marked on the appropriate model. How many slices?
If all foam models are inappropriate, let the respondent show you, using his hand, any model or any other object, and measure with your ruler the length, width and thickness.

Chunks of bread: if bread is available, weigh a chunk, if bread is not available, use popcorn or foam models.

(c) was any spread used:

- What? Check label. Distinguish between real dairy BUTTER and margarine.
- On how many of the slices of bread?
- How much: a scraping, medium or thick; as defined during the training.

(d) Was there anything else on the bread - jam, peanut butter, fish spread, fray bentos, oil, dripping.

- how much: a scraping, medium or thick, as defined during the training.
- on how many of the slices of bread

(e) VETKOEK:
- brown or white flour used?
- if homemade: what fat was used for frying?
- what size: small, medium, large
- with or without jam/other filling eg meat/ margarine

(f) <u>Bunny chow</u> quantify and specify bread
quantify and specify filling

3. <u>BREAD SPREADS</u>

1. Please differentiate between real butter and margarine; brick and tub margarine, etc

2. Butro (is a mixture of 60% butter, 20% oil and 20% moisture)

3. (a) Tub margarine (Rama Soft, Floro, Cardin, Kraft, Sunshine D, Golden Spread)

   (b) Medium fat spreads (also in tubs) (floro lite, golden spread, stork country spread, Rama, Olé, Blossom)

4. Brick margarine, white and yellow (Rama, Blossom, Stork, Sunshine D, Golden Spread, Olé). 250 g, 500 g, 1 kg

5. White margarine/cooking fat (Holsum, Wooden Spoon)

6. Dripping (Beef, mutton or pork fat, from home cooking, bought at shop or butchery), eg Eskort Lard (500 g)

Please be specific. Please remember to check for the addition of any of these fats or oil <u>in the preparation of food</u>.

7. Meat spreads: liver spread ± 12 cm = 125 g; 20 cm = 250g

8. Peanut butter: how much? - a scraping, medium or thick, as defined during the training.

9. Jam: how much? - a scraping, medium or thick, as defined during the training.

4. <u>CHEESE</u>

Cheddar, gouda (sweet milk),
low fat and fat free cottage cheese,
cheese wedges and cheese spread.

- Which cheese was eaten? Please check on the cottage cheese container (if available) whether it was fatfree, low fat or cream cheese.

- How much? Was the cheese grated or sliced. If grated, was it spread thin/medium/thick; on how many slice(s) of bread; <u>or</u> how many spoonfuls. If sliced what were the dimensions of the slices of cheese.
  How many spoonfuls (specify size of spoon, level or heaped) of cottage cheese, cheese spread. Number of cheese wedges.

5. <u>EGGS</u>

How many eggs did the person eat yesterday? How was it prepared? In which fat was it prepared?

6. <u>MAIZE AND OTHER CEREAL DISHES</u>

1. Porridge

(a) What kind: soft maize meal, oats, or instant cereals eg pronutro, weetbix, or other

(b) How much: Use the oats from your kit, and allow the respondent to demonstrate the volume consumed. Use your <u>measuring cup</u> to measure volume. Should there be porridge available, use your <u>scale</u> to weigh an amount equivalent to what was eaten "yesterday".

(c) How prepared: was <u>margarine</u> or any other fat added to the porridge.

(d) Was it eaten with <u>sugar</u>: how much? See page 23 for level and heaped spoonfuls.

2. Umqa and umphokoqo
Stiff porridge (umqa) or crumbly porridge (umphokoqo).How much - use the popcorn and allow the respondent to demonstrate. Use your measuring cup to measure <u>ml</u> of popcorn.
Was milk/amazi used. How much? What type of milk?

3. Samp (Umngquisho)

(i) <u>Plain samp (no beans</u>)

(a) How much: use your measuring cup and the popcorn from your kit, and allow the respondent to demonstrate the volume consumed. If any cooked samp is available please weigh and double-check.

(b) How prepared: were any stock cubes and/or fat added?
Was it eaten with gravy, or vegetables or meat?

(ii) <u>Samp and beans (umngquisho nembotyi</u>)

(a) Was it the bought mixture, were extra beans added? - <u>or else</u>, how much samp were used to how much beans? If nobody present in the house can tell how much samp to beans was used yesterday, check whether there are any leftovers to judge "plenty" or "little" beans. Or ask respondent whether the food was "brownish" because of plenty beans, or "whitish" because of more samp than beans (ie if white beans were not used!!)

Please write down the ratio of samp to beans (samp first) eg 1 to 1, 3 to 1, or 5 to 1 <u>or</u> state plenty/little beans. Keep in mind that the bought mixture of samp and beans (with NO extra beans added) would go through as "little" beans. (i.e. 5:1 mixture)

(b) How much was eaten: Use your measuring cup and the popcorn from your kit, and allow the respondent to demonstrate the volume consumed. If some of the food is available, ask the respondent to dish the same quantity as was eaten "yesterday", and weigh. Please double-check the weight.

These same principles apply for all the other maize dishes:

Umqa, umphokoqo, isigwampa, umqa wethanga. <u>The same also applies to rice</u>.

(c) How was it prepared/served:
were stock cubes and/or margarine or fat added.
Was it served with vegetables, fat, meat, or gravy, amasi.
How much of these?

7. <u>MEAT AND MEAT DISHES</u>

Specify beef, mutton, pork or chicken
Specify COOKING METHOD eg
<u>fried</u> ie with extra fat, oil or dripping
<u>roast</u>, oven or potroast, little extra fat, basting
<u>stewed</u> with liquid, such as casserole
<u>grilled</u> ie no fat added, eg in oven, or "braai" over coals; crumbed and fried

- how much?

<u>For "SOLID" meats</u>, record size of pieces:

sausage: allow respondent to demonstrate size and measure with your ruler.

mutton chop or piece of beef - allow respondent to demonstrate the size in relation to foam models, or any equivalent sized object, and measure length, width and thickness

chicken - specify cut eg wing, breast, drumstick, thigh

meatballs - measure diameter and height.

<u>FOR FLUID MEATS eg stew and mince.</u>

Using the oats or popcorn, and the measuring cup or the ladle-spoon, let the respondent demonstrate how much. Write down in ml. If vegetables and potato were cooked with the meat, please quantify the meat, potato, vegetables and gravy <u>separately</u>.

Please state whether there was bone in the meat. When minced meat and vegetables were mixed, state whether there was <u>plenty meat</u> and little vegies or little meat and plenty vegies.

What type of extra fat was added?

<u>COLD CUTS, POLONY, VIENNA SAUSAGES, BRAWN</u>

Please give diameter of polony and number of slices. Diameter varies from about 3 cm to 6 and 10 cm. Slices cut in shop, or homecut? If homecut, how thick?
Short or long viennas, how many.

8. FISH

(a) FRESH FISH

If the kind of fish is known, give the name, eg snoek. How was it prepared: fried in oil, with batter or crumbed grilled (no extra fat added)
How much: Allow the respondent to demonstrate the size of the pieces, and measure with your ruler: length, width and thickness, or
specify letter on appropriated foam model (NB check thickness also!)

(b) TINNED FISH

What kind (eg minced, in tomato sauce, pickled). Give brand name.
How was it prepared? eg fish cakes fried in oil;
How much was eaten: ladlespoonful, tablespoonful, or use oats or foam models to allow respondent to demonstrate how much was eaten.

9. SOUP

(a) Specify main ingredients eg water, samp and beans or beef stock, vegetables and beans

(b) Specify whether the soup was thick or watery

(c) Measure in ml: using measuring cup and water - allow respondent to demonstrate.

10. VEGETABLES AND FRUIT

POTATOES: cooking method: boiled, fried in oil, chips, roasted with meat, mashed, baked "in jacket";

how much: If there are (raw) potatoes in the house of the same size that was eaten "yesterday", please weigh it and record weight. If not, use any other standard eg an egg or describe length, width and thickness; or spoonfuls if mashed. What fat was added to mash or any other form of potato.
For chopped vegetables and fruit, state number of level or heaped table/ladle spoonfuls, saucerfuls or use popcorn or oats to determine ml.

For WHOLE fruit or vegetables, give number and size.
MEDIUM - size is what we decide on during training.

- how prepared: please state when sugar and/or fat or margarine was added.

For stir-fried vegetables (eg cabbage): what fat was used?

Brand name Co commercial – c/m
Homemade – H/m

11. CAKE, BISCUITS AND PUDDING

What was eaten, how much, how was it prepared.

Cake with/without icing; homemade/bought;

Biscuits/cookies: use brandname eg lemon creams, Romany creams, Tennis, eet-sum-more etc; plain or with filling.

Puddings: Canned fruit: halves or sliced;
Custard: homemade or bought; type of milk
Instant pudding: type of milk, how much
Icecream: how many spoonfuls or use oats or popcorn to demonstrate.
Please try to identify whether it was SORBET, MELLORINE, REAL ICECREAM, CONE. Use brandnames.
Tarts: bought or homemade
Size of portion: use ruler to measure length, width, and thickness or use appropriate number of foam model.

14. SWEETS

(a) Bubble and chewing gums: chappies, beechies, gum strips. (artificially sweetened? AS)

(b) Chocolates: assorted centres: pick-a-mix, easter egg coated bars: small, medium, large bars eg bar one, crunchie, caravan, tex, nux, kit-kat, smarties, Buttons = 3 x 35 g string.

chocolate slabs: milk, plain, flakes, nuts and raisins, etc
small, medium, large.

(c) Dried fruit sweets: squares, fruit sticks, fruit bars (10 sticks = 250 g), (8 bars = 250 g), fruit rolls (125 g for ± 15 cm) froozies, meebos (250 g for 11)

(d) Hard/jelly sweets: fruit drops, acid drops, menthol, butter milk, dimes, cola, wilsons, pepper mints (mint imperials), fizz-pops, lollipops, sugus, liquorice (all sorts), jelly babies, jelly snakes, jelly berries, fruit pastilles, nutpuffs, fruit sherbet, bon-bons.

(e) Ice suckers, bunnylicks, popsickles, also see icecream, minipop, giant-pop.

(f) marshmallow: plain marshmallows and coconut; marshmallow fish, easter egg (choc coated)

(g) peanut brittle

APPENDIX H

COPY OF THE QUESTIONNAIRES

UNIVERSITY OF CAPE TOWN AND MEDICAL RESEARCH COUNCIL

BRISK STUDY, 1990

All information is confidential and will be used only for research.

Office number [ ] [ ] [ ] [ ] [ ] [ ] 6

[0] [1]

1. Team [ ] [ ]
2. Interviewer number [ ] [ ]
3. Sequence number [ ] [ ] [ ] 15
4. Date (DD MM YY) [ ] [ ] [ ] [ ] [ ] [ ]
5. Starting time ...... h ...... min [ ] [ ] [ ] [ ]
6. Area [ ] [ ]
7. Sector [ ] [ ]
8. Block/hostel/shack area [ ] [ ] [ ]
9. Site/number of hostel [ ] [ ] [ ] [ ] [ ]
10. No of houses (if more than one main dwelling) [ ]
11. Adjacent site number (if used) [ ] [ ] 40
12. Status of site [ ]
13. If "other" (status=4), explain .....

....

Stop here unless status=3 ie "proceed"

Key to status

(Use for both site and household)

1. Not at home
2. Refused
3. Proceed
4. Other
5. No-one in quota } for households only
6. Excluded }

14. Number of households on site [ ]
15. Number of household chosen [ ]
16. First household Status [ ]
17. Second household Status [ ]
18. Third household Status [ ] 46
19. If "other" (Status=4), explain ......

....

....

20. Sequence number of person in household (if more than 1 person interviewed in household) [ ]
21. Sequence number in family (if more than one person in family interviewed) [ ]

Blood sample (for adults over 15 years old)

Number of tubes [ ]

Code on tubes [ ] [ ] [ ] [ ] [ ] 54

Spare coding blocks

(Do not fill in)

[ ] [ ] [ ] [ ] [ ]

[ ] [ ] [ ] [ ] [ ] 64

021083

Office number

BRISK 1990

| | | | | | | 6 |

| 0 | 2 |

I. GENERAL INFORMATION

1. Interviewer number [|] Sequence number [| |]

2. Index person: Postal address for results, if required.

Name and address: ....

....

....

....

....

2.1 Telephone number .... (h)

.... (w)

3. Type of dwelling:

Built formal housing unit:	council or core house	1		
	other (specify)	2		
Informal shack-shelter:	on defined site (controlled)	3		
	haphazard shacks (uncontrolled)	4		
	backyard of formal house	5		
Hostel		6		
Tent		7		
Other (specify)		8		14

4. Is this dwelling:

Rented	1	
Purchased (99 year leashold)	2	
Squatting (no rent)	3	
Other, specify	4	
Don't know	5	

5. Do you have electricity available inside your household? | Yes=1 | No=2 | |

6. How is your water supplied?

Tap in house	1		
Tap outside house	2		
Shared tap (4 houses)	3		
Communal tap (5 or more houses)	4		17

7. What do you use for cooking?

	Yes	No	
Electricity	1	2	18
Gas	1	2	
Paraffin	1	2	
Wood	1	2	
Coal	1	2	
Other (specify)	1	2	

8. Do you have a fridge/deep freeze in your house? (in working order) — Yes=1 No=2

9. Does any one or more persons in your household own a motor car? — Yes=1 No=2

10. Do you listen to a radio in you household?	Yes=1	No=2	
11. Have you watched TV this week?	Yes=1	No=2	
12. Have you read a newspaper this week?	Yes=1	No=2	28

II. <u>DEMOGRAPHIC AND URBANIZATION INFORMATION</u>

1. Sex — Male=1, Female=2

2. Age: date of birth ☐☐ Day ☐☐ Month ☐☐ Year

Age at last birthday (yrs) ☐☐

Accurate=1 estimate=2 ☐

3. Place of birth .... (Village/town) .... (District) ☐☐☐ Office

3.1 Were you born in/on ......

rural village	1
a farm	2
a small town	3
a large town/city	4

4. Where did you spend most of your childhood? .... (up to 10 years)

In a rural village	1	
On a farm	2	
In a small town	3	
In a large town/city	4	
Don't know	5	37

5. When was the first time that you came to a big city? (If born in city give year of birth)

Date: | 1 | 9 | | | year | 1 | 9 | | | 41

| | | month (new arrival)

6.1 Have you spent any time periods away from the city, for at least a full year without a break, since you first arrived or since birth?

Yes=1	No=2

6.2 If yes:

Place	Length of time Years	Place	Length of time Years
1.		9.	
2.		10.	
3.		11.	
4.		12.	
5.		13.	
6.		14.	
7.		15.	
8.		16.	
TOTAL		TOTAL	

7. What is your home language?

Xhosa	1
Zulu	2
Sotho	3
Tswana	4
English	5
Afrikaans	6
Other (specify)	7

47

8. Do you work for money or goods at all? (NA=0) | Yes=1 | No=2 | | 48

8.1 If no, are you a:

housewife?	1	
student?	2	
disabled? (unfit for work)	3	
unemployed (fit for work)	4	
pensioner?	5	
Other (specify)	6	

NA = 0

Are you looking for work? | Yes=1 | No=2 |

If yes, for how long have you been unemployed?

Time period: ☐☐ ☐☐ Years and months ☐☐ ☐☐ 54

(Office)

Describe your last job: ....

....

8.2 If yes, describe the work you do for: 1=money, 2=goods, 3=both

.... N.A.=00

....
(e.g. shopkeeper, painter, taxi or busdriver, salesman etc)

Sector: Formal=1, Informal=2 ☐ 64

9.1 What is the highest standard you passed at school?

No educational qualifications	01		
Sub A	02		
Sub B	03		
Std 1	04		
Std 2	05		
Std 3	06		
Std 4	07		
Std 5	08		
Std 6 or Form I	09		
Std 7 or Form II, ETC	10		
Std 8 or NTC I or Form III	11		
Std 9 or NTC II or Form IV	12		
Std 10 or NTC III or Form V	13		66

9.2 Do you have other training or education? | Yes=1 | No=2 |

If YES

Please indicate your highest qualification:

Formal training after school (eg NTC Diploma, IV or V nursing) - specify	1	
Graduate training	2	
Postgraduate training/education - Specify	3	
Informal training - Specify	4	
Other - Specify	5	68

Office No.

						6

0	3

Person number

III. RISK FACTOR INFORMATION

1. PHYSICAL ACTIVITY

1.1 WORKING HOURS

1.1 Does YOUR WORK involve mostly: | Not working | NA=0 |

	sitting and standing (minimal walking), e.g. office work, sewing, teaching	1	
or	a lot of walking, e.g. postman, nursing, milkman, house cleaning	2	
or	hard physical work (sweat work) e.g. building, digging, manual labour	3	14

1.2 AFTER HOURS

A. Do you get any regular exercise (muscle work) <u>OUTSIDE WORKING HOURS</u> (eg walking/ cycling to and from work (>1 km), gardening, sport etc)		Yes=1	No=2	15
		If yes go to B		
B. Is it light exercise e.g. gardening, walking, housework?	NA=0	Yes=1	No=2	
and				
C. strenuous exercise, e.g.soccer, boxing, jogging, cycling	NA=0	Yes=1	No=2	

2. TOBACCO USE

Do you use tobacco regularly? (more than 1 cigarette or one pipe, or one snuff or one "pruimpie" (chewing tobacco) per day)	Yes=1	No=2	
	If yes, go to 2.1	If no, go to 2.2	

2.1 SMOKERS

(a)	How many cigarettes do you usually smoke per day?	NA=00		20
(b)	For how many years have you been smoking up to now?			
(c)	Do you smoke pipe regularly?	Yes=1	No=2	
(d)	At what age did you start smoking regularly?			
(e)	Do you use snuff regularly?	Yes=1	No=2	
(f)	Do you use chewing tobacco ("pruimpie") regularly?	Yes=1	No=2	

2.2 <u>If no</u>: Have you smoked regularly before? Yes=1 No=2

2.3		
Some people think:	Smoking is harmful to one's health	1
Other people think:	Smoking is good for your health	2
For some people:	It does not matter to one's health whether one smokes or not	3
What do you think?		29

3. ALCOHOL

Do you drink any alcohol?

Yes=1	No=2		30
If yes, go to 3.1	If no, go to 4 (pto)		

DRINKERS

3.1 How much alcohol do you drink on average on weekends?

KEY
1 drink equals
one glass of wine one tot (25 ml) of hard liquor (brandy, rum, gin) one beer (340 ml) one carton (1l) (2 x 500 ml) 1/3 "concoction"

Non-drinker	0	
No drinking during the week	1	
1-2 drinks per day	2	
3-4 drinks per day	3	
5 or more drinks per day	4	
Communal drinking	5	

3.2 How much alcohol do you drink on average during the week?

Non-drinker	0	
No drinking during weekend	1	
1-2 drinks per day	2	
3-4 drinks per day	3	
5 or more drinks per day	4	
Communal drinking	5	

4. MEDICAL HISTORY

4.1 PERSONAL

(a) Has a doctor or nurse told you that you had or have:

	Yes	No	Do not know		
High blood pressure	1	2	3		
Diabetes or sugar in the blood	1	2	3		
Heart attack/angina	1	2	3		
Stroke: muscle paralysis, sensory loss	1	2	3		
High blood cholesterol (fats)	1	2	3		37

(b) Do you take medication prescribed by a doctor (pills or injections) for:

	Yes	No	Do not know		
High blood pressure	1	2	3		38
Diabetes or sugar in the blood	1	2	3		
Heart disease	1	2	3		
Other (specify)	1	2	3		

4.2 FAMILY

Do you have a close relative (father, mother, brother, sister or child) who has or had any of the following conditions?

	Yes	No	Do not know		
High blood pressure	1	2	3		
Diabetes/sugar in the blood	1	2	3		
Heart attack/angina	1	2	3		
Stroke	1	2	3		
High blood cholesterol (fats)	1	2	3		46

5. Have you attended any of the following health facilities in Cape Town during the past two weeks? (Read all the options)

	Yes	No	
Day hospital	1	2	
Clinic	1	2	
Private hospital/Provincial hospital	1	2	
Private doctor	1	2	
Chemist shop	1	2	
Christian faith healer	1	2	
Traditional healer or herbalist	1	2	
Health Services in the working situation	1	2	
Dentist	1	2	
Other, specify	1	2	

6. Are you covered by a Medical Aid or Medical benefit scheme? (Any scheme that helps you pay for health (drug services)

Yes=1	No=2		57
Do not know = 3			

BRISK MEASUREMENTS

		6
	0 4	
Person number		
Mid upper arm circumference	,	16
Systolic blood pressure 1		
Diastolic blood pressure1		
Systolic blood pressure 2		25
Diastolic blood pressure2		
Systolic blood pressure 3		
Diastolic blood pressure3		
Body weight	,	
Body height	,	42

010154
Office number

BRISK 1990

CHILDREN'S QUESTIONNAIRE

Children 10 years and older can answer for themselves. For children younger than 10 years, the mother (or childminder) must be available to assist with the interview.

0 2

I. **GENERAL INFORMATION**

1. Interviewer number [ ][ ]   Sequence number [ ][ ][ ]

2. Index person: Postal address for results, if required.

   Name and address: ....

   ....

   ....

   ....

   2.1 Telephone number: .... (h)

   .... (w)

3. Type of dwelling:

Built formal housing unit:	council or core house	1
	other (specify)	2
Informal shack-shelter:	on defined site (controlled)	3
	haphazard shacks (uncontrolled)	4
	backyard of formal house	5
Hostel		6
Tent		7
Other (specify)		8

14

4. Is this dwelling:

Rented	1
Purchased (99 year leashold)	2
Squatting (no rent)	3
Other, specify	4
Don't know	5

5. Do you have electricity available inside your household? Yes=1 No=2

6. How is your water supplied?

Tap in house	1
Tap outside house	2
Shared tap (4 houses)	3
Communal tap (5 or more houses)	4

17

7. What is used for cooking?

	Yes	No		
Electricity	1	2		18
Gas	1	2		
Paraffin	1	2		
Wood	1	2		
Coal	1	2		
Other (specify)	1	2		

8. Do you have a fridge/deep freeze in your house? (in working order) | Yes=1 | No=2 |

9. Does any one or more persons in your household own a motor car? | Yes=1 | No=2 |

Q. 10-12. For **CHILDREN YOUNGER THAN 10 YEARS**, fill in NA=0

10. Do you listen to a radio in you household?	Yes=1	No=2		
11. Have you watched TV this week?	Yes=1	No=2		
12. Have you read a newspaper this week?	Yes=1	No=2		28

II. <u>**DEMOGRAPHIC AND URBANIZATION INFORMATION**</u>

1. Sex | Male=1, Female=2 |

2. Age: date of birth [|] Day [|] Month [|] Year | Age at last birthday (yrs) | Accurate=1 estimate=2 |

Office

3. Place of birth .... (Village/town) .... (District)

3.1 Were you born in/on

rural village	1
a farm	2
a small town	3
a large town/city	4

4. Where did you spend most of your childhood? .... (up to 10 years)

In a rural village	1		
On a farm	2		
In a small town	3		
In a large town/city	4		
Don't know	5		37

5. When was the first time that you (or this child) came to a big city? (If born in city give year of birth)

Date: 1 9 _ _ year | 1 9 _ _ 41

_ _ month (new arrival) | _ _

6.1 Have you (or this child) spent any time periods away from the city, for at least a full year without a break, since you first arrived or since birth?

Yes=1	No=2	

6.2 If yes:

Place	Length of time Years	Place	Length of time Years
1.		9.	
2.		10.	
3.		11.	
4.		12.	
5.		13.	
6.		14.	
7.		15.	
8.		16.	
TOTAL		TOTAL	

7. What is your home language?

Xhosa	1
Zulu	2
Sotho	3
Tswana	4
English	5
Afrikaans	6
Other (specify)	7

47

9.1 What is the highest standard you passed at school?
(For **PRESCHOOL CHILDREN** fill in NA=00).

No educational qualifications	01	
Sub A	02	
Sub B	03	
Std 1	04	
Std 2	05	
Std 3	06	
Std 4	07	
Std 5	08	
Std 6 or Form I	09	
Std 7 or Form II, ETC	10	
Std 8 or NTC I or Form III	11	
Std 9 or NTC II or Form IV	12	
Std 10 or NTC III or Form V	13	49

9.2 Do you have other training or education? Yes=1 No=2
(for **PRESCHOOL CHILDREN**, fill in NA=0)
If YES

Please indicate your highest qualification:

Formal training after school (eg NTC Diploma, IV or V nursing) - specify	1	
Graduate training	2	
Postgraduate training/education - Specify	3	
Informal training - Specify	4	
Other - Specify	5	51

Office No.

III. RISK FACTOR INFORMATION

1. **PHYSICAL ACTIVITY** For **PRESCHOOL CHILDREN** fill in NA=0.
For **SCHOOL CHILDREN** fill in code 1.

1.1 WORKING HOURS

1.1 Does YOUR WORK involve mostly: Not working NA=0

	sitting and standing (minimal walking), e.g. office work, sewing, teaching	1	
or	a lot of walking, e.g. postman, nursing, milkman, house cleaning	2	
or	hard physical work (sweat work) e.g. building, digging, manual labour	3	52

1.2 **AFTER HOURS** For **PRESCHOOL CHILDREN** fill in NA=0. For **SCHOOL CHILDREN** please complete A, B and C.

A. Do you get any regular exercise (muscle work) <u>OUTSIDE SCHOOL HOURS</u> (eg walking/ cycling, sport etc)

Yes=1	No=2		53
If yes go to B			

B. Is it light exercise e.g. gardening, walking, housework?

NA=0	Yes=1	No=2	

and

C. strenuous exercise, e.g.soccer, boxing, jogging, cycling

NA=0	Yes=1	No=2	

2. **TOBACCO SMOKING**

(For **PRESCHOOL CHILDREN** fill in NA=0)

Do you smoke regularly? (more than 1 cigarette or one pipe per day)

Yes=1	No=2	
If yes, go to 2.1	If no, go to 2.2	

2.1 <u>SMOKERS</u>

(a) How many cigarettes do you usually smoke per day? NA=00 58

(b) For how many years have you been smoking up to now?

(c) Do you smoke pipe regularly?

Yes=1	No=2	

(d) At what age did you start smoking regularly?

2.2 <u>If no</u>: Have you smoked regularly before?

Yes=1	No=2	

2.3

Some people think:	Smoking is harmful to one's health	1
Other people think:	Smoking is good for your health	2
For some people:	It does not matter to one's health whether one smokes or not	3
What do you think?		65

(For **CHILDREN YOUNGER THAN 10 YEARS**, fill in NA=0)

5. Have you (or has the child) attended any of the following Health facilities in Cape Town during the past two weeks? (Read all the options)

	Yes	No		
Day hospital	1	2		66
Clinic	1	2		
Private hospital/Provincial hospital	1	2		
Private doctor	1	2		
Chemist shop	1	2		
Christian faith healer	1	2		
Traditional healer or herbalist	1	2		
Health Services in the working situation	1	2		
Dentist	1	2		
Other, specify	1	2		75

6. WHO WAS ANSWERING MOST OF THESE QUESTIONS ?

THE CHILD 1
THE MOTHER 2
OTHER 3

BRISK MEASUREMENTS

	[ ][ ][ ][ ][ ][ ]	6
	0 4	
Person number	[ ][ ][ ][ ][ ]	
Mid upper arm circumference	[ ][ ].[ ]	16
Body weight	[ ][ ][ ].[ ]	
Body height	[ ][ ][ ].[ ]	42

IV. DIETARY INFORMATION

10 Office No. 6

0 5

Interviewer:

Sequence number 13

Date:

We now change to questions on food.

1. Do you eat your food: or does the child eat his/her food:

well salted?	1
OR lightly salted?	2
OR not salted?	3

2. Do you (or does this child) add EXTRA SALT OR AROMAT/FONDOR to his serving of food?

No, I never add extra salt/Aromat	1
Yes, but TASTE FIRST and then add	2
Yes, even BEFORE having tasted the food	3

3. Do you eat (or does this child) eat salty snacks more often than three times per week (i.e. luxuries such as chips, niknaks, salty peanuts, salty biscuits, biltong, dried sausage)

Yes=1 | No=2 16

4. How many eggs do you (or this child) usually eat per week (7 days)?

Do not eat eggs = 0 0 18

5. How are these eggs usually prepared, and at what meal are they usually eaten?

	N/A	Break-fast	Lunch	Evening meal	Between meals	
Fried in oil	0	1	2	3	4	19
Fried in margarine	0	1	2	3	4	
Fried in dripping/butter	0	1	2	3	4	
Boiled	0	1	2	3	4	
Scrambled	0	1	2	3	4	
Egg dish (eg omelette, specify: ....)	0	1	2	3	4	24

6. Do you (or does this child) usually eat the fat on meat (Do not mention the options)

Yes=1 | No=1

Eat only lean meat	3
Do not eat meat	4

25

7. Do you (or does this child) eat the skin of chicken (all poultry, duck, turkey)?

Yes=1 | No=2

Do not eat poultry = 3 26

8. How often did you (or this child) eat the following during the last week? (7 days)

Cheese		27
Fish (fresh and tinned)		
Chicken (excluding chicken feet)		
Beef, mutton, pork (including mince, sausage)		
Liver, kidney, brains		
Offal (including tripe, pootjies)		
Cold meats (polony, viennas)		
Peanut butter		
Dried beans, peas, lentils (excluding soup mix)		
Nuts (eg peanuts)		

8. What fat is used <u>mainly</u> for:
Please tick appropriate column and supply brand name.

NO FAT = 0

	Butter (Brick)	Marg. (Brick)	Marg. (Tub)	Marg. (Tub) (Med.fat)	White Marg. (Holsum)	Oil	Lard Drip-ping		
Frying	1	2	3	4	5	6	7		37
Roasting and stewing	1	2	3	4	5	6	7		
Making cake and bread	1	2	3	4	5	6	7		
As spread on bread, etc	1	2	3	4	5	6	7		
In gravies	1	2	3	4	5	6	7		
With cooked vegetables	1	2	3	4	5	6	7		42

If in doubt, please comment ....

....

....

APPENDIX I

COPY OF THE FEEDBACK SHEET

NORMAL LEVELS

RESULTS OF THE BRISK STUDY

MS MATHABO [redacted] 20959
[redacted]
KHAYELITSHA
7784

Dear Sir/Madam

You smoke 0 cigarettes per day.

Do not start smoking since it is bad for your health and can lead to lung cancer.

Your total cholestrol was 3.79 mmol/L

It is normal

Your blood pressure was 94/ 62 mmHg.

It is normal

Your haemoglobin was 13.5 mg/dl.

It is normal

Attached you will find guidelines for a healthy life style to protect your heart

Krisela Steyn (Dr.)

COORDINATOR BRISK STUDY

HIGH RISK LEVELS

RESULTS OF THE BRISK STUDY

MR HEZEKIAH [redacted] 20012
ROOM [redacted] OLD FLA
LANGA
7455

Dear Sir/Madam

You smoke 0 cigarettes per day.

Do not start smoking since it is bad for your health and can lead to lung cancer.

Your total cholestrol was 5.12 mmol/L

It is normal

Your blood pressure was 180/110 mmHg.**

** It is high - go to a clinic or a doctor to have it treated

Your haemoglobin was 12.5 mg/dl. **

** It is low - go to a clinic or a doctor to have it treated

Attached you will find guidelines for a healthy life style to protect your heart

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COORDINATOR BRISK STUDY

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MEDICAL RESEARCH COUNCIL
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Date/Datum September 1990

Dear Sir/Madam

Thank you again for participating in the BRISK study. The analyses of your blood is now complete. your results are printed on the attached form. If you have any values marked with a star(*) you should take these results to your clinic or doctor who will give your the appropriate treatment.

We hope that the results of this study will contribute to protecting the people of Cape Town townships from developing heart disease.

It is important that you take these results to a clinic or doctor if any are marked with a star(*).

Signed by candidate

Signature removed

Mnumzana/Nkosikazi/Nkosazana obekekileyo

Sithatha eli thuba lokukubulela ngokuthi uthathe inxaxheba kuphando ngezifo ezinxulumene nentliziyo (BRISK study). Kungovuyo ukukwazisa ukuba uphononongo lwegazi lakho luggityiwe, yaye oku kukukwazisa ngeziphumo zolo vavanyo. Ukubangaba kukho umqondiso oyinkwenkwezi(*) ecaleni kwesinye sezi ziphumo, zithathe uzise ekliniki okanye kuggirha apho uyakufumana unyango olulungele imeko yakho.

Siyathemba ukuba iziphumo zolu phando ziyakuthi zincede ekukhuseleni abantu base Kapa kwizifo zentliziyo.

Kubalulekile ukuba uzise ekliniki okanye kuggirha ezi ziphumo ukubangaba kukho kuzo ezinophawu oluyinkwenkwezi(*).

Signed by candidate

Signature removed

DR K STEYN

HOW TO KEEP YOUR HEART HEALTHY

The main causes of heart disease are: - high blood pressure ("i-high-high"), high blood cholesterol (a type of fat in the blood) and cigarette smoking. Other important causes are nervous tension, lack of exercise and the eating of too many fatty foods especially the type of fat found in animal products (such as in fatty meat and chicken skin and even in full cream milk and cheese).

If your way of life includes any of the causes of heart disease listed above, or if any members of your family have suffered from heart disease at a young age, we recommend the following lifestyle.

<u>To keep your heart healthy</u>: -

1. Have your blood pressure measured at a clinic or doctor once every 5 years.

2. Do not smoke.

3. Eat plenty of vegetables and fresh fruit. Use whole grain products (unrefined) such as whole wheat bread, unsifted mealie meal, oats and whole grain porridges (pap).

4. Eat less fat, especially animal fats which are harmful: -

   a. Cut off all the fat you can <u>see</u> from meat and try to buy lean meat (not fatty).

   b. Eat less of the foods which contain fat which you <u>can't see</u>, such as fried foods (like fish and chips), pies, pastries, cakes, cookies and factory made meats like polony and sausages.

   c. Use chicken (without the skin) and fish more often than red meat. Dried beans, lentils and split peas are also healthy substitutes for red meat, when they are eaten with cereals (e.g. beans with samp - "umngqusho", or lentils with rice.)

   d. Do not make gravy from the dripping (hard fat) of meat. Rather use a <u>little</u> sunflower ("fish") oil.

   e. Use ("fish") oil instead of butter or lard in baking and tub margarine as a spread. But use very little of both of these.

   f. Use skimmed milk instead of full cream milk and rather make your own amasi from skimmed or low fat milk.

5. Do not eat too much food which has a lot of cholesterol (a <u>type</u> of animal fat) for example brains, liver, kidneys, egg yolk and the marrow in bones. We suggest you do not eat more than 3 eggs per week. This includes eggs used in <u>preparing food</u> as in baking and even in bought mayonnaise.

6. Do not eat too much sugar or sweet foods which contain a lot of sugar, for example, sweets, jam, biscuits, cakes, etc.

7. A little alcohol does not increase the blood fats or blood pressure but too much can do so. (Not more than 2 drinks a day.)

8. Do not eat too much salt or salty foods, such as chips, salty biscuits, polony, soup powders and other salty seasonings.

9. Take regular exercise (3 or 4 times per week for at least 20 minutes) walking, running, cycling can be done. Remember not to do too much too quickly.

10. Do not become overweight. If you are overweight (the clinic can measure this) try to lose the extra weight by following the above guidelines, eating smaller amounts and doing more exercise.