SUCKING PATTERNS AND BREASTFEEDING BEHAVIOUR IN ASPHYXIATED AND MATCHED CONTROL NEONATES: AN EXPLORATORY STUDY

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Abstract

This study focuses on sucking patterns in the neonatal period, and their association with various mother-infant behaviours observed during breastfeeding. It uses as its framework the model of an active infant, whose behavioural repertoire influences the perceptions and actions of her/his caregiver, and is in turn modified by their responses.

From a group of 193 neonates, assessed over a period of 9 months, the sucking patterns of 15 infants diagnosed as asphyxiated at birth, on the basis of an APGAR score of < 6 at 5 minutes, and a TSR of $>$ 5 minutes, are presented. Various parameters of the sucking pattern are obtained from traces recorded by a suckometer, which simulates the breast-feeding situation as closely as possible. These are compared daily, from birth until the pattern stabilises, with 15 matched control S, who have uncomplicated birth histories. The behaviours of the mother-infant dyad during breast-feeding are then observed over 3 feeds, between 7 and 23 days after birth.

It is argued on the basis of the sucking results, that the asphyxiated group of infants comprises two subgroups, whose sucking responses fall at either end of the normal burst pause spectrum. This separation appears to be substantiated by dissimilar behaviour trends during breast-feeding.

The final picture which arises is that of a group of

asphyxiated neonates who suck for long periods with few pauses, and do not actively interact with their mothers, who consequently stimulate them less and terminate breast-feeding earlier, than mothers in the second group. Infants in the latter show a sucking pattern characterised by short bursts and long intervals. Their mothers interact with them in ways which appear directed towards organising their erratic behaviours, and over time their breastfeeding relations are observed to approximate those of their controls. It is concluded that discrepancies in early sucking patterns may reflect problems in integrative and adaptive mechanisms, which could continue to influence behaviour and relationships.

While this can only be an exploratory study in terms of the numbers investigated, certain measures are suggested to support those mother-infant dyads who appear at risk for disengaged breastfeeding relationships. Finally, indications for further research are discussed.

AIMS AND ORGANISATION OF THESIS

This thesis presents an investigation of a compromised group of neonates, who typically enjoy nominal attention once their biological functions stabilise. It aims at providing more detailed information about early development, and suggests possibly beneficial interventions, for the consideration of nursing staff and paediatricians.

The first chapter traces briefly the background of frameworks within which research on infant development has been carried out. It then delineates the particular model on which this study is based, and provides a specific rationale for the choice of sucking patterns and breastfeeding behaviours, as the focus of interest.

The second and third chapters aim to provide more detailed literature reviews of reported work on the sucking reflex, and on observation of early mother-infant breastfeeding interactions. The variables which require control in the study, as indicated by this literature, are isolated and presented, together with the hypotheses developed for evaluation.

Chapter Four outlines the methods used in selection of subjects, and the procedures for collecting data (which are further amplified in the Appendices). Chapter Five presents the results of the research.

Finally, Chapter Six discusses the results obtained within the context of other researchers' findings, and attempts to integrate the sucking patterns, breastfeeding behaviours and

subject characteristics, into a composite and meaningful picture. The chapter concludes with a survey of possible long-term effects, intervention procedures and suggestions for further research.

CHAPTER ONE

INTRODUCTION

Theoretical and experimental commentaries on the human infant, and his/her early relationships, have within the last few decades begun to take a new direction. In this introduction the flow of work is briefly examined to establish the present state of the field, and provide a theoretical framework for this investigation.

1.1 The Framework of Infant Development

Almost all psychological theories, whether in the tradition of Watson or Freud, celebrate the importance of infancy, and early experiences (Kessen, 1963). Perhaps the most distinctive aspect of human development is the infant's immaturity at birth, and concommitant period of dependence upon its parents or other care-givers. This allows time not only for intellectual development, and experimentation with behaviours in a protective environment, but also for the introjection of social norms. Thus, " ... in learning to communicate and in becoming aware of the expectations in a particular culture, the child becomes a social being" (Shipman, 1972, p.27). Theories of infant development concern themselves ultimately with the explanations of these changes, which through time transform a dependent infant

into a social adult.

Two major, inter-related issues arise from this general consideration of infant development. Firstly, what is the assumed status of the "dependent infant" and "social adult". Secondly, how is the "transformation" achieved.

Historically, the baby's essential helplessness in its biological state, became equated with a correspondingly inactive position in relationships. Parents and educational institutions were thus the determinants of human development, and the infant a 'biological baby' who was 'made social'. A position which was lent credibility probably by the obviously discrepant psychic structures of the infant and adult (Spitz, 1959). These views held as their basic assumption that an infant's initial repertoire of responses was ill-suited for functioning in a social world. The "dependent infant" was truly "dependent" until profound alterations had been effected (Ainsworth et al, 1976).

This position was matched by models of development which have been described as "mechanistic" and "reductionistic" (Lerner, 1976; Sameroff, 1972). Essentially the infant, having been posited as a passive structure presented with various stimuli by the adult, absorbed and eventually summed them to reproduce appropriate social behaviour. The transformation from a "dependent infant" into a "social "adult was thus presented as a unidirectional flow of influence from parent to child (Fitzgerald et al, 1982). A corollary of this stance was the "fixation hypotheses" that these early

experiences constituted later unalterable personality structures (Ainsworth and Bell, 1969).

It would appear that new insights into the theoretical assumptions underlying the characteristics of the infant, have produced the major thrust for recent departures in this field. The inter-relation of the two points identified however, indicates that conceptualisations of how an infant becomes a social adult were also necessarily revised.

The advancements in neonatal research and biomedical technology have highlighted the extraordinary physical capabilities of the newborn. Brazelton and Als, (1979), Moss (1973) and Newson (1977), among others, have commented on the infant's ability to reach out for, and organise a response towards social and environmental cues. More specifically, studies on auditory competence indicated conclusively that a newborn responds even to moderately intense tones. An infant's cries are distinguishable as indicating different states, and optimally, elicit appropriate caretaker action. They actively prefer to look at a regular rather than a scrambled face, and under 3 weeks of age fixate discriminatively on the face area 21% of their waking time. In addition, while motor control is relatively undeveloped, the newborn has a strong tonic neck and sucking reflex, which facilitates its feeding (Appleton et al, 1975, Bushnell, 1982, von Hofsten, 1982).

The change in emphasis however has been towards recognising not only the precocity, but also the variation and selectivity

of the infant behaviour (Richards, 1974). Researchers, prompted perhaps by the increasing number of ethologists, whose detailed in vivo observations illustrated the interactive features of animal behaviour, (e.g. Hinde and Procter, 1976; Kaufman and Rosenblum, 1967) questioned the unidirectional flow of information to so active an infant. Bell (1968) was one of the first authors to conclude that congenital differences among children could elicit different patterns of caretaker behaviour. It was suggested that the adult too appeared to be biologically programmed with certain behaviours, albeit presenting them within a particular historical and cultural context. These mutual selective attentions then predisposed the adult and the infant to interaction which leads to development. The exact patterning of the interaction was dependent not only on the caregivers responses, but also on the infant's congenital temperamental characteristics and the response his/her behaviours elicited in the adult (Ainsworth et al, 1976; Bell, 1971; Fitzgerald et al, 1982; Richards, 1974; Thomon, 1975).

The acknowledgement of the infant as an active contributer in her/his relationships has been associated with correspondingly different theories of development. The "mechanistic" viewpoint was replaced by one which has been termed "organismic" (Lerner, 1976; Sameroff, 1972).

Neonatal behaviours were seen as transformed through these earliest transactions with significant others. The trans-

formations could only be understood by examining the infant as a whole, however, because there was a multiplicative interaction between the infant and its environment. Adult behaviour was also seen as a dynamic product where inner structures were more or less modifyable through experience, just as experience was influenced by new structure. Early experience was not seen therefore as the sole, major and unalterable determiner of later outcome (Ainsworth and Bell, 1969).

The framework within which this study is located is broadly that discussed above; of an active infant whose behaviour interacts with that of his/her caretakers, and by implication is modified by their responses. Both the behaviours, and their modification, can only be meaningfully viewed, though, by examining them in their totality, within an appropriate context.

1.2 Rationale for the Investigation of Neonatal Sucking and Breastfeeding Behaviour.

Coincidentally with the development of the "organismic" viewpoint, much impetus to examine the very early relationship between mother (or primary caregiver) and child was provided by the work of Bowlby (1978). His conceptualisation of the developmental importance of the "bond" between the major caretaker and the infant, logically resulted in "measures of attachment" becoming the focus of much research (Ainsworth, 1976; Bernal, 1976; Blurton Jones, 1972).

"Atachment behaviours", which he grouped into two main classes, included signalling behaviours, e.g. crying, smiling and babbling, and approach behaviours, e.g. following and clinging (Bowlby, 1969). It was postulated that these behaviours represented operationally definable entities, which could be objectively observed, and their effect upon the caretaker quantified. This, together with observations of the caretakers' responses, was proposed to lead to a concrete formulation of what constituted optimal behaviour and conditions for attachment, and, ultimately, the closer "bond" with a caregiver, and thus healthy development.

The importance of understanding what was involved in the making and breaking of this "attachment" also received attention from the medical profession. Their concern was related to the ever increasing numbers of physically compromised babies who were surviving as a result of improved medical care (Brazelton et al, 1976; Werboff, 1963). This was perhaps a continuation of the ethos which owed its inception to the "battered baby" syndrome, found to be significantly higher among premature babies who were initially separated from their parents (Klaus and Kennell, 1976). The profession was alerted to the inadequate and unacceptable relationships which could arise between caretaker and "abnormal" child if "bonding" was disturbed. Their concern was thus to identify significant indicators of poor attachment, or what may precipitate it, for purposes of prevention and amelioration.

Both Bowlby and Klaus and Kennell's papers have been vociferously criticised. Bowlby's theory of attachment was seen by Bell (1974) as failing to acknowledge the infant's inherent social bias, which includes attachment behaviours, but supercedes them. Rutter (1977) emphasised the relative flexibility of infant attachment, both between people and over time, and felt Bowlby laid too great an emphasis on initial experiences with a single caregiver. Similarly Chess and Thomas (1982), and Herbert et al (1982) have challenged Klaus and Kennell's (among others) pessimistic view of the irreversibility of early events during hospitalization. They pointed out the importance of taking into account the mother and infant's total psychosocial and physical states, and refuted the desirability of laying down absolute conditions for "optimal" mother-child "bonding".

Essentially, however, these criticisms are grounded in the extant viewpoint of the infant's active role in early relationships and the continuing dynamic interaction of environment and experience, to which both Bowlby, and Klaus and Kennell, adhere. While there is undoubtably controversy about the degree of importance of the very early interactive processes between infant and adult, these theorists have provided the impetus for much of the research in the area. Klaus and Kennell, in addition, have certainly contributed somewhat to tempering the contemporary medical view of birth as a health crisis, during which women are separated from chosen companions and denied the right to make decisions.

Although generally a less extreme view of these first interactions is now taken (Bernal Dunn, 1977) in contrast to earlier work (Robertson, 1969), this does not detract from the merit of optimising early experiences. While they may not result in "unalterable" adult personality structures, based crudely on the success or failure of initial "bonding", they do constitute the beginnings of a style of behaviour in human relationships which will manifest in later interactions. During the earliest weeks of life, the major proportion of interactive behaviours centre around feeding (Bernal and Richards, 1977; Sander, 1969). It will be the experiences of both caregiver and infant in this relationship which will contribute to their perceptions of one another and their ongoing interaction. Furthermore, Kessen (1963) has suggested that stable differences in infant behaviour may be apparent in the sucking pattern from the first days of life, and that early learning and adaptation is also optimally viewed in the feeding situation. This early and vital interaction thus appears to provide an ideal cameo for studying the effects an active infant has on his/her caretaker, during a mutually significant period.

1.3 Essential Design of Research Presented

Several strategies are available for observing the effects infants' behaviour has on their caretakers. Lewis and Rosemblum (1974) have collated these into three groups. A particular attribute of the infant may be altered experimentally, and the effect this has on the caretaker observed.

Secondly, different characteristics of the infant may be presented to the adult and the dimension of the latter's behaviour monitored. Finally, the more biological dimensions of an infant may be observed and their real and potential effect on the caregiver considered. They go on to comment however, that none of these methods really address the dynamic elements of the dyadic system, which can only be captured through dyadic study.

This research attempts to combine both a study of a variable biological dimension of an infant, which can be monitored independently of the dyadic relationship, and observation of a dyadic interaction, in which the variable is an important factor. Within the third group of strategies suggested by Lewis and Rosenblum (1974), the biological dimension selected is the sucking reflex. The dyadic interactive situation, breastfeeding is suggested to be of relatively great signficance during the first month of life, for those mothers who elect to breastfeed. The study thus addresses itself to a situation which is of practical and emotional importance to mother and child.

In conclusion, it has been established in this chapter that the task of this study is

> not so much to convince the community that the organism affects and alters its caregivers, but rather to determine what might be the manner of this effect and how it might be measured.
>
> (Lewis and Rosenblum, p.xvi ibid)

The time period for investigation has been narrowed to the neonatal period, during which the importance of mother-child interaction is accepted, although the extent of its ramifications is debated. Finally, the focus of the research has been presented as the breastfeeding situation, and the biological variable the infant takes into this interaction, the sucking reflex.

CHAPTER TWO

RESEARCH ON THE SUCKING REFLEX

In this section, the characteristics of the neonatal sucking reflex are described in detail, and its reported variation between different populations examined, with specific focus on the sucking reflex of asphyxiated neonates. Factors which influence the sucking reflex are deduced from a literature review and presented as variables, for which it was necessary to control in this study. The chapter concludes by outlining the specific characteristics of the sucking pattern which were tapped for investigation, and the null hypotheses proposed for statistical evaluation.

2.1 The Sucking Reflex as a Research Variable

The neonate's sucking reflex was a part of their behavioural repertoire which appeared to be largely taken for granted in the past. Kashara (1916) asserted that "idiots" always showed irregularities in their sucking curves, and the following year Blanton (1917) corroborated, while warning that only the analysis of the "fine structure" of sucking patterns would indicate retardation or injury. These early reports were only to be enlarged upon to any great extent, however, within the last two decades.

This is surprising, since the sucking reflex obviously lends itself to empirical research. Sucking has been elicited by stimulation about the mouth area, in the human foetus at 29 weeks age (Bosma, 1969). In term infants this reflex is one of the most highly developed, and is one of the few well defined responses in the infant's repertoire (Kaye, 1967). Furthermore it is demonstrably stable and while recordings from hours after birth may be the most sensitive measures of infant differences (Anderson-Shanklin, 1980), by the 4th. day it is said to assume a characteristic set pattern in normal neonates (Brown and Pieper, 1973; Ngai and Yamada, 1971; Wolff, 1968).

In the uncompromised newborn, sucking occurs in "bursts", interspersed by pauses with no sucking ("interburst intervals"), which tend to become longer as the feed progresses. The sucking itself involves several complex mouth, tongue and jaw movements. Essentially it comprises a negative pressure component by which the infant "suctions" milk into its mouth, by lowering intraoral pressure, and an expressive component, which expels milk from the nipple/teat by compressing it ("mouthing"). While "suctioning" seldom occurs without mouthing, the latter may be seen without "suctioning". The exact characteristics of the negative pressure and expressive components may be defined in several ways including measures of frequency, amplitude (mm HG), percentage time of occurance, change in rate, and so forth. Sucking thus has both a rhythm of total activity and a wealth of finer movements in each response (Benoit, 1971; Crook, 1979; Kaye, 1967; Nagai and

Yamada, 1971; Sameroff, 1968).

2.2 Reported differences in the Sucking Behaviour of Compromised Neonates

The relative ease and accuracy with which sucking may now be monitored, has promoted a growing body of work concerning this reflex. Several studies have attempted to demarcate populations of babies whose sucking patterns deviate from the norm. One of the most comprehensive classical studies was reported by Wolff (1968). His sample included 29-30 week gestational age prematures, Downes Syndrome babies, hypoxic babies, babies with hyperbilirubinemia, dysmature infants (low birth weight), babies who suffered seizures of unknown origin, infants with metabolic disorders and major brain malformities, and several adults with severe neurological disease. He maintained that in alert normal neonates there was little variance in his normal control's sucking parameters. He found that this pattern was also shown by premature babies at 33 weeks onwards, those whose metabolic disorders were treated, and in babies whose brain malformation affected only the higher centres.

In addition, 2 adult patients, one with chronic encephalopathy and one with senile dementia differed from normal adults in showing a typical neonatal sucking pattern. Those S whose sucking behaviour was significantly different from the control group included Downe's children, hyperbilirubinemias, dysmature babies, and those who had suffered seizures.

Wolff's study was confounded by very low numbers, particularly in the group of brain injured infants, and the eroneous belief that intra-oral pressures were directly equal to intra-nipple pressures. He provided, however, a significant starting point for other research into the differences between sucking patterns of "at risk" and normal neonates.

These later investigations have commonly included only one group of Wolff's (1968) abnormal S - the premature babies. Drew et al (1979) found that preterm infants with low obstetrical optimal scores differed in sucking pattern, both from controls, and preterm infants whose obstetrical history was optimum. Barrett and Miller (1973) found differences amongst their preterm infants associated with conceptional age and not with gestational age, and Miller (1975) later related differences to histories of prenatal distress as well.

The use of premature infants, whose sucking patterns do appear from reported research to differ from those of uncompromised full term babies, as a comparison for the purposes of this study is contra indicated. Most obviously the specialised treatment required by prematures would mean they were separated from their mothers, and the interaction therefore unobservable, until perhaps after their sucking patterns had returned to normal (33 weeks according to Wolff (1968)).

The other groups of neonates whose sucking patterns have been

investigated and found to be deviant, may be collectively termed the "at risk" group. They include those who had prenatal, intrapartum or neonatal complications as assessed by common paediatric procedures. Cowett et al (1975) classifying their low birth weight group as severely or mildly stressed, primarily on their neonatal course, found only the former group to differ from normals. Dubignon et al (1969) found that prenatal factors were also associated with differences in sucking patterns, as did Drew and Wolff (1972).

Previous research thus indicated a large potential population of S who could be distinguished by their sucking from normal S. The stresses related to these distinct sucking patterns were far from uniform though. The selection of S was based on observed complications after birth, however they arose, or on several prenatal and/or intrapartum factors. In order to examine the relationship between sucking pattern and mother-infant behaviour, it was considered desirable to compare as homogenous a stressed group as possible, with normals. This would eliminate as far as practical any confounding by the different stresses, in their contribution to differences in mother-infant behaviour, beyond that of the sucking abberations.

2.3 The Sucking Reflex of Asphyxiated Neonates

"Asphyxia Neonatorum" is one of the medical syndromes which is commonly known, clinically, to affect sucking ability of the newborn. Asphyxia, or failure to begin breathing

spontaneously at birth, usually results either from intra-uterine asphyxia, or as a result of anaesthetics and analgesics administered to the mother, the latter being a known variable which can be controlled (Hull, 1971). In view of the asphyxiated baby's initial difficulties with sucking, it is surprising that no published study appears to have specifically focused on this group of infants previously. Molteno (1976) suggests that one of the factors which may have contributed to this omission is the difficulty in defining asphyxia. At least one other study, however, has included asphyxiated infants in its "at risk" group. Wolff (1968) found principally that the variance in his S's sucking pattern was greater, but reported no other significant differences compared to those of his other experimental groups. This may be indicative of the general clinical observation; that many asphyxiated neonates appear to "recover" and be returned to their mothers within a relatively brief time period after birth. Apparently no detailed work has been done on whether their sucking pattern also "recovers", since they are able in some way to obtain enough milk to thrive, and are thus soon of no continuing medical interest.

The first part of this investigation was therefore directed towards establishing what, if any, were the differences in sucking behaviour between a group of asphyxiated, and normal neonates. It was motivated by the apparent homogeneity of the group, (although of course different degrees of asphyxia were expected), the lack of previous research in this area, and a pilot study which had already indicated tentative differences (Conacher, 1979).

2.4 Factors affecting the Sucking Reflex

Several investigations have described factors, both in the mother and in the neonate, which bear a relationship to its sucking pattern. A survey of this research is complicated by the fact that definitions of 'sucking patterns' and methods of recording them, are far from uniform. Ultimately the prospective researcher bears the responsibility of defining the measures to be used in the proposed study, and can only be guided by research findings based on similar recording methods.

The aim of this study being to relate sucking patterns to behaviour during breastfeeding, it was considered most appropriate to record sucking under conditions which resembled the breastfeeding situation as closely as possible. Essentially this implied that breast milk would be delivered in a manner which simulated that of the mothers breast. Several reports have indicated a marked difference in "non-nutritive" sucking (where no fluid is delivered) and "nutritive" sucking (fluid is available) conditions (e.g. Bosack, 1973; Crook, 1976; Dubignon et al, 1969). The literature surveyed here (Tables I, II and III) thus all focused on "nutritive" sucking situations during the first few days of life, although research on non-nutritive sucking was also noted (e.g. Barrett and Miller, 1973; Brown, 1972; Brown and Pieper, 1973; Dreier and Wolff, 1972; Dreier et al, 1979; Dubignon et al, 1969; Filippova, 1972; Goldec et al, 1970; Hiveau, 1976; Lester et al, 1976; Nosikov and Shabalov, 1978; Wolff, 1968; Wormith et al, 1975).

TABLE 1 : PREVIOUS RESEARCH ON FACTORS ASSOCIATED WITH THE MOTHER WHICH AFFECT SUCKING PATTERNS.

AUTHOR	S's	FACTORS CONTROLLED FOR	SUCKING MEASURES
Dubignon, Campbell, Curtis and Partington 1969	94 neurologically normal 1-4 day neonates, 66 of whom had non-optimal factors in their medical history Conclusions Length of labour, anaesthetic and sedation and parity were significantly related to changes in sucking measures.	Type of delivery Birth weight Gestational age Method of feeding (breast/bottle) Apgar rating Sex	Sucking time Total number of sucking responses Sucking rate Over 2 mins.
Fillipova	91 healthy and 47 compromised 1-6 day old infants Conclusions Length labour affects infant's sucking pressures on day 6, and is particularly important for infants of complicated deliveries.	Time before feed Infant state Infant age	Peak sucking pressure over 20-30 minutes
Kron, Litt, Phoenix, Finnegan, 1976	43, 1-3 day old babies of drug-dependent women. 10 normal babies Conclusions Measures differ significantly between groups, according to mother's drug history.	Analgesic, sedative and anaesthetic drugs during normal mother's labour	Sucking rate. Nutrient consumptions. Peak sucking pressures.

.. continued on p.19.

TABLE II : PREVIOUS RESEARCH ON FACTORS ASSOCIATED WITH THE NEONATE WHICH AFFECT SUCKING PATTERNS.

AUTHORS	S's	FACTORS CONTROLLED FOR	SUCKING MEASURES
Dubignon, Campbell, Curtis and Partington 1969	94 neurologically normal 1-4 day neonates 66 of whom had non-optimal factors in their medical history. Conclusions Type of delivery, birth weight, gestational age and apgar ratings were related to changes in sucking measures. Method of feeding (breast/bottle) and sex was NOT associated with change.	Length labour. Anaesthetic and sedation. Parity	Sucking time Total number of sucking responses Sucking rate. Over 2 mins.
Kron, Stein, Goddard, 1963	20 normal new-borns 1-7 days old Conclusions Sucking rate and volume consumed increased as the infant got older, and was not due to 'learning effects' on the apparatus.	Sex. Method of feeding. Time of feeding. Environmental temperature, noise, light.	Number of sucks per minute (sucking rate). Volume consumed. Peak sucking pressure. Over 9 mins.
Lipsitt, Reilly Butcher, Greenwood, 1976	44 normal infants aged 3-6 days Conclusions No differences on sucking measures related to whether infant was breast/bottle fed, or sex.	Environmental temperature, noise and light. Position of infant.	Total number of responses. Inter-burst intervals. Sucking rate.

FEEDING PATTERNS.

AUTHORS	S's	FACTORS CONTROLLED FOR	SUCKING MEASURES
Bosack, 1973	50 normal babies aged 1-4 days. Conclusions Nutritive sucking is significantly different on all measures from non-nutritive sucking.	Time after previous feeding Position of infant	Overall sucking frequency. Number of sucks per burst. Within burst sucking rate. Over 15 mins.
Burke, 1977	24 normal 2-4 day old babies Conclusions IRT changed with change in fluid sugar composition	Position of infant. Delivery of fluid. State of infant. Time after previous feeding Birth weight Sex. Age.	Sucking (ve pressure), inter-response times (IRT's) (essentially the inverse of sucking rate). Over 9 minutes.
Crook, 1976	53 normal 2-3 day old babies. Conclusions IRT and cumulative pausing changed by fluid composition.	Time after previous feeding. Position of infant. Environmental noise. Delivery of fluid.	Total number of responses. Cumulative pausing time IRT's Over 4 minutes.
Woolridge, Drewett, Baum, 1980	24 bottle-fed normal babies aged 4-9 days Conclusions It must be milk flow rate and not milk fat composition which changes a baby's sucking pattern during a feed, i.e. no difference found on all measures.		Milk intake rate. % rest time during feed Sucking rate Over time taken to drink 40ml milk

AUTHOR	S's	FACTORS CONTROLLED FOR	SUCKING MEASURES
Drewett and Woolridge, 1979 & 1981	122 6-day old breast-fed infants, uncom-promised Conclusions Difference in sucking pattern during breastfeeding is not related to changes in milk fat composition during feed.	Mass Sex Parity	Volume taken from alternate breasts
Elder, 1970	27 normal 3-5 days old babies Conclusions Temperature of environment, age of infant and time of feeding (morning/ afternoon) related to pressure	Weight Apgar score. Method of feeding	Sucking pressure Over 30 minutes
Hillman, Bruner, 1972	48 normal 1-4 month old infants Conclusions Rate of delivery of milk is associated with changes in sucking measures	Type of feeding Position of feeding Person doing the feed-ing Environmental noise	Inter-burst intervals Sucking burst Over 30 minutes
Lipsitt, Reilly, Butcher, Greenwood, 1976	44 normal infants aged 3-6 days Conclusions Differences on all sucking measures realted to type of fluid delivered.	Environmental temper-ature, noise, lighting. Position of feeding	Total number of res-ponses. Inter-burst intervals. Sucking rate.
Macfarlane 1975	20 normal breastfed infants, ages 3-6 days Conclusions By age 6 days babies showed a differential response to their mother's breast pad smell.	Gestational age, Chronological age, Sex, Drugs, Delivery	NO sucking measures Head turning examined

2.5 Variables controlled and compared in Examining the Sucking Reflex of Asphyxiated and Uncompromised Neonates

An examination of these, at times conflicting, studies led to the conclusion that it was necessary to control for certain factors, to prevent their confounding the proposed research:

1. Factors associated with the mothers;	anaesthetics and analgesics length of second stage of labour alcoholism/drug addiction (mothers were excluded) smoking parity
2. Factors associated with the neonates;	mass gestational age sex age in days from start of sucking
3. Factors associated with the method of feeding;	rate of milk delivery time since last feeding time of day state composition of milk smell of apparatus position of the infant environmental temperature, noise and lighting the person feeding the baby (only mother and author)

Where these factors could not be held constant, they were matched between groups.

The variables chosen for comparison between the two groups, based on the preceding research summary, and the elements of the sucking reflex discussed in 2.1 were:

Mean number of responses per burst
Mean interburst interval
Mean intraburst rate
Ml taken per sucking minute
Ml taken per minute
% time spent mouthing
Mean amplitude of mouthing
% time spent sucking
Mean amplitude sucking

The construction of an instrument designed to monitor these variables in a manner which resembled the breastfeeding situation as closely as possible is described in Appendix A, together with definitions of the measures, which were made over 20 minutes of feeding time. The null hypotheses proposed for statistical evaluation were; there will be no difference between the 9 sucking variables of the normal and asphyxiated neonates, during their first 4 days of sucking, and once their pattern has stabilised.

Having established the range of sucking measures obtained independently from the neonates for comparison between the two groups, it is necessary to review the interactive breastfeeding situation in which the sucking pattern manifests.

CHAPTER THREE

OBSERVATION OF THE MOTHER-INFANT DYAD

This chapter begins with a discussion of the general use of in vivo observation as a research strategy. Those factors which have been reported as interacting specifically with mother-infant behaviours when under observation are then presented. The literature on studies of mother-infant breastfeeding relations is reviewed, to present a rationale for the method used in this study, and the difficulties associated with including compromised neonates in research discussed. Hypotheses concerning behaviours associated with breastfeeding, its success and duration are finally developed for evaluation.

3.1 The Use of Observation in Research

While much of the earliest work utilising in vivo observations as a research strategy involved the study of animals, it has become an increasingly popular technique in the study of human behaviour. Common to both groups of researchers is the belief that the behaviour of the species is adapted to its environment, and is most meaningfully studied in this natural setting, unless specific reactions to abnormal situations are of interest. Much of the criticisms of observational studies has been based on misunderstandings

of the purposes of these investigations, or the belief that they are underpinned by an equation of animal with human behaviour. Some reports have fostered the latter misapprehension, for example, Klaus and Kennell's work on "sensitive" or "critical" periods for mother-infant bonding, analogous to those in animals (Kennell, Trause and Klaus, 1975). Certainly it is not this author's intention (along with many others, e.g. Werboff (1963), Kessen (1963)) to construe the observations reported here on the base of ethological work.

The alternative to observations of human interaction are indirect methods of study; questionnaires, anecdotal reports or interviews. These are all highly susceptible to the collection of distorted information, either because of the time lapse and intervening experiences since the occurences, or the censorship of culturally unaccepted behaviours (Moss, 1965). Furthermore, much interest has recently centred around the fine details and sequences of behaviours, which no one can be expected to remember, particularly if they are a participant in the interactions.

The collection of this detailed information has also been presented as a fallability of observational research however; - that the attention to fine behaviour results in an unawareness of significant global patterns (Richards and Bernal, 1972). It is contended, in answer, that the grouping of fine behaviours on a statistical basis, allows for a less biased picture of interactions, than does the selection of

global definitions based on some theoretical premise.

Observational techniques are certainly not without their own methodological problems though. Most obviously the presence of an observer will influence the behaviour under observation. In addition, naturalistic observations by definition lack standardisation, as the living situation varies from home to home. Specific settings and situations will have idiosyncratic meanings to different people. Finally, the method of recording information during the observation holds issues, both about the selection of items and the mode of capturing them (Moss, 1965).

In considering the selection of items the researcher needs to address the issues of reliability and relevance or validity. The reliability will be a part of the clear definition of discrete observable behaviours, and will interact with the suitability of the recording method chosen to capture them. Behaviours cannot be observed unidirectionally. Any interaction may affect the course of subsequent ones in the relationship, and thus measures of behaviour of either participant are affected by influences from the other. The measures of behaviour have reference for the relationship, and do not represent uncontaminated characteristics of either individual. In order to record observations in such a situation (specifically with 2 people) either dyadic descriptions must be given, or co-occurences of behaviour noted. In the first, items (for example, contingent response to infant distress) often exclude other behaviours, and their recording

is limited by time. The second strategy artificially represents the elements as occurring in isolation, and although the frequency and sequence of items is preserved, their duration and the time separating them is not (Hinde and Hermann, 1977; Yarrow and Anderson, 1979).

The validity of items may be assessed by comparison with other studies. It must be remembered however that people invent their own signals and variations on common signals, and the better integrated the communication between subjects, the more subtle, cursory and difficult to capture it is. It is a matter of conjecture at times (unless reported research has suggested otherwise) that what is important for the researcher, also has import for the S, and this is particularly so for work with infants (Whiten, 1977).

3.2 General Factors found to Influence Mother-Infant Observations

Bernal Dunn and Richards (1977) commented on the paucity of reported observational studies of the neonatal period, and a current review of the literature reveals that there are still relatively few publications. Some general factors are beginning to emerge, however, as being of importance when observing early mother-infant interaction.

a) Bernal Dunn and Richards (1977) commented that they found mothers were at ease with observers who had interacted with them from the time of their delivery. The

mothers themselves preferred an observer in the room to a camera, or observation by an unseen person. It has also been found that emphasising the normative, non-evaluative task of the observational study, and de-emphasising the mother's role as a subject, contributed to a more relaxed and less contrived atmosphere (Moss, 1965; Richards and Bernal, 1972).

b) Environmental Context

This has been discussed as determining to some extent how an infant and his/her mother will behave (Yarrow and Anderson, 1979). Chess and Thomas (1982) have pointed to the anomaly of drawing conclusions from what to the infant must seem curious procedures in strange situations, and the importance of researching 'natural' contacts.

c) Social Background

Tulkin and Kagan (1975) have pointed to the difference in mother-infant interactions between "working class" and "middle class" groups. They found essentially that the former mothers stimulated their infants more physically, and the latter, more verbally. Certainly it is reasonable to assume that the mother's own socialisation, and the subcultural styles, will affect behaviour in many situations including breastfeeding.

d) Infant State

This is a factor which has general applicability to mother-infant observation, but discussion of it is witheld to the following section, where its particular significance in the breastfeeding-situation is reviewed.

3.3 Significant Factors in Observational Research on Mother-Infant Feeding Interactions.

The framework of this study is that of an active infant who influences her/his caretaker and whose behaviour is in turn modified by their interaction. This means that by implication all the factors controlled for because they may confound sucking measures have equal applicability here. Any factor which may alter a baby's sucking pattern would modify the mother-infant interactive behaviours during feeding, due to the influence the modified sucking pattern would have on the mother, and in turn her response to the baby. In this section all the factors which in previous research have been found to influence observed breastfeeding behaviours are discussed, although they may have already been identified as confounding variables in the previous chapter.

a) Sociopsychological background of family

One of the classical studies on social class and mother-infant feeding was carried out by Newson and Newson (1963).

They reported that increased modesty and lack of privacy resulted in fewer working class mothers breastfeeding. Although these two conclusions were not supported by Richards and Bernal's study (1972), they did find that certain other indices differentiated the group of mothers who chose to breastfeed, from those who bottle-fed. These included age of mothers, age gap between children and contraceptive methods. Switzky, Vietze and Switzky (1979) also found attitudinal and demographic differences between breastfeeding and bottle feeding mothers. Breastfeeding mothers had a higher educational standard, more breast-feeding friends and perceived their husbands as more supportive of their feeding mode. The bottle feeding mothers reportedly perceived their marriages as having more conflict and favoured hastening the development of their infants. While this study limits itself to breastfeeding mothers, it was considered possible that in a population where breast-feeding is strongly advocated, those factors which are associated with bottlefeeding in other studies, may mediate the success and persistence of breastfeeding.

Entwhistle, Doering and Reilly (1982) in a very elegant study, have shown that in their population social class was not as important as prior preparation for breastfeeding and whether the mother herself was breastfed, in determining success of breastfeeding. The strongest predictor of success, they reported, was

the woman's prenatal intentions. Although no published work has studied these factors in the population under investigation in this study, it was considered better to be conservative and to control for the possibility of their confounding the research questions on success and perseverance of breastfeeding, and specific behaviours during breastfeeding

The sociopsychological factors monitored in this study thus included the parental ethnic group, the mother's relationship to the father (legal and emotional), her financial position, living conditions and environmental support structure, and the parental educational standards and occupations.

b) Factors associated with the Mother

Closely allied to the mother's intentions about breast-feeding are her parity and previous breastfeeding experiences, if any. Bernal Dunn and Richards (1977) found that primiparous mothers stimulated their babies to suck more often, looked away from their babies less and spent less time rubbing their babies to burp them, for the first few days postpartum. Thoman (1970) also found that first babies sucked less when being breast or bottle-fed by their mothers, although their sucking pattern was no different to second babies when being bottle fed by an experienced nurse. Campbell (1973) described a very similar sucking pattern in the infants of his primiparae. Thus the consensus appears

to be that the mother's previous experience, and presumably the success or otherwise of prior breastfeeding, interacts with the infant's feeding behaviours.

In this study, parity and experiences with earlier breastfeeding attempts, as well as the mother's intentions to breastfeed, were held constant.

c) Delivery Factors

Although it has been suggested that a woman's experience during labour and delivery may affect her intention to breastfeed, and her success and persistance, this has not been corroborated (Entwhistle et al, 1982). A closer examination of behaviour during breastfeeding did, however, indicate that relatively long second stage labour was associated with difficulty in feeding. Mothers engaged in more behaviours directed towards encouraging feeding, and infants lost the nipple more often. These relationships were less apparent after the first week (Bernal Dunn and Richards, 1977).

It is difficult to dissociate the effects of a long second stage labour and drugs administered during labour, although Bernal Dunn and Richards (1977) indicate these may not be connected. Certainly it is generally agreed that anaesthetics and analgesics alter the behaviour of both mother and infant from birth, and may set up a "drugged style" of interaction that gives rise to persistant differences in behaviour

(Aleksandrowicz and Aleksandrowicz, 1976; Bernal Dunn and Richards, 1977).

In this research, type of delivery, length of second stage of labour (if applicable) and drugs administered, were monitored and controlled.

d) Factors associated with the Infant

One of the most significant factors recently identified as affecting all caretaker infant interactions, is the "state" of the infant - whether the baby is asleep, alert, crying, etc. Ainsworth and Bell (1969) have shown how this influences feeding behaviour and most other researchers include it in their observations as a matter of course (Bernal Dunn amd Richards, 1977). An interesting observation made by Moss (1975) was that when state was controlled for in his study, a sex difference in behaviour, which has been widely reported, disappeared. Generally, male infants have been presented as more active (Moss, 1975) and taking longer to feed (Lewis, 1972). It is also apparent however that male babies are stimulated more (Field, 1977) and that the sex differences appear to be, initially, more attributable to the mothers than the infant's behaviour (Belotti, 1975; Lewis, 1972; Thoman, 1975).

Whatever the direction of the responsibility for differences, the infant's sex is a significant factor which was matched in the two groups. State was monitored during observations.

3.4 Limitations of the Research with Mothers and Compromised Infants.

In spite of as many factors as possible being controlled by matching, there are three major variables which cannot be accommodated in this study. All of the mothers whose babies were asphyxiated at birth were aware that there had been complications. It is impossible to predict precisely how this knowledge would affect the mother's feelings and behaviour towards her child. Closely allied to this was the additional problem that many of the asphyxiated babies were separated from their mothers after birth, for intensive care treatment, which in some cases lasted days.

The normal hospital procedure allowed the control group mothers contact with their babies immediately after birth, if they requested it. They then had them beside their beds in hospital after about 6-8 hours, until they were discharged. The third variable, again linked to the problem of working with compromised neonates, was the onset of the mother's lactation.

Much research, a lot of it in the Klaus and Kennell (1976) tradition, has been carried out on mother-infant early separation and the subsequent consequences. At present, as has been mentioned earlier, the field is in a state of flux, with criticism being directed towards the "all or none" hypothesis of early bonding. More sophisticated studies are being directed towards evaluating the short and long term effects of separation, on both parents/family

and infant, and the mediating factors which lead to these effects.

Reports on short-term effects of amount of contact on mother-infant behaviour abound. The study reported here to illustrate these, was selected because it focuses specifically on feeding behaviour. Carlsson et al (1977) using Richards and Bernal's (1972) behaviour categories for feeding observation concluded that contact between mother and child for a period of time not exceeding 2 hours immediately after birth, affected nursing behaviour during the first four days after delivery. Specifically they reported an increase in "affective" components of nursing behaviour.

While the latter study focused on very early contact after uncomplicated births with healthy infants, others have looked at the consequences of longer term separation with compromised infants. Leiderman and Seashore (1977), taking into account often neglected variables such as parity of the mother, sex of the infant, and social background of the family, found that all these interacted with the mother's behaviour and reported feelings, after a 3-week separation from a premature infant. Although the effects of separation continued for a month after the pair were reunited, follow up at 11, 12 and 15 months indicated that the only difference persisting was that non-separated mothers continued to touch their infants more.

In a recent attempt to elaborate on the interactions which occur between parents, infants and staff, when a baby requires

separation and intensive care, La Rue Jones (1982) has indicated the complexity of the situation. She found that infants tended to vocalise less as their number of days increased in the Intensive Care Unit (ICU) environment. Parent-infant contact correllated inversely with distance between hospital and home. Preferences of staff for infants were related essentially to long term prognosis, family-infant and staff-infant relations, staff sense of success or failure when working with the infant, familiarity, and physical and perceptual accessibility of the infant.

It would therefore appear that no immediate contact after birth, longer mother-infant separation, and accommodation in an ICU will have some effect on the infant's status and the mother-infant interaction. While differences in nursing behaviours have been indicated between breast/bottle fed infants, no comparable study has apparently shown differences in recorded sucking patterns. In fact it has been postulated that bottle fed infants in ICU may be more familiar with the recording bottles and thus be at an advantage (Richards and Bernal, 1971). The recording and comparison of sucking patterns between the two groups does not therefore seem to be as affected by these factors, as the observation of mother-child interaction.

Mercer and Russ (1980) have thoroughly investigated the variables affecting the time between childbirth, and the establishment of lactation. They found that the timing of the first breastfeeding experience was of greatest importance although in addition mothers who received no drugs

generally lactated earlier than those who were medicated. The use of drugs having been matched for in this research (Chapter Two), it became obvious that the mothers who were separated from their infants needed particular care to help them express milk regularly.

In this study, it was only possible to note these confounding variables initially, and to minimise mother-infant separation in every way possible. In fact, as reported in Chapter Six and indicated by the results, it was ultimately possible to control for these factors.

3.5 Formulation of Hypotheses for Evaluation

Having established the major factors reported to influence mother-infant interactions during feeding, for the purpose of controlling potentially confounding variables, it was necessary to compile an observational schedule, which is described in Appendix B. This was based on those few reported in earlier work (Moss, 1965; Richards and Bernal, 1972; Thoman, 1977; Whiten, 1977) and on approximately 58 hours of unstructured observations of mothers breastfeeding their infants, by the author. Both the literature and clinical experience informed the formulation of hypotheses for evaluation.

The broadest question is whether there is any difference between any of the behaviours during breastfeeding in control dyads, and dyads in which the infant suffered asphyxiation at birth.

A research review indicates, however, that certain behaviours and their sequencing, appear to be of particular significance for the mother and baby. Several authors have commented on the importance of dyadic interactions for facilitating the organisation of the infant's behaviour. In the feeding situation this appears to be evidenced by a mutual adaptation to the baby's burst pause pattern of sucking. Mothers are least likely to talk to their infant while she/he is sucking, and more likely to look away. If he/she stops sucking the mother is most likely to look directly at the child. During the pause in feeding, eye contact is maintained more frequently, the mother vocalises more often, and finally stimulates the baby physically in an attempt to reinitiate sucking. The timing of the stimulation however must be in synchrony with the infant's natural pause pattern; if it occurs too early it prolongs the pause and does not facilitate sucking. The infant thus also informs the mother as to the appropriateness of her intervention (Bernal Dunn and Richards, 1977; Field, 1977; Kaye, 1977; Moss, 1975; Thoman, 1977). These behaviours show a change in pattern over time (Bernal Dunn and Richards, 1977).

One of the behaviours discussed above which has been focussed on specifically, is that of eye to eye contact. Robson (1976) felt this was one of the most important behavioural indicators of a positive relationship between parent and infant, in the first month of life, and it is consistently observed in reported studies.

Moss (1975) has also pointed to mothers' responses to their infant's cry as an important index of synchronicity, and whether the infant has reinforced the mother's feeling that she is able to intervene with some effect.

A last specific variable focussed on by Bernal Dunn and Richards (1977) was the 'latency to cry' after the removal of the nipple at the end of the feed. They found an association between this and the "difficulty" of the feed.

In conclusion, it was therefore decided in this study to evaluate:

a) the percentage frequency of behaviours during breastfeeding in control dyads and dyads with a compromised (asphyxiated) infant, over time (specifically the neonatal period).

b) the mean % frequency of each mother activity, in both groups, occurring in conjunction with her infant not sucking, over time.

c) the mean % frequency of each mother activity, in both groups, occurring in conjunction iwth her infant crying, over time.

d) the mean % frequency of eye-to-eye contact in both groups over time.

e) the 'latency to cry' after the removal of the nipple, over time.

f) the frequency of mother or infant being responsible for ending the feed.

g) the mean length of the breast feed, and

h) the number of mothers who terminate breastfeeding.

The precise methodological issues in recording the sucking patterns, and mother-infant behaviours in the selected groups, is dealt with in the following section.

CHAPTER FOUR

METHOD

In Chapter Four the environment within which this study took place is briefly described. The selection of S is discussed in terms of the defining characteristics by which they were allocated to each group. Finally, the procedure for monitoring sucking patterns is outlined and followed by an account of the observational data collection, with an aside on the additional procedures followed with mothers of asphyxiated neonates.

4.1 Outline of environmental setting

This study took place at the Peninsula Maternity Home in the District Six area of Cape Town. The hospital serves the non-white population of the Cape Town area, including the group areas set aside for coloured and black people some distance from Cape Town. Most mothers are booked into the hospital before their confinement, but there are no official prenatal contacts or educational classes. Unless a birth is to be induced the mothers are brought in once their labour has started and delivered in the "labour room" which comprises 3-4 beds in a circular arrangement. They remain in the Home, in wards of up to 40 beds, for 2-3 days after a normal vertex delivery, and 5-6 days

after an uncomplicated caesarean section, and look after their newborns personally throughout this time, with nursing help if needed. The hospital admits approximately 400 mothers per month.

Follow up care is provided by community clinics, and paediatric clinics at the hospital only monitor physically "at risk" babies.

4.2 Selection of Subjects

Selection for the study was based essentially on the baby's immediate post natal history of asphyxia, and a matched control with an uncomplicated birth history was then found. The major criteria for the diagnosis of "asphxia neonatorum in this research, was an APGAR score of less than 6 at 5 minutes, and a "time of spontaneous respiration" (TSR) of more than 5 minutes. Both these assessments are routinely carried out at the hospital by midwives and paediatricians, and recorded.

As soon as was considered reasonable after the birth, the mother was approached for inclusion in the study. The procedure was explained in a detailed way, and the focus presented as a study of her baby's sucking. The mothers were encouraged to consult their families before making their final decision. Once consent had been obtained, Form A (Appendix C) was completed. This form was devised to tap the relevant variables for control by matching,

formulated in Chapters 2 and 3. In addition, the mothers were questioned about miscarriages, a brief medical history obtained, and some idea of whether they hoped for a male or female baby recorded. These factors, it was intuitively felt, may be of importance in determining some of the mother's attitudes and behaviours towards her infant.

Mother-infant dyads, who matched mothers with infants who had fulfilled the criteria of diagnosis on all the relevant variables, were only included in the study if the mother had no history of hypertension, placental infarct, or other major medical illness; the baby had an APGAR of more than 8 at 1 and 5 minutes, breathed spontaneously after birth, had no meconium-stained liquor and was found to be healthy in every way by a paediatrician.

Only 7 of the 193 mothers who agreed to take part in the research during the 9 months of data collection later withdrew. (78 women refused to take part after being approached). The majority of the mother-infant dyads (102) were not followed up because they failed to match a baby in the asphyxiated group, or moved to an inaccessible area. 45 were excluded from being part of the control group, because the mothers had a history of major medical illness, or pregnancy complications of some sort. 9 babies who were diagnosed as asphyxiated at birth were later excluded from the study, 2 because gross brain damage was suspected, 1 - a Downes Syndrome, 4 because their mothers returned to work and primary caregiving was taken over by other family

members, and 2 because their mothers moved to other residential areas.

4.3 Procedure

Once a mother had consented to inclusion in the study, Form B (Appendix C) was completed, to record all the significant infant characteristics. Factors seen as of diagnostic importance both for asphyxia neonatorum and the general neurological status of a neonate were recorded daily, if present.

Recording of sucking patterns commenced on the first morning after birth, between 8.00 am and 11.00 am. The mothers were asked from the first day to express breast milk into a sterile bottle. If their onset of lactation was delayed, other breast milk was used initially. The mothers were also asked to "warm" the latex moulded "breast" which comprised part of the sterilised apparatus used to record the sucking pattern. It was carried to the hospital's ICU or adjoining nursery with the mothers breast pad over it, and fitted onto the apparatus which was filled with the braet milk warmed to body temperature. All feeding was done by the author, in the same quiet stable environment. A "feed" lasted an average 30 minutes and was continued until the baby was satiated (with appropriate winding!). Twenty minutes of sucking trace from when the infant began feeding was then analysed, according to the criteria listed in Appendix A. Monitoring of sucking patterns continued

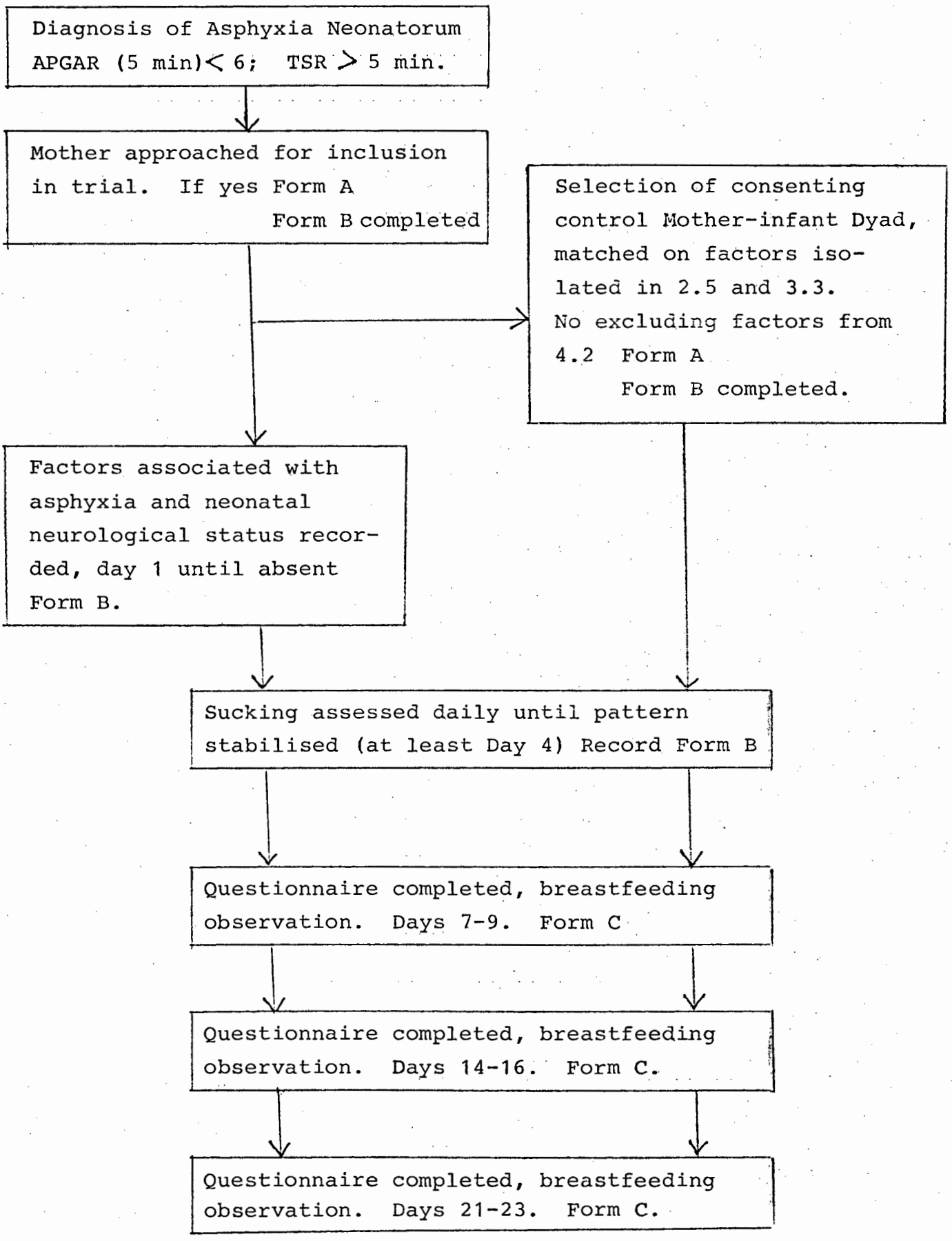
until a "stable" pattern was obtained (see Appendix A) or at least for 4 days if a stable pattern was obtained earlier.

Observations of the breastfeeding situation and completion of Form C (Appendix C) were made in the home environment on days 7-9, 14-16 and 21-23 after birth. The mother was telephoned to ascertain when a feed was due if she had a telephone, if not, the home was visited the day prior to the observation, to inquire into the routine. Observation began as the mother sat down to feed her baby, and ended once she verbalised that the feed was over. All recording was carried out by the author, with various inter-observer reliability checks during the research period (see Appendix B).

The essential procedural details are presented in Table IV.

TABLE IV

PROCEDURE



4.4 Additional Procedures followed with Mothers of Asphyxiated Neonates.

In order to minimise the mother-child separation which occurred with some asphyxiated infants and their mothers (see 3.4), several additional steps were followed outside the normal procedure.

The mothers were encouraged to visit their infants in the ICU or adjoining nursery as frequently as they wished, and touch or hold the baby whenever possible. The one mother who was discharged before her child was ready to return home was provided with daily bus tickets to visit. The author's involvement with the mother and baby appeared to increase the interest of the nursery staff in the couple. In addition, the infants were often relatively alert and physically available compared with other ICU inmates, and thus naturally elicited a fair amount of additional personal attention. Whenever they visited, the family was also encouraged at least to go and see the infant. By taking care therefore; to inform the mothers and families of what to expect of their baby's appearance; to encourage as much contact and stimulation as possible between mother/family and infant; to stimulate mother's lactation and by allowing breastfeeding as early as possible, it was attempted to minimise the difference between the two groups, in terms of the variables discussed in 3.4.

In conclusion this chapter has outlined the general procedure and a few specific modifications needs in researching compromised neonates. The results obtained are presented in the following chapter.

CHAPTER FIVE

RESULTS

This section summarises the results on sucking and be-behaviour measures for the 15 mother-infant dyads where the neonate suffered asphyxia at birth, and the 15 matched control mother-infant dyads. The statistical results of the sucking variables are given first, and it is argued on the basis of these that the asphyxiated group of neonates is not homogenous, and is more meaningfully discussed as two separate groups. The behavioural data is then presented for the two groups and their controls, and a summary of the maternal and infant characteristics provided.

5.1 Comparison of Sucking Variables

Initially it was planned to compare the sucking measures from the group of babies who were asphyxiated at birth, with their controls, daily, until the former's pattern stabilised. Once the data was collected however, it became apparent (using the control groups day 4 pattern as a comparison with later days sucking measures of the asphyxiated group) that the same variables remained significantly different. Furthermore, what was considered most important was the infant's apparently stable final sucking pattern, since

the mother-infant dyad worked with this at home during breastfeeding.

The sucking results presented in Table V thus represent differences between the two groups until day 4, when the sucking pattern of normal newborns is reported to stabilise, and a comparison of the sucking variables recorded on the day the mother and infant were discharged. Wilcoxins T statistic is used both for the simplicity in representing differences between matched pairs, and because it is used in previous reported work, which allows comparison of results.

Table V provides the statistically significant differences between the sucking variables of the 'asphyxiated' and 'control' groups. Mean response per burst, and percentage time spent mouthing and suctioning, are all highly significant from day 1 to the last day when patterns 'stabilised'. Ml taken per sucking minute differs more and more significantly from day 2, ml per minute is statistically different on day 4 and last day, and the mean amplitude of suctioning is significant on days 3, 4 and the last day.

While these quantitative differences provided obviously significant results for discussion, qualititative observations of the entire traces indicated that the asphyxiated neonates sucking patterns were of two distinct types. One was characterised by very short sucking bursts and long pauses, and the other by long sucking bursts with few, if any pauses. It was felt that combining these two sub-groups confounded the true differences between the asphyxiated baby and his/

TABLE V

Wilcoxin's T statistic for Asphyxiated vs Control Group on all Sucking Measures (Two-tailed)

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
Mean response per burst	12 ***	9 ***	10 ***	6 ***	14 ***
Mean interburst interval	29	48	32	54	43
Mean interburst rate	46,5	54	38	53	49
Ml taken per sucking minute	36	23 *	27 **	0 ***	10 ***
Ml taken per minute	32	24	33	0 ***	11 ***
% tine spent mouthing	5 ***	0 ***	0 ***	3 ***	2 ***
Mean amplitude of mouthing	41	49	28	29	27
% time spent suctioning	21 *	8 ***	12 ***	5 ***	4 ***
Mean amplitude of suctioning	60	44	12 ***	5 ***	13 ***

n = 15

* p 0,05
** p 0,02
*** p 0,01

her control, and they were therefore separated. Tables VI and VII summarise these results. Figures I and II provide the means and standard deviations of the sucking variables on the last day to indicate the direction of differences.

It is apparent that the group of asphyxiated infants whose sucking pattern is characterised by short bursts and long pauses have a lower mean amplitude of suctioning (days 3, 4 and last); spend less % time sucking (all days); have a lower mean amplitude of mouthing (days 2, 3, 4 and last) but spend more % time mouthing (all days) and not surprisingly therefore they do not differ on response per burst or inter-burst interval. They take less milk per minute feeding time (days 2, 4 and last) and fewer mls per minute sucking (days 2, 4 and last) however. Significantly, all the measures they differ on at some time, are represented as differences on the day of discharge, when mother and infant return home with no further intervention (except intraburst rate).

The group of asphyxiated infants whose sucking bursts are extended do differ significantly on the mean response per burst from their matched controls (all days). Their mean interburst interval differs on days 1 and 3. Most of their response comprises mouthing movements initially (significantly different on all days), although % time spent suctioning is also higher on day 4 and the last day. Their consumption in terms of ml milk per sucking minute and ml milk per min. is only significantly higher on day 4.

TABLE VI

Wilcoxin's T Statistic for 'Non Sucking Asphyxiated' vs Control Group on all Sucking Measures (two-tailed)

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
Mean response per burst	8	6	5	6	9
Mean interburst interval	11	13	11	13	9
Mean intraburst rate	14	14	0 **	13	9
Ml taken per sucking minute	7	0 **	2 *	0 **	0 **
Ml taken per min.	6	0 **	10	0 **	0 **
% time spent mouthing	1 *	0 **	0 **	0 **	0 **
Mean amplitude of mouthing	10	1 *	0 **	0 **	0 **
% time spent suctioning	0 **	0 **	0 **	0 **	0 **
Mean amplitude of suctioning	4	3	0 **	0 **	0 **

n = 7

* p 0,05
** p 0,02
*** p 0,01

FIGURE I

MEANS AND STANDARD DERIVATIONS OF SUCKING VARIABLES ON DAY OF DISCHARGE (LAST DAY) : "NON SUCKING ASPHYXIATED" VS CONTROL GROUP

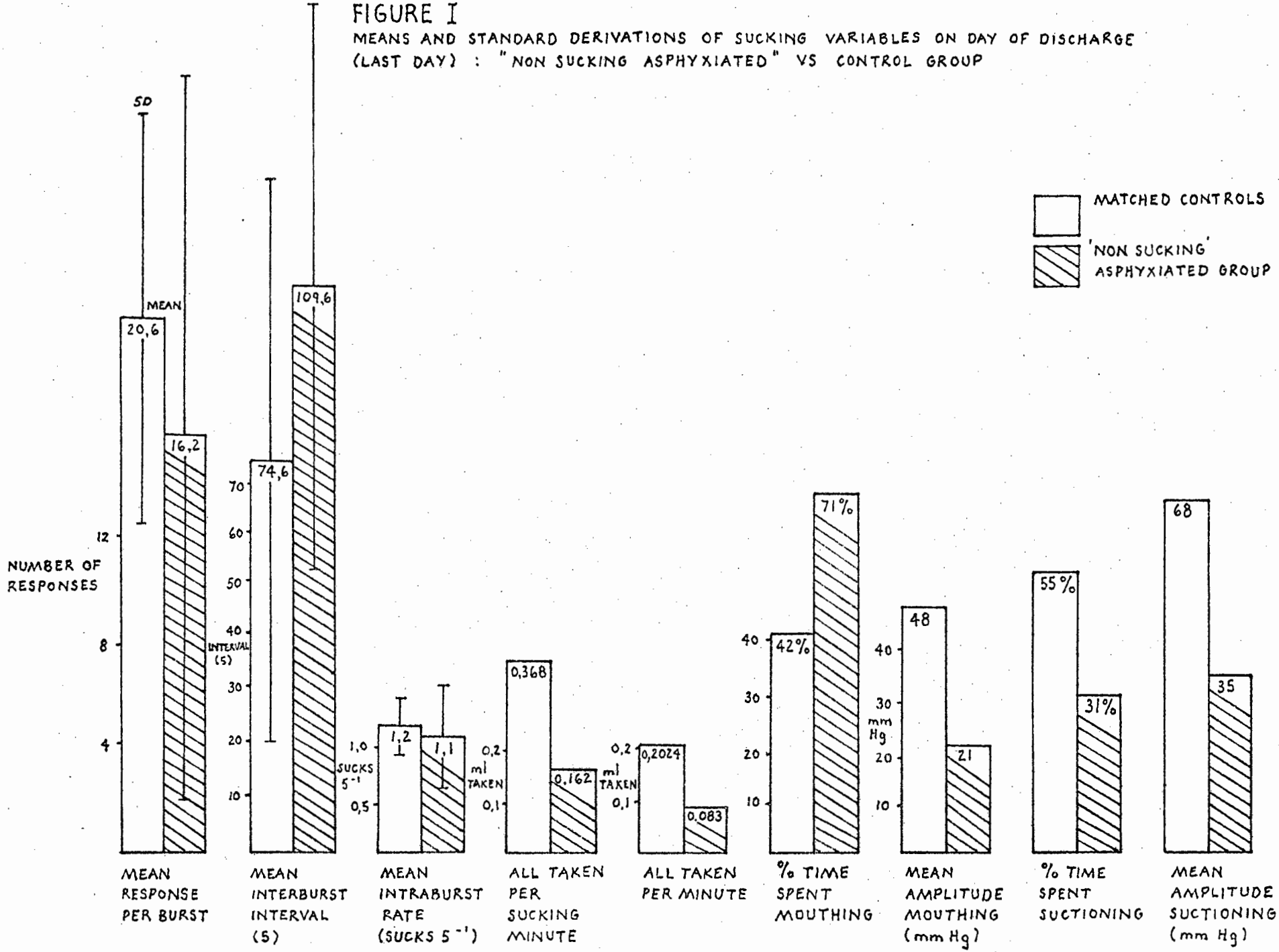


TABLE VII

Wilcoxin's T Statistic for 'Sucking Asphyxiated' vs Control Group on all Sucking Measures (two-tailed)

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
Mean response per burst	1 **	0 ***	1 **	0 ***	2 **
Mean interburst interval	3 *	13	4 *	15	9
Mean interburst rate	13	18	16	10	17
Ml taken per sucking minute	12	8	7	0 ***	6
Ml taken per min.	16	16	8	0 ***	6
% time spent mouthing	3 *	0 ***	0 ***	2 **	2 **
Mean amplitude of mouthing	6	12	16	15	15
% time spend suctioning	15	7	8	3 *	2 **
Mean amplitude of suctioning	9	11	10	5	15

n = 8

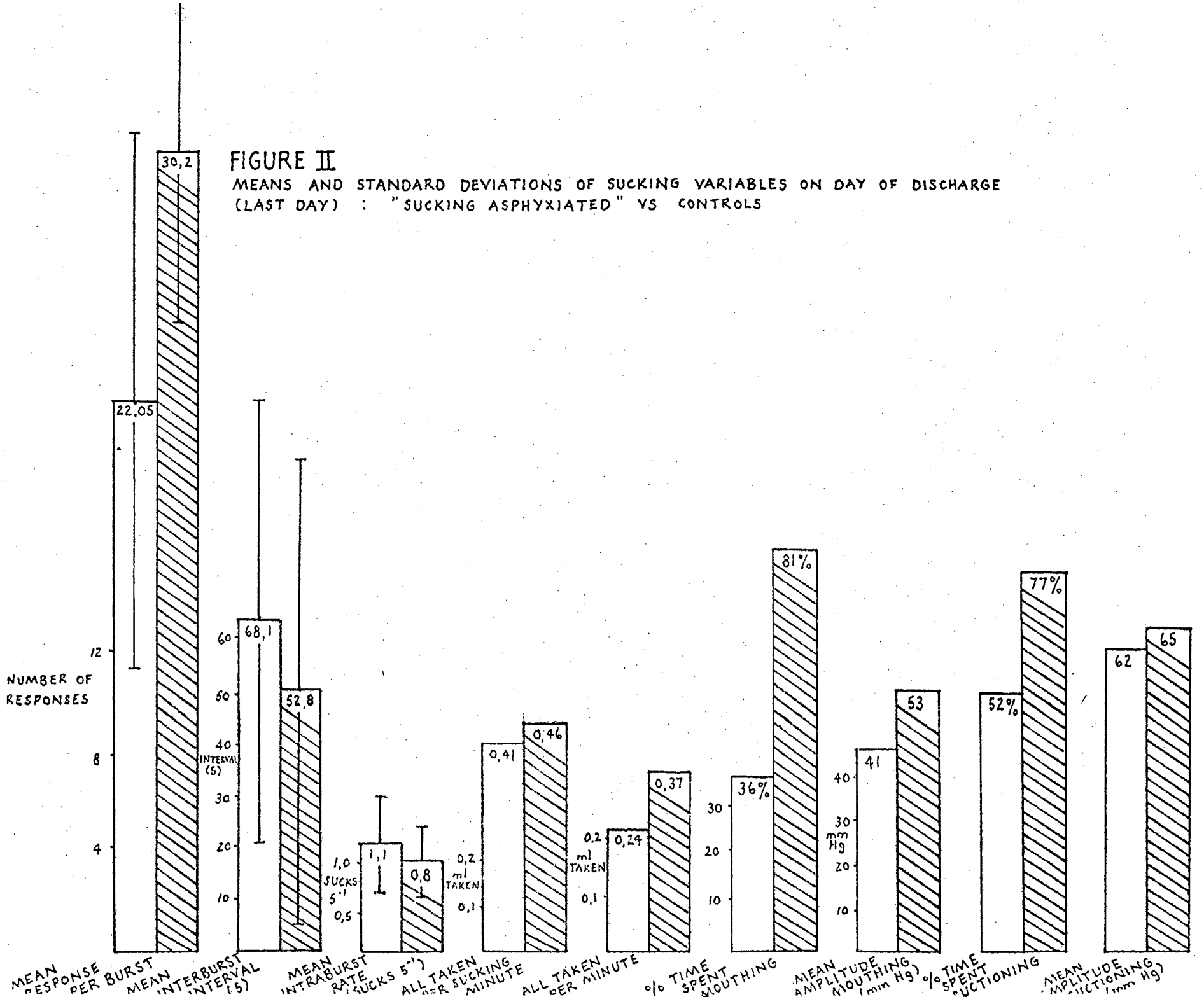
* p 0,05

** p 0,02

*** p 0,01

FIGURE II

MEANS AND STANDARD DEVIATIONS OF SUCKING VARIABLES ON DAY OF DISCHARGE (LAST DAY) : "SUCKING ASPHYXIATED" VS CONTROLS



5.2 Comparison of Behaviours during Breastfeeding

The division of the group of asphyxiated neonates into two meant the numbers were reduced to a level where statistical analysis of observed behaviours was not appropriate, particularly since more than one behaviour could occur during a single observation period, and variability was high. It is only possible, therefore, to talk of trends in behaviours.

As can be seen from Figs. III and IV there are some differences in the mean percentage frequencies of behaviours for the two separated groups of asphyxiated babies and their controls. Of note, firstly, is that some of these persist over time; secondly, there are differences between the two groups of asphyxiated babies; and, thirdly, the matched control means of the split groups are very similar.

The "non sucking asphyxiated" group tend to show differences from their controls which decrease over time, with the exception of the mother's initiating sucking, and touching and looking at the infant. The baby itself is more often swaddled, and has the nipple out of its mouth more frequently, and in less. The "sucking asphyxiated" group have different behaviours which seem to persist, or even become more obvious over time. Specifically the mothers touch their babies less, kiss them, rock them and wind them infrequently, do not stimulate them to suck and look away more often. By the third week they also do not appear to talk to them as much. The infants appear to be cradled

FIGURE III

MEAN PERCENTAGE FREQUENCY OF BEHAVIOURS :
"NON SUCKING ASPHYXIATED" VS CONTROLS

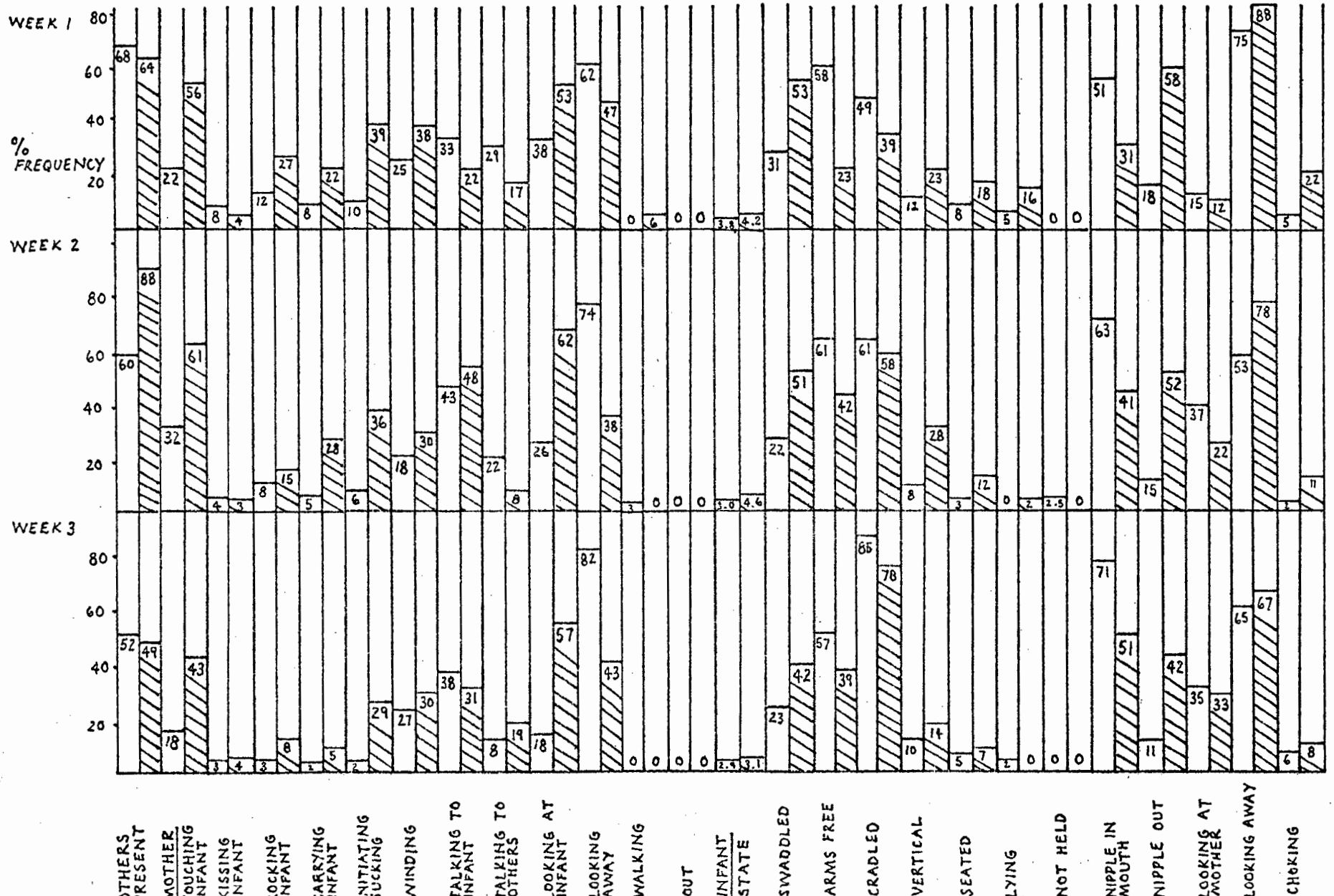
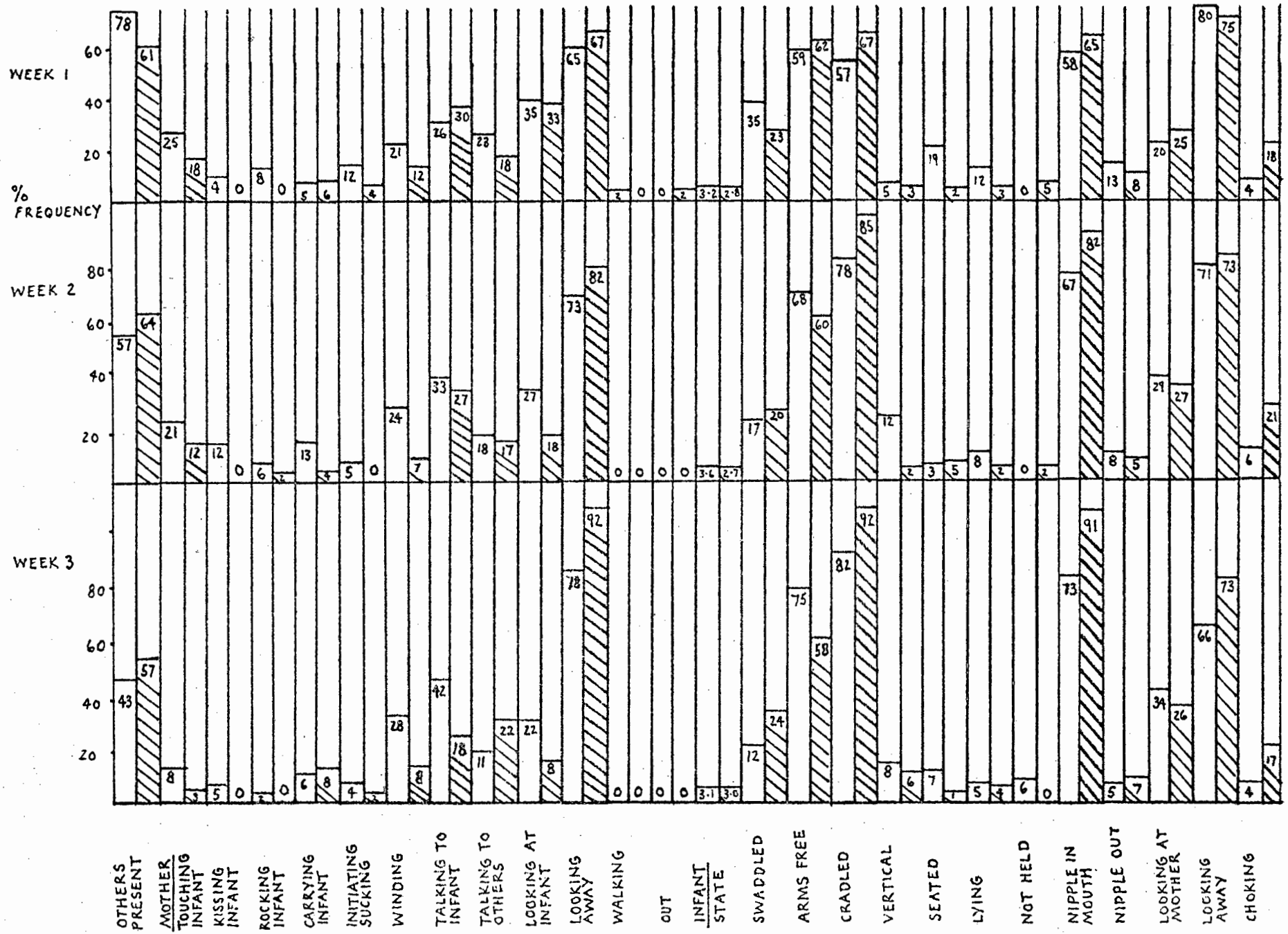


FIGURE IV

MEAN PERCENTAGE FREQUENCY OF BEHAVIOURS:
"SUCKING ASPHYXIATED" VS CONTROLS



more, have the nipple in their mouths more often (and out less) and choke frequently.

Figures V and VI represent the maternal behaviours when the nipple is out, i.e. infant is not sucking. In the "non sucking asphyxiated" group the mothers appear to respond with a limited variety, but more frequent number of responses. They initiate sucking, talk to the infant and look at him/her. The maternal behaviours in the "sucking asphyciated" group are all of a lower frequency than their controls, specifically stimulating sucking, and looking at the infant.

When the infant is in states 5/6, that is fussing or crying, there is again a difference in the maternal responses. Mothers of "non suckers" touch their infants more often, kiss them, talk to them and look at them more. Mothers of "suckers", however, tend to carry their infants or initiate sucking, look away more and do not kiss their infants. (figures VII and VIII).

Table VIII summarises the single variables which were of interest in the breastfeeding situation. The frequency of eye to eye contact is highest for the control group babies and their mothers, although the "non-sucking asphyxiated" group is almost the same by week 3. The "sucking asphyxiated" remains slightly lower over time, more so at week 3. The latency to cry over all three feeds is highest for the "non-sucking asphyxiated" and lowest for the "sucking asphyxiated".

FIGURE V

MEAN PERCENTAGE FREQUENCY OF MATERNAL BEHAVIOURS WHILE NIPPLE OUT: "NON SUCKING ASPHYXIATED" VS CONTROL

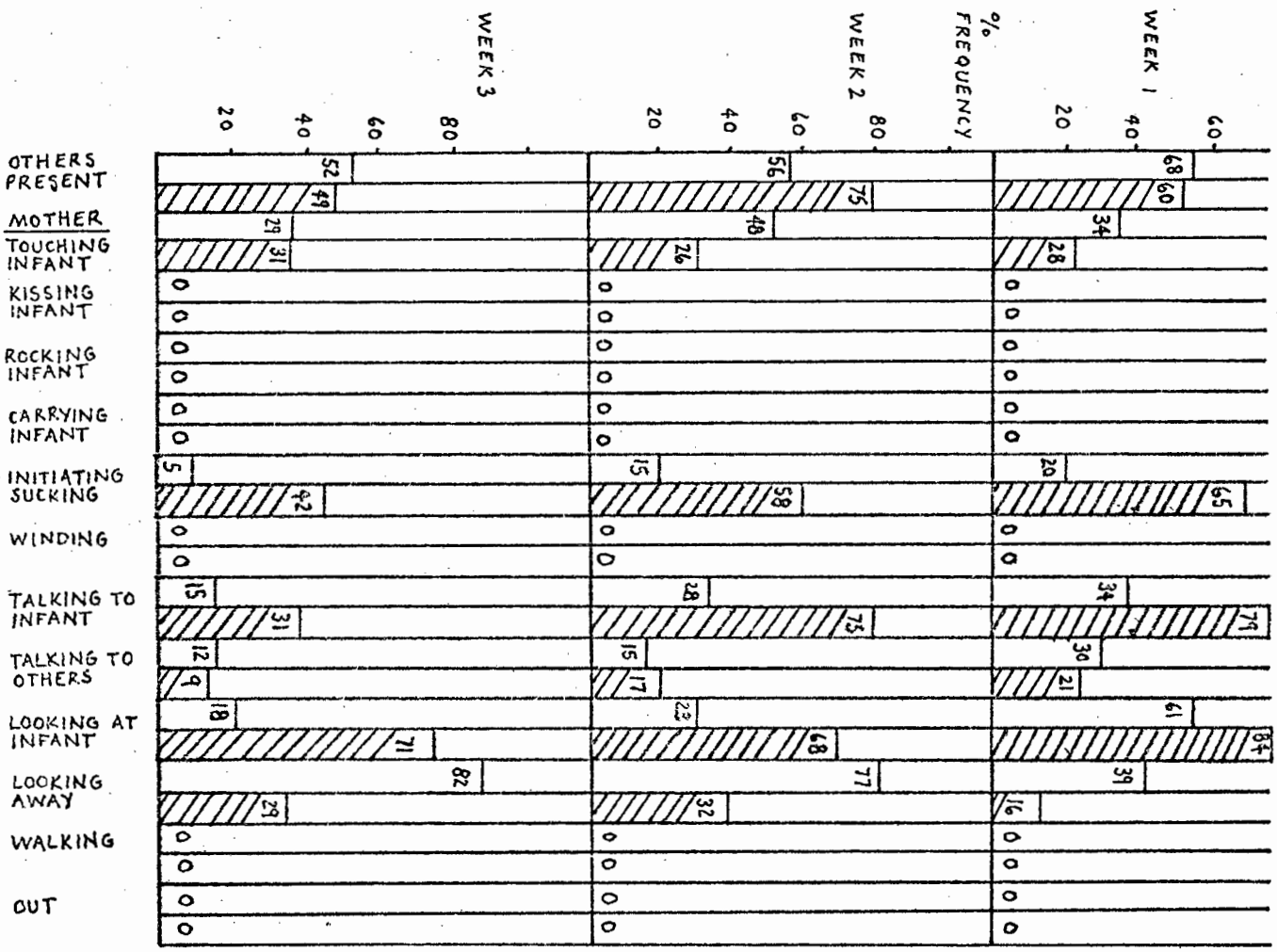


FIGURE VI

MEAN PERCENTAGE FREQUENCY OF MATERNAL BEHAVIOURS WHILE NIPPLE OUT: "SUCKING ASPHYXIATED" VS CONTROL

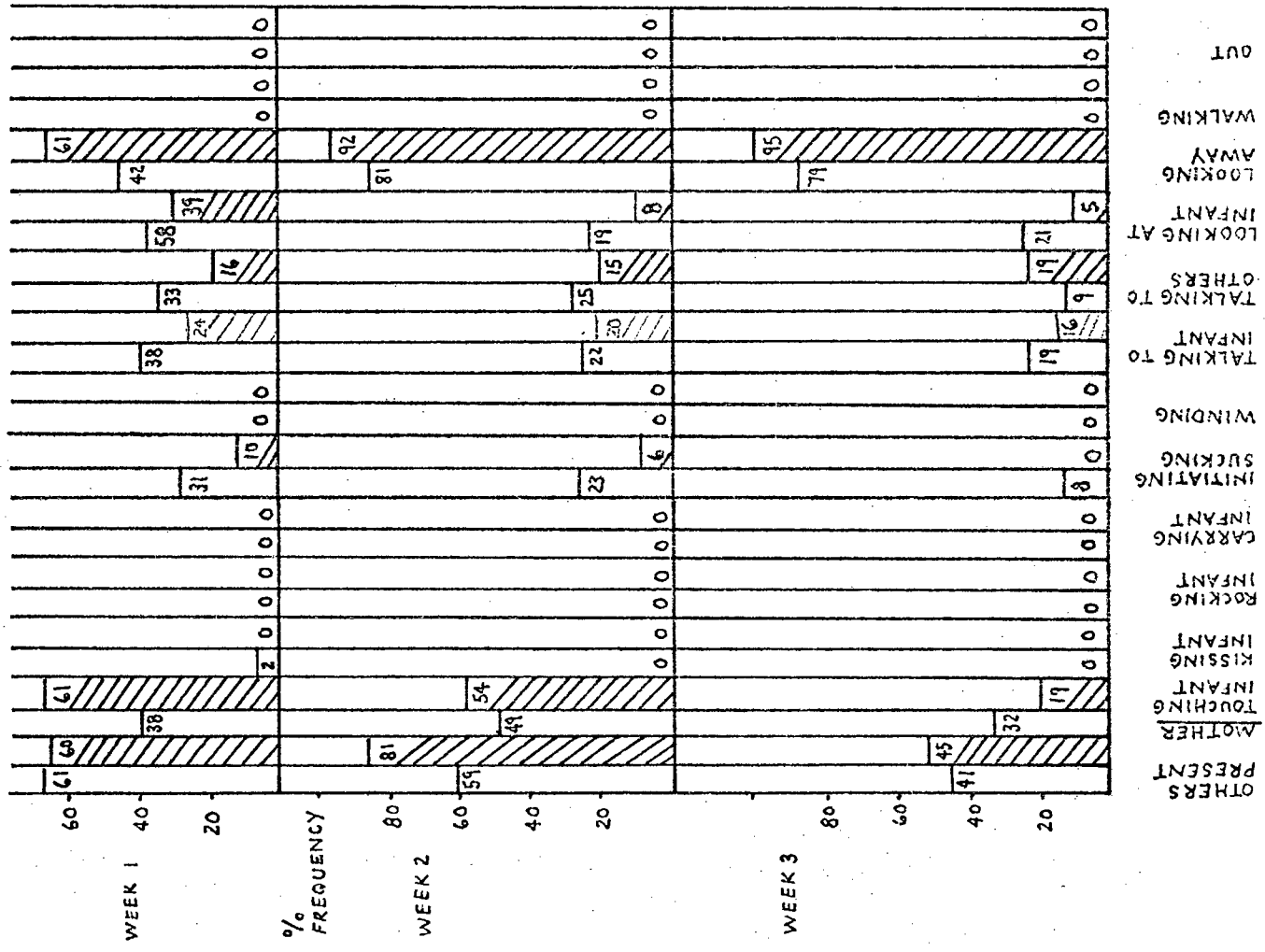


FIGURE VII

MEAN PERCENTAGE FREQUENCY OF MATERNAL BEHAVIOURS WHILE INFANT CRYING (STATE 5/6) "NON SUCKING ASPHYXIATED" VS CONTROL

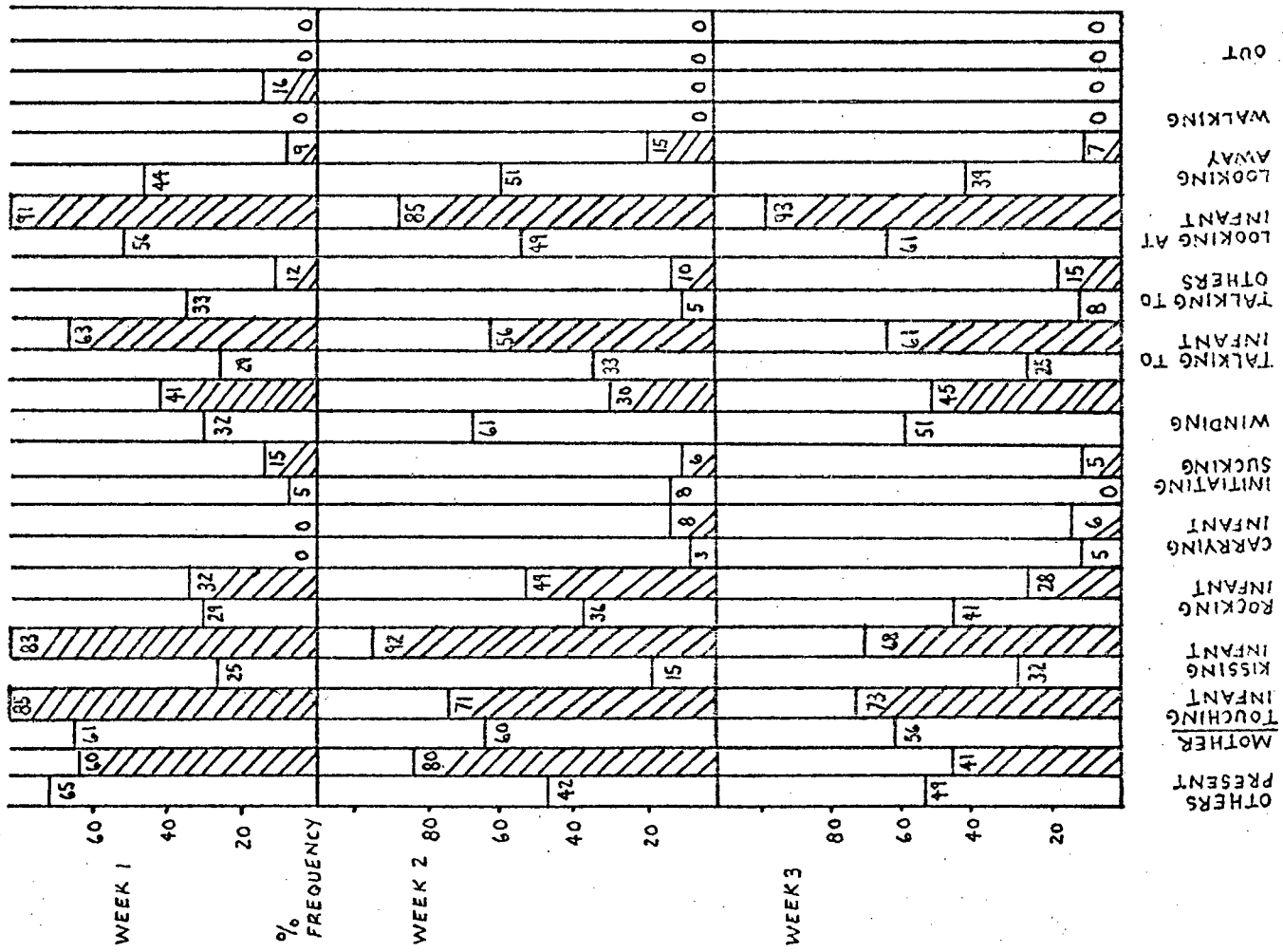


FIGURE VIII

MEAN PERCENTAGE FREQUENCY OF MATERNAL BEHAVIOURS WHILE INFANT CRYING (STATE 5/6): "SUCKING ASPHYXIATED" VS CONTROL

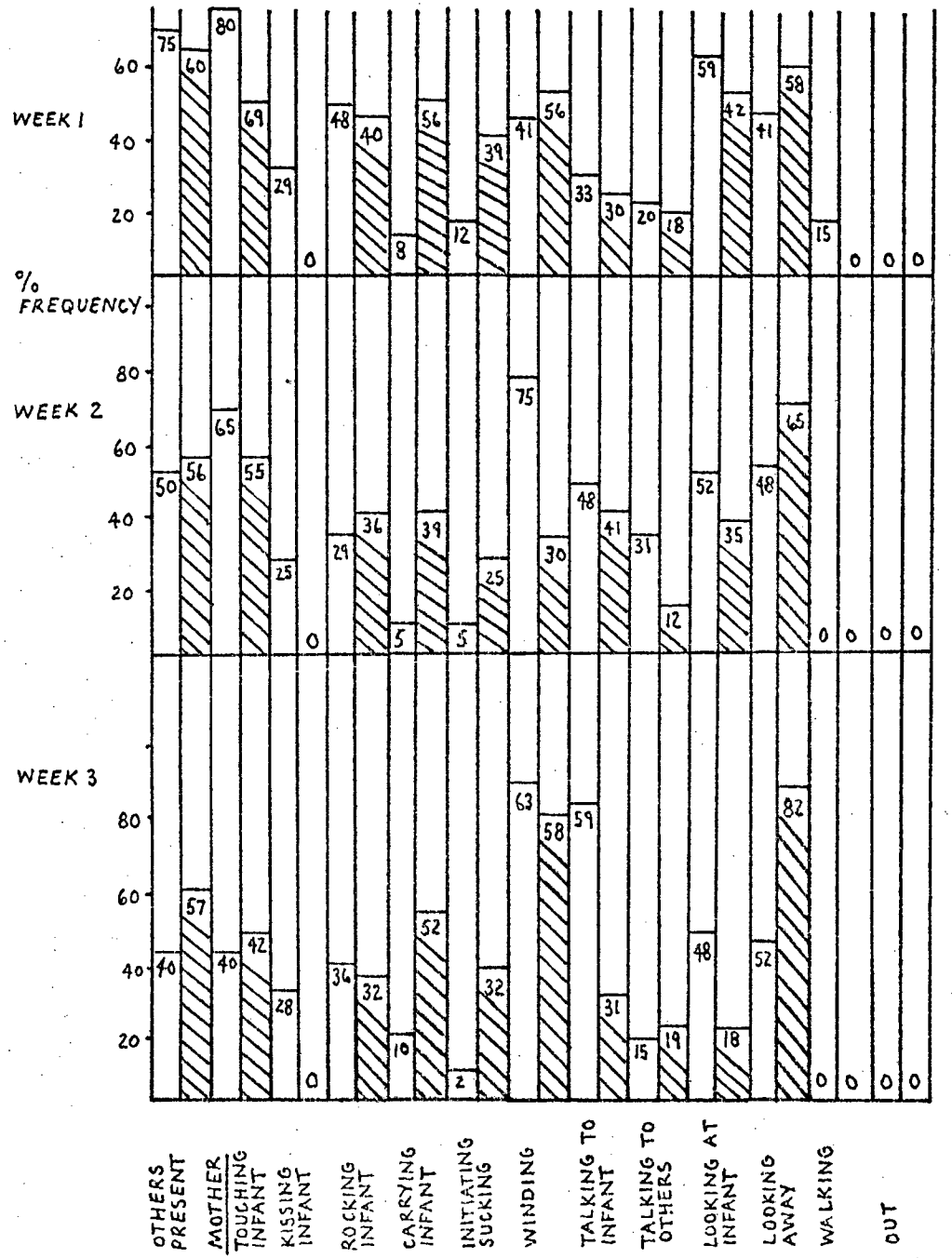


TABLE VIII

Summary of Single Variables Associated with Breastfeeding

Variable	"Non-sucking asphyxiated	Control	"Sucking asphyxiated	Control
% frequency eye to eye contact : Week 1	5.4%	9.6%	7.8%	10.4%
Week 2	10.8%	14.9%	12.1%	13.9%
Week 3	20.9%	22.5%	17.9%	21.1%
Mean latency to cry, summed over 3 weeks (seconds)	29.6	16.3	6.4	17.1
Responsibility for ending feed, summed over 3 weeks mother : infant	3.4:3.6	5.2:1.8	8:0	6.7:1.3
Mean length of feed, summed over 3 weeks (seconds)	2864	1972	1305	1864
Mothers still breast-feeding : Week 1	7	7	8	8
Week 2	7	7	7	8
Week 3	7	7	4	8

Responsibility for ending the feed is more often the baby in the "non sucking asphyxiated" group but always the mother in the "sucking asphyxiated". The mean length of feed is shortest for the "sucking asphyxiated" and longer for the "non sucking". Finally, only 4 mothers, all from the "sucking asphyxiated" group, stopped breastfeeding during the neonatal period.

Tables IX, X and XI present summaries of the matched S characteristics, neonatal characteristics, and mothers' responses to the questionnaires over week 1-3 after birth. It would appear that in the "sucking asphyxiated" group the mothers are somewhat younger, more likely to be having their first or second child and came from difficult home environments. They had a longer second stage of labour, gave birth to more males and would have preferred female babies. Babies who show a short burst, long pause sucking pattern are slightly premature, and have a lower birth weight. Their mothers second stage of labour is marginally shorter than their controls, they have breastfed their children for shorter periods, had more problems breastfeeding and intend to breastfeed for a shorter period with this infant.

TABLE IX

Summary of Matched Subject Characteristics

Characteristic	Controls	"Non-sucking Asphyxiated"	"Sucking Asphyxiated
Mean gestational age of Neonates (weeks)	39,1	37,5	38,7
Mean mass of Neonates (g)	3,143	2,960	3,178
Number of Females	7	4	3
Number of Males	8	3	5
Number of Mothers with complications during pregnancy	0	1	1
Number of Caesarean section births	10	5	5
Number of normal vertex deliveries : drug free/drug aided	1:4	0:2	1:2
Mean length of second stage of labour (mins)	25	20	37
Mother's mean : parity/gravidy	3.2:3.9	3.9:4.5	2.5:2.5
Number of babies : planned/unplanned	6:9	2:5	2:6
Number of babies : wanted/unwanted	14:1	7:0	7:1
* Number of babies of hoped for sex born/ other sex born	2:5	2:1	0:4
Mean length of previous breastfeeding experiences (months)	14.5	9.1	12.5
Number of mothers with previous breast-feeding problems	1	2	0
Mean intended length of breastfeeding this baby (months)	17	12	15
Mean age of mothers (years)	26.8	27.1	23.2
Number of mothers with previous medical problems	1	0	1
Number of mothers who smoke cigarettes	9	4	5
Number of Bantu mothers	3	2	1
Number of Moslem mothers	2	1	1
Number of Coloured mothers	10	4	6
** Mean educational standard of Mother	2.8	2.7	3.1
Mean educational standard of Father	3.3	2.5	2.6
*** Number of Mothers with difficult home environments	8	2	6

*
**
*** See notes overleaf

Notes on TABLE IX

* Many mothers felt they would be happy with either sex.

** It was considered most appropriate to classify "educational standard" in terms of scholastic education and occupational position held. Thus

(or higher) education and managerial (or higher) position	1 = High School
education and/or skilled position.	2 = High School
education and semiskilled position.	3 = school
education and unskilled position.	4 = school
education and/or unskilled position.	5 = no formal

*** difficult home environments included such factors as the mothers being unmarried or emotionally unsupported and/or in financial difficulties and/or with inadequate housing.

TABLE X

Summary of Neonatal Characteristics

Characteristic	Controls	"Non-sucking Asphyxiated"	"Sucking Asphyxiated"
Number of days before beginning to suck	0	1.7	1.0
Mean APGAR score 1 minute	9.4	3.3	2.3
5 minutes	10	6.3	4.1
Mean time of Spontaneous Respiration (mins)	0	10.0	19.8
Number of babies with tachycardia	0	0	0
bradycardia	0	6	8
type 2 dips	0	2	2
Number of babies with decreased foetal movement	0	2	4
Number of babies with meconium stained liquor	0	6	7
Number of babies with scalp pH > 7.2	0	6	7
Number of babies with tense fontanels	0	2	4
Number of babies who suffered convulsions	0	1	3
Number of babies with abnormal movements and behaviour	0	6	8
Number of babies with real damage	0	4	3
Number of babies with necrotising enterocolitus	0	0	0
Number of babies with abnormal lumbar puncture	0	0	1
Number of babies with abnormal CT scans	0	0	0
Other	0	0	1 hypoglycaemic 1 hyperglycaemic
Number of days separated from Mothers	0	4.1	5.5

TABLE XI

Summary of Questionnaires Weeks 1-3

Responses		Control	"Non sucking Asphyxiated"	"Sucking Asphyxiated"
Number of mothers complaining of breast-feeding problems	Week 1	1	3	4
	Week 2	0	3	5
	Week 3	0	0	2
Number of complaints about Mother's emotional state	Week 1	2	3	4
	Week 2	1	1	6
	Week 3	1	0	5
Number of complaints about Mother's physical state	Week 1	0	0	3
	Week 2	1	0	4
	Week 3	0	0	3
Number of complaints of baby's physical state	Week 1	0	1	3
	Week 2	0	0	3
	Week 3	0	0	2

The asphyxiated babies are all separated from their mothers, whereas their matched controls are not. The "sucking asphyxiated" group differs from the "non suckers" in having lower APGAR scores, longer TSR, more factors indicating foetal distress and suffer more problems later including tense fontanels, convulsions, abnormal movements and behaviour and taking longer to begin sucking. In addition, one baby from this group had an abnormal lumbar puncture.

During the 3-week follow-up the mothers of "non suckers" complained during the first week of various problems, for example, physical pains and tiredness, which then seemed to resolve themselves. The mothers of the "sucking asphyxiated" group tended to continue having problems and saw their infants as having problems.

It would thus appear that there are fairly consistent trends and differences in the infant sucking patterns and mother-infant relationships between the group of asphyxiated babies and their controls. Although the breastfeeding behaviours have been discussed in terms of the mother or baby, it must be remembered that they are in fact a characteristic of the dyadic relationship. The last chapter in this thesis discussed these results, and their implications, while integrating them with current literature in the field.

CHAPTER SIX

DISCUSSION

In this concluding chapter the results of the research are brought together in a summary, and discussed in terms of other reported studies. The possible implications of this work are explored, and other attempts at extrapolation of results obtained in the early neonatal period are focused on. Intervention programs in early development, and their effects on the behaviours and relationships of compromised neonates are briefly presented. Finally, suggestions of implementing changes in hospital procedures, and follow-up clinics, on the basis of this research are made, and indications for further research are presented.

6.1 Discussion of Results

The separation into two groups of the neonates who were diagnosed as suffering from asphyxia neonatorum at birth, appears to be justified not only in terms of their statistically discrepant sucking patterns, but also on the basis of fairly consistent differences in their, and their mothers' behaviours during breastfeeding. The general picture which emerges is that differences in sucking patterns are associated with different patternings of interactive behaviours during breastfeeding. The complexity of factors

surrounding the development of an infant warn against any attempts to infer causal links (Denenberg, 1979) and the following discussion of the results rests on the assumption that this is not being attempted.

The sucking measures illustrate the variable repertoire with which infants may begin their interactions with their caregivers. The variability of the sucking reflex in newborns who suffered asphyxia at birth was commented upon by Wolff (1968), although he made no attempt to account for it. A Russian study on infants who were born with "circulatory disorders" has found a similar distribution of sucking responses at the two extremes of the normal burst-pause pattern. The definition of "circulatory disorders" was unfortunately never clarified however (Noskov and Shabalov, 1978). Another study reported in Russian specifically identified two types of aberrant sucking pattern in asphyxiated neonates (Filippova, 1972). Only the negative pressure component of sucking was tapped, however, so the author was unable to comment on the increased mouthing or expressive component, which was so characteristic of both groups of asphyxiated infants in this study. Further confirmation of distinctly different sucking patterns in this group of compromised infants has recently been forthcoming from Brown (1982).

It is pertinent to discuss a few studies which have addressed themselves to the importance of the burst-pause sucking pattern in neonates. Field (1977) has commented on the

increase in mother-infant interaction during the pause in sucking. Kaye (1977) has gone even further in postulating that the pattern is the earliest precursor to turn-taking and ultimately to social dialogue. The relationship between sucking and early speech has been postulated by Shirataki (1973) as being mediated by the non-nutritive component of sucking (mouthing). He points out that while nutritive sucking maintains a stable pattern, non-nutritive movements change in the first week of feeding, and again at about 3 months when the first preverbal vocalisations begin.

Non-nutritive sucking patterns have also been discussed in terms of providing gratification (Brazelton, 1973) and as a screening off device for extraneous and disturbing stimuli (Lester et al, 1976).

What appears to be common in all these studies are the ideas of the pause period (interburst interval) allowing the infant an opportunity for interaction, and the mouthing movements (particularly non-nutritive) shutting it off from outside stimulation, and this perhaps forming the basis of later receptive and expressive processes. A disturbance in the normal sucking pattern pauses from birth, as occurs in the "sucking asphyxiated group", may restrict the infant's opportunities to experience stimulation during feeding. It may be postulated that the increase in mouthing activities represents an attempt by both groups of babies, to restrict the amount of incoming stimulation, on their recently assaulted central nervous system.

A decrease in attempts at stimulation is certainly seen in the mothers of the "sucking asphyxiated" group. They engage in fewer directly interactive behaviours (kissing, touching, rocking, winding, talking and stimulating to suck) and look away from their babies more often. This is true even when the baby is apparently signalling it is ready for interaction, by not sucking or crying. The mothers engage in physically pacifying activities (carrying or stimulating them to suck) but do not look at, or talk to, them. This pattern of interaction appears to be unsatisfying to the mothers concerned, and they thus complain of various problems during the neonatal period and are at risk for giving up breastfeeding, although their milk supply is adequately stimulated by their baby. One possible contribution to their apparent disengagement from the breastfeeding situation is the reduced mutual eye contact they experience. Robson (1967) has shown that reports of the baby focusing on the mothers' eyes are quickly followed by an unconscious increase in play activities with the baby.

While in the "sucking asphyxiated" group the infant is apparently "closed" to interaction, the opposite is the case in the "non-sucking" asphyxiated group. The mothers concommitantly seem to interact more often, but in a way which aims at restricting their infants' behaviours. They initiate sucking, keep them swaddled and touch and look at them more often, for example. If the infant is not sucking they focus their attentions on resuming the feed, and if the infant is crying, attempt a number of behaviours

to quieten him/her. As over time their behaviours approximate those of their matched controls, the mother-infant dyads seem to gain some degree of organisation over the infant's initial irritability and asynchronicity of sucking. Thus, although their feeds take longer and the mothers experience early difficulties with feeding, as reported on their questionnaires, they tend to persist in breastfeeding and gain satisfaction from it.

As was seen from Tables IX and X however, it is not only the infants' sucking patterns which differ between groups. It may be that the mothers and infants contribute in other ways to the trends in relationship behaviours. The mothers of the "sucking asphyxiated" group report problems in their environment more often, which may affect their availability to the infant (Richards, 1971). They are younger and the babies are more often their first and second compared to the "non-sucking" asphyxiated group, also reportedly significant variables in determining mother-child interactions (Campbell, 1973). Generally they seem less satisfied with the sex of their baby, and (perhaps in terms of their difficult circumstances) less happy with having to care for an unplanned baby at all. Moss (1975) found a correlation over two years between the psychological status of a mother towards having and nurturing a baby, and measures of maternal responsivity. In addition the infants themselves show more signs of neurological assault and are more often males, which may contribute, with their sucking pattern, to differences.

The mothers of the "non sucking asphyxiated" group also differ from their controls, specifically in terms of prior breastfeeding problems and anticipated length of breast-feeding this baby. The neonatal characteristics of the group include smaller masses and slight prematurity, which may also influence their sucking response, although these were matched for in the control group from whom their pattern differed. A recent study by Fish and Crokenberg (1981) has indicated that motor activity at 9 months was most related to infant characteristics, and least influenced by the mother, whereas "sociability" related postively to the mother's responsiveness. It is possible that the mothers in this group find it easier to accept their infants' general motor activity (than the "sucking asphyxiated" mothers), and the babies thus respond to their mother's interaction by becoming more "sociable", and approximating the behavioural measures of their controls.

In conclusion, it would seem that these results are best summarised from the position which Waters, Vaughn and Egeland (1980) adopt, in looking at early neonatal differences and attachment relationships. Discrepancies in early sucking patterns may reflect problems in integrative and adaptive mechanisms, which continue to influence behaviour, and relationships, as they interact with different environments.

The difficulty in attempting to chart even the earliest interactions and changes in the developing human, as seen in this study, warn against accepting simplistic statements

which link factors in an implicitly cause-and-effect manner. For example, Field (1977) maintained that early separation led to more stimulation during feeding. This does not appear to be always the case; the characteristics of the specific mother-infant dyad may in fact lead to the opposite as found in the "sucking asphyxiated" group. Whiten (1977) also reported a difference in the behaviours ofmothers who had no contact with their infants after birth, as opposed to those who had. He attempted to emphasise the role of the mother in giving rise to the differences, again an erroneously simple position. The characteristics of the infant also play an important part in the relationship.

The latter have been studied in relative isolation to find indicators of later stable characteristics. Bell (1975) posited an association between a long latency to cry on removal of the nipple, and an increase in "pleasurable responses" later. It is difficult to comment directly on his study from the data obtained in this research. The differences in the neonates who exhibited the longest latency to cry however, (the "sucking asphyxiated" group) indicate that there are many mediating factors to this response which may have different implications in different circumstances. Thus to conclude, as Bell does, that there is an inverse association between high amplitude speed or frequency of responses in the newborn, and "optimal" behaviour in the preschool period, is perhaps a bit precipitous.

6.2 The significance of early differences

The tendency to link early behavioural measures of some sort with later outcome, appears in part to be an attempt to predict which infants are "at risk" and may benefit from planned intervention (Brazelton, 1973). A few studies have reported longitudinal data on children who had aberrant sucking patterns. Jung (1979) found no evidence of a congenital disturbance in satiation and appetite control in obese people. Anke (1971) also reported inconclusive results on an association between extended nutritive sucking and later continued thumb sucking. It may be that such studies are focusing on too global and complex later behavioural phenomena. Bernal Dunn and Richards (1977) have found some correlations between early behaviours and those at 30 weeks, 14 months and 5 years, but report them cautiously. Only Dielman (1972) has confidently related early differences in "involvement" of the mother-infant dyad, to later behaviour problems.

Another focus of research has been on the longitudinal development of children who suffered anoxia at birth. Carey (1971) reported an association between early respiratory difficulties, and language and perceptual dysfunctions. Sameroff and Chandler (1975) in reviewing a number of studies in this field conclude that although there appear to be early effects of the trauma of asphyxia, "intellectual" impairment in the preschool period appears to disappear by the time the child begins school. Scores on early "intelligence" tests however are notoriously unstable. Of more

interest perhaps is that several other studies have indicated significant impairments in social competence (Sameroff and Chandler, 1975) which may be tentatively predicted from this study in terms of early differences in behaviours during breastfeeding, at least of the "sucking asphyxiated" group.

6.3 Indications for Intervention

If, in fact, there may be some persisting differences between the groups, which render a child susceptible to later difficulties, then the possibility of early intervention becomes an important issue. Whitt and Casey (1982) have shown how intervention in normal child care procedures, by arranging groups for mothers and encouraging their interaction with their infants, led to more "sensitivity" and appropriateness of interventions and play. Crockenberg (1973) used social support to mitigate the effects of "unresponsive" mothers. Powell (1974) and Scarr-Salaptik and Williams (1973) have both reported successful outcomes of intervention programmes with parents of low birth weight babies. All these reports support the fluidity of development, and the observation that non-optimal environments and birth circumstances do not inevitably lead to problems (Rutter, 1978).

Continued breastfeeding is of importance for the population under investigation, as the traditional mode of nursing, and also for its nutritional and protective elements in a sub-economic environment. In addition, work has tentatively indicated that lowered sociability and learning disorders

are found more often in bottle-fed children, even with control of complex factors (Richards and Bernal, 1972). In an epidemiological study by Power, Willoughby and de Waal (1979) it was found that only 19% of infants at 1 month were bottle fed in the population under investigation in this study, and that bottle feeding was in these cases associated with young mothers and maternal employment. A similar study but on a different population indicated an incidence of only 6% being bottle fed at one month (Westphal, Phillips and Irving, 1981). Thus the 50% of mothers who terminated breastfeeding in the sucking asphyxiated group, represent a major deviation.

It would appear that early supportive intervention is necessary in this group of mother-infant dyads. In fact, in the hospital they were meted out less attention that the group of "non sucking asphyxiated" mother infant dyads. The latter represented a group with obviously difficult babies in terms of their early reluctance to feed. Indeed the mothers' persistence and success with breastfeeding may reflect this early intervention. The group of "sucking asphyxiated" babies ostensibly had no such problems. The outcome of this study suggests however that they are as much, if not more, in need of support.

Brazelton (1979) has suggested the use of an educational feedback type model to help mothers adapt to anomalous infant behaviours. This could well be utilised in this group of mothers, explaining their infant's sucking pattern to them

and encouraging them to use the few pauses in sucking to engage in interaction. This would need to continue beyond the hospitalisation period, and should include the entire family of which the child is a part (Lamb, 1978). Simply alerting hospital staff to this pattern of interaction may do much to ameliorate the situation.

6.4 Indications for further research

Ultimately, because of the small numbers, this study is only an exploratory one, and can really only report trends which need further confirmation, and longitudinal follow-up. Bernal Dunn and Richards (1977), among others, have warned against observing only one point in time and drawing conclusions on what may be a misleading picture. It is possible that other activities, such as bathing, would present quite a different picture of the mother-child interaction. Ideally, a more complex environmental study would also include other members of the intimate group, of which the baby is a part (Lamb, 1978). It may also be useful to extend these observations to other population groups, and to bottle fed infants, to increase the generalisability of the results.

Aside from these general extensions however, there are specific areas of further research which are suggested by the study, examples of which are presented briefly.

Firstly, the differences in sucking patterns are of interest to neonatal neurologists who contend that they may reflect

specific areas of central nervous system disorganisation (Stern, 1980). It may be necessary to broaden the range of data collected to include respiration and swallowing, as Burke (1977), Johnson and Salisbury (1975), and Soetgen et al (1969) have indicated that this group of behaviours reflect a complex under central nervous system control, which is affected in various ways by assault.

The exact sequencing and timing of responses may be more important than their frequency. The use of video equipment for recording may allow a more detailed analysis of the observational data. It may also allow a verification of qualitative differences in behaviour, which were noted during this research. For example, the eye contact of the "sucking asphyxiated group" had more the quality of a fixed stare than the lively eye contact of the controls.

Finally, the psychodynamics of the mother-infant relationship during breastfeeding are of great interest. It may be important to collect more systematic data on the mother's feelings during breastfeeding (Leff, 1983; Mills, 1981). For example, one of the mothers in the "sucking asphyxiated" group complained that her baby was "draining" her and she "didn't have enough to satisfy him".

6.5 In conclusion

This research attempted to study the effects a specific variable, sucking response, could have on the mother child

interaction in a specific setting, breastfeeding. Although many factors were controlled by matching, differences in the mothers and infants of the two groups were noted, which no doubt themselves interacted with sucking pattern to produce variable behaviours. The trends illustrated by the results however, indicate that if the sucking reflex is aberrant, it is indeed associated with a different type of relationship during breastfeeding. The influence this early experience may have on latter patterns of perception, expectation and action cannot be categorically stated. This does not detract however from the usefulness of early intervention in optimising the breastfeeding relationship, which otherwise may be threatened in certain circumstances, and the relevance this research has for mothers with infants who were asphyxiated at birth.

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APPENDICES

APPENDIX A

CONSTRUCTION AND STANDARDISATION OF SUCKOMETER

The basic structure of the instrument used to record the sucking patterns ("suckometer"), followed that of deLucia (1967). Certain modifications were made to enable the simultaneous recording of both mouthing (expression) and suctioning (negative pressure) components of the sucking reflex. The mode and rate of delivery of milk was also altered to simulate as closely as possible the breastfeeding situation. Data on the latter was obtained from a study which used ultrasound to make in vivo measurements of milk flow and infant sucking (How et al, 1979).

A standard feeding bottle was used as a container for the milk. This was fitted with a specially moulded top which contained a disc with a one way valve, and openings for 3 cardiac pressure tubes, one to the environment, one to the inside of the teat and one out through the middle of the teat. The one way disc prevented backflow of milk into the bottle, as this cannot occur in the human breast. The negative pressure build-up in the bottle, caused by the infant sucking and withdrawing milk, therefore had to be equalised by the pressure tube opening to the environment. The tube to the inside of the teat allowed measurement of mouthing, as the infant squeezed the teat with her/his gums and changed the air pressure inside it. The last tube out through the

middle of the teat reflected the negative pressure changes inside the infant's mouth, as she/he suctioned milk.

A latex "breast" was moulded to the shape of a human breast, and a standard teat fitted into this. The choice of teat caused some difficulty because it not only had to accommodate the negative pressure tube, but also to allow the delivery of milk at a rate equivalent to that of the human breast, at average infant buccal negative pressures. Several teats on the market were tested for flow rate over a range of negative pressures. The results are presented in Figure IX. It was decided to use teat C. It should be noted here however, that the structure of commercial teats is very different to that of the nipple, and elicits slightly different mouth and jaw movements in the neonate (Benoit, 1971). This dissimilarity could not be overcome in devising the apparatus.

The cardiac pressure tubes were joined to negative pressure transducers. It was decided to import aeroplane altometers from the Boeing Company as these provided the smallest and most accurate pressure transducers. In the final design they were housed in a perspex case which clipped onto the pocket of the researcher's coat. From here leads to the preamplifier and two channel recorder, housed on a moveable trolley, provided the final link between the infant's mouth and recording of the data (see Figures X and XII).

The suckometer was calibrated to provide 22ml of breastmilk, of viscosity found on the 3rd day after parturition, at a

FIGURE IX

FLOW RATES OF COMMERCIAL TEATS

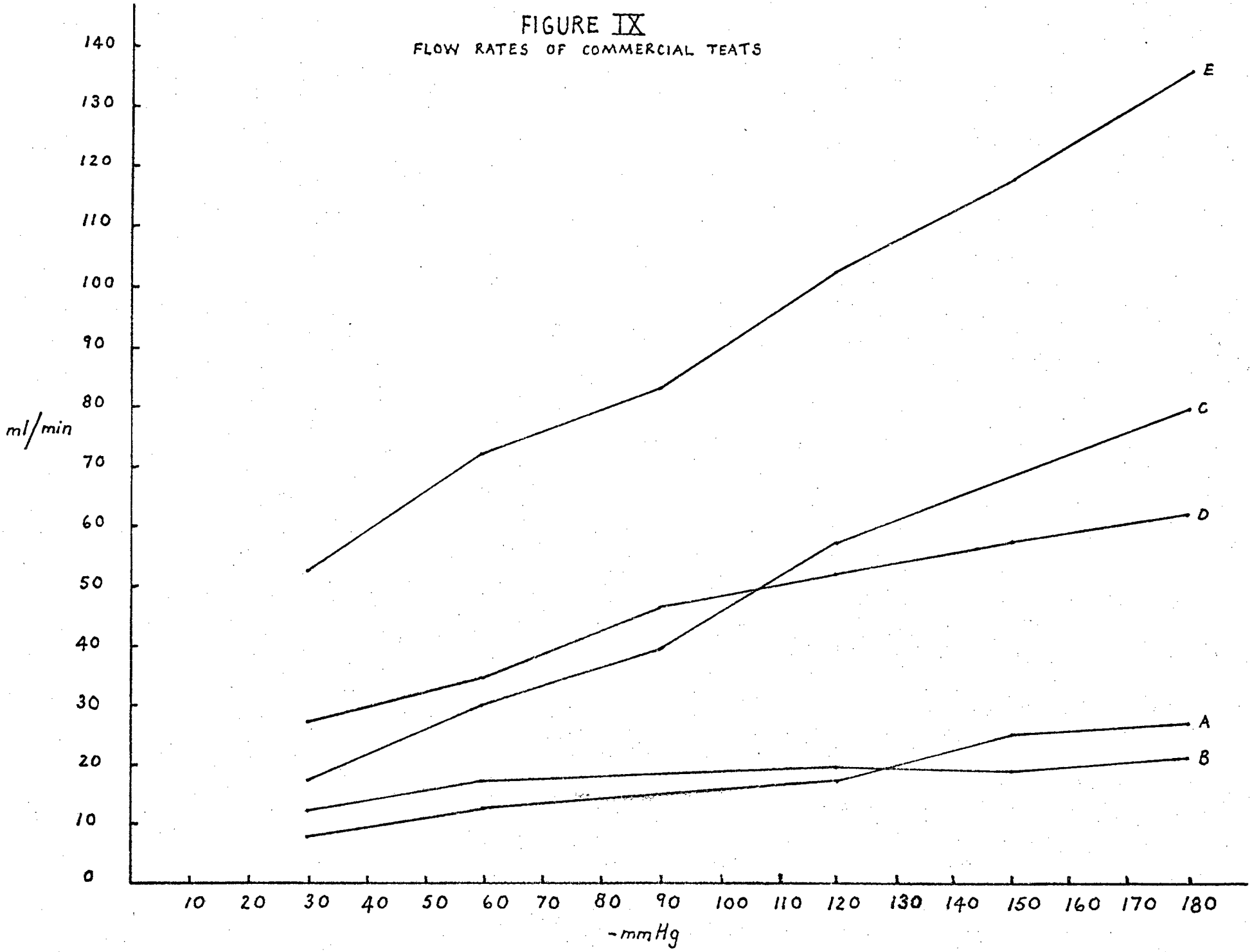
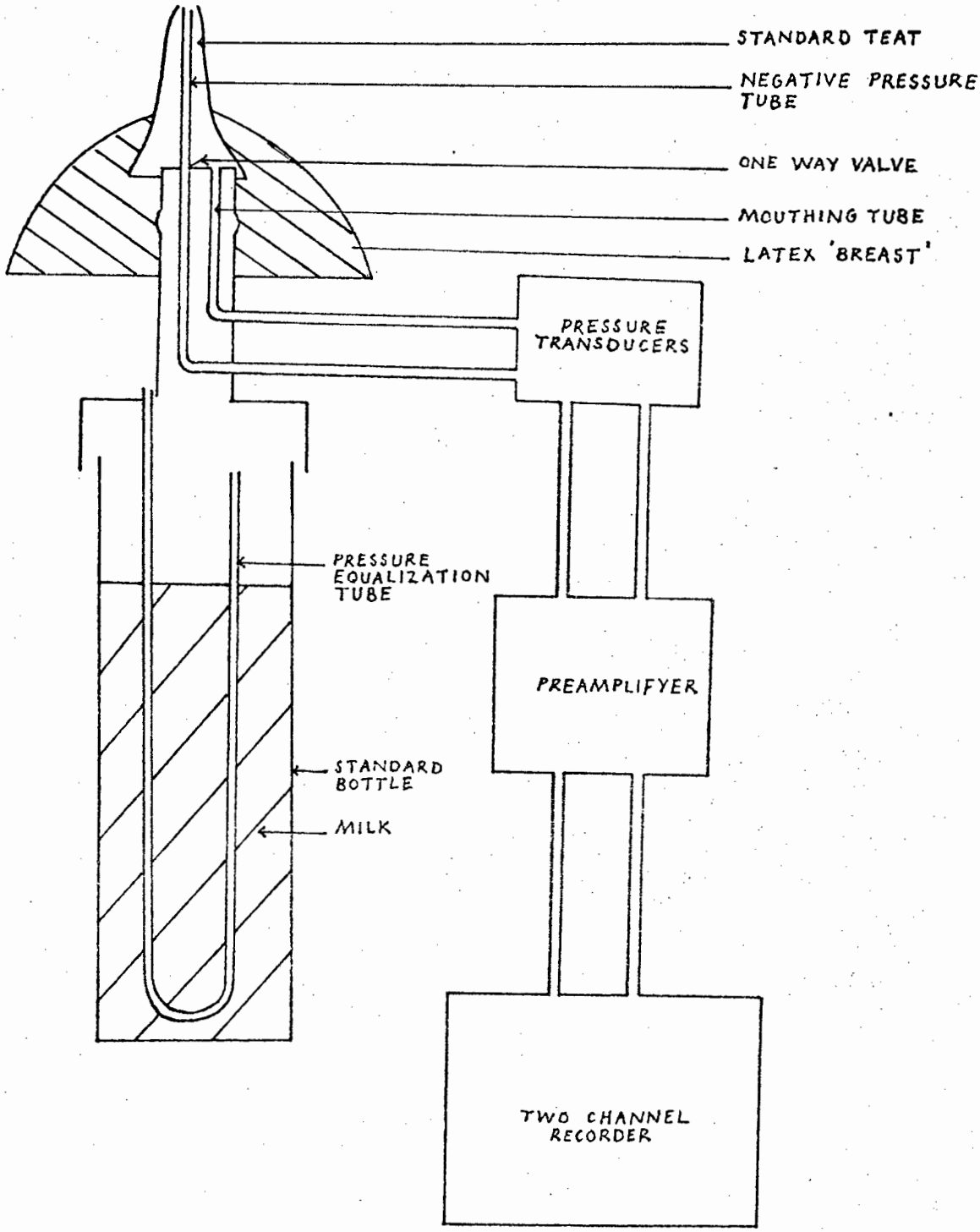


FIGURE X

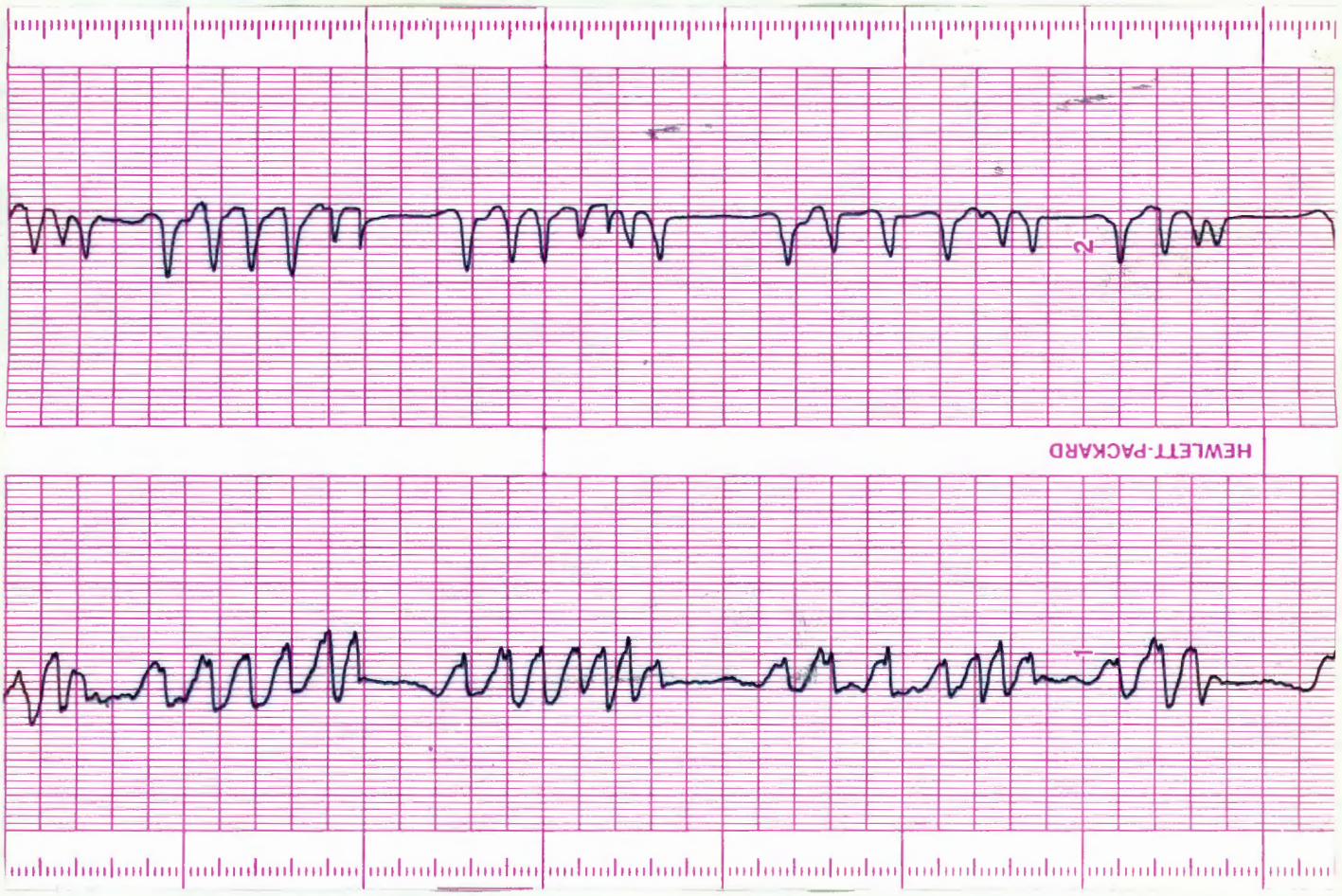
DIAGRAMMATIC REPRESENTATION OF APPARATUS



negative pressure of 60mm Hg. This corresponds to the average data for an uncompromised neonate sucking on the breast (How et al, 1979). An example of the traces thus recorded is provided below.

FIGURE XI

SAMPLE OF SUCKING TRACES



Note : Chart speed is 5mm s^{-1}

5mm is proportional to 12,5mm Hg on mouthing channel

5mm is proportional to 50mm Hg on negative pressure channel.

FIGURE XII

APPARATUS IN USE

Analysis of the traces began at the first synchronised suctioning and mouthing response, and ended at the end of a burst after 20 minutes of feeding, or 5 minutes of no response. The definitions used in the analysis of the trace were:

- A mouthing (expression) 'response' = $\geqslant$ 5mm Hg.
- A Suctioning (negative pressure) 'response' = $\geqslant$ 20mm Hg.
- A 'burst' = $\geqslant$ 2 responses separated by $\leqslant$ 1s.
- An 'interval' = $>$ 1s of no responses.
- Mean number of responses per burst = total number of 'responses' in a burst (with synchronous mouthing and suctioning responses counting as 1 response)/number of bursts.
- Mean interburst interval = total time during which there no responses (s)/number of intervals.
- Intraburst rate = number of responses in a burst/burst length(s).
- Ml taken per sucking minute = total ml taken in feed/ minutes during which responses occurred.
- Ml taken per minute = total ml taken in feed/total duration of feed (minutes).
- % time spent mouthing only = time spent mouthing with no concurrent suctioning(s)/total time of feed(s).
- Mean amplitude of mouthing only = total amplitude of mouthing in every third burst (mm Hg)/total number of mouthing responses in bursts.
- % time spent suctioning = time spent suctioning through out feed(s)/total time of feed(s).

- Mean amplitude of suctioning = total amplitude of suctioning in every third burst (mm Hg)/total number of suction responses in bursts.

The apparatus was standardised by comparing mean number of responses per burst, mean interburst interval, intraburst rate, ml taken per sucking minute, and ml taken per minute from recordings, with the same measures observed during breast-feeding. 10 neonates and their mothers, all of whom had uncomplicated deliveries, were used in the standardisation. The first two feeds of the morning were used for comparison, one normal breastfeed and one feed on the suckometer, in alternating sequence, on the first 3 days after birth. The traces were analysed for the appropriate parameters, and a hand record was kept of number of responses and length of interburst interval during observations of breastfeeding. The babies were accurately weighed before and after breast-feeding to determine the amount of milk taken. A comparison of results indicated very good concordance between measures estimated by recording sucking on the suckometer, and those computed from in vivo observations of breastfeeding. The range of differences between measures on the two feeds was no bigger than the range of differences between measures observed during breastfeeding. The separation of mouthing and suctioning responses on the breast could not be done visually, as of course the estimation of amplitude of responses (mm Hg) could not. These measures could not therefore be used in the standardisation. It appeared, however, from the construction of the apparatus, and the concordance

obtained on the other measures, that this suckometer would enable a relatively accurate tracing of the pattern of sucking during breastfeeding to be made.

APPENDIX B

COMPILATION OF BEHAVIOUR CATEGORIES OBSERVED DURING BREASTFEEDING

Initially, behaviours were outlined as occurring during breastfeeding on the basis of the researcher's experience. These were used during trial observations, and new behavioural definitions included as it became obvious that behaviours were occurring, which had not been previously outlined. When a schedule had been compiled that effectively allowed monitoring of all observable mother and infant behaviours during breastfeeding, the literature was reviewed for similar studies. Reported observational schedules (see Chapter 3) were compared with the one compiled on the basis of in vivo experiences of the author, and some behavioural definitions modified to give simpler and more unitary definitions of behaviour. The final categories of behaviour and the definitions used are given below.

Touching infant: Placing hands or finger on some part of the infant's body and moving them around or taking them off and replacing them.

Kissing infant: Placing mouth close to/touching part of infant's body and removing it after at least 1 second.

Rocking infant: Making rhythmical 'to and fro' or side to side movements with entire body or arms while holding infant.

Carrying infant: Walking with infant in arms.

Initiating sucking: Placing nipple in or around infant's mouth, or patting infant's cheeks, or flicking/rubbing baby's hands and feet to stimulate sucking.

Winding: Making rhythmical circular or patting movements on the baby's back directed towards encouraging burping.

Talking to infant: Talking obviously directed towards infant by choice of words or mother looking at infant.

Talking to others: Talking not directed towards baby.

Looking at infant: Mother's eyes directed onto infant's body for 3 seconds.

Walking: Mother moving about without holding baby.

Out: Mother not present.

Infant state: 1 = sleeping with no gross bodily movements, 2 = sleeping with gross movements, 3 = drowsy, 4 = alert, 5 = fussing/very active, 6 = crying (categories defined in accordance with 'SCANLON' and other well-known behavioural scales.

Swaddled: Arms and body restricted by clothes/wrappings.

Arms free: Arms free to move.

Cradled: Baby held with mother's arms around baby in approximately 45° position.

Vertical: Baby held at 90° to floor.

Seated: Baby held so that it assumes sitting position, with torso upright and legs horizontal.

Lying: Baby horizontal with mother's arms not surrounding it, but may be on it or keeping it from moving.

Not held: Infant does not have mother's arms touching it.

Nipple in mouth: Nipple inside mouth cavity with baby's lips closed around it.

Nipple out: Nipple available for baby to suck on but not in mouth.

Looking at mother: Infant's eyes directed towards mother 2s

Looking away: Infant's eyes directed at anything except Mother.

Choking: Infant makes choking sounds or vomits.

Observation began when the mother sat down to feed her baby, and ended when she verbalised that the feed was finished.

A trained nursing sister was involved in joint observation and critical appraisal of the behavioural categories throughout the compilation of the schedule. Interobserver reliability checks between her and the author after the definitions had been finalised, yielded between 87 and 92% agreement. Throughout the study, several interobserver checks were made, and the percentage agreement never fell below 85.

APPENDIX C

FORM A

Mother's questionnaire

The purposes of this investigation have been explained to me by Bridget Conacher, and I consent to have my baby's sucking patterns monitored, and to be observed feeding my baby. I understand that all the information collected for the trial is confidential.

Signed ..... Witness .....

.....

Date .....

Name ..... Age .....

Address .....

.....

Medical factors

Parity ..... ☐☐

Gravity ..... ☐☐

Length of second stage of labour ..... ☐☐☐ mins.

Drugs during labour .....

Type of delivery .....

Smoking habits .....

Drinking habits .....

Brief medical history : Operations .....

.....

Illnesses .....

.....

Pregnancy .....

.....

Social factors

Ethnic group .....

Relationship to baby's father .....

Was the baby planned? .....

Is the baby wanted? .....

Was a boy or girl wanted? .....

Living conditions: housing belongs to? .....

type of housing? .....

number of people living in the house? .....

Mother's educational standard .....

Father's educational standard .....

Mother's occupation .....

Father's occupation .....

/Contd....

Financial position of family in which baby will be part .....
.....
Major caring for baby by? .....

If previous babies : did mother breastfeed? .....
for how long? .....
any problems? .....
any other problems with previous children? .....
.....

Breastfeeding : how long does mother intend to breastfeed? .....
.....
feelings about breastfeeding .....
.....

Other comments :

BREASTFEEDING STUDY

FORM B

Infant form

Name ..... Group .....

Date of birth ..... Time of birth .....

Medical factors

Apgar ..... ☐ 1 min ..... ☐☐ 5 mins.

TSR ..... ☐☐ min.

Weight ..... ☐☐☐ g.

Gestational age ..... ☐☐ weeks

Sex .....

Factors associated with asphyxia neonatorum

Abnormal foetal heart rate : > 200 (tachycardia) ..... ☐

< 120 (bradycardia) ..... ☐

type 2 dips ..... ☐

Decreased foetal movement ..... ☐

Meconium stained liquor ..... ☐

Scalp pH < 7.2 ..... ☐

Daily observation	1	2	3	4	5	6	7	8	9	10
Tense fontanel										
Convulsions										
Abnormal movements and behaviour										

Renal damage ..... ☐

Necrotising enterocolitis ..... ☐

Lumbar puncture .....

C.T. scan .....

Laboratory investigations .....

.....

Other comments :

FORM B continued

Sucking parameters

Day	No. responses per burst		Interburst interval (s)		Intraburst rate (su/s)		Ml. taken per sucking min	Ml. taken per min.
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	Mean
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

Day	% time spent mouthing only	Amplitude of mouthing only		% time spent suctioning	Amplitude of suctioning	
		Mean	S.D.		Mean	S.D.
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

BREASTFEEDING STUDY

FORM C

Mother infant observation

Name ..... Group .....

Date of observation ..... Time of observation .....

Mother's comments on how feeding is going .....

.....

.....

Mother's physical state : pain from birth? .....

eating? .....

sleeping? .....

Mother's emotional state: .....

.....

Baby's physical state? .....

.....

Other comments prior to observation:

Latency to cry on removal of nipple after feed ..... ☐ mins.

Responsibility for ending feed .....

Other comments after observation:

Form C continued

Name .....

Form number .....

Others present?

Mother

Touching infant

Kissing infant

Rocking infant

Carrying infant

Initiating sucking

Winding

Talking to infant

Talking to others

Looking at infant

Looking away

Walking

Out

Infant

State

Swaddled

Arms free

Cradled

Vertical

Seated

Lying

Not held

Nipple in mouth

Nipple out

Looking at mother

Looking away

Choking