THE LONGITUDINAL GROWTH AND FEEDING PRACTICES OF INFANTS FROM BIRTH TO TWELVE MONTHS

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DECLARATION

I, the undersigned, hereby declare that the work contained in this thesis is my own original word and that I have not previously in its entirety or in part submitted it at any university for a degree.

26/11/2003

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ABSTRACT

INTRODUCTION: Malnutrition is a silent emergency. WHO estimates that 55% of all child deaths in developing countries are associated with malnutrition. Inadequate dietary intake and disease are the two immediate causes of malnutrition. The underlying causes are household food insecurity, inadequate maternal and child-care and poor water/ sanitation and inadequate health services. Stunting is a major problem in pre-school children in South Africa. This indicates a long term inadequate dietary intake. Furthermore, the initiation of breastfeeding in South Africa is about 90%, and the duration thereof tends to be less than 3 months after birth. A great majority of children in this country consume a diet deficient in energy and of poor nutrient density to meet their micronutrient requirements. The aim of this study was to identify feeding practices of infants that could contribute to the development of malnutrition.

METHOD: This was a cohort study with a prospective experimental design. Forty-four of the original 73 mother-infant pairs that were recruited, were interviewed monthly on feeding practices of the infants. Anthropometric measurements (weight and height of the infants) were measured monthly.

RESULTS: Weight-for-age Z-scores dropped significantly with age from around 4 months, when weaning had started. Inadequate dietary intake, more specifically weaning practices and breastfeeding practices, were identified as the immediate cause that could contribute to the development of malnutrition in this community. Except for the positive relationship between the level of education of the father and an increase in HAZ over time, growth was not affected by socio-economic and demographic factors in this community. This is probably because of the fact that there were very small differences in socio-economic and demographic factors.

CONCLUSION: Weaning and breastfeeding practices should be addressed in all nutrition education programmes.

OPSOMMING

INLEIDING: Wanvoeding is 'n stil gevaar. Die WGO skat dat daar 'n verband is tussen wanvoeding en ongeveer 55% van alle kindersterftes in ontwikkelende lande. 'n Onvoldoende dieetinname en siekte is die twee onmiddellike oorsake van wanvoeding. Onvoldoende huishoudelike voedselsekuriteit, onvoldoende moeder- en kindsorg en swak sanitasie en watervoorsiening asook onvoldoende gesondheidsorg is die onderliggende oorsake. Dwerggroei is 'n groot probleem in Suid-Afrika onder voorskoolse kinders. Dit dui op 'n langdurige onvoldoende dieetinname. Bydraend hiertoe, is die aanvang van borsvoeding in Suid-Afrika ongeveer 90%, maar die duurte van borsvoeding is minder as 3 maande na geboorte. Die meerderheid van alle kinders in Suid-Afrika se dieet het 'n tekort aan energie en die nutriëntdigtheid van hulle diëte voldoen nie aan hulle daaglikse behoeftes ten opsigte van mikronutriënte nie. Die doel van hierdie studie was om voedingspraktyke te identifiseer wat kan bydra tot die ontwikkeling van wanvoeding.

METODE: Dit was 'n kohortstudie met 'n prospektiewe eksperimentele ontwerp. Vier-en-veertig van die oorspronklike aanvanklike moeder-babapare wat gewerf is, is maandeliks ondervra met betrekking tot die voedingspraktyke van die baba en antropometriese metirngs (gewig en lengte van die baba) is maandeliks geneem. **RESULTATE:** Z waardes van gewig vir ouderdom het beduidend gedaal namate die kinders ouer geword het, veral vanaf 4 maande, toe spening begin het. 'n Onvoldoende dieetinname, meer spesifiek spenings- en borsvoedingspraktyke, is geïdentifiseer as die onmiddellike oorsake wat tot die ontwikkeleing van wanvoeding kan bydra in hierdie gemeenskap. Daar was 'n positiewe verband tussen lengtegroei (Z waardes van lengte vir ouderdom) en die vlak van opvoeding van die vader. Groei is nie deur die ander sosio-ekonomiese en demografiese faktore beïnvloed nie, moontlik as gevolg van die klein verskille in sosio-ekonomiese en demografiese eienskappe van die studie populasie.

GEVOLGTREKKING: Spenings- en borsvoedingpraktyke behoort aandag te geniet in alle voedingsvoorligtings-programme.

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ABBREVIATIONS

PEM	Protein Energy Malnutrition
WHO	World Health Organisation
HIV	Human Immuno-deficiency Virus
AIDS	Aquired Immuno Deficiency Syndrome
IQ	Intelligence Quotient
GNP	Gross National Product
SD	Standard Deviation
NFCS	National Food Consumption Survey
SA	South Africa
U5MR	Under 5 Mortality Ratio
IMR	Infant Mortality Ratio
NCHS	National Center for Health Statistics
UNICEF	United Nations Children's Fund
INP	Integrated Nutrition Program
TB	Tuberculosis
MUAC	Mid Upper Arm Circumference
IMCI	Integrated Management of Childhood Illnesses
CDC	Center for Disease Control and Prevention
USA	United States of America
UNAIDS	Joint United Nations Programme on HIV/Aids
PBF	Predominantly Breastfed
MF	Mixed Feeding
PFF	Predominantly Formula Fed
GLM	General Linear Model
WAZ	Weight-for-age Z-score
HAZ	Height-for-age Z-score
WHZ	Weight-for-height Z-score
i.e.	that is
HFBNP	Health Facility Based Nutrition Programme
PHC	Primary Health Care

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CHAPTER 1

INTRODUCTION

1.1 THE EXTENT OF MALNUTRITION IN THE AFRICAN CONTINENT

Child growth is internationally recognised as an important public health indicator for monitoring the nutritional status and health in populations.[1] Growth faltering in children is the best single general indicator of incipient problems in child health and development.[2] Protein energy malnutrition (PEM) in young children is currently the most important nutritional disorder in Asia, Latin America and Africa. In 1995, the World Health Organisation (WHO) estimated that the so-called *silent emergency* (malnutrition) was associated with over half (55%) of all child deaths in developing countries.[3] Many children suffer from multiple types of malnutrition, so numbers tend to overlap. Some 67 million children are estimated to be wasted, which means that they are below the weight they should be for their height. About 183 million children weigh less than they should for their age. It is reliably estimated that globally 226 million children are stunted – shorter than they should be for their age, and shorter than could be accounted for by any genetic variation. [4] This is the result of a reduced dietary intake, illness, or both. Stunting is associated with a long-term reduction in dietary intake most often closely related to repeated episodes of illness and poor quality diets.[5] Estimated trends indicate that overall stunting rates in developing countries will continue to decrease from 29.8% in 2000 to 16.3% in 2020, although progress will be uneven in different regions. In Africa, a minor improvement in the prevalence from 34.9% to 31.1% is predicted for the next 20 years. Although it seems quite unlikely that stunting rates will decrease with current droughts, poverty and HIV/Aids in Sub-Saharan Africa, nothing was found in the literature showing the contrary. However, the decreasing rates of stunting will translate into increasing numbers of affected children (from 44 million in 2000 to 48 million in 2020) due to population growth. In Asia, Latin America, and the Caribbean, both the prevalence and numbers of stunted children, in turn, are expected to continue to decrease further during the same period.[1]

In most populations in developing countries, the marked degree of growth retardation incurred in early childhood, generally remains into adulthood. The potential for catch-up growth increases as maturation is delayed and the growth period is prolonged. However, maturational delays in developing countries are usually less than two years, only enough to compensate for a small fraction of the growth retardation of early childhood.[6] A number of studies in developing countries show an association between

stunting and several developmental indices and/or cognitive performance in both pre-school and school aged children. In two towns on the island of Mauritius, it was found that malnutrition at age three years was associated with poor cognition at age eleven years independent of psycho-social adversity. Children with three indicators of malnutrition had a 15.3 point deficit in IQ at age eleven years.[7] In this regard, other studies from Kenya support the belief that nutritional, family and environmental factors all play a role independently, although later performance and achievement are best predicted by a combination of these influences.[8] High levels of stunting among children suggest that there will also be long-term deficits in mental and physical development that can leave children ill prepared to take maximum advantage of learning opportunities in school. This can also have consequences for children later in life. Stunting does not directly cause poor intellectual development in children. Rather, the same underlying factors that cause stunting, are also likely to impair children's intellectual growth.[3] The dilemma is how to demonstrate conclusively that nutritional deprivation *per se* has an effect independent of psychosocial and environmental influences. The undernourished child comes from an impoverished environment, where many other influences may negatively affect the child's development.[9] If malnourished children live past their childhood, they are robbed of their mental as well as physical potential. They will become adults with lower physical and intellectual abilities, lower levels of productivity and higher levels of chronic illness and disability. At the family level, the increased costs and pressures that malnutrition-linked disability and illness place on those who care for them can be devastating to poor families – especially to mothers. When the losses that occur in the microcosm of the family are repeated millions of times at the societal level, the drain on global development is staggering. In 1990 alone, the world-wide loss of social productivity caused by four overlapping types of malnutrition – stunting and wasting, iodine deficiency disorders and deficiencies of vitamin A and iron – amounted to almost 46 million years of productive, disability-free life, according to the World Development Report by the World Bank in 1993. In terms of national economy, losses attributable to vitamin and mineral deficiencies are estimated to cost some countries the equivalent of 5% of the Gross National Product (GNP) in lost lives, disability and productivity. Malnourished children's low resistance to illness diminishes the effectiveness of the considerable resources that are spent to ensure that families have access to basic health services and sanitation. Malnutrition's pernicious

effects on brain development and intellectual performance compromise investments in basic education by governments and their partners. PEM manifests itself as a disease with social, developmental as well as nutritional dimensions.[3]

A national survey in 1994 among South African children under the age of six years, reported a low (<5%) prevalence of wasting (-2SD), a low (<10%) prevalence of being underweight for age, (-2SD) and a medium (20.0-29.9%) prevalence of stunting. Significantly, children in rural communities were nutritionally at a greater disadvantage than children living in urban areas. The prevalence of being underweight tended to be higher in children living in informal housing and was the lowest for children whose mothers were well educated. Significantly though, the prevalence of stunting was the highest in children living in traditional or informal housing and had poorly educated mothers. On the basis of these findings, stunting was identified as a major public health problem in this country. Stunting peaked in the 12-23 months age group.[10] More recently, the National Household Food Consumption Survey (NFCS) was done in 1999 in South Africa. In the age group 1-3 years, the prevalence of wasting (-2SD) was 4%, the prevalence of being underweight for age (-2SD) was 12.4% and the prevalence of stunting (-2SD) was 25.5%. In the age group 4-6 years of age, the prevalence of wasting, underweight and stunting was 3.4%, 8.8% and 20.7% respectively. In this survey, 21.6% of children between 1-9 years of age were reported to be stunted.[11]

Nationally representative data regarding other health status indices in South Africa are limited. A number of studies in other countries have demonstrated the association between increasing severity of anthropometric deficits and mortality. Furthermore, the contribution of all degrees of malnutrition to child mortality is widely accepted.[12] Child mortality statistics are valuable indicators of health, socio-economic circumstances and growth and development within a country as well as communities. The aim of all interventions amongst children should be to improve child survival. Nevertheless, recent estimates (1996) placed South Africa 69th in the under-five mortality rankings. The Under 5 Mortality Rate (U5MR) in South Africa was 66 and the Infant Mortality Rate (IMR) was 50 in 1996. Mortality rates in rural areas are higher than in urban areas. These figures dropped somewhat according to statistics published in 1998 to 61 (U5MR) and 45 (IMR).[13] Young child mortality rates are

increasing, possibly due to the increasing prevalence of HIV/AIDS, and currently (2002), the U5MR is 100, and the IMR is 59. [14] When divided into Provinces, the Western Cape Province shows lower mortality figures for young children compared to all other provinces in the country (Table 1).[14] Child mortality statistics of South Africa are comparable to some surrounding countries on the continent (2000), despite the better conditions (Table 2).[3, 14] It was only the child mortality rates in Namibia that decreased over the past six years, the other mentioned countries, including South Africa, showed an increase in young child mortality statistics. In Zimbabwe, longitudinal data on weight and height in a sample of children who were breastfed for a mean of 21 months, indicated that growth was similar to or even exceeded that of the National Center for Health Statistics (NCHS) reference population. Thereafter, growth faltering was common. It was suggested that these children were failing to realise their full genetic potential for growth because of adverse environmental factors.[15]

In most regions of the developing world, malnutrition rates have been declining over the last two decades, but at markedly different paces.[16] The exception is Sub-Saharan Africa, where malnutrition rates began increasing in most countries during the early 1990s, following the economic decline that began in the late 1980s. As government budgets shrank, basic social services and health services were hit hard. Per capita incomes also declined, affecting people's ability to purchase food. Poor households spend a large proportion of their income on food, leaving them with very little to spend on other basic services i.e. water and sanitation, health and education.[3]

TABLE 1: PROVINCIAL VARIATION IN YOUNG CHILD MORTALITY (2002)

Region	IMR* (In deaths per 1 000 live births)	U5MR** (In deaths per 1 000 live births)
Western Cape	30.0	46.0
KwaZulu Natal	68.0	124.7
Eastern Cape	72.0	112.0
Free State	63.0	106.0
Mpumalanga	59.0	106.0
Northern Cape	46.0	72.0
Limpopo	53.0	87.0
North West	56.0	95.0
Rural (1998)	52.5	71.2
Urban (1998)	32.6	43.2

* IMR: Infant Mortality Rate

** U5MR: Under 5 Mortality Rate

TABLE 2: UNDER 5 MORTALITY RATES (U5MR) AND RANKING AND INFANT MORTALITY RATES (IMR) OF SOUTH AFRICA AND SURROUNDING COUNTRIES

Country	U5MR Rank (1996)	IMR (1996)	IMR (2000)	U5MR (1996)	U5MR (2000)
South Africa	69	50	55	66	70
Mozambique	9	133	Not available	214	Not available
Zimbabwe	65	49	73	73	117
Namibia	60	60	56	77	69
Malawi	8	137	Not available	217	Not available
Zambia	13	112	Not available	202	Not available
Botswana	80	40	74	50	101

1.2 THE CAUSES OF MALNUTRITION

Malnutrition contributes to child mortality as it could lead to death if not treated. Mortality statistics are indicators of health.

Growth during childhood is determined by the continuous interaction between genetic and environmental factors. The influence of different environmental factors on growth patterns of children are well documented.[2, 17-20] Ethnic differences might cause children from different ethnic backgrounds to follow different growth curves, but the question whether ethnic differences in growth potential are relevant, remains unanswered. When the factors which influenced growth variables of pre-school coloured children in Cape Town were analysed, a genetic influence manifested as a correlation between growth variables and mothers' weight and height and fathers' height.[2] Habicht, on the other hand, believes that factors other than nutrition and disease play a relatively small role in determining the growth retardation of population means.[18] In addition to this, Waterlow *et al* found that the nutritional risk of infants is also influenced by unfavourable social and economic factors as well as the unavailability of nutritional support should growth faltering occur.[21] Therefore, the possibility exists that disturbances in any of these interactions could cause disturbances in growth patterns. There is evidence of an association between infant feeding practices and overall infant mortality, diarrhoea-associated infant morbidity and mortality and infections in developing countries.[21, 22]

UNICEF proposed a strategy for improved child survival in 1990. As part of this strategy, the conceptual framework of the causes of malnutrition was developed. The Department of Health, Directorate: Nutrition, has afforded a high priority in addressing the prevention and/or treatment of malnutrition in the country by means of the Integrated Nutrition Programme (INP). The INP adopts the UNICEF conceptual framework, the so-called Triple A cycle, which enables the analysis of the causes of malnutrition and death in a community to be determined, and it also indicates the interrelationship of the various contributing factors (Figure 1).[3, 23, 24]

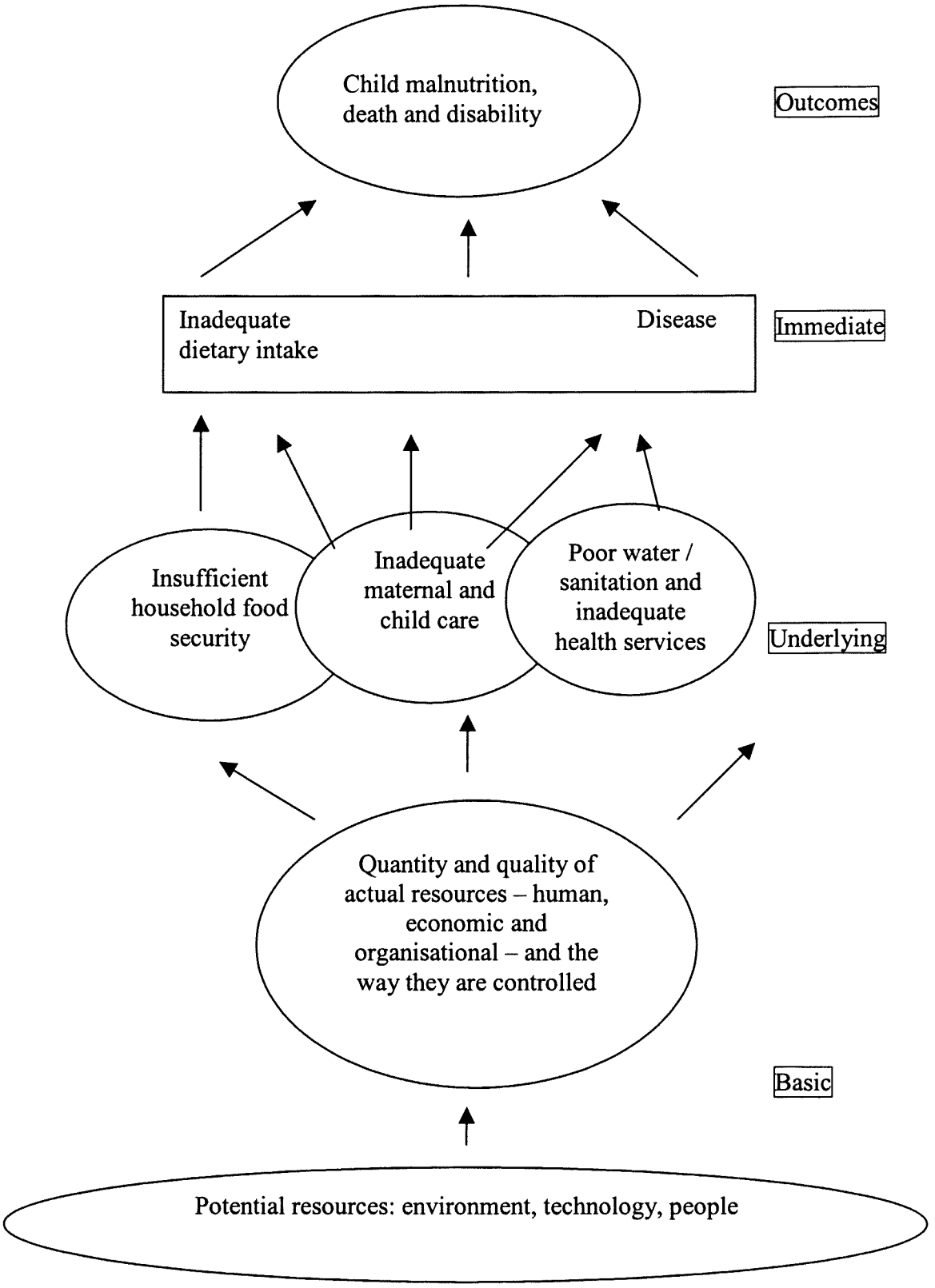


FIGURE 1: THE CAUSES OF CHILD MALNUTRITION
(Adapted from: Bellamy C. The State of the World's Children 1998. UNICEF)

An understanding of the complex and subtle causes of malnutrition is important to appreciate the scale and depth of the problem, the progress achieved to date and the possibilities for further progress that exist. Malnutrition is not a simple problem with a simple solution. Multiple and interrelated determinants are involved in why it develops, and a similarly intricate series of approaches, multifaceted and multisectoral, are needed to deal with it. (Figure 1) This conceptual framework on the causes of malnutrition was developed in 1990 as part of the UNICEF Nutrition Strategy. The framework shows that causes of malnutrition are multisectoral, embracing food, health and caring practices. They are also classified at an individual level as immediate causes, at the household and family level as underlying causes and at the societal level as basic causes. Factors at one level influence other levels.[3]

1.2.1 Immediate causes of malnutrition

The two most significant immediate causes of malnutrition, inadequate dietary intake and disease, tend to create a vicious cycle. A malnourished child whose resistance to illness is compromised, falls ill and malnutrition worsens. Children who enter this malnutrition-infection cycle can quickly fall into a potentially fatal spiral as one condition feeds off the other. Malnutrition lowers the body's resistance to infection by undermining the functioning of the main immune response mechanisms. This increases the duration and the severity of the illness and leads to more frequent episodes. Infections cause loss of appetite, malabsorption and metabolic and behavioural changes. As a result the body's requirements for nutrients increase and the young children's eating patterns and how they are cared for are even further affected.[3, 25]

1.2.1.1 Disease patterns in South Africa

Where socio-economic conditions are poorer, infant mortality is higher. It is estimated that 11.4% of the total South African population is HIV positive (2002). In the Western Cape, 10.7% of the total population is HIV positive.[14] Added to that, the Western Cape has the third highest incidence (among men: 562/100 000/year) of Tuberculosis (TB) infection in the country. For many years the Western Cape Province had the highest incidence, but now both KwaZulu Natal and the Eastern Cape have a higher incidence.[26] The incidence of diarrhoea in South Africa in children (under the age of five years) per 1 000 was 286.4 in 1998 and 133.4 in 2002,

and in the Western Cape it was 214.8 in 1998 and 94.8 in 2002. Only the Gauteng and Free State Provinces had lower incidences of diarrhoea (59.4 and 78.1 respectively) in 2002.[14] Disease plays a major role as an immediate cause of malnutrition, (and eventually mortality) amongst pre-school children in South Africa.

1.2.1.2 Inadequate Dietary Intake in South Africa

Dietary intake of children in this country can also be described as inadequate. Summarising the findings from the National Food Consumption Survey during 1999 regarding nutrient intake, in general one out of two children had an intake of approximately less than half of the recommended level for a number of important nutrients. More specifically, the great majority of children consumed a diet deficient in energy and of poor nutrient density to meet their micronutrient requirements. The nutrient intake of children living in rural areas was overall considerably poorer than that of children living in urban areas. All variables associated with household food insecurity were associated with a poorer dietary intake and a poorer anthropometric status, particularly stunting and underweight. A significant correlation was found at the national level between energy intake and stunting. The consumption of animal products (milk and dairy products, eggs, meat, fish) significantly correlated with stunting and underweight. This was the case overall for children in all age groups in five of the nine Provinces and for children living in formal urban areas.[11]

Breastfeeding practices are not optimal in this country, (even in the context of HIV/Aids, which is beyond the scope of this discussion) since it is known that initiation is good, but duration of exclusive breastfeeding is not. In the national survey in 1994 among children under the age of six years in South Africa, the percentage of three-year olds who had been breastfed averaged 88%. There was a tendency for younger children to have been breastfed for periods shorter than three months. Mothers in urban areas with a higher education tend to breastfeed for shorter lengths of time.[7] According to the South African Demographic and Health survey, 7.5% of children less than five years of age were exclusively breastfed. [26] In a study amongst black South African infants by Delport, at six and twelve months, 86% and 81% of infants, respectively were receiving breastmilk. By three months, 78% of infants were receiving complementary food.[27] Looking further at the available local research on complementary feeding practices, the weaning process starts very early, often before

the age of three months, the variety of complementary foods in the weaning diet is limited and not well balanced and the frequency of meals is not adequate to ensure a sufficient energy intake. [14, 28-33]

1.2.2 Underlying causes of malnutrition

There are three clusters of underlying causes that lead to inadequate dietary intake and disease. These are household food insecurity, inadequate care for women and children and inadequate health services including an unhealthy environment.[3, 23]

1.2.2.1 Household food insecurity

Household food security is defined as *sustainable access to safe food of sufficient quality and quantity, including energy, protein and micronutrients, to ensure adequate intake and a healthy life for all members of the family.*[3] Household food security may depend on access to land and other agricultural resources to guarantee sufficient domestic production in rural areas. In urban areas food is largely bought at shops or markets. A range of food must be available at accessible prices to ensure food security. Household food security depends on *access* to food (including financial, physical and social access), as well as *availability* of food. There may be plenty of food in the shops but poor families cannot afford it and are therefore not food secure. It might also be the case that poor families have adequate access to food for the early part of a month, after pay day, but do not have enough food during the last few days of the month. Access to food must be consistent and sustainable. There must be alternatives to cushion them in times of hardship. Women play an important role in maintaining food security in the house. In most societies they are solely responsible for preparing, cooking, preserving and storing the family's food. In many societies they also even have the primary responsibility of producing and purchasing it. This overwhelming burden of work must be reduced or redistributed so that other needs of children relating to good nutrition can be met.[3, 23]

Household food security in South Africa

- At the national level in SA one out of two households experiences hunger, one out of four is at risk of hunger and only one out of four households appears to be food secure. [11]

- In the rural areas a significantly higher percentage of households experiences hunger when compared to households in the urban areas.[11]
- There is an overall consistent association between the hunger risk classification and anthropometric status. A similar association is found with energy intake and the intake of micronutrients. [11]
- Households at risk of hunger or experiencing hunger procure a smaller number of food items and have a similarly smaller number of food items in the household inventory. Additionally, households at risk of hunger or experiencing hunger tend to be of the informal dwelling type, have the lowest monthly income and spend the lowest amount of money weekly on food. The mothers of such households also have a lower standard of education. [11]
- Food insecurity is, on average, experienced nationally by two out of three households, five out of ten individuals and four out of ten children respectively at the household, individual and at the child hunger level. [11]
- It would appear that women sacrifice the quality of their diets and limit the amount of food eaten by the adults in a household in order to preserve the amount of food available to their children.[11]

With such a large percentage of households being food insecure, it is surprising that the prevalence of wasting and stunting is not higher. This highlights the point of this discussion, namely that a combination of factors could contribute to the development of malnutrition.

1.2.2.2 Poor water / sanitation and inadequate health services

An essential element of good health is access to curative and preventative health services that are affordable and of good quality. There should be a health centre within reasonable distance, with qualified staff equipped to give the advice and care needed. Preventative health and nutritional care are components that should be emphasised more as curative care are still more in demand.[3] In terms of environmental health a lack of ready access to a safe water supply and proper sanitation, the unhygienic handling of food, as well as the unhygienic conditions in and around homes, have significant implications for the spread of infectious diseases,

including most incidences of childhood diarrhoea. Diarrhoeal disease is one of the leading causes of infant mortality, and is closely related to both the socio-economic situation and environmental health issues like access to clean water.[14] When food is handled under unhygienic conditions and the environment is unhealthy, with a risk of contamination by animal and human waste, young children are also more prone to infection by intestinal parasites – another cause of poor growth and malnutrition.[34]

The number and type of health facilities in the country is undergoing constant change. The utilization rate of Primary Health Care (PHC) is the number of visits per person to Primary Health Care Facilities per year. It is calculated from the PHC headcount divided by the total population. It was 2.4 in the Western Cape and 1.8 nationally in 2002. National PHC models generally calculate a need for 3-3.5 visits per capita per year. This data is roughly half the expected value for the full range of PHC services.[13, 14]

1.2.2.3 Inadequate maternal and child care

Since the proclamation of the Child Care Act 74 of 1983, suspected cases of child abuse and neglect have been declared as notifiable by medical personnel. In 1994 to 1995, a survey was carried out by the Social Work Department in Tygerberg Hospital, in the Western Cape Province, to highlight the importance of a central register of suspected cases of child abuse. Cases of severe malnutrition were also registered as suspected cases of child abuse. Malnutrition was confirmed in 23 out of 127 (18%) registered cases. The median age of malnourished children due to neglect was 12.6 months (range 1-38 months)[35] A comprehensive nutritional status survey was undertaken in a semi-rural village of Lebowa in 1993. Although 12% of the children were underweight and 28% stunted, only 4% of the caregivers were thin, but 31% of them were overweight.[36] According to Dietz, there is a high prevalence of obesity among adults in poor populations.[37] The paradox of fat caregivers with underweight children can be interpreted as an inadequate distribution of food in the household. In order for the caregiver to become (and stay) overweight, the caregiver must have an ongoing high intake of energy foods. This implies that there are energy providing foods in the home, but it is difficult for a child to eat sufficient of the staple food to meet his/her energy requirements.[36]

Other investigators have emphasised that under-nutrition is not simply a lack of food in the home.[38] Children can still be malnourished in a house with adequate food in a safe and healthy environment with access to health services. Inadequate care for children and women is the third element of the underlying causes of malnutrition. The Care Initiative (UNICEF 1997) aimed at providing decision makers with knowledge and skills to assess, analyse and take action to support or change care practices to improve nutrition.[39] Care is manifested in the ways a child is fed, nurtured, taught and guided. Nutritionally, care encompasses all measures and behaviours that translate available food and health resources into good child growth and development. This complex of caring behaviours, is often mistaken to be the exclusive domain of mothers. In fact, it is the responsibility of the entire family and the community. In communities where mothers are supported and cared for, they are better able to care for their children. There is a range of caring behaviours that affect child nutrition and health, and the following are most critical:[34]

Feeding: Exclusive breastfeeding for six months, and continued breastfeeding with the addition of safe, high quality complementary foods into the second year of life, provides the best nourishment for children. The introduction of complementary foods is a critical stage as feeding needs to be frequent and meals should be dense in energy and easy to digest. Feeding children and preparing their meals is time-consuming. Mothers need to have good information on feeding children, unbiased by cultural habits and misconceptions. Nutrition is also affected by whether a child is fed first or last among family members. [34]

Protecting children's health: Ensuring that children receive essential health care at the right time is part of the caring act and requires that the mother has the insight to take the child for health care when necessary. Early treatment can prevent a disease from becoming severe. Essential health care includes immunisations according to a specific schedule, sound health information and support to the ones caring for the children as well as therapeutic treatment for disease.[34]

Support and cognitive stimulation for children: To ensure optimal development children require emotional support and cognitive stimulation.[25, 40] The link between caring stimulation and malnourished children is important, as malnourished children

who receive verbal and cognitive stimulation have higher growth rates than those who do not receive the stimulation.[25] Breastfeeding affords the best early occasion to provide support and stimulation. It enables mother and child to develop a close emotional bond that benefits both. All children need, and delight in, the kind of play and stimulation that is essential for their cognitive, motor and social development. Verbal stimulation by caregivers is particularly important for a child's linguistic development. Ill or malnourished children who are in pain and have lost their appetite, need special attention to encourage them to feed and take renewed interest in their surroundings during recovery. Regular interaction with other young children contributes to cognitive development. Parents and caregivers need to be educated to improve the quality of these actions. Timing must be carefully planned since many early child development activities concentrate on children older than three, where the focus should be on children younger than three. Activities should link care, good feeding and pshycosocial activities, since many of these development milestones take place before the age of three.[3]

Care and support for mothers: Caring practices vital to nutritional well-being of children rely on equal division of labour and resources in families and communities. Girls and women also need to receive equal opportunities in education and employment. A number of measures are essential to enable women and girls to develop their skills and abilities. These include ensuring their access to family and community resources, such as credit, and to education and information.[3]

1.2.3 Basic causes of malnutrition

It is often said that poverty at the family level is the principal cause of child malnutrition. This statement tells only part of the story. Many poor families do in fact receive adequate nutrition, and malnutrition is also found in many better off families. The broader explanation lies within a fuller understanding of the different types of resources necessary for good nutrition, as well as the factors that affect families' ability to access and control these resources. The three components of nutrition, food, health and care, interact closely in their influence on family life. Often efforts to fulfil one precondition for good nutrition compete for the same resources required to fulfil another condition. If a woman has to spend excessive time in producing food to achieve household food security, her ability to provide adequate child care can be

compromised. The result may be malnutrition in her young child. [3] In the current African context, with HIV/Aids as a major epidemic and especially females being ill (12.8% of females vs. 9.5% of males in South Africa)[14] and eventually dying at an early age of Aids (9.3% of people aged 15-24 years estimated to be HIV positive), the responsibility of food security, care and support could often be shifted to someone else (grandparents, young children or other community members). Political, legal and cultural factors at national and regional levels may defeat the best efforts of households to attain good nutrition for members. Girls and women should be protected by law and custom, and the political and economic system should ensure a fair and equal distribution of income and assets.

The ideologies and policies that govern the social sectors should also provide for the rights of women and girls. Women should be able to make the best use of available services for themselves and their children.[3]

1.3. GROWTH MONITORING AND PROMOTION

A small number of behaviours and nutritional practices aimed at addressing the immediate causes of malnutrition in women and young children have measurable impact on health and nutritional status. [34] The internationally recommended way to assess malnutrition at population level is to take body or anthropometric measurements (e.g. weight and height). Based on combinations of these body measurements, anthropometric indices are constructed. These indices are essential for the interpretation of body measurements. In children the three most commonly used anthropometric indices are weight-for-height, height-for-age and weight-for-age. These indices can be expressed in terms of z-scores, percentiles or percentage of median, which enable comparison of a child or a group of children with a reference population. Mid-upper arm circumference (MUAC) has been proposed as an alternative index of nutritional status for use where the collection of height and weight measurements is difficult such as emergency situations. In these situations, low MUAC, based on a fixed cut-off point such as 12.5 cm, has been used as a proxy for low weight-for-height or wasting.[41] Comparisons of the two indicators, however, showed that they are poorly correlated.[42, 43] In community based studies, MUAC based on a fixed cut-off, seems to have been an excellent predictor of childhood mortality in many studies.[43-45] Skinfold measurements assess the thickness of subcutaneous tissue. Used alone, however, they are of limited value to assess the degree of wasting because they fail to take into account the changes in muscle mass. In addition, the high intra- and inter-individual variation, cost of equipment and the lack of widely acceptable reference data preclude their application for children for the diagnosis of either over- or under-nutrition. Also, highly skilled individuals must take the measurements.[41]

A comparison of the patterns of growth faltering in developing countries shows that interventions during the earliest periods of life are likely to have the greatest impact in preventing child malnutrition. Special emphasis should thus be given to the development of effective interventions to stop the critical faltering that occurs from birth to 24 months.[5] Even in the poorest regions, on average, growth is normal after the age of two years.[26] Therefore, growth monitoring and prevention of growth faltering is one of the primary interventions that is proposed to reduce the prevalence of malnutrition in South Africa.[24]

Growth *promotion* is the motivation of caregivers, families, communities and health workers to practise behaviours that support adequate growth (height and weight gain) in young children. These behaviours include adequate preconception and prenatal nutrition for mothers to build a strong foundation for infant growth, breastfeeding and complementary feeding and preventive health care, micronutrient supplementation, timely and appropriate attention to illness.[34]

Growth *monitoring* is the measuring of weights and / or heights of individual children periodically (e.g. monthly) to see if they are growing adequately.[34] The position of a single measurement on the weight chart is of less importance than the pattern of growth over time.[41] It is good clinical practice to monitor the growth of children, as it can help detect underlying medical problems before they become serious and can reinforce good caring practices.[34]

Growth monitoring/promotion programmes require frequent, accurate weighing of all children, correct interpretation of measurements and follow-up action. Counselling and follow-up activities particularly are often neglected. Growth faltering can be prevented before it occurs by dealing with feeding problems early, as suggested in the Integrated Management of Childhood Illness (IMCI). Growth monitoring and promotion efforts should focus on young children from birth to two years and should ideally begin with monitoring nutritional status of pregnant women. Growth monitoring can be accompanied by immunisations, early detection of infections, micronutrient supplementation and deworming.[34]

When a child with poor growth is detected, health workers should look for underlying problems. Detailed assessment of the causes should be made if growth continues to be poor and appropriate intervention measures should be taken. Growth monitoring activities provide an excellent opportunity to give counselling on feeding practices and micronutrient supplementation. Growth monitoring activities are also useful to target resources, increase participation, mobilise communities and to track progress in the reduction of malnutrition. The counsel and follow-up activities should in particular get more attention.[34]

1.3.1 Growth standards

Conclusions about growth patterns of infants are determined by the growth standard used.[46] When growth patterns of infants all over the world are compared with one standard, the NCHS-WHO reference, growth patterns differ from the standard.[15, 47, 48] Differences are so great that recent literature recommended that the need for a new international growth reference is becoming a matter of urgency, especially in underprivileged populations where whom the optimal nutritional management of infants and young children is a key to survival or at least to prevent severe infections.[49] Reasons for these differences could be many, especially when the number of factors which are known to influence growth patterns is kept in mind. The growth standards developed for infants that are currently in use, are based on groups that were fed predominantly formula or cow's milk with the addition of solid foods.[50] Growth patterns of breastfed and artificially fed infants differ from each other.[15, 51, 52] Several studies support the hypothesis that breastfed infants regulate their own intake, work hard to get the food and consume smaller amounts of solids compared to formula-fed infants who are persuaded to consume substantially more milk and solid foods and thus calories, than are needed for optimal growth. Formula-fed infants are therefore fatter than breastfed infants.[51, 52, 53, 54] Other studies question this hypothesis and others attribute no effect on weight gain or absolute weight to the method of feeding.[55, 56] It can therefore be said that the evidence of past studies of the relative weight gains of breastfed and artificially fed infants has been inconclusive. Some reports have failed to show any difference in early weight gains between infants fed by either method,[53] and others show that artificially fed infants gain weight more rapidly than those breastfed.[54, 57]

The Centres for Disease Control and Prevention (CDC) developed percentile curves which represented a cross section of children who lived in the United States of America(USA); breastfed infants were represented on the basis of their distribution in the USA population and the charts matched the national distribution of birth weight as well as corrected the disjunction between weight-for-length and weight-for-height or length-for-age and height-for-age found in the 1977 charts.[58] A comprehensive review of the use and interpretation of anthropometric data concluded that the present international growth reference for infants did not describe physiologic growth adequately. Thus a new anthropometric reference was recommended for young

children from birth to five years.[49] The 2000 CDC growth charts were recommended for use in the USA.[58] Currently, the "Road to Health" card that is used in South Africa, is still based on the 1977 National Centre for Health Statistics (NCHS) charts.

1.3.2 The WHO growth monitoring and promotion protocol

A growth monitoring/promotion package consists of:

- Regular assessment of child growth.
- Making decisions about what actions the caregiver should take for the child.
- Making decisions about what the community or programmes need to do to support the family.
- Follow-up on the effects of the actions

A child who is not growing as quickly as a well nourished child of the same age is considered to be faltering in growth, or falling behind in weight for his/her age. Growth faltering is a danger sign, an indicator that action is required from the caregiver or the family and the health worker. If children are weighed monthly, the growth curve / direction of the line must be classified. [34]

- Simple classifications such as "gaining weight" (line going up), "not gaining weight" (straight line, not up or down), and "losing weight" (line is going down) can be used.
- Some programmes give health workers guidelines on acceptable weight gain over a certain period e.g. 500grams in three months, etc.
- More complex classifications could be more sensitive in detecting problems For example:
    - Growing well is when a child is growing at the same rate or faster (compare the child's slope with the reference curve) than the reference curve, regardless whether he/she is in the "Road to Health" (between the 3rd and 97th percentile), or not.
    - A child who has not gained adequate weight for 1-2 months, but who is within the "Road to Health" and not currently ill, needs attention to feeding to prevent continuation of inadequate weight gain.
    - If there is inadequate weight gain for 1-2 months as well as illness, the child needs medical attention for the illness. Additionally, if there is a

lack of appetite, the child needs special attention to feeding. It can also be a sign of illness.

- More urgent attention is needed if there is inadequate weight gain and the child is below the "Road to Health".
- The child is at high risk and the situation is really urgent if the child has not gained adequate weight for three months or more.
- A child who is ill, regardless of growth, needs medical attention.[34]

1.3.3 Growth monitoring in South Africa

The "Guidelines for Nutrition Interventions at Health Facilities to Manage and Prevent Malnutrition", has eleven primary intervention activities in its package to prevent malnutrition. One of these is growth monitoring and prevention of malnutrition. It is recommended that [24]:

- All children less than two years of age should be provided with a Road to Health Chart. The Road to Health Chart should be provided to all children at birth.
- All infants/young children must be weighed at health facilities to monitor growth. [24]
- The growth curve of each child should be recorded on the Road to Health Chart. [24]
- Routine weighing, plotting, interpretation and feedback are recommended monthly during the first two years of life, andthereafter at three-month intervals. This amounts to 36 times within the first five years, providing reasonable opportunity to promote a good relationship between health workers with the parent(s), caregiver and child to detect problems early and to initiate intervention.[24]
- Children whose growth is not progressing adequately or who deviate from their own growth curve, should be monitored frequently (at least weekly) until there is evidence of catch-up growth. If a child continues to have inadequate weight gain for his/her age, the child should be referred to the appropriate higher level of care for specialised evaluation.[24]

1.4. INFANT FEEDING

Nutrition has been expressed as a right in international human rights instruments since 1924. Among these are *declarations*, which are non-binding, *conventions* and *covenants*, which are treaties carrying the force of law.[3]

In 1924 the **Declaration on the Rights of the Child**, (also known as the **Declaration of Geneva**), affirmed that "the child must be given the means needed for its normal development, both materially and spiritually" and states that "the hungry child should be fed."[3]..

In 1948, the **Universal Declaration of Human Rights** proclaimed in article 25 that "everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food...." This article also affirms that "motherhood and childhood are entitled to special care and assistance."[3]

The **Declaration on the Rights of the Child** in 1959 was adopted unanimously by the United Nations General Assembly. The Declaration states in principle 4 that children "shall be entitled to grow and develop in health" and that "children shall have the right to adequate nutrition...."[3]

In 1966 the **International Covenant on Economic, Social and Cultural rights** affirms the right of everyone to an adequate standard of living, including adequate food, and the "fundamental right of everyone to be free from hunger." This was adopted by the United Nations and ratified by 137 States as of mid-September 1997.

Article 8 of the **Declaration on the Right to Development** (1986) calls for all States to ensure equal opportunity for all in access to health services and food.[3]

The **Convention on the Rights of the Child** (1989), is the most widely ratified human rights treaty. The Convention establishes as international law all rights to ensure children's survival, development and protection. Article 24 mandates state parties to recognise children's rights to the "highest attainable standard of health" and to take measures to implement this right. To combat disease and malnutrition within the framework of primary health care, through the provision of adequate nutritious foods, and safe drinking water and sanitation, and to provide families with information about the advantages of breastfeeding, are included in the key steps mandated to States. It was ratified by 191 States as of mid-September 1997.[3]

The **World Declaration and Plan of Action on the Survival, Protection and Development of Children** (1990): The world leaders attending the World Summit for Children committed themselves to "give high priority to the rights of children" in the

Summit's World Declaration. The summit's Plan of Action set out the steps in seven major and 20 supporting goals for implementing the Declaration. Reducing severe and moderate malnutrition by half of 1990 levels among under-five children by the end of the century was the main nutritional goal. [3]

Both the causes and solutions of nutritional problems are multisectoral (See figure 1), as are the benefits of improved nutrition. Many interventions in the health, agricultural and education sectors have been developed and implemented to reduce malnutrition. A small number of behaviours and nutrition practices aimed at addressing the immediate causes of malnutrition in women and young children have a measurable impact on health and nutritional status. Growth failure in children is concentrated in the first two years of life and in South Africa it peaked in the 12-23 months age group[10]. Time is of the essence. Efforts to reduce child malnutrition levels must be aimed at the fetus and the first two years after birth. Intervention to protect, promote and support adequate dietary intake in the first two years are affordable and can be integrated into ongoing health services.[34]

1.4.1 Breastfeeding

Number 3 of the top ten Facts for Life states that: "For the first few months of a baby's life, breastmilk *alone* is the best possible food and drink. Infants need other foods, in addition to breastmilk, when they are about six months old." The prime messages to accompany this Fact for Life, are[59]:

1. Breastmilk alone is the best possible food and drink for a baby. No other food or drink is needed for about the first six months of life. [59]
2. Babies should start to breast feed as soon as possible after birth. Virtually every mother can breastfeed her baby. [59]
3. Breastfeeding causes more milk to be produced. A baby needs to suck frequently at the breast so that enough breastmilk is produced to meet the baby's needs. [59]
4. Breastfeeding helps to protect babies and young children against dangerous diseases. [59]
5. A variety of additional food is necessary when a child is about six months old, but breastfeeding should continue well into the second year of a child life, and longer if possible. [59]

Breastfeeding offers tremendous benefits for mothers and babies. But breastmilk, like blood or semen, is a body fluid that can transmit the human immunodeficiency virus. Women who are HIV-positive do not always transmit the virus to their babies during pregnancy, during childbirth or through breastfeeding. But breastfeeding increases the chances of infection. All HIV positive women, UNAIDS recommended, should be advised of the risk of transmitting the virus to their children through breastfeeding, and if they choose not to breastfeed, they should be assisted in their choice not to do so.[60] These prime messages should be expanded in the context of HIV/AIDS as such that feeding infant formula can be lifesaving in some situations where HIV exposed infants are concerned. If mothers choose to feed infant formula, cups are a safer method to feed their babies formula. Cup-feeding subsequently avoid the use of bottles, which tend to be more difficult to clean and thus may harbour bacteria. [61] The further discussion of breastfeeding and HIV is beyond the scope of this thesis.

Another primary intervention action as proposed in the Guidelines for Nutrition Interventions at Health Facilities to manage and prevent malnutrition, is to protect, support and promote breastfeeding. The following statements support this intervention action: [24]

1. Breastfeeding is an unequalled natural way of providing ideal food for the healthy growth and development of infants.
2. The anti-infective properties of breastmilk protect infants against disease.
3. All babies should be exclusively breastfed, starting within 30 minutes to 1 hour after birth, and preferably continuing into the second year of life.
4. Breastfeeding has a unique biological and emotional influence on the health of both the mother and child.
5. Breastmilk from a well-nourished mother is a good source of vitamin A for up to six months and iron for up to three months.
6. Exclusive breastfeeding provides natural contraception
7. Pregnant women who are aware of their HIV status should be counselled on the benefits of breastfeeding, on the risk of HIV transmission through breastfeeding and on the dangers and disadvantages associated with other methods of infant feeding.
8. Pregnant women who are aware of their HIV status should make the final decision on what is the appropriate option to feed their infants. [24]

Exclusive breastfeeding means giving the infant only breastmilk, no other solids or liquids, except vitamin and mineral drops and medicines. The WHO and UNICEF recommend that infants should be exclusively breastfed for at least four and, if possible, the first six months of life.[24]

One of the aims of Nutrition Interventions at Health Facility Level is to inprove: Exclusive breastfeeding rates for 6 months, appropriate complementary feeding and weaning practices of infants and young children, feeding practices during childhood illnesses as well as during pregnancy and lactation. [24]

Breastmilk is a safe, hygienic source of energy, nutrients and fluids. It contains disease-fighting substances that support the body's natural immune system. Compared to infants who are exclusively breastfed, infants given breastmilk plus other liquid or food, including infant formula or no breastmilk at all, are many times more likely to die of diarrhoea and acute respiratory diseases. No extra fluids are needed, even in a hot climate, when a baby is breastfed. Exclusive breastfeeding provides all the fluid a healthy infant needs to satisfy thirst and to avoid dehydration. [24]

Breastfeeding soon after birth helps to establish the mother's milk supply, helps her uterus to contract, reduces bleeding in the mother, protects the new-born against hypothermia, provides colostrum or first milk that contains immunoglobulins and concentrated nutrients for infants. It has important pshycosocial benefits for the mother and infant. Keeping the new-born with the mother (rooming in) and not giving additional infant formula or glucose water are important to establishing successful breastfeeding. Giving additional fluids or foods to new-borns or young infants reduces milk supply and creates health problems.[34]

Breastfeeding is important for diarrhoea case management and is one of the most cost effective interventions for diarrhoeal disease control. It costs less to prevent diarrhoea through breastfeeding promotion than through any other intervention. Breastfed children who have diarrhoea, recover more quickly than non-breastfed children, and they have fewer complications such as dehydration. [34]

Breastfed infants self-regulate their energy intake when complementary foods are introduced. When infants are given other fluids, infant formula or foods, they cut back on the amount of breastmilk they consume.[61] Even if families can afford to buy and prepare infant formula adequately, it cannot fully replace the benefits of breastfeeding. [34]

In the national survey among children under the age of six years in South Africa in 1994, the percentage of three-year-olds who had been breastfed averaged 88%. There was a tendency for younger children to have been breastfed for periods shorter than three months, especially in urban areas.[10] According to the South African Demographic and Health survey, as many as 87% of babies were breastfed for at least some time. Seven percent of children less than five years of age were exclusively breastfed, and 6% were fully breastfed (i.e. supplemented with water only). Exclusive breastfeeding featured only in the group younger than 2 months.[26]

1.4.1.1 Reported problems in practising exclusive breastfeeding

Women may not or may not continue breastfeeding for a number of reasons. These difficulties can be overcome in almost all of the cases.

- Health Care Practices:

  In many parts of the world breastfeeding problems begin at birth. The Baby Friendly Hospital Initiative addresses a major factor which has contributed to the erosion of breastfeeding: that is, health care practices which interfere with breastfeeding.[62] Even when mothers understand the benefits and are committed to it, women may encounter difficulties with breastfeeding effectively, generally because they do not know enough about what breastfeeding involves and because those around them do not know how to support them. Most health professionals are not trained in the specialised skills of breastfeeding counselling. The attitudes of mothers and all around them can affect whether and how long a woman breastfeeds.[34]

- Insufficient milk:

Mothers frequently see "infant crying" as a sign that their babies are not getting enough milk. Thinking the baby is thirsty, this leads to the introduction of other liquids, solids or water. This shows misunderstanding of how breastmilk is regulated and that infants do not need extra water. At various stages of growth, the infant's nutritional requirements may briefly outstrip breastmilk intake, but this temporary deficit resolves itself if infants are allowed to nurse freely. If other milk, water or complementary foods are introduced during this time, milk intake will fall because they do not nurse on demand. Milk production will also fall because the stimulation to produce prolactin (milk producing hormone) has declined.[62, 63] Weight gain is a better indicator of adequate breastmilk intake. Infant crying is not a reliable indicator of poor breastmilk supply. [34]

- Mother's work and breastfeeding

Mothers may introduce fluids and foods too early because they need to work, but recent studies show that women employed in the formal work force generally do not leave their infants for long periods of time during the first few months after delivery. Mothers must be taught how to express breastmilk for times when they have to be separated for longer hours from their babies. Bottles must not be used to feed infants. Mothers and caregivers must be taught how to cup feed as it is safer and more hygienic than bottles. [34,61]

1.4.2 Complementary feeding

Appropriate feeding between six and 24 months of age means giving children enough energy and nutrients from a combination of breastmilk and complementary foods that are hygienically prepared and fed, and taking special measures to feed children appropriately during and after illness. The feeding of infants in the 6-24 months age group can require special efforts by caregivers and families to make sure that children consume hygienically prepared food containing adequate energy and nutrients. There should be a gradual shift from exclusive breastfeeding to a mix of complementary foods plus breastfeeding during 6-24 months of age, and eventually to the family diet with no breastfeeding.[34] Sellen compared the infant feeding patterns for non-industrial populations from reports published between 1873 and 1998 with current

recommendations. The data on the introduction of non-breastmilk substances suggest that in more than 70% of non-industrial populations, children were typically supplemented with non-breastmilk liquids before six months of age and often within a few weeks of birth. Children were typically fed complementary solid foods before six months in more than 50% of these populations, and the central tendency for transition to solid foods fell between five and six months of age. Wide variation estimates across populations remain unexplained and serious limitations in the available data precluded proper assessment of the underlying distribution of the timing of weaning transitions within populations.[64] The relationship of growth, feeding practices and infections was studied in black South African infants. This study included a qualitative dietary evaluation to assess the intake of porridge, vegetables and protein-rich foods. At six and twelve months, 86% and 81% of infants respectively were receiving breastmilk. By 3 months, 78% of infants were receiving complementary food. The results showed that breastfeeding mainly coincided with a greater-than-average growth performance with regard to weight gain during the first three months of life. From the age of three months after birth, a decline in growth performance in boys and girls occurred and it was associated with the timing of the introduction of complementary foods. Complementary foods were introduced at too early an age. [27] The early introduction of complementary foods was found in many other studies done in South Africa.[28, 30, 65, 66] The early introduction of complementary foods leads infants to decrease the volume of breastmilk intake. When complementary foods are introduced, breastmilk intake is decreased and its beneficial properties diluted. [62, 63] Therefore, it was recommended that mothers should be encouraged to increase the period of exclusive breastfeeding to a minimum of four months. [27]

The following are key principles to feeding young children successfully:

- Adequate frequency of feeds.
- Sufficient amounts of foods at each feed.
- Use of foods to increase nutrient density in the diet.
- Ensuring that the food is utilised after it is eaten by reducing the incidence of infections from contaminated food.

The child must be given high quality as well as a variety of foods. Infants and children have a limited stomach capacity and cannot eat on an adult schedule, but

need small, frequent servings. Otherwise their appetites will be satisfied before they have had enough nutrition. Sufficient quantities should be eaten at each meal. Family foods are generally bulky with low nutrient density and therefore special nutrient dense ingredients should be added. The foods are often readily available, but not fed to children often enough or in a way that provides adequate nutrition. Food preparation and feeding should be hygienic to prevent the spread of bacteria. Caregivers need to spend adequate time on the feeding and care of young children.[34]

1.4.2.1 Reported problems during the weaning stage

The early introduction of complementary foods has been reported in many South African studies.[28, 30, 65,66] Iputo and Makuzeni[67] investigated the dietary patterns of urban and rural Transkeian children with protein-energy malnutrition. They found that children with PEM consumed diets with little variety, as maize-based dishes were the most common food eaten by the children.[67] Steyn et al[65] found that the bulk of the weaning diet of pre-school Pedi children consisted of refined maize-meal porridge, tea and brown bread. Furthermore, these diets were found to be high in carbohydrate-rich foods and low in fats and sugar. Green and yellow fruits and vegetables featured prominently, although the portions consumed were very small.[65]

Starting at about six months, when children become more active and exposed to bacteria in the environment, they may experience reduced appetite that makes feeding even more difficult. They may also have a tendency to become distracted by other activities. Caregivers need to recognise these behaviours and take special steps to encourage a child to eat. Careful assessment of the cause of a lack of interest in food or poor appetite by an alert mother or health worker could reveal an underlying infection that should be treated as soon as possible. [34]

To improve young children's diets several methods can be used: counselling mothers and other caregivers to provide enough of a variety of foods and continuing breastfeeding for at least two years, paying special attention to the needs and interests of children when they are well and during/following illness and teaching mothers special skills such as active feeding to encourage children to

eat enough amounts of the needed types of foods. The period from 6-24 months is a nutritional challenge for many children and families. Counselling to improve child feeding involves reinforcing and encouraging good practices, assessing feeding problems, discussing possible solutions and motivating mothers and caregivers to try at least one or two modifications in how they feed their infants. How to feed the child is just as important as the type and amount of foods. Paying attention to the children's desires and helping them get the food they need is of the utmost importance. Active feeding is one strategy that mothers have found useful. It can be used to overcome poor appetite, as well as the physical or developmental inability of young children to feed themselves adequately. Active feeding may also stimulate social and motor development. All who counsel caregivers on infant feeding should encourage families to support these active feeding styles or methods: [34]

- Mothers and caregivers should feed according to the child's age and abilities. This includes the eating implements given to the child. The utensils or method used should be appropriate for the age.
- Feeding should be in response to the child's demand or interest in feeding. The mother or caregiver should understand or detect the cues of hunger from the child such as gestures, eye movements, or sounds. The younger child below the age of two needs frequent and responsive feeding. A strict schedule or the ability to deal with hunger should wait until after the age of two.
- Force feeding is dangerous and should be strongly discouraged. Mothers and caregivers should, however, encourage the child to eat more at each feeding after he/she has stopped showing an interest in eating. [34]

1.5. PROBLEM IDENTIFICATION AND MOTIVATION

Malnutrition, more specifically stunting as a result of chronic malnutrition, is a major problem in South Africa. In 1999, the National Household Food Consumption Survey was done in South Africa. In the age group 1-3 years, the prevalence of wasting (-2SD) was 4%, the prevalence of being underweight for age (-2SD) was 12.4% and the prevalence of stunting (-2SD) was 25.5%. In the age group 4-6 years of age, the prevalence of wasting, underweight and stunting was 3.4%, 8.8% and 20.7% respectively. In this survey, 21.6% of children between 1-9 years of age were reported to be stunted.[11] These children are unable to attain optimal growth and stunting is in many cases not reversible. Failure to grow adequately is the first and most important manifestation of Protein Energy Malnutrition. The WHO estimates that malnutrition was associated with over half of all child deaths that occurred in developing countries in 1995.[3] South Africa has an under-five mortality rate of 100 deaths in children under 5 years per 1 000 live births and an infant mortality rate of 59/1 000 live births. [13, 14] Improving the nutritional status and well-being of children stimulate the proper function of the immune system namely protection against infections and eventually contributes to child survival. Correct nutrition also improves their physical and mental development that cause them to grow into more productive adults who can contribute to economic growth through enhanced productivity. [25]

The Department of Health, Directorate: Nutrition, has placed a high priority on addressing the prevention and/or treatment of malnutrition in the country by means of its Integrated Nutrition Programme (INP). The INP aims at facilitating a coordinated, inter-sectoral approach to solving the current nutritional problems in the country. The INP adopts the UNICEF conceptual framework, the so-called Triple A Cycle, which enables the analysis of the causes of malnutrition and death in a community to be determined, and it also indicates the interrelationship of the various contributing factors.[24, 68]

Feeding practices, amongst other factors, influence growth of children.[69] The immediate causes of malnutrition are disease and inadequate dietary intake.[3] Complementary feeding practices contribute greatly to adequate dietary intake in infants. Attempts to improve child health are often hampered because normative

practices differ quite markedly from recommended ones for a number of reasons. For example, perceived milk insufficiency, work activities and lack of social support often undermine maternal intentions to initiate and maintain breastfeeding.[64]

Chronic malnutrition was identified as a major problem in South Africa. Feeding practices influence growth patterns and socio-economic factors influence feeding practices and growth. Feeding practices in poor socio-economic areas which increase the risk for developing malnutrition during infancy should be identified. Feeding practices which could contribute to malnutrition should be described and the intervention activities of the INP should aim at including activities to correct these practices. If the feeding practices and socio-economic factors influencing the development of malnutrition during the first year of life can be identified, early measures can be taken to reduce the incidence of stunting and underweight in South Africa and other developing countries. Adequate nutrition during the first year of life will assist to reduce the prevalence of malnutrition in later years of life.

In order to understand infant health and malnutrition in a specific community, knowledge of its infant feeding practices are essential. Dietary intake of children with Failure to Thrive was determined in the same community (Bishop Lavis) in 1994. [33] However, children aged 1-4 years were included in the study sample, and dietary intake and not feeding practices was determined. Several studies were undertaken in South Africa in the recent years in order to describe infant feeding practices and evaluate the prevalence of malnutrition. [28,30,33,36,65- 67, 70] None of these studies made use of the longitudinal documentation of data design, or investigated the correlations between growth and feeding practices. This study design (longitudinal) is unique in the field of the relation between feeding practices and growth. To the knowledge of the researcher, there are no publications of similar study designs in a similar community in this field.

This study describes the feeding practices of infants and correlates it with growth longitudinally from birth to one year in a poor socio-economic area.

1.5.1 AIM

The aim of this study is to identify feeding practices relating to the development of malnutrition during the first year of life in a poor socio-economic area.

1.5.2 OBJECTIVES

1. To determine whether breastmilk and infant formula result in differences in growth patterns.
2. To determine whether the age at which solids are introduced affects growth patterns.
3. To determine whether the type of weaning food results in differences in growth patterns.
4. To determine whether the duration of breastfeeding affects growth patterns.
5. To determine whether certain socio-economic factors influence feeding practices.
6. To determine whether certain socio-economic factors influence growth patterns.

1.5.3 HYPOTHESIS

Null hypothesis: There is no relation between feeding practices and growth patterns in infants in their first year of life.

CHAPTER 2

METHODS

2.1 APPROVAL

The study was submitted to the Research Sub Committee C of the former Faculty of Medicine, University of Stellenbosch for ethical considerations and approved by the said sub-committee. The Local Authority, former City of Tygerberg, gave oral approval to commence with the study. (Appendix A)

2.2 STUDY DESIGN

This was a cohort study. Because data collected refer to different points in time, it was longitudinal. The study had a prospective (follow-up on an identified group over a period of time) experimental design. Cohort studies can investigate the causes of disease as well as the natural history of disease[71]

2.3 MATERIALS REQUIRED

2.3.1 Consent information document

Mothers were invited, on behalf of their infants, to take part in the study. Mothers were informed concerning the aims of the study and what information was needed from them and their infants. It was also explained to them what would be expected from them and what the advantages and disadvantages of taking part in the study would be. They were informed that the information obtained through the study was confidential and that, after the study, they could have access to the results. They were also informed that they could stop participation in the study at any time if they so wished and would not be penalised in any way if they did so. Before they on behalf of their infants submitted to further questions or measurements, they were required to confirm in writing that they understood the conditions and that they participated voluntarily (Appendix B).

2.3.2 Questionnaire

The researcher developed a questionnaire to obtain socio-demographic and anthropometric information as well as information on feeding practices. Dr J Hugo (Health Promotion Consultant) gave comments on the content, clarity and format of the questions before it was pre-tested by the researcher on mothers during November 1999 at Bishop Lavis Clinic. The initial questionnaire comprised a set of twelve questionnaires per respondent, one for each follow-up visit. Only the first questionnaire was tested during the test period, as testing the set of twelve was

deemed unnecessary since the content was the same. After the pre-test, changes were made to the wording of some questions. After the pilot study (May – July 2000) the set of twelve questionnaires per respondent was condensed into one questionnaire per respondent (Appendix C), providing enough space to follow-up during the period of the study. This was done to decrease the administrative load of twelve questionnaires per respondent as well as to reduce printing costs.

2.3.2.1 Socio-demographic information:

Socio-demographic information was obtained during the first interview. The following aspects were covered:

a. Infant:

- Address
- Date of birth
- Place of birth
- Gestational age
- Health status with each interview

b. Mother:

- Address
- Age (Date of birth)
- Number of children
- Highest qualification obtained
- Marital status
- Body Mass Index (BMI)
- Health status
- Smoking habits

c. Father:

- Highest qualification obtained

d. Other:

- Number of people per house
- Number of rooms per house
- Availability of running water and electricity
- Monthly household income
- Caregiver of the infant with each interview

The questions pertaining to this questionnaire were repeated only at the 4th, 8th and 12th interview. This time frame was deemed sufficient to capture any meaningful change in socio-demographic profiles. In many cases the mother was not the caregiver at the 4th, 8th or 12th interview. Many of the questions pertained to the mother herself, such as weight, smoking habits and income and as such information to these aspects could not be obtained from another caregiver. Therefore, the *data on socio-demographic information repeated in this thesis pertain only to the cases where the mother was the caregiver at the time of the interview.*

2.3.2.2 Anthropometry

Anthropometry at birth (weight, length and head circumference) was recorded from the infants' "Road to Health" cards. Weight and length were measured at each interview for the duration of the study, until the infant was one year old.

2.3.2.3 Feeding practices

Information on feeding practices was obtained during each visit. Questions on feeding practices covered the following aspects:

a. Milk feeding practices:

- The type of milk that the infant receives
- Breastfeeding practices: Method of feeding, frequency and duration of feeds, storage of expressed breastmilk
- Infant formula feeding practices: Type of formula, preparation, storage and frequency of feeds
- Administration of other fluids e.g. water, tea, fruit juice or cold drink

b. Complementary foods

- Porridge: The age of introduction of porridge, preparation methods, frequency of feeding porridge
- Vegetables: The age of introduction of vegetables, the type of vegetables eaten at various ages, preparation methods, frequency of feeding vegetables
- Fruit: The age of introduction of fruit, the type of fruit eaten at various ages, frequency of feeding fruit

- Other complementary foods: The age of introduction of meat, chicken, fish, egg yolk and egg white, white and brown bread, rice, pasta, margarine, peanut butter, sweets, chips, chocolates and biscuits

c. Meals

- Times of day that the infant receives his/her meals
- Place where the infant receives his/her meals
- Person responsible for feeding the infant his/her meals

Since the information on feeding practices pertained to the infant, the caregiver (whether the mother or someone else eg. grandmother, other family members or day mother) had to answer these questions. If the usual caregiver was not available at the time of the interview (in cases when a home visit was made) information on feeding practices was not considered as reliable and as a result the relevant questions were answered "do not know". This was, however, the exception to the rule.

2.3.3 Scales

Infants' weights were measured with the clinic scales. All the clinics used a Tanita baby scale, made in South Africa. Scales were standardised between the four clinics, and a variation of less than 50gram (on 2.7kg) was noted at one clinic, Valhalla Park Clinic. The other three clinics' scales showed no difference in weight measurement. Weight was measured to the nearest 50g.

Mothers' weights were measured with an electronic Maskott scale. Both fieldworkers had their own scale. An individual was weighed on both scales by both the fieldworkers to standardise measurement techniques as well as to standardise the scales. The scales did not differ in measurements.

2.3.4 Measuring boards

A wooden measuring board was used to measure length of the infants. There were two measuring boards in use during the study, one by each field-worker. The wooden measuring boards were made privately by a craftsman in South Africa for the Department of Human Nutrition, University of Stellenbosch.

2.3.5 Stadiometer

Mothers' heights were measured with a stadiometer at the first interview. There were 2 stadiometers in use during the study, one by each fieldworker. The stadiometers were made privately by a person in South Africa for the Department of Human Nutrition, University of Stellenbosch.

2.4 RESEARCH STUDY

2.4.1 Area

All the clinics within the Tygerberg West II area of the local authority were included in the study, namely:

1. Bishop Lavis Clinic
2. Matroosfontein Clinic
3. Netreg Clinic
4. Valhalla Park Clinic

Tygerberg West II is an area of poor socio-economic status with mainly coloured people living in formal housing with basic water and sanitation. There is one squatter camp nearby whose residents attend the Bishop Lavis Clinic.

2.4.2 SAMPLE

The recorded births in the birth registers for September 1998 at the Bishop Lavis Maternity and Obstetric Unit and Tygerberg Hospital were compared to the registers for new-born babies at the Bishop Lavis , Valhalla Park , Netreg and Bonteheuwel Clinics in order to get an idea of how many mothers who gave birth attend the clinics for immunisations and growth monitoring after birth. At the Bishop Lavis MOU, 47 mothers from the surrounding areas gave birth, and 45 (96%) of them attended the nearest clinic within a month after birth. At Tygerberg Hospital, 39 mothers from the surrounding areas (Bishop Lavis, Kalksteenfontein, Netreg, Valhalla Park and Bonteheuewel) gave birth and all of them attended the nearest clinic within a month after birth. From this information it was clear that clinic attendance of new-born babies is very good. Therefore the recruitment of respondents at the baby clinics can be assumed to have included almost the significant majority of all new-born babies within the area of the study.

During 1998, an average of 67, 28,18 and 25 new-born babies with a birth-weight above 2.500kg respectively attended the Bishop Lavis, Valhalla Park, Netreg and Matroosfontein Clinics on a monthly basis. An average of 138 new-born babies (excluding Low Birth-weight infants) attended these clinics monthly during 1998. It was expected that at least 100 mother-infant pairs would take part in the study. Therefore all new-born infants who attended one of the aforementioned four clinics within the Tygerberg West II area during November to December 2000 were screened to take part in the study. Eventually 73 were recruited, of which only 44 were followed up for the entire duration of the study. Due to the longitudinal study design, no more time could be spent on the recruitment of respondents. The choice of statistical methods that were used for the analysis of the data, have provided for the small numbers in the study population.

2.4.2.1 Criteria to *include* infants in the study

Normal gestational age i.e. babies born after 37 weeks of gestation

Normal birth-weight infants, i.e. infants with a birth weight of 2 500g or more

Infants who visit the Primary Health Care Clinic within four weeks after birth.

Infants who were coloured.

Infants of mothers who gave informed consent to take part.

2.4.2.2 Criteria to *exclude* infants from the study

Infants with Fetal Alcohol Syndrome (if indicated on primary health care records).

Infants with inborn errors of metabolism.

Infants with major congenital abnormalities of especially the brain, heart and digestive system.

Infants with neurological disease which influence swallowing.

Infants with TB / Mother with TB(if it is known).

Infants of HIV-positive mothers (if it is known).

Twins or triplets.

When there is an intention to move out of the area within 12 months.

2.4.3 PROCEDURE

2.4.3.1 Pilot study

A pilot study was performed from May to July 2000. (See Appendix B)

2.4.3.2 Field-worker

A qualified dietitian was trained to do the data collection together with the researcher. The field-worker worked at the Matroosfontein, Netreg and Valhalla Park Clinics. The researcher collected data at theBishop Lavis Clinic. The field-worker resigned after eight months because she got a permanent appointment and another dietician who was also fully trained, was employed to do the field-work. The researcher and the field-worker were standardised in doing the anthropometric measurements before the start of the study.

2.4.3.2 Data collection

First interview

Infants were screened for participation at their visit to the clinic from November to December 2000. If they qualified according to the aforesaid criteria, the consent information document (Appendix C) was discussed with the mother. If she was in agreement she was required to sign it. The questionnaire was then administered, her weight and height were measured as well as the infant's weight and length. Birth-weight and length, gestational age and place of birth were recorded from the Road to Health card. If it was not recorded on the Road to Health card, the information was omitted. The date for the baby's first immunisation was then recorded and an appointment was made for a follow-up interview.

Follow-up interviews

Follow-up appointments were given to coincide with the 6, 10 and 14 weeks immunisations. Mothers and caregivers were expected to bring infants to the clinics for these follow-up appointments. Thereafter monthly follow-up appointments were made until the infant was one year old. Follow-up interviews after the 14 week immunisation in the Bishop Lavis area were done by means of home visits. This area was considered to be safe enough for the researcher to make home visits. If the mother or caregiver was not at home at the time of the home visit, another home visit was scheduled. If the mother or caregiver was again not at home after two unsuccessful attempts, a telephone appointment was made and, if still unsuccessful, the respondent was excluded from further participation in the study.

Follow-up interviews after the 14 week immunisation in the Matroosfontein, Netreg and Valhalla Park areas were done at the clinics. This was dependant on the mother or caregiver's compliance to bring the infant to the clinic. These areas were not considered to be safe enough for the field-worker to make home visits. If the mother or caregiver did not attend according to their appointment, the field-worker phoned to make another appointment. In most of the cases there was not a telephone available. If not possible to phone, a house call, accompanied by a voluntary worker in the area, was made to deliver a note stating the date for the next appointment, or to arrange the next appointment. If the mother did not attend after the house call, the infant was also excluded from further participation in the study.

In many cases more than one month elapsed between interviews due to circumstances beyond the control of the researcher or the field-worker:

- The mother went back to work and did not inform the researcher or field-worker. When a recall or home visit was made, the mother was not at home. It took some time to trace the caregiver of the child to recall the infant or to make a follow-up home visit.
- Mother or caregiver not at home when the home visit or recall was made.
- Mother or caregiver did not attend the clinic on the given date for follow-up.
- Mother or caregiver asked the researcher to come back at another time as the time of the home visit was not convenient.
- Mother and infant out of town for holiday.
- Mother not in, and the caregiver could not give the necessary information.
- Mother had moved and did not inform the researcher or field-worker of new address.
- Wrong address given.

Every possible attempt was made to do monthly follow-ups. When more than two months elapsed without interviewing the caregiver or mother and measuring the infant, the participant was excluded from further participation in the study.

Anthropometric measurements

Only one weight measurement was taken at each interview to weigh and measure infants as they often cried too much to do more measurements.

Weighing of infants was done with minimum clothing, i.e. a vest. The weight was recorded once the infant was lying still and as soon as the scale had stabilised. The weight of the infant was measured to the nearest 50grams. The mother was weighed without shoes and with minimum clothing i.e. underwear plus one layer of clothing. The weight of the mother was measured to the nearest 100grams.

Recumbent length of the infant was measured with a wooden measuring board by the researcher or fieldworker with the assistance of the mother. The infant was placed face upward, with the head towards the fixed end and the body parallel to the long axis of the board. The shoulder blades rested against the surface of the board. The mother had to apply gentle traction to bring the crown of the child's head into contact with the fixed headboard and positioned the head so that the Frankfurt plane was vertical. The researcher held the infant's feet (without shoes), toes pointing directly upward and slid the headboard to rest firmly against the heels. The reading was taken to the nearest millimetre. If the infant was restless, only the left leg was positioned for the measurement. The mother's height was taken with a portable measuring rod with a right angle headboard that could slide up and down according to the height of the subject. This measuring rod was positioned next to a vertical surface to ensure accurate measurements. Shoes were not worn and clothing was minimal, i.e. underwear and one layer of clothing so that posture could be clearly seen. The subject had to stand straight with the head positioned such that the Frankfurt plane was horizontal, feet together, knees straight and heels, buttocks and shoulder blades in contact with the wall behind the measuring rod. Arms had to hang loosely at the sides with palms facing the thighs. Subjects had to take a deep breath and stand tall to aid the straightening of the spine; shoulders had to be relaxed. The movable headboard was then gently lowered until it touched the crown of the head. The height measurement was taken at maximum inspiration. Height was recorded to the nearest millimetre. If the reading fell between millimetre marks, the lower reading was recorded.[72]

Frequency of data collection

Demographic data was collected during the first interview. This interview was in most cases between the mother and the researcher or fieldworker.

Social information was collected during the first interview.

Anthropometric data and data on **feeding practices** were collected at monthly intervals.

2.4.4 TIMES AND DATES

First interview: Recruiting respondents

The recruiting of the respondents was held from November to December 2000 during the times that clinics held their "Well Baby Clinics". The field-worker recruited respondents at three clinics simultaneously, and rotated between the three clinics (Matroosfontein, Netreg and Valhalla Park). The researcher recruited infants at the Bishop Lavis Clinic, and did so every morning between 8:00 and 12:30.

Follow-up interviews

Follow-up interviews were usually held when infants came back for their immunisations at 6, 10 and 14 weeks and thereafter at monthly appointments from December 2000 to December 2001. Follow-up interviews coinciding with the immunisations was in the morning between 8:00 and 12:30 and afternoons from 13:30 until 15:30 from Monday to Thursday. Clinics preferred not to give appointments for immunisations on Fridays, which were booked for family planning or emergencies. After the 14-weeks immunization, follow-up appointments at Matroosfontein, Netreg and Valhalla Park Clinics were booked according to the fieldworker's schedule so as to rotate between the clinics. The home visits in Bishop Lavis were made during the mornings, when babies were awake and the mother not yet out at friends or shopping.

2.5 ANALYSIS OF DATA

Definitions:

"Compliers": The caregiver-infant pairs who had 10 (of the maximum of 12) or more contact sessions at monthly intervals from birth to one year.

"Non-compliers": The caregiver-infant pairs who had less than 10 (of the maximum of 12) contact sessions at monthly intervals from birth to one year.

Exclusive breastfeeding: The infant receives only breastmilk from his or her mother or expressed breastmilk, and no other liquids or solids with the exception of drops or syrups consisting of vitamins, mineral supplements or medicine.[37]
Predominantly breastfed group: (PBF group) Caregivers fed the infants less than 50ml infant formula per kg per day during the first six months*.
Mixed feeding group: (MF group) Caregivers fed the infants 50-100ml infant formula per kg per day during the first six months*.
Predominantly formula fed group: (PFF group) Caregivers fed the infants more than 100ml infant formula per kg per day during the first six months*.
* *According to the South African Breastfeeding Guidelines for Health Workers (January 2000), health workers should promote exclusive breastfeeding for about six months after birth.*[73]

The available data of all the respondents (n=73) were analysed to describe the feeding practices from birth to twelve months in the community. Because not all respondents participated in all of the follow-up interviews, the respondents were divided into "compliers" and "non-compliers". Socio-economic and demographic data of the "non-compliers" were compared with the "compliers" and the anthropometry of both groups was compared as far as data were available for the "non-compliers". The "compliers" were further divided into three groups according to the volume of infant formula that they received per day during the first six months.

Socio-economic and demographic data, anthropometry and data on feeding practices for the PBF, MF and PFF groups were compared.
Monthly measurements for weight and height were taken from birth to twelve months. Z-scores for weight-for-age, height-for-age and weight-for-height were calculated for all the available data. The mean Z-scores for the two groups, "compliers" and "non-compliers", were compared as far as data were available for the "non-compliers". The mean Z-scores for the three sub-groups, PBF, MF and PFF (according to milk feeding practices) in the "compliers" group were also compared using the General Linear Model (GLM) with Statistica 6.0.

In all the tests that were done to determine whether the differences were significant, a 5% level of significance was used. Therefore a p-value of less than 0.05 was used to indicate a significant difference.

2.5.1 Socio-economic and demographic information

The socio-economic and demographic information was analysed with Microsoft Excel 2000. Descriptive statistics were used to indicate the means, medians and ranges. Socio-economic and demographic information was compared between the "compliers" and "non-compliers" with Statistica 6.0. The following tests were used to determine the significance of differences between the various groups for the different variables:

Wilks' Lambda

To determine the correlation between both WAZ and HAZ and the socio-economic and demographic factors namely number of people per room, number of children, monthly household income, marital status of the mother, age of the mother, level of education of the mother, smoking status of the mother and level of education of the father.

The General Linear Model, Repeated Measures of Analysis of Variance, Test of hypothesis for between subject effects, Pr>F value

To determine whether there were any differences between HAZ and WAZ of the PBF, MF and PFF groups and socio-economic and demographic factors namely number of people per room, number of children, monthly household income, marital status of the mother, age of the mother, level of education of the mother, smoking status of the mother and level of education of the father.

The General Linear Model, Repeated Measures of Analysis of Variance, Univariate Test of hypothesis for within subject effects, Pr>F value

To determine whether time affected the HAZ and WAZ for infants in the "compliers" group with different socio-economic and demographic circumstances namely number of people per room, number of children, monthly household income, marital status of the mother, age of the mother, level of education of the mother, smoking status of the mother and level of education of the father. It was not necessary to use the adjusted p values as the Huynh-Feldt Epsilon values were all between 0 and 1.

Kruskal Wallis test, Pr> Chi square value

To determine whether socio-economic and demographic factors between the PBF, MF and PFF groups differed significantly. The socio-economic and demographic factors

that were used for the analysis were: gender, place of birth, age of the mother, highest level of education of the mother and father, number of children, number of people per room, availability of running water, availability of electricity, mother's BMI, mother's health, mother's marital status, mother's change in marital status, monthly household income, mother's smoking status, number of cigarettes per day, the caregiver, and number of episodes of disease

Wilcoxon two-sided t-approximation test

To determine whether socio-economic and demographic variables with numerical variables namely age of the mother, number of children, number of people per room and mother's BMI differed significantly between the "compliers" and "non-compliers"

The two-sided Fishers Exact test

To determine whether socio-economic and demographic factors with categorical variables namely place of birth, availability of running water and electricity, monthly household income, mother's marital status, highest level of education for mother and father, mother's smoking habits and caregiver differed significantly between the "compliers" and "non-compliers". This test was also used to determine whether the caregivers differed significantly between the PBF, MF and PFF groups at the 1st, 4th, 8th and 12th interview.

2.5.2 Feeding practices

The feeding practices were analysed with Microsoft Excel 2000. Descriptive statistics were used to indicate the means, medians, ranges and frequencies. The information on feeding practices was compared between the "compliers" and "non-compliers" with Statistica 6.0. The following tests were used to determine the significance of differences between the "compliers" and "non-compliers" for the different feeding practices:

Wilks' Lambda

To determine the correlation between both WAZ and HAZ and the feeding practices namely the age of introduction of complementary foods, the duration of any breastfeeding and the duration of only breastfeeding.

The General Linear Model, Repeated Measures of Analysis of Variance, Test of hypothesis for between subject effects, Pr>F value

To determine whether there were any differences between HAZ and WAZ of the PBF, MF and PFF groups and the feeding practices namely the age of introduction of complementary foods, the duration of any breastfeeding and the duration of only breastfeeding.

The General Linear Model, Repeated Measures of Analysis of Variance, Univariate Test of hypothesis for within subject effects, Pr>F value

To determine whether time affected the HAZ and WAZ for infants in the "compliers" group with different feeding practices namely the age of introduction of complementary foods, the duration of any breastfeeding and the duration of only breastfeeding. It was not necessary to use the adjusted p values as the Huynh-Feldt Epsilon values were all between 0 and 1.

Chi-Square test

To determine whether there were significant differences between the PBF, MF and PFF groups for feeding practices namely volume of water, tea, juice and cold drink from birth to twelve months, the age of the first introduction of porridge, vegetables and fruit, the frequency of feeding porridge, vegetables and fruit from birth to twelve months, the choice of milk feed from birth to twelve months, the frequency of breastfeeding from birth to twelve months, the storage of expressed breastmilk from birth to twelve months, the duration of a breastfeed from birth to twelve months and the age when an infant formula was introduced for the first time.

2.5.3 Anthropometric information

The gender distribution was not equal. The ratio of boys to girls was 1.3:1. Boys' anthropometry values usually have higher absolute values for age than girls. Therefore, absolute values were not used but anthropometric indices (based on each individual's sex, age, weight and height) were calculated. The different indices were expressed in terms of Z-scores (also referred to as standard deviation units). The Z-score in the reference population (reference population for boys and girls separately) has a normal distribution with a mean of zero and a SD of 1. Therefore, if the study population has a mean WAZ of zero, this would indicate that the study population has

the same median WAZ as the reference population.[41] Z-scores for weight-for-age, height-for-age and weight-for-height were calculated with Epi info version 2002. The NCHS reference standards were used as the reference population, and not the CDC 2000 standards as current Road to Health cards are still based on the NCHS reference standards. Statistica 6.0 was used to calculate the means, medians and ranges. The following tests were used to determine the significance of differences between the various groups for the mean HAZ, WAZ and WHZ:

General Linear Models, Repeated measures of analysis of variance, test for hypothesis for between subject effects

To determine whether the HAZ and WAZ (i.e. the growth during the period of follow-up between the PBF, MF and PFF groups) varied between the PBF, MF and PFF groups during the study.

General Linear Models, Repeated measures of analysis of variance, univariate test for hypothesis for within subject effects: Wilks' Lambda t-test

To determine whether the HAZ and WAZ varied within subjects (i.e. the growth during the period of follow-up for each infant in the "compliers" group) from birth to twelve months in the three groups, (PBF, MF and PFF) during the study. It was not necessary to use the adjusted p values as the Huynh-Feldt Epsilon values were all between 0 and 1. Pr>F values were reported.

Bonferroni (Dunn) t-test: Bon grouping

To determine whether the HAZ, WAZ and WHZ differed significantly between the three groups, PBF, MF and PFF, at each monthly interview from birth to twelve months.

Kruskal Wallis test, Pr> Chi square value

To determine whether the HAZ, WAZ and WHZ differed significantly between the "compliers" and "non-compliers" at each monthly interview for as long as data were available for the "non-compliers". It was also used to determine whether anthropometric measurements at birth differed significantly between the PBF, MF and PFF groups and between the "compliers" and "non-compliers".

CHAPTER 3

RESULTS

3.1. STUDY POPULATION

The total study population consisted of 73 respondents, 42 boys and 31 girls. Five of the 73 respondents dropped out after the first visit for various reasons. During the period of follow-up (one year), more participants dropped out of the study at various stages (Table 3). Only the data of the respondents who had a minimum of 10 (out of the maximum of 12) interviews during the period of follow-up was used to draw longitudinal comparisons. Therefore, the total study population (n=73) was divided into two groups according to compliance i.e. "compliers" (n=44, 60%) and "non-compliers" (n=29, 40%). (The information of the "non-compliers", that was gathered at the first interview, included the five mother-infant pairs who dropped out after the first visit.)

The exact definitions of the PBF, MF and PFF groups as seen in Chapter 2, paragraph 2.5, were drawn up for the purpose of this study specifically, and information should not be compared to other data on infants who received predominantly breastmilk, infant formula or a mixture of breastmilk and infant formula unless the same criteria were used to define the milk intake of the infant. For the purpose of convenience and easy reading, the definitions are hereunder repeated:

Definitions:

"Compliers": The caregiver-infant pairs who had 10 (of the maximum of 12) or more contact sessions at monthly intervals from birth to one year.

"Non-compliers": The caregiver-infant pairs who had less than 10 (of the maximum of 12) contact sessions at monthly intervals from birth to one year.

Exclusive breastfeeding: The infant receives only breastmilk from his or her mother or expressed breastmilk, and no other liquids or solids with the exception of drops or syrups consisting of vitamins, mineral supplements or medicine.[37]

Predominantly breastfed group: (PBF group) Caregivers fed the infants less than 50ml infant formula per kg per day during the first six months*.

Mixed feeding group: (MF group) Caregivers fed the infants 50-100ml infant formula per kg per day during the first six months*.

Predominantly formula fed group: (PFF group) Caregivers fed the infants more than 100ml infant formula per kg per day during the first six months*.

* *According to the South African Breastfeeding Guidelines for Health Workers (January 2000), health workers should promote exclusive breastfeeding for about six months after birth.*[73]

3.1.1 "Compliers"

Due to the low frequency and duration of exclusive breastfeeding in this study population, it was decided to compare the infants who were **predominantly breastfed** (PBF), instead of exclusively breastfed, with infants who were **predominantly formula fed** (PFF) and infants who received a **mixture** of almost as much breastmilk as infant formula (MF). This grouping is in line with other publications on infant feeding. Due to a limitation of the available literature on studies on the duration of exclusive breastfeeding for six months, growth outcomes are compared in the literature between children who were predominantly breastfed and partially breastfed.[74] Therefore the group of "compliers" (n=44) was divided according to milk feeding practices. The number of daily feeds of infant formula and the mean volume per feed that the caregiver fed the baby was recalled retrospectively at every interview. This information was used to calculate the mean volume of infant formula per kg per day for every month in the first six months after birth. Of the "compliers", 20 (45%) were in the PBF, 9(20%) were in the MF and 15(35%) were in the PFF groups.

3.1.2 "Non-compliers"

The remaining 29 participants stopped participation in the study at different ages and for various reasons (Table 3). The "non-compliers" were **not** divided into PBF, MF and PFF as information was incomplete and many of them dropped out before the age of six months. The mean volume of infant formula intake during the first six months could not be calculated as more than half of the infants dropped out before the age of six months after birth.

TABLE 3: THE REASON FOR NON-COMPLIANCE AND THE AGE AND NUMBER OF INTERVIEWS WHEN PARTICIPATION IN THE STUDY STOPPED (N=29)

Reason for non-compliance*	Age of infant in months when dropped out	Number of completed interviews *
Mother was not interested in taking part in the study anymore (n=12)	< 1 month	1 (n=1)
	2	3 (n=2)
	3	4 (n=1)
	4	4 (n=1)
	5	6 (n=2)
	7	7 (n=1)
	7	8 (n=1)
	8	8 (n=1)
	8	9 (n=1)
	10	9 (n=1)
Did not attend the follow-up appointments and gave wrong addresses (n=4)	< 1 month	1 (n=2)
	7	8 (n=1)
	8	9 (n=1)
Moved, no forwarding address (n=1)	< 1 month	1 (n=1)
Plaster cast on both legs (n=1)	< 1 month	1 (n=1)
Moved to Mitchells Plain, Belhar, Wynberg, Kraaifontein, grandmother's (n=8)	1	2 (n=1)
	2	3 (n=3)
	3	4 (n=1)
	4	4 (n=1)
	7	8 (n=1)
	8	9 (n=1)
Baby started to attend crèche in Goodwood (n=1)	3	4 (n=1)
Mother did not respond to recalls (n=1)	7	8 (n=1)
Mother started working, caregiver did not want to bring infant (n=1)	7	8 (n=1)

* n=number of respondents as mother-infant pairs

3.2. SOCIO-ECONOMIC AND DEMOGRAPHIC INFORMATION

Socio-economic and demographic information were described for the total sample (n=73). It was compared between the "compliers" (n=44) and "non-compliers" (n=29). Comparisons were also made between the PBF (n=20), MF (n=9) and PFF (n=15) groups ("compliers") and correlated with growth.

3.2.1 General

3.2.1.1 Number of people per house

The total sample had a median of five people per house [(mean: 5.6) (SD: 2.58)] with a range of 2-15 people per house.

The "compliers" had a median of five people per house [(mean: 5.7) (SD: 2.84)] with a range of 2-15 people per house. The MF group had significantly less people per house than the PBF and PFF groups (p =0.045) (Table 4).

The "non-compliers" had a median of five people per house [(mean: 5.4 people) (SD: 2.16)] with a range of 2-11 people per house. The difference between the "compliers" and "non-compliers" were not significant [(p=0.959) (Table 5)].

3.2.1.2 Number of people per bedroom

The total sample had a median of three people per bedroom [(mean: 3.2 people) (SD: 1.64)] with a range of 1-9 people per bedroom.

The "compliers" had a median of 2.7 people per bedroom [(mean: 3 people) (SD: 1.61)] with a range of 1-7 people per bedroom. The PBF group had more people per room but the differences between the PBF, MF and PFF groups were not significant [(p=0.1425)(Table 4)].

The number of people per bedroom did not affect the growth for HAZ (p=0.1305) or WAZ (p=0.7614) between the PBF, MF and PFF groups during the period of follow-up.

TABLE 4: GENERAL SOCIO-ECONOMIC AND DEMOGRAPHIC VARIABLES FOR PBF, MF AND PFF GROUPS

Variable	PBF			MF			PFF			p value
	Mean (SD)	Median	Range	Mean (SD)	Median	Range	Mean (SD)	Median	Range	
Number of people per house	6.35 (2.76)	6	4-15	4.55 (3.00)	4	2-12	5.53 (2.80)	4	3-13	0.0451
Number of people per bedroom	3.63 (1.90)	3.5	1-8	2.27 (1.03)	2	1-4	2.69 (0.96)	2.5	1-4	0.1425
Number of children	2.2 (1.15)	2	1-5	1.2 (0.44)	1	1-2	1.7 (0.80)	2	1-3	0.0385
Age of mother (years)	26.7 (6.76)	27	16-40	22.3 (4.79)	22	16-33	25.5 (6.21)	25.5	15-36	0.2403
Mothers BMI	25.17 (4.25)	24.9	17.08-34.38	25.85 (3.54)	25.7	21.79-33.55	24.43 (3.03)	24.1	19.69-28.73	0.6314

TABLE 5: GENERAL SOCIO-ECONOMIC AND DEMOGRAPHIC VARIABLES FOR "COMPLIERS" AND "NON-COMPLIERS"

Variable	"Compliers" (n=44)			"Non-compliers" (n=29)			p value
	Mean (SD)	Median	Range	Mean (SD)	Median	Range	
Number of people per house	5.7 (2.84)	5	2-15	5.4 (2.16)	5	2-11	0.9589
Number of people per bedroom	3.1 (1.61)	3	1-8	3.5 (1.75)	3	1-9	0.2737
Number of children	1.8 (0.99)	2	1-5	2.2 (1.03)	2	1-5	0.1048
Age of mother (years)	25 (6.31)	24	15-40	27 (6.38)	27	16-45	0.4367
Mothers BMI	25.05 (3.69)	25	17.08-34.38	27.13 (7.14)	26	18-53.83	0.3672

Time did not affect HAZ (p= 0.3363) or WAZ (p= 0.7408) within the PBF, MF or PFF groups when the number of people per bedroom was considered.

The "non-compliers" had a median of three people per bedroom [(mean of 3.5 people) (SD: 1.75)] with a range of 1.25-9 people per room. The differences between the "compliers" and "non-compliers" were not significant [(p=0.2737) (Table 5)]

3.2.1.3 Water and electricity

All the respondents had access to running water and the majority, [n=64(87.6%)] had inside running water. Electricity was available in 72 of the 73 households. The household that did not have electricity also had no inside running water. This respondent was the only one who resided in the nearby squatter camp. This respondent was a "non-complier" and was therefore not included in the correlations between growth and socio-economic factors.

All the "compliers" had running water and electricity. Forty subjects (91%) had inside running water and four (9%) had outside running water only. In the PBF, MF and PFF groups, 19 (95%), 7 (78%) and 14 (93%) respectively had access to inside running water and the remaining households had outside running only. The differences between the PBF, MF and PFF groups, were not significant [(p=0.311 for access to running water and p=1.000 for access to electricity) (Table 6)].

Of the "non-compliers", 24 (83%) had inside running water, and 5 (17%) had only outside running water. Twenty-eight subjects (97%) had access to electricity.

The differences in access to running water and electricity between the "compliers" and "non-compliers" were not significant [(p=0.469 for access to inside running water and p=0.397 for access to electricity) (Table 7)]

TABLE 6: GENERAL SOCIO-ECONOMIC AND DEMOGRAPHIC VARIABLES IN THE PBF, MF AND PFF GROUPS (n= number of respondents)

Variable	PBF n (%)	MF n (%)	PFF n (%)	p value
Percentage of households with access to inside running water	19 (95%)	7 (78%)	14 (93%)	0.3111
Percentage of households with access to electricity	20 (100%)	9 (100%)	15 (100%)	1.000
Percentage of households with a monthly income	16 (80%)	6 (66%)	14 (93%)	0.2876
Percentage of mothers being married when baby was born	9 (45%)	2 (22%)	7 (47%)	0.5117
Percentage of mothers being the caregiver at the first interview	20 (100%)	9 (100%)	15 (100%)	1.000
Percentage of mothers with a secondary education	17 (85%)	9 (100%)	13 (87%)	0.6022
Percentage of mothers smoking	7 (35%)	1 (11%)	7 (47%)	0.2116
Percentage of fathers with a secondary education	15 (75%)	8 (89%)	11 (73%)	0.6288

TABLE 7: GENERAL SOCIO-ECONOMIC AND DEMOGRAPHIC VARIABLES FOR "COMPLIERS" AND "NON- COMPLIERS" (n= number of respondents)

Variable	"compliers" (n=44) n (%)	Non "compliers" (n=29) n (%)	p value
Percentage of households with access to inside running water	44 (100%)	29 (100%)	0.4686
Percentage of households with access to electricity	44 (100%)	28 (97%)	0.3973
Percentage of households with a monthly income	36 (82%)	26 (90%)	0.3547
Percentage of mothers being married when baby was born	18 (41%)	15 (52%)	0.3908
Percentage of mothers being the caregiver at the first interview	44 (100%)	29 (100%)	-
Minimum level of Mothers' education	Primary School	Primary School	0.2247
Percentage of Mothers smoking	15 (34%)	11 (38%)	0.8052
Minimum level of Fathers' education	Primary School	Primary School	0.3961

3.2.1.4 Monthly household income

Of the total sample eight (11%) of the mothers did not know how much their monthly **household** income was. The majority 54 (74%) had an income and eleven subjects (15.1%)did not have any income. Thirty-three of the households, which are almost half (45%), had a monthly household income above R1 000. Eight households (11%) had a monthly household income between R1 and R501 per month.

Of the "compliers" seven (16%) of the mothers did not know how much the monthly household income was. The majority, 29 (66%), had an income and eight (18.%) did not have any income. Eighteen (41%) had an income of more than R1 000 per month, 7 (16%) had an income between R501 and R1 000 per month and 4 (9%) earned between R1 and R501 per month (Figure 2). In the PBF, MF and PFF groups, 16 (80%), 6 (66%) and 14 (93%) respectively had a monthly income. Differences in monthly household income between the PBF, MF and PFF groups, were not significant [(p=0.288) (Table 6)].

The monthly household income did not affect the growth for HAZ (p=0.7876) or WAZ (p=0.6078) between the PBF, MF and PFF groups during the period of follow-up.
Time did not affect HAZ (p= 0.6923) or WAZ (p= 0.7150) within the PBF, MF and PFF groups when the monthly household income was considered.

There was no interaction between the monthly household income and the choice of milk feeding (p=0.6051).

There was no interaction between the monthly household income and the age of introduction of complementary foods (p=0.2870).

Of the "non-compliers" one mother did not know how much the monthly household income was. Three (10.3%) mothers in this group did not have a household income and the majority, 25, (86.2%) had a monthly household income. More than half, 15 (52%) of the respondents from this group had a monthly household income above R1 000. Four (14%) had a monthly household income between R1 and R501 and six

(20%) had a monthly household income between R500 and R1 000 per month (Figure 3).

The differences in monthly household income between the "compliers" and "non-compliers" were not significant [(0.356) (Table 7)].

3.2.1.5 Number of children

Twenty-eight (38%) of the infants were the first child, 25 (34%) were the second and in 19 (26%) of the cases the mother had more than two children with the maximum being five children. In one case there was no information.

In the "compliers" group, the median was two children [(mean 1.8) (SD: 0.99)] with a range of one to five children. Twenty of the infants (46%) were the first, 15 (34%) were the second and six (14%) had more than two children. The mothers in the PBF and PFF groups had a median of two [(mean: 2.2 and 1.7 respectively) (SD: 1.15 and 0.80 respectively)] children. The mothers in the MF group had a median of one child [(mean: 1.2) (SD: 0.44)] The range was 1-5, 1-2 and 1-3 children in the PBF, MF and PFF groups respectively. The MF group had significantly less children than the PBF and PFF groups. [(p=0.039) (Table 4)].

The number of children for the mother did not affect the growth for HAZ (p=0.3606) or WAZ (p=0.9213) between the PBF, MF and PFF groups during the period of follow-up.

Time did not affect HAZ (p= 0.6664) or WAZ (p= 0.3781) within the PBF, MF and PFF groups when the number of children of the mother was considered.

In the "non-compliers" group, mothers had a median of two [(mean: 2.2) (SD 1.03)] children with a range of 1-4 children. Eight (28%)of the mothers had only one child, ten (35%) had two children and ten (35%) had more than two children.

The differences in number of children between the "compliers" and "non-compliers" were not significant [(p=0.105) (Table 5)].

FIGURE 2: THE MONTHLY HOUSEHOLD INCOME OF "COMPLIERS"

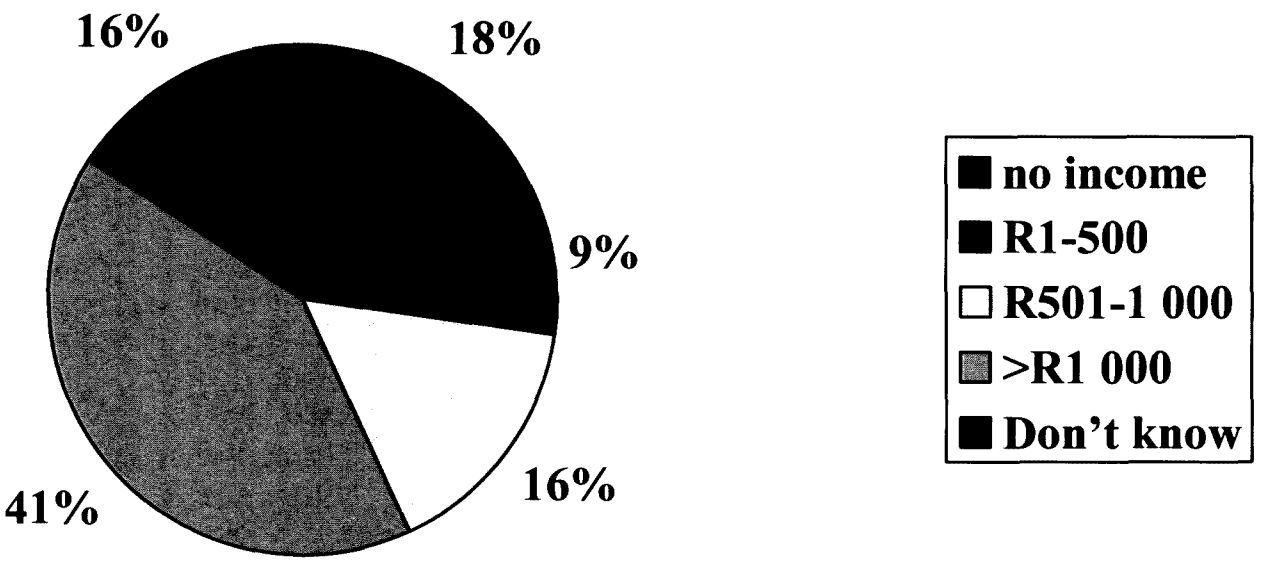
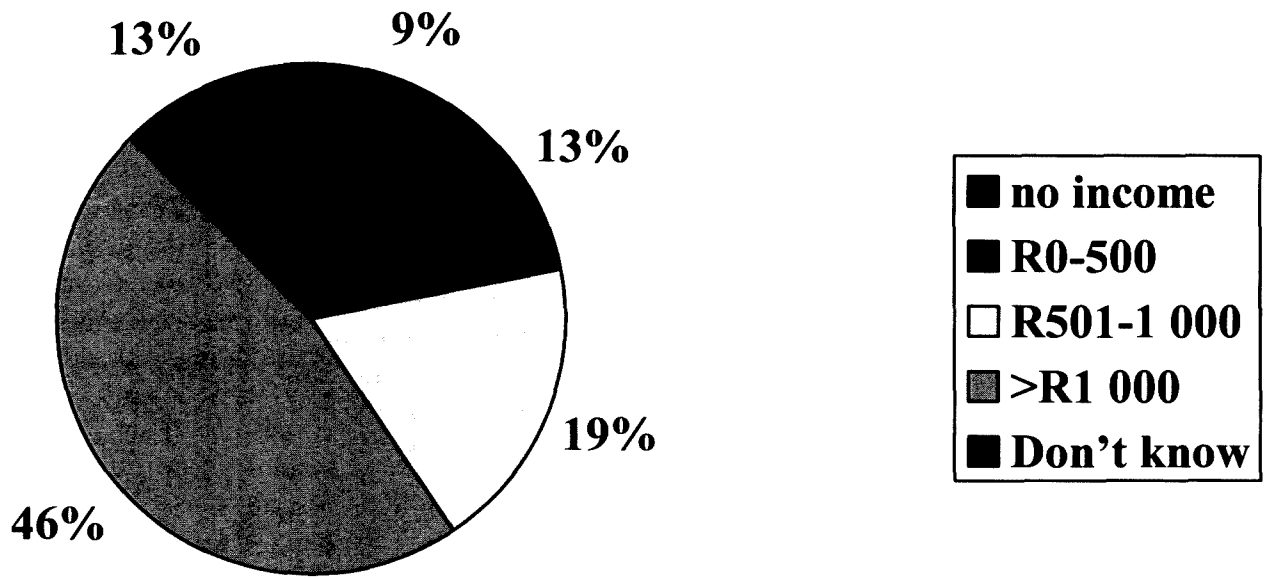


FIGURE 3: THE MONTHLY HOUSEHOLD INCOME OF "NON-COMPLIERS"



3.2.1.6 Mother's marital status

Less than half of the total sample, 34 (46%), of the mothers were married when their babies were born. The remaining 39 mothers were not married. Two of the latter were divorced or separated.

Eighteen (41%) of the mothers of the group of "compliers" were married when their babies were born. Of the remaining 26, one was separated and 25 (56.8%) were not married. A change in marital status was also determined amongst the "compliers" during follow-up. One mother became separated and one got married. Of the mothers in the PBF group, nine (45%) were married, 10 (50%) were not married and one (5%) was separated from her husband. Only two mothers (22%) in the MF group were married, with the remaining seven (78%) not married. In the PFF group seven mothers were married (47%), and eight (53%) not married. The differences in marital status between the mothers in the PBF, MF and PFF groups, were not significant [(p=0.51) (Table 6)].

The marital status of the mother did not affect the growth of the children for HAZ (p=0.2000) or WAZ (p=0.4892) between the PBF, MF and PFF groups during the period of follow-up.

Time did not affect HAZ (p= 0.2894) or WAZ (p= 0.4614) within the PBF, MF and PFF groups when the marital status of the mother was considered.

There was no interaction between the mother's marital status and her choice of milk feeding (p=0.5960).

There was no interaction between the mother's marital status and the age of introduction of complementary foods (p=0.1267).

More than half, 16 (55.2%), of the mothers of the "non-compliers" were married when their babies were born. The remaining 13 (45%) were not married. One was divorced. The change in marital status during the year of the study was not determined amongst the "non-compliers" as the information on change in marital status for the "non-compliers" was incomplete.

The differences in the marital status between the "compliers" and non-"compliers" were not significant [(p=0.39) (Table 7)].

3.2.1.7 Caregiver

All the babies in the total sample were taken care of by the mother during the first month after birth. For the group of "compliers", the mother was not constantly the person being the caregiver during the period of follow-up (Table 8). At the times when the mother was not the caregiver (PBF group and PFF group), the child was taken care of by other family members i.e. grandmothers or aunts. Only two children in the PBF group and one child in the PFF group were in the care of someone other than family during the day. None of the differences between the PBF, MF and PFF groups for caregiver at three, seven and eleven months after birth were statistically significant (Table 8)

Socio-economic information was not analysed for the "non-compliers" during the rest of the period of follow-up because the available data was incomplete due to non-compliance.

TABLE 8: PERCENTAGE OF MOTHERS BEING THE CAREGIVER FROM BIRTH TO ONE YEAR AMONGST "COMPLIERS"

Age in months	PBM	MF	PFF	p value
Birth to one month	100% (n=20)*	100% (n=9)	100% (n=15)	-
3 months	66.7% (n=18)	75% (n=8)	73.3% (n=15)	1.000
7 months	46.7% (n=15)	37.5% (n=8)	45.5% (n=11)	0.6630
11 months	26.7% (n=15)	44.4% (n=9)	16.7% (n=12)	0.9584

*n refers to the number of interviews undertaken at the mentioned age. Of the "compliers" group, a minimum of 10 interviews out of the possible 12 interviews were undertaken and therefore all the "compliers" were not being interviewed at each monthly interview

3.2.1.8 Facility where infants were born

Almost half, (49.3% (n=36)) of the total sample (n=73) were born at a Maternal Obstetric Unit (MOU). The remaining 37 (51%) were born at tertiary, [(n=23) (32%)], provincial, [(n=7) (10%)] and private, [(n=7) (10%)] hospitals (Table 9).

Almost half, 21 (48%), of the "compliers" (n=44) were born at a Maternal Obstetric Unit and the remaining 23 (52%) were born at tertiary, [(14) (32%)]%), provincial, [(4) (9%)] and private, [(5) (11%)] hospitals (Table 9).

More than half, 15 (52%) of the "non-compliers" (n=29) were born at a Maternal Obstetric Unit and the remaining 14 (48%), were born at tertiary, [(9) (31%)], provincial, [(3) (10%)] and private, [(2) (7%)] hospitals (Table 9).

These differences in place of birth between the "compliers" and non-"compliers" were not significant [(p=0.43) (Table 9)].

Infants in the PBF group were born predominantly in a MOU (11) or tertiary hospital (7). Very few of them were born in a private (1) or provincial (1) hospital. Infants in the MF group were also predominantly born in a MOU (5). None of them were born in a tertiary hospital and two each were born in a provincial and private hospital. Infants in the PFF group were predominantly born in a tertiary hospital (7) and some (5) were also born in a MOU. A few were born at a provincial hospital (1) and a private hospital (2). These differences were not significant [(p=0.4304) (Table 10)]

3.2.1.9 Episodes of illness

Amongst the "compliers", the PBF, MF and PFF groups had a mean of 11, 11.4 and 11.8 visits respectively during the follow-up period of 12 months. The caregiver was asked at each interview whether the infant had had an episode of illness since the last interview. The mean episodes of illness during follow-up for the PBF, MF and PFF groups were 3.3 (30%), 3.1 (27.2%) and 3.6 (30.5%), respectively. These differences were not significant (p=0.5430).

This was not calculated for the "non-compliers" as information was incomplete for the corresponding time frame.

TABLE 9: FACILITY WHERE INFANTS WERE BORN: TOTAL SAMPLE
(n = number of subjects and percentage in parenthesis)

Place of birth	Total Sample n (%)	"Compliers" n (%)	"Non- Compliers" n (%)
MOU	36 49%	21 (48%)	15 (52%)
Tertiary Hospital	23 (31%)	14 (32%)	9 (31%)
Provincial Hospital	7 (10%)	4 (9%)	3 (10%)
Private Hospital	7 (10%)	5 (11%)	2 (7%)

*p=0.8758

TABLE 10: FACILITY WHERE INFANTS WERE BORN: "COMPLIERS"
(n = number of subjects and percentage in parenthesis)

Place of birth	PBF n (%)	MF n (%)	PFF n (%)
MOU	11 (55%)	5 (56%)	5 (33%)
Tertiary Hospital	7 (35%)	0 (0%)	7 (47%)
Provincial Hospital	1 (5%)	2 (23%)	1 (7%)
Private Hospital	1 (5%)	2 (23%)	2 (13%)

p=0.4304

Mother

3.2.2.1 Age of mother

The median age of the mothers in the total sample was 25 years [(mean 26) (SD: 6.32)] with a range of 15-45 years. The majority of mothers were within the age range of 21 to 29 years (n=38).

The median age of the mothers in the "compliers" group was 24 [(mean 25 years) (SD: 6.31)] with a range of 15 to 40 years. Half, [(50%) (n=22)] of the mothers were within the age range of 21 to 29 years. Differences between the PBF, MF and PFF groups were statistically not significant [(p=0.24) (Table 4)]

The mother's age did not affect the growth for HAZ (p=0.2417) or WAZ (p=0.8555) between the PBF, MF and PFF groups during the period of follow-up.

Time did not affect HAZ (p= 0.4412) or WAZ (p= 0.7536) within the PBF, MF and PFF groups when the mother's age was considered.

The median age of the mothers in the "non-compliers" group was 27 years [(mean 27 years) (SD: 6.38)] with a range of 16 to 45 years. Sixteen of the mothers (55%) were within the age range of 21 to 29 years. These differences in age between the mothers in the "compliers" and "non-compliers" groups were not statistically significant [(p=0.4367) (Table 5)].

3.2.2.2 Mother's education

All the mothers in the total sample had at least a primary school education, except in one case where it was unknown. The majority, 84.8% (n=62) had more than a primary school education. One mother had a tertiary education and 10 had only a primary school education. It could therefore be concluded that except for the unknown one, all the mothers were literate.

All the mothers in the "compliers" group had at least a primary school education and 40 (91%) had more than primary school education. One mother had a tertiary education and only 4 (9.1%) had only a primary school education. Only one (5%) in the PBF group had a tertiary education and two each (10% and 13%) in the PBF and

PFF groups had a primary education. In the PBF, MF and PFF groups, 17 (85%), 9 (100%) and 13 (87%) respectively had a secondary education. The differences in level of education between the mothers in the PBF, MF and PFF groups, were statistically not significant [(p=0.60) (Table 6)].

The level of education of the mother did not affect the growth of the different groups (according to the level of education of the mother) for HAZ (p=0.1173) or WAZ (p=0.1918) between the PBF, MF and PFF groups during the period of follow-up.

Time did not affect HAZ (p= 0.4666) or WAZ (p= 0.0621) within the PBF, MF and PFF groups when the mother's level of education was considered.

There was no interaction between the level of education of the mother and the choice of milk feeding (p=0.6864).

There was no interaction between the level of education of the mother and the age of introduction of complementary foods (p=0.2972).

In the "non-compliers" group, 22 (75%) had at least a primary school education, six (21%) had a secondary school education and for one (3%) the information was unknown. None of them had a tertiary education.

These differences in level of education between the mothers in the "compliers" and "non-compliers" groups were not statistically significant [(p=0.225) (Table 7)].

3.2.2.3 Smoking status of the mother

More than one in three of the mothers [(n=26) (36%)] in the total sample smoked at the first visit, when their babies were less than one month old. The number of cigarettes smoked ranged from 2 to 20 per day with a median of 4.

A similar picture was seen amongst the "compliers", with 15 (34%) mothers smoking at the first visit. In the PBF, MF and PFF groups, 7 (35%), 1 (11%) and 7 (47%) respectively smoked at the time of the first interview. The differences in the percentage of mothers who smoked at the time of the first interview, between the

mothers in the PBF, MF and PFF groups, were statistically not significant [(p=0.21) (Table 6)].

Whether the mother smoked or not, it did not affect the growth of the infants for HAZ (p=0.7721) or WAZ (p=0.8470) between the PBF, MF and PFF groups during the period of follow-up.

Time did not affect HAZ (p= 0.7671) or WAZ (p= 0.9497) within the PBF, MF and PFF groups when the mother's smoking status was considered.

There was no interaction between the mother's smoking habit and her choice of milk feeding (p=0.2041).

There was no interaction between the mother's smoking habit and the age of introduction of complementary foods (p=0.5936).

In the group of "non-compliers", figures were almost the same as the "compliers" with 11 (38%) mothers smoking at the first visit.

These differences in the mother's smoking habits between the "compliers" and non-"compliers" were not statistically significant [(p=0.81) (Table 7)].

3.2.2.4 Mother's health

All the mothers in the total sample were healthy according to themselves at the first visit within one month after the baby's birth.

In the PBF group of the "compliers", two mothers had one episode of illness during the follow-up period of the study, and in the PFF group, one mother had an episode of illness during this period. No mothers in the MF group had an episode of illness during the period of the study. These differences were not statistically significant (p=0.6202).

The mothers in the "non-compliers" groups were not interviewed for the full period of the study and therefore information on episodes of illness amongst the mothers in the "non-compliers" group was not analysed as it was incomplete.

3.2.3 Father

3.2.3.1 Father's qualification

Fifteen (21%) of all the mothers did not know the level of the father of the baby's education. Of those that knew the level of education of the father of the baby, (n=58), all in the total sample had at least a primary school education. Fifty-five (94.8%) had more than a primary school education. It could therefore be concluded that, except for the unknown 15 (21%) all the fathers were literate.

Eight (18%) of the mothers in the "compliers" group did not know the level of the father of the baby's education. Of those that knew (n=36), all in the group had at least a primary school education. Thirty five (80%), had more than a primary school education. Two of the fathers in this group were known to have a tertiary education. In the PBF, MF and PFF groups, 15 (75%), 7 (79%) and 12 (83%) respectively had a secondary education. The differences in level of education between the fathers in the PBF, MF and PFF groups were statistically not significant [(p=0.63) (Table 6)].

The level of education of the father did not affect the growth of the different groups (according to the level of education of the father) for HAZ (p=0.8774) or WAZ (p=0.7641) between the PBF, MF and PFF groups during the period of follow-up.

Time did not affect WAZ (p= 0.4090) but it did have a significant effect on HAZ (p= 0.0189) within the PBF, MF and PFF groups when the father's level of education was considered.

There was no interaction between the level of education of the father and the choice of milk feeding (p=0.6414).

There was no interaction between the level of education of the father and the age of introduction of complementary foods (p=0.6723).

Seven (24%) of the mothers in the "non-compliers" group did not know the level of the father of the baby's education. Of those that knew (n=21), all in the group had at least a primary school education. Nineteen (66%) had more than a primary school education. None of the fathers in this group were known to have a tertiary education.

The differences between the level of education of the fathers in the "compliers" and "non-compliers" groups were not statistically significant [(p=0.40) (Table 7)].

3.3 ANTHROPOMETRY

3.3.1 Mother

Of the total group of respondents, one mother was underweight (BMI <18) at the first visit. The majority, 37 (51%), were overweight (BMI>24.9) of which 10 (13.6% of total sample) were obese (BMI>30). Of the total sample, 35 (48%) were within the range of a normal BMI (18-24.9). The median BMI of the mothers was 25.1 [(mean 25.8) (SD: 5.38)]) with a range from 17 to 54.

The median BMI in the "compliers" group was 24.7 [(mean 25.1) (SD: 3.69)] with a range of 17.1 to 34.4. The one mother who was underweight was from the "compliers" group (BMI=17.1). Twenty-one (48%) had a BMI above 24.9, of which three (7%) were obese (BMI>30). Twenty-two (50%) had a normal BMI, between 18 and 24.9 (Figure 4). The mean BMI amongst the PBF, MF and PFF groups was 25.2 (SD: 4.25), 25.9 (SD: 3.54) and 24.4 (SD: 3.03) respectively. Differences between the PBF, MF and PFF groups were not significant [(p=0.63) (Table 4)].

The median BMI in the "non-compliers" group was 26.1 [(mean 27.1) (SD: 7.14) with a range of 18 to 54. None of the "non-compliers" was underweight. Sixteen (55%) had a BMI above 24.9 of which 7 (24%) were obese (BMI>30). Thirteen (45%) had a normal BMI, between 18 and 24.9. (Figure 5) The differences between the mothers in the "compliers" and "non-compliers" groups were not statistically significant [(p=0.37) (Table 5)].

FIGURE 4: MOTHER'S BMI: "COMPLIERS"

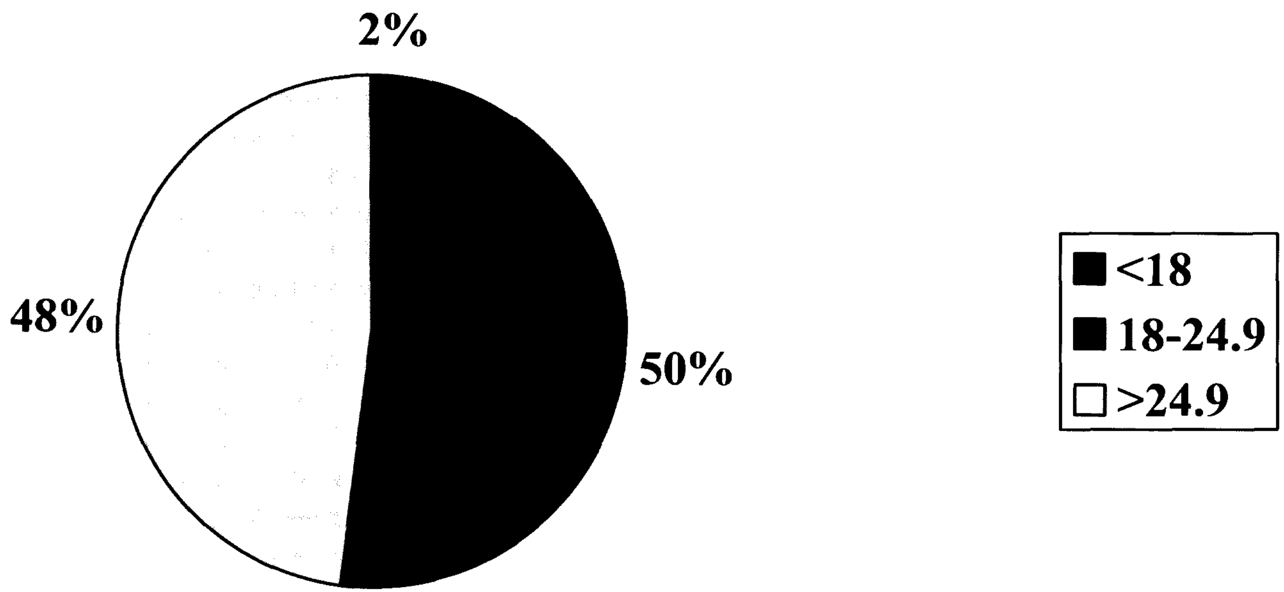
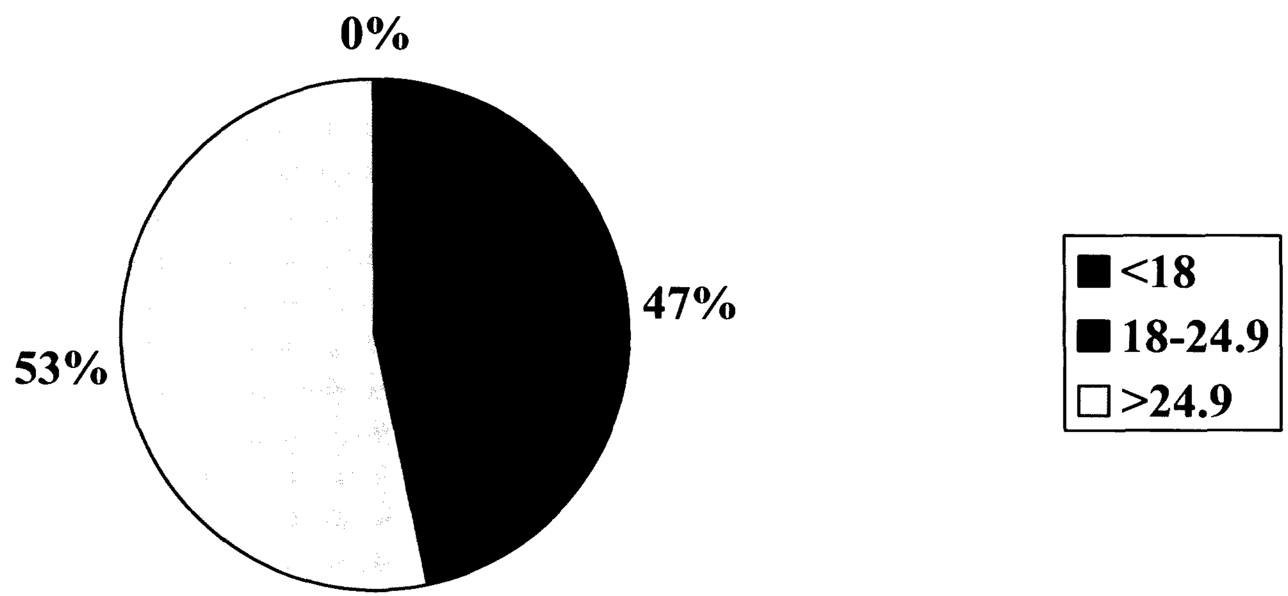


FIGURE 5: MOTHER'S BMI: "NON-COMPLIERS"



3.3.2 INFANT'S ANTHROPOMETRY

3.3.2.1 Anthropometry at birth

Weight: All the infants in the caregiver-infant pairs, according to the aforementioned criteria of the study, had to have a birth-weight of more than 2 500g. (A birth-weight of 2 500g falls on the 3rd centile for boys and the 7th centile for girls and WAZ equals –1.87 and –1.48 for boys and girls respectively.) The median birth-weight of all the babies was 3 200g [(mean 3 257g) (SD: 426.28)] with a range of 2 540-4 276g (Table 11). The median birth-weight in the "compliers" group was 3 257g [(mean 3284g) (SD: 382.67)] with a range of 2 540-4 276g. The mean WAZ at birth for the "compliers" was 0.07 (SD: 0.8). The median birth-weight in the "non-compliers" group was 3100g [(mean 3 216g) (SD: 489.45)] with a range of 2 560-4 221g. The mean WAZ at birth for the "non-compliers" was 0.04 (SD: 1.2). The differences in mean birth-weight between the "compliers" and "non-compliers" were not statistically significant [(p=0.30) (Table 11)].

Length: The median length of all the babies at birth was 51cm [(mean 50.51cm) (SD: 3.45)] with a range of 37 to 60cm (Table 11). The median length at birth in the "compliers" group was 51cm [(mean 51cm) (SD: 3.58)] with a range of 37 to 58cm. The median length at birth in the "non-compliers" group was 51.5cm [(mean 52cm) (SD: 3.22)] with a range of 46 to 60cm. The differences between the "compliers" and "non-compliers" were not statistically significant [(p=0.31) (Table 11)].

Head Circumference: The median head circumference of all the babies was 34cm [(mean 34.2cm) (SD: 1.6)] with a range of 30 to 39cm (Table 11). The median head circumference in the "compliers" group was 34cm [(mean 34.2cm) (SD: 1.56)] with a range of 31 to 39cm. The mean head circumference in the "non-compliers" group was 34cm [(mean 34.2 cm) (SD: 1.73)] with a range of 30 to 37cm. The differences between "compliers" and "non-compliers" were not statistically significant [(p=0.81) (Table 11)].

TABLE 11: THE WEIGHT, HEIGHT AND HEAD CIRCUMFERENCE OF RESPONDENTS AT BIRTH (MEAN, (SD) MEDIAN AND RANGE)

Group	Anthropometry at birth								
	Weight (g)			Length (cm)			Head circumference (cm)		
	Mean (SD)	Median	Range	Mean (SD)	Median	Range	Mean (SD)	Median	Range
Total sample	3 257 (426.28)	3 200	2 540-4 276	50.51 (3.45)	51	37-60	34.2 (1.62)	34	30-39
"Compliers"	3 284 (382.67)	3 257	2 540-4 276	51 (3.58)	51	37-58	34.2 (1.56)	34	31-39
"Non-compliers"	3 216 (489.45)	3 100	2 560-4 221	52 (3.22)	51.5	46-60	34.2 (1.73)	34	30-37
p-value: "compliers" and non-"compliers"	0.2970			0.3075			0.8132		

*Length and head circumference at birth was not recorded in all of the Road to Health Cards

3.3.2.2 Anthropometry at follow-up

Weight-for-age

The mean Z-scores for weight-for-age (WAZ) for "compliers" and "non-compliers" were compared as far as data was available for the "non-compliers" (Table 12). Both "compliers" and "non-compliers" had a mean WAZ of 0.07 (SD: 0.8) and 0.04 (SD: 1.2) respectively at birth. A weight-for-age Z-score of 0 indicates that the individual's weight-for-age equals the median weight-for-age, or 50th percentile for weight-for-age, of the reference population, in this case the 50th percentile of the NCHS percentiles. Both groups had a mean WAZ below zero (below the 50th percentile of the reference population), -0.21 (SD: 0.9) and –0.34 (SD: 0.9) respectively for the "compliers" and "non-compliers" at the first interview, which was within two weeks after birth.

The mean WAZ of the "compliers" decreased to –0.21 (SD: 0.9) within the first month after birth. Thereafter their mean WAZ increased to a maximum of 0.29 (SD: 1.0)at the age of four months. After four months, the WAZ of the "compliers" started to drop to a minimum of –0.09 (SD: .1.1) at eight months. The effects of growth *within subjects* were compared over time, i.e. the growth during the period of follow-up for each infant in the "compliers" group. There was a significant interaction between WAZ and time, p= 0.0015 for WAZ of the "compliers" (Table 12). Therefore infants started off with a WAZ above zero, which increased before weaning started (around 3-4 months). After the age when weaning was initiated, WAZ decreased significantly in this group of respondents. This indicates that WAZ decreased significantly as the children grew older.

The mean WAZ for the PBF, MF and PFF groups (Table 13) in the "compliers" group was compared from birth to twelve months (Figure 6). There was no significant difference for WAZ (p=0.8336) values between different feeding groups (PBF, MF and PFF), The Bon grouping for the mean WAZ for each group (PBF, MF and PFF) was A at each time interval, indicating that the groups did not differ significantly from each other. Milk feeding practices did not influence growth in weight amongst the "compliers" during the period of follow-up. (Table 13)

The interaction between time and feeding groups (PBF, MF and PFF) and growth was not significant for WAZ [(p=0.8999) (Table 13)]. Therefore time together with feeding group (PBF, MF and PFF) did not have a significant effect on the WAZ of the infants in any of the three groups i.e. PBF, MF or PFF. No interaction between time and different feeding practices (PBF, MF and PFF) was reflected at each time period [(p=0.834) (Table 13)].

The "non-compliers" had a mean WAZ of –0.34 within two weeks after birth, and it increased to 0.29 (SD: 0.9), 0.16 (SD: 0.8) and 0.32 (SD: 0.8) at one, two and three months respectively after birth. At the age of four months the mean WAZ in the "non-compliers" was 0.0 (SD: 0.9) and thereafter it decreased to –0.66 (SD: 1.4) at eight months after birth. Thereafter, no more measurements were made in the "non-compliers" group because they did not take part in the study after this age.

Differences in WAZ between the "compliers" and "non-compliers" at each time interval were not statistically significant (Table 12).

Height-for-age

The mean Z-scores for height-for-age (HAZ) for "compliers" and "non-compliers" were compared as far as data was available for the "non-compliers" (Table 12). The "compliers" had a mean HAZ of 0.37 (SD: 1.5) and "non-compliers" had a mean HAZ of 0.84 (SD: 1.4) at birth [(p=0.27) (Table 12)]. The mean HAZ for the "compliers" and "non-compliers" dropped to –0.61 (SD: 0.9) and –0.46 (SD: 0.8) respectively within two weeks after birth. The mean HAZ in both "compliers" and "non-compliers" stayed below zero (below the 50th percentile of the NCHS percentiles) for the remaining period of the study. HAZ differed significantly between the "compliers" and "non-compliers" at the age of six months after birth, with the "non-compliers" having a lower HAZ than the "compliers" at that age. (Height at birth was not measured by the researcher and could have been measured in a different method as was measured during the study.)

The "compliers" had a mean HAZ of –0.6 (SD: 0.9) within one month after birth as well as between one and two months after birth. The HAZ for "compliers" increased gradually during the period of follow-up to a maximum of –0.04 (SD: 0.8) (at ten

months after birth). The effects of growth *within subjects* were compared over time i.e. the growth of each individual in the "compliers" group during the period of follow-up. There was a significant interaction over time *within subjects* [($p<0.0001$ for HAZ) (Table 12)]. This indicates that the HAZ decreased significantly as the children grew older. The mean Z-scores for height-for-age for the PBF, MF and PFF groups (Table 14) in the "compliers" group were compared from birth to twelve months (Figure 7). There was no significant difference for HAZ ($p=0.2713$) values between different feeding groups (PBF, MF and PFF) and therefore milk feeding practices did not influence growth in length (Table 14).

The interaction between time and different feeding groups (PBF, MF and PFF) and growth was not significant for HAZ ($p=0.9278$). Growth, as indicated by HAZ, was not affected by feeding groups (PBF, MF and PFF) and age (Table 13). No interaction between time and feeding practices (PBF, MF and PFF) was reflected at each time period. There were no significant differences between the PBF, MF and PFF groups amongst the "compliers" for HAZ at any time during the follow-up period. The Bon grouping for the mean of each group (PBF, MF and PFF) at each monthly interview was A and therefore the differences were not significant (Table 14).

The "non-compliers" had a mean HAZ of –0.46 (SD: 0.8) and –0.5 (SD: 0.9) within one month after birth and between one and two months after birth. Thereafter the "non-compliers" had a lower HAZ than the "compliers" during all the interviews until the age of eight months. After this age, no data was available for "non-compliers" as they stopped taking part in the study after this age.

Differences in HAZ between "compliers" and non-"compliers" at each time interval were not statistically significant (Table 12).

Weight-for-height

The mean Z-scores for weight-for-height (WHZ) between "compliers" and "non-compliers", were compared as far as data was available for the "non-compliers" (Table 12). The "non-compliers" and "compliers" at birth had a mean WHZ of –1.50 (SD: 0.9) and –0.90 (SD: 0.9) respectively. This differed significantly from each other [($p=0.030$) (Table 12)]. At the age of one month after birth, the mean WHZ in the

"non-compliers" and "compliers" were 0.85 (SD: 0.8) and 0.80 (SD: 1.0) respectively. WHZ stayed above zero for the remaining period of follow-up except for a value of – 0.04 (SD: 1.4) in the "non-compliers" at the last interview (eight months). WHZ for the "compliers" stayed above zero after birth and it varied between 0.8 (SD: 0.9) and 0.2 (SD: 1.22) (Figure 8).

The WHZ at each time interval for the PBF, MF and PFF groups did not differ significantly (Table 15).

Differences in WHZ between "compliers" and "non-compliers" at each time interval were not statistically significant (Table 12).

TABLE 12: THE MEAN Z-SCORES AND STANDARD DEVIATION FOR WEIGHT-FOR-AGE HEIGHT-FOR-AGE AND WEIGHT-FOR-HEIGTH AT MONTHLY INTERVALS FOR "COMPLIERS" AND "NON-COMPLIERS"

Age in months	Weight-for-age					Height-for-age					Weight-for-height				
	"Non-compliers"		"Compliers"		p-value	"Non-compliers"		"Compliers"		p-value	"Non-compliers"		"Compliers"		p-value
	mean	SD	mean	SD		mean	SD	mean	SD		mean	SD	mean	SD	
Birth	0.04	1.2	0.07	0.8	0.2330	0.84	1.4	0.37	1.5	0.2683	-1.50	0.9	-0.9	0.9	**0.0300**
Birth-1	-0.34	0.9	-0.21	0.9	0.4945	-0.46	0.8	-0.61	0.9	0.5118	-0.18	0.7	0.2	0.8	0.1038
1	0.29	0.9	0.06	0.7	0.5438	-0.50	0.9	-0.6	0.9	0.7125	0.85	0.8	0.8	1.0	0.7621
2	0.16	0.8	0.27	0.8	0.3866	-0.50	0.9	-0.43	0.7	0.6697	0.70	0.8	0.8	0.9	0.8585
3	0.32	0.8	0.28	0.9	0.9051	-0.29	0.9	-0.17	0.8	0.7627	0.64	0.8	0.5	0.9	0.7023
4	0.00	0.9	0.29	1.0	0.1944	-0.62	0.9	-0.27	0.8	0.1467	0.54	0.8	0.62	1.2	0.7586
5	-0.04	1.0	0.26	1.1	0.3897	-0.85	0.9	-0.27	0.8	0.0880	0.74	1.1	0.35	1.2	0.8678
6	-0.08	1.0	0.2	1.2	0.5913	-1.00	0.7	-0.33	0.9	**0.0435**	0.82	1.1	0.51	1.2	0.2417
7	-0.24	1.1	0.13	1.1	0.3342	-0.81	0.9	-0.41	0.8	0.3605	0.45	1.0	0.68	1.3	0.6065
8	-0.66	1.4	-0.09	1.1	0.8952	-0.78	0.7	-0.37	0.8	0.9370	-0.04	1.4	0.42	1.0	0.4606
9			0.05	1.2	-			-0.21	0.8	-			0.36	1.3	-
10			0.13	1.2	-			-0.04	0.8	-			0.32	1.2	-
11			-0.01	1.3	-			-0.2	1.0	-			0.37	1.3	-
12			-0.04	1.0	-			-0.17	0.7	-			0.22	1.2	-
p within	n/a		0.0015			n/a		<0.0001			n/a		n/a		

TABLE 13: THE MEAN Z-SCORES AND STANDARD DEVIATION FOR WEIGHT-FOR-AGE AT MONTHLY INTERVALS BY MILK FEEDING PRACTICES (number of subjects in parenthesis)

Age (in months)	PBF		MF		PFF	
	Mean (n)	SD	Mean (n)	SD	Mean (n)	SD
Birth	0.21 (20)	0.8	-0.30 (9)	0.9	0.10 (15)	0.8
Birth-1	0.00 (20)	1.0	-0.38 (9)	0.7	-0.07 (15)	0.7
1	0.07(16)	0.6	-0.51 (9)	1.0	-0.49 (13)	0.6
2	0.41 (18)	0.8	-0.45 (9)	0.8	0.24 (14)	0.8
3	0.42 (18)	0.9	0.04 (7)	0.9	0.23 (15)	0.9
4	0.38 (18)	1.0	0.15 (8)	0.8	0.32 (15)	1.1
5	0.35 (20)	1.2	0.16 (9)	1.1	0.47 (14)	1.0
6	0.32 (18)	1.2	0.10 (9)	1.3	0.15 (14)	1.1
7	0.29 (16)	1.0	0.21 (7)	1.1	-0.10 (11)	1.3
8	-0.03 (17)	1.2	-0.04 (8)	0.5	-0.16 (13)	1.2
9	0.07 (18)	1.2	-0.12 (7)	1.1	0.14 (13)	1.3
10	0.10 (16)	1.2	0.04 (9)	1.2	0.08 (13)	1.3
11	-0.12 (15)	1.2	0.21 (7)	1.4	0.17 (10)	1.3
12	0.07 (13)	1.2	-0.07 (5)	0.4	-0.18 (7)	0.9
p between PBF, MF and PFF: 0.8336; p between time and PBF, MF and PFF: 0.8999						

TABLE 14: THE MEAN Z-SCORES AND STANDARD DEVIATION FOR HEIGHT-FOR-AGE AT MONTHLY INTERVALS BY MILK FEEDING PRACTICES (number of subjects in parenthesis)

Age (in months)	Height-for-age					
	PBF		MF		PFF	
	Mean (n)	SD	Mean (n)	SD	Mean (n)	SD
Birth	0.53 (20)	2.0	0.18 (9)	0.5	0.28 (15)	1.2
Birth-1	-0.37 (20)	0.8	-0.77(9)	1.1	-0.84 (15)	0.9
1	-0.44 (16)	0.8	-1.02 (9)	1.1	-0.57 (13)	0.8
2	-0.28 (18)	0.6	-0.61 (9)	0.9	-0.53 (14)	0.8
3	0.16 (18)	0.7	-0.35(7)	0.8	-0.49 (15)	0.7
4	-0.05 (18)	0.7	-0.36 (8)	0.9	-0.50 (15)	0.8
5	-0.04 (20)	0.7	-0.39 (9)	0.9	-0.51 (14)	0.8
6	-0.07 (18)	0.9	-0.54 (9)	1.0	-0.54 (14)	0.9
7	-0.36 (16)	0.9	-0.55 (7)	1.0	-0.40 (11)	0.7
8	-0.20 (17)	0.9	-0.36 (8)	0.9	-0.61 (13)	0.6
9	0.04 (18)	0.9	-0.49 (7)	0.7	-0.39 (13)	0.8
10	0.10 (16)	0.9	-0.15 (9)	1.1	-0.15 (13)	0.5
11	-0.01 (15)	1.0	-0.37 (7)	1.3	-0.35 (10)	0.7
12	-0.17 (13)	0.8	-0.02 (7)	0.8	-0.26 (7)	0.6
p between PBF, MF and PFF: 0.2713, p between time and PBF, MF and PFF: 0.9278						

TABLE 15: THE MEAN Z-SCORES AND STANDARD DEVIATION FOR WEIGHT-FOR-HEIGHT AT MONTHLY INTERVALS BY MILK FEEDING PRACTICES (number of subjects in parenthesis)

Age (in months)	Weight-for-height						p value
	PBF		MF		PFF		
	Mean (n)	SD	Mean (n)	SD	Mean (n)	SD	
Birth	-0.981 (20)	0.9	-0.964 (9)	0.8	-0.859 (15)	0.9	0.9081
Birth-1	0.267 (20)	0.8	-0.310 (9)	0.8	0.201 (15)	0.7	0.4475
1	0.748 (16)	0.62	0.886 (9)	1.5	0.752 (13)	0.9	0.8909
2	0.795 (18)	1.0	0.861 (9)	1.0	0.795 (14)	0.9	0.8702
3	0.314 (18)	1.0	0.781 (7)	1.1	0.621 (15)	0.9	0.3686
4	0.550 (18)	1.4	0.492 (8)	1.0	0.774 (15)	1.0	0.8084
5	0.120 (20)	1.0	0.870 (9)	1.3	0.685 (14)	0.9	0.2375
6	0.382 (18)	1.0	0.909 (9)	1.4	0.556 (14)	1.	0.5947
7	0.805 (16)	1.1	0.854 (7)	1.4	0.367 (11)	1.5	0.4946
8	0.320 (17)	1.2	0.510 (8)	0.7	0.491 (13)	1.1	0.9568
9	-0.001 (18)	1.2	0.358 (7)	1.1	0.809 (13)	1.3	0.1443
10	0.242 (16)	1.4	0.183 (9)	0.8	0.468 (13)	1.3	0.8751
11	-0.066 (15)	1.2	0.620 (7)	1.1	0.809 (10)	1.4	
12	0.535 (13)	1.3	-0.176 (5)	1.3	-0.074 (7)	1.1	

FIGURE 6: THE MEAN Z-SCORES FOR WEIGHT-FOR-AGE AT MONTHLY INTERVALS FOR "COMPLIERS" AND "NON-COMPLIERS"

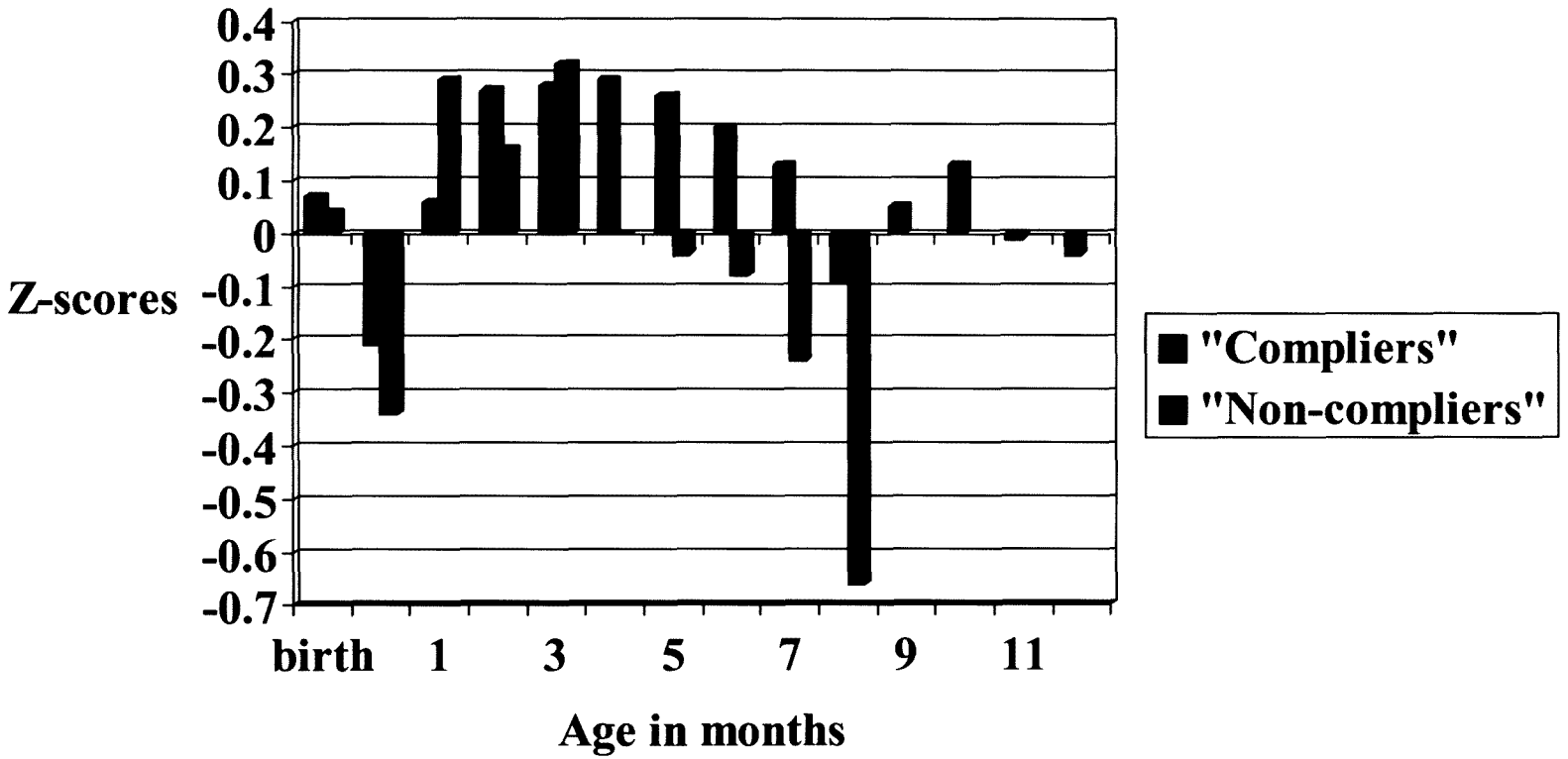


FIGURE 7: THE MEAN Z-SCORES FOR HEIGHT-FOR-AGE AT MONTHLY INTERVALS FOR "COMPLIERS" AND "NON-COMPLIERS"

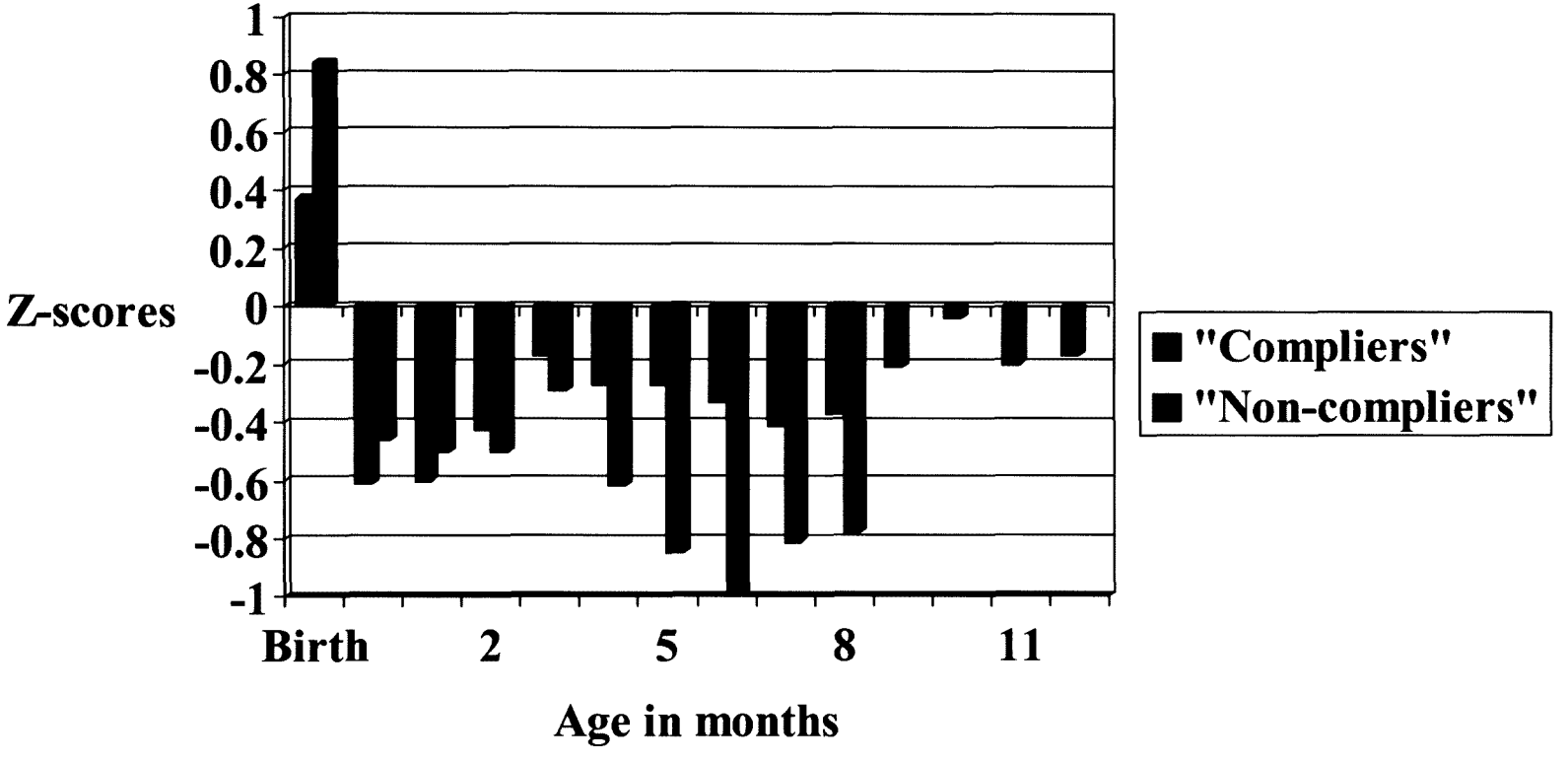
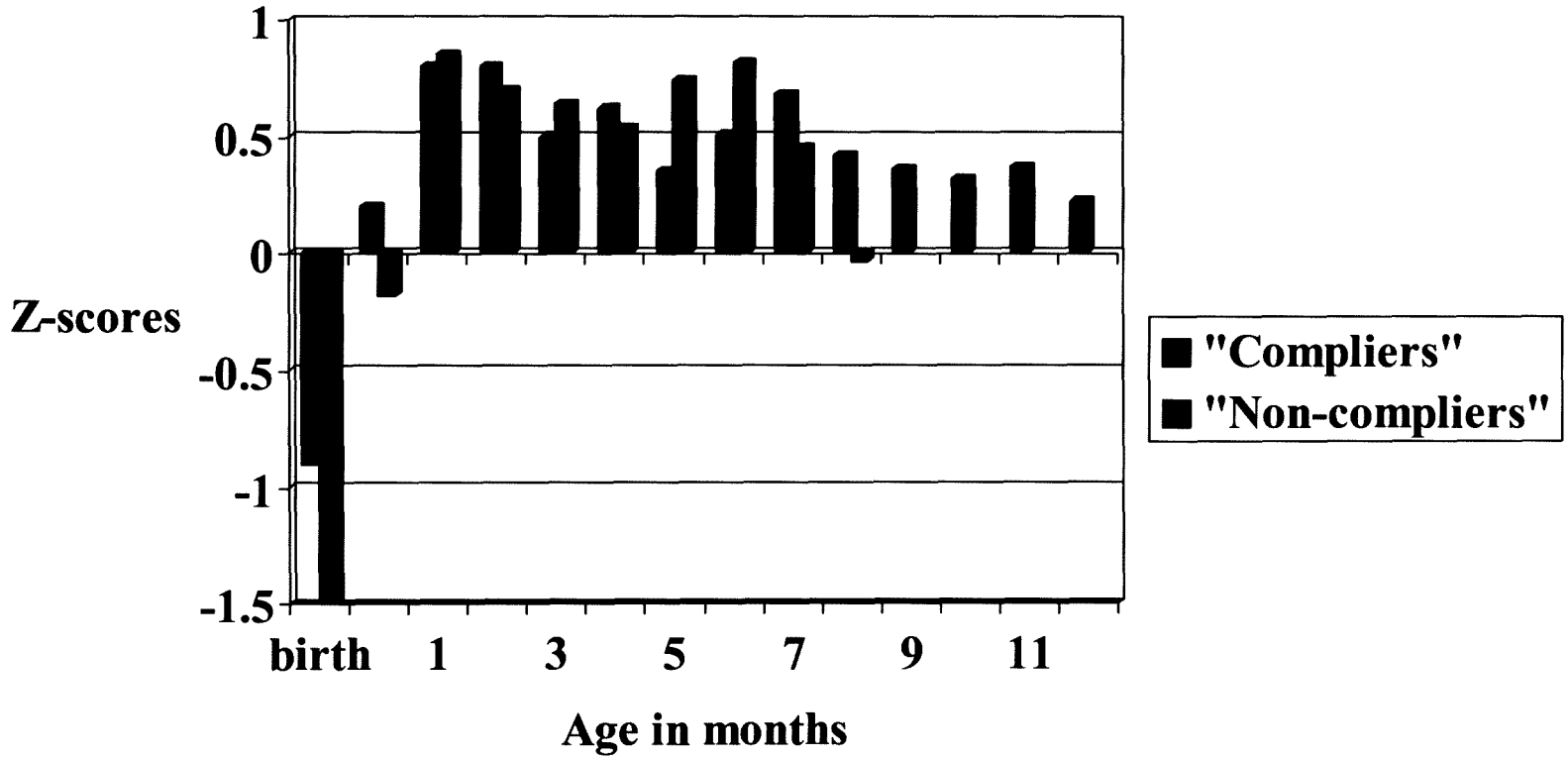


FIGURE 8: THE MEAN Z-SCORES FOR WEIGHT-FOR-HEIGHT AT MONTHLY INTERVALS FOR "COMPLIERS" AND "NON-COMPLIERS"



3.4 FEEDING PRACTICES

Feeding practices were analysed and *described* at monthly intervals for all the respondents who where interviewed at each monthly interview. Table 16 indicates the number of respondents at each interview. Numbers varied at each monthly interview for various reasons (Table 3). When the study started, 73 mother-infant pairs where recruited. Of these only 44 had a minimum of 10 (out of the maximum of 12) interviews during the study ("compliers"). Feeding practices in this group ("compliers") were analysed and compared amongst three sub-groups PBF, MF and PFF from birth to twelve months and correlated with their growth.

The remaining 29 respondents had less than 10 interviews and the information on their feeding practices was not used to compare feeding practices or to correlate feeding practices with growth or socio-economic and demographic information because their data was incomplete. As many of them (18) dropped out before the age of six months, the mean daily volume of infant formula intake under six months could not be calculated. Therefore, the "non-`compliers" could not be divided into PBF, MF or PFF groups in order to compare the data with that of the "compliers".

TABLE 16: THE NUMBER OF RESPONDENTS WHO WERE INTERVIEWED EACH MONTH DURING THE PERIOD OF FOLLOW-UP

Age in months at monthly interview	Number of respondents
Between birth and 1 month	73
1 month	62
2 months	60
3 months	59
4 months	57
5 months	54
6 months	53
7 months	44
8 months	43
9 months	39
10 months	38
11 months	32
12 months	25

3.4.1 Milk

3.4.1.1 Type of milk from birth to one year

Breastmilk:

At the first visit, within one month after birth, 60 (79,4%) of the mothers (n=73) were feeding breastmilk only. These numbers declined rapidly (Figure 9) and at the age of three months after birth, only 13 (22%) were still feeding breastmilk as the only source of milk. After four months, this number declined even more to seven (12%) out of 57 mothers. For the mothers who were still interviewed every month after the age of four months ("compliers"), the number of mothers who continued giving breastmilk as the **only** source of milk, stayed below 20% (one in 5). At the age of one year, 5 (21%) of the 25 mothers who were interviewed, were still breastfeeding. Analysing the number of mothers who breastfed at each monthly visit, even though **in combination** with other milk i.e. formula or cow's milk or both, (Figure 10) at one year (the last interview), 9 (36%) of mothers were still breastfeeding.

To compare the growth of the infants according to the duration of feeding breastmilk, with or without complementary foods, as the **only** source of milk, the the duration of feeding breastmilk as **only** source of milk did not affect the growth for HAZ (p=0.7247) or WAZ (p=0.8273) significantly. WAZ was higher in the infants who received only breastmilk for less than a month throughout the period of the study. The infants who received only breastmilk for 1-3 months seemed to have a lower WAZ at monthly intervals than the infants who received only breastmilk for four months or longer. Differences were not statistically significant (Table 17, Figure 11).

When considering the duration of feeding breastmilk as **only** source of milk, with or without complementary foods, time significantly affected WAZ (p= 0.0199) (Table 17, Figure 11) but not HAZ (p= 0.3188). WAZ decreased significantly over time for the group of "compliers" (within subjects) irrespective of the duration of feeding breastmilk only (between subjects).

The duration of any breastfeeding (in **combination** or without other milk and with or without complementary foods) did not affect the growth of the infants for HAZ (p=0.2155) or WAZ (p=0.8243) significantly.

The duration of any breastfeeding (in **combination** or without other milk and with or without complementary foods), did not affect the growth of infants for HAZ (p=0.6401) or WAZ (p=0.1698).

FIGURE 9: PERCENTAGE OF MOTHERS (OF THOSE PRESENTING FOR FOLLOW-UP) GIVING BREASTMILK AS THE ONLY SOURCE OF MILK FROM BIRTH TO ONE YEAR

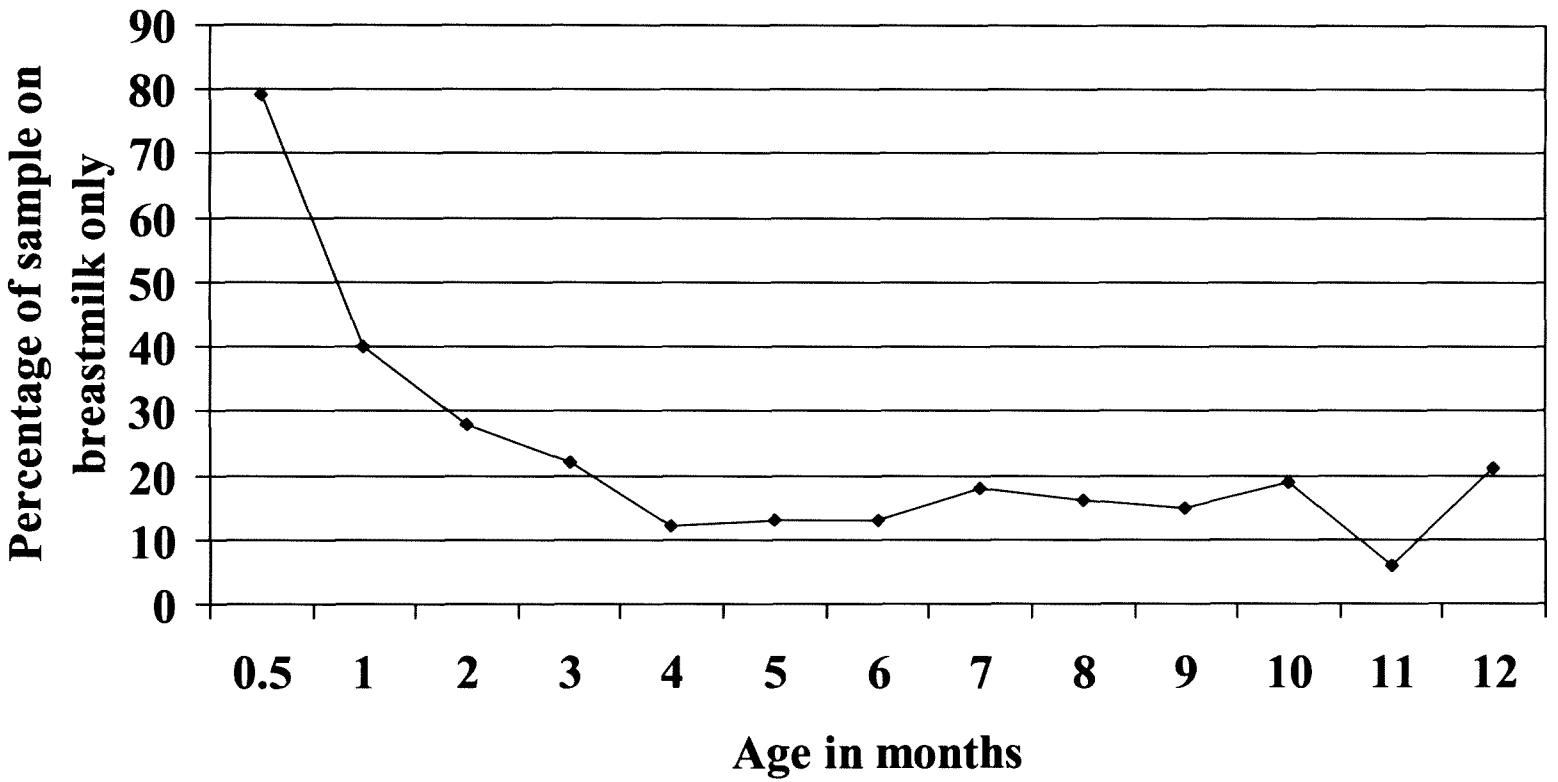


FIGURE 10: PERCENTAGE OF MOTHERS GIVING BREASTMILK IN COMBINATION WITH OR WITHOUT OTHER MILK FROM BIRTH TO ONE YEAR

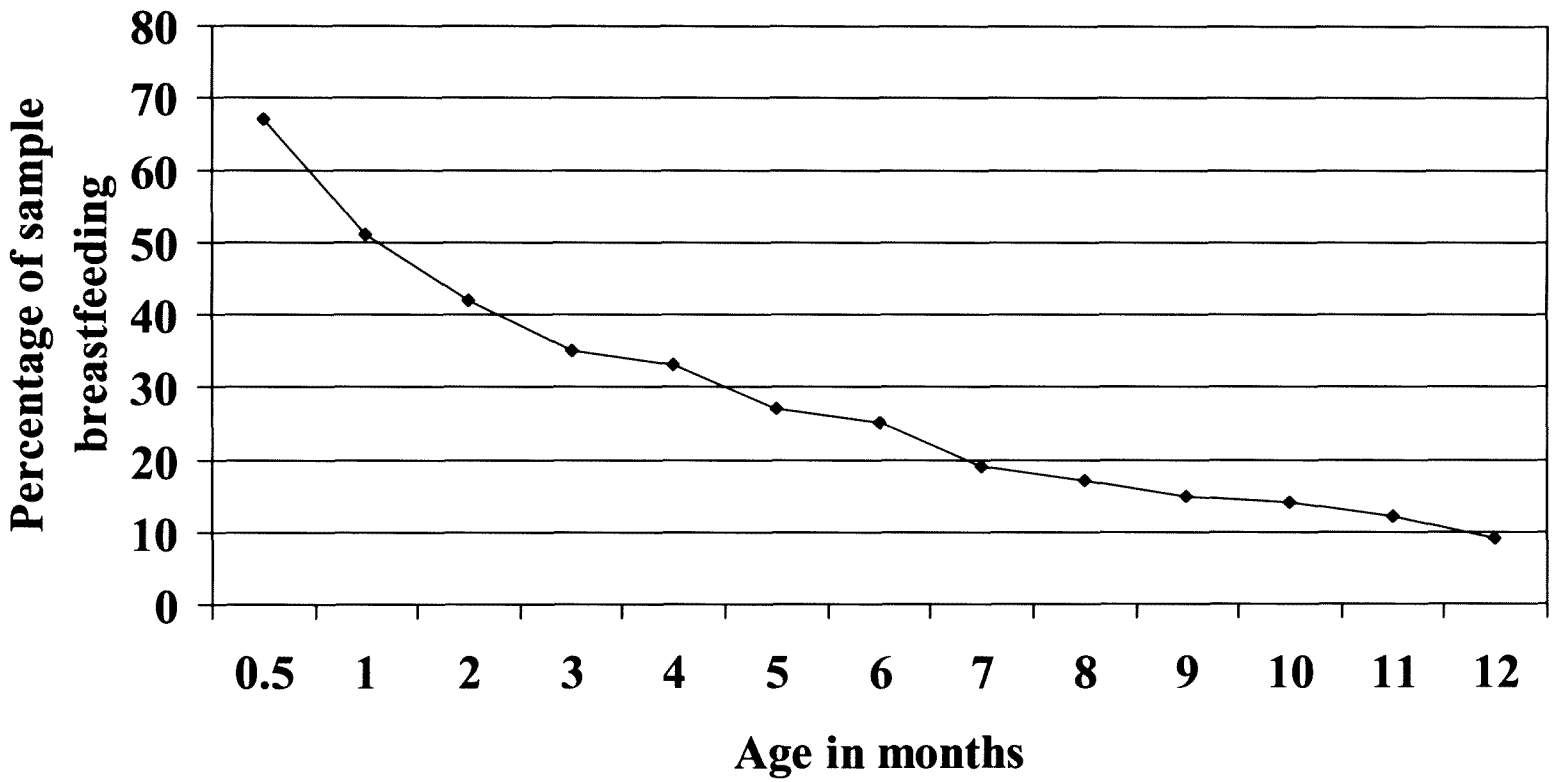
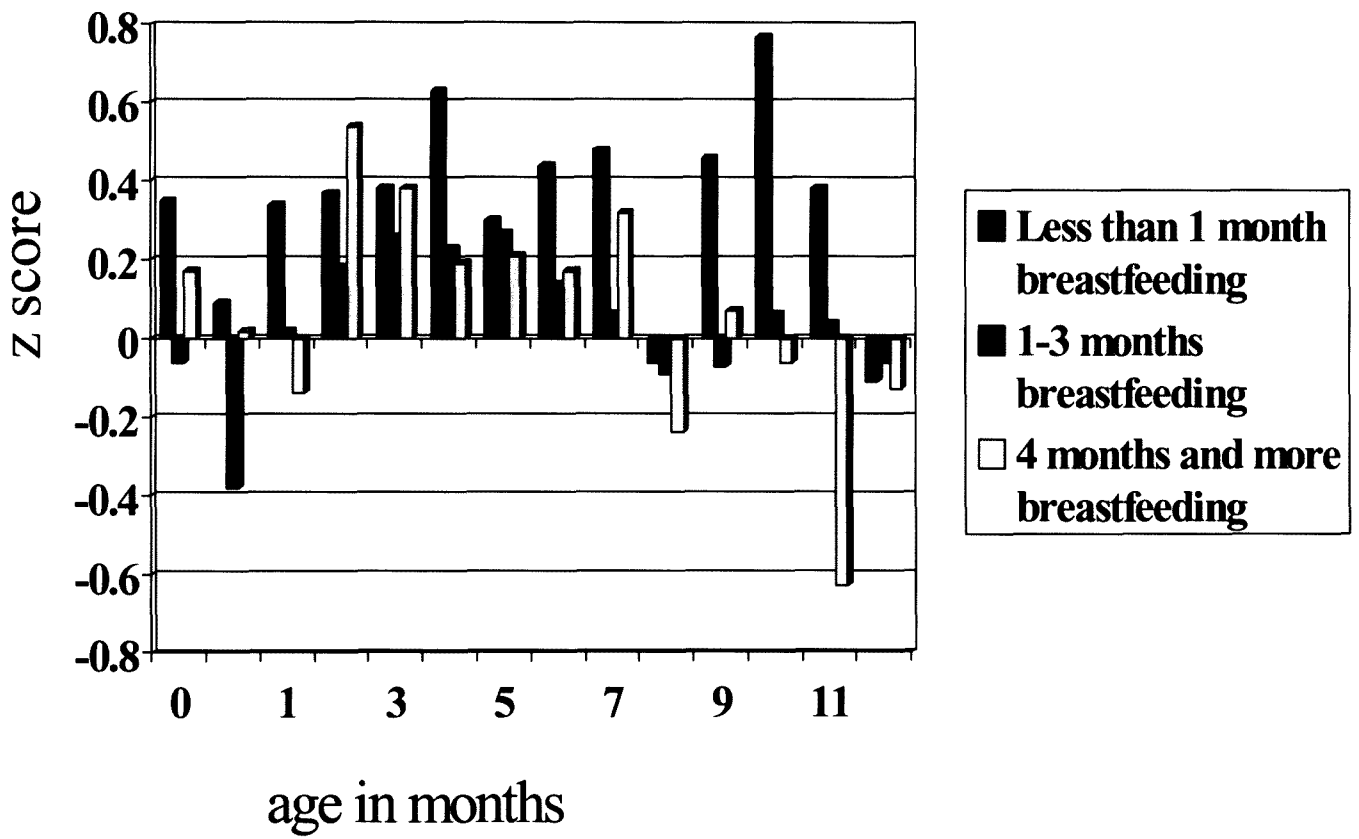


TABLE 17: THE MEAN Z-SCORES (SD) FOR WEIGHT-FOR-AGE AT MONTHLY INTERVALS BY DURATION OF FEEDING BREASTMILK ONLY FROM BIRTH TO TWELVE MONTHS IN THE "COMPLIERS" GROUP

	WAZ @ birth	WAZ @ < 1 month	WAZ @ 1 month	WAZ @ 2 months	WAZ @ 3 months	WAZ @ 4 months	WAZ @ 5 months	WAZ @ 6 months	WAZ @ 7 months	WAZ @ 8 months	WAZ @ 9 months	WAZ @ 10 months	WAZ @ 11 months	WAZ @ 12 months
Breastfeeding less than 1 month	0.35 (0.94)	0.09 (0.66)	0.34 (0.60)	0.37 (0.64)	0.38 (0.60)	0.63 (0.84)	0.30 (0.86)	0.44 (1.08)	0.48 (1.91)	-0.06 (1.36)	0.46 (1.57)	0.77 (1.75)	0.38 (1.81)	-0.11 (1.23)
Breastfeeding for 1 month	-0.15 (0.77)	-0.47 (1.05)	-0.09 (0.93)	0.01 (0.95)	0.06 (1.14)	0.16 (1.22)	0.18 (1.20)	0.02 (1.26)	-0.15 (1.18)	-0.10 (1.16)	0.00 (1.30)	-0.01 (1.20)	-0.09 (1.48)	0.07 (1.50)
Breastfeeding for 2-3 months	0.11 (0.63)	-0.23 (0.69)	0.21 (0.61)	0.43 (0.62)	0.60 (0.62)	0.35 (0.69)	0.41 (0.92)	0.36 (1.20)	0.42 (1.03)	-0.07 (0.85)	-0.20 (0.93)	0.17 (1.32)	0.18 (1.24)	(0.39)
Breastfeeding for 4 months	0.05 (0.99)	-0.18 (0.89)	0.14 (0.45)	0.42 (0.36)	0.53 (0.39)	0.60 (0.53)	0.39 (0.49)	0.50 (0.41)	0.23 (0.43)	0.02 (0.58)	0.07 (0.62)	0.27 (0.28)	0.13 (0.50)	0.48 (0.10)
Breastfeeding for > 4 months	0.30 (1.09)	0.22 (0.91)	-0.55 (0.06)	0.65 (1.34)	0.19 (1.96)	-0.36 (1.28)	0.03 (2.12)	-0.09 (1.96)	0.44 (1.95)	-0.50 (2.14)	0.06 (2.03)	-0.28 (2.13)	-1.39 (2.07)	-0.75 (2.54)

- p=0.0199 for *within subjects* over time from birth to twelve months (When considering the duration of feeding breastmilk as **only** source of milk, with or without complementary foods, time significantly affected WAZ)
- p=0.8273 for *between subjects* (groups) according to duration of breastfeeding

FIGURE 11: THE MEAN WAZ AT MONTHLY INTERVALS BY DURATION OF FEEDING BREASTMILK ONLY FROM BIRTH TO TWELVE MONTHS



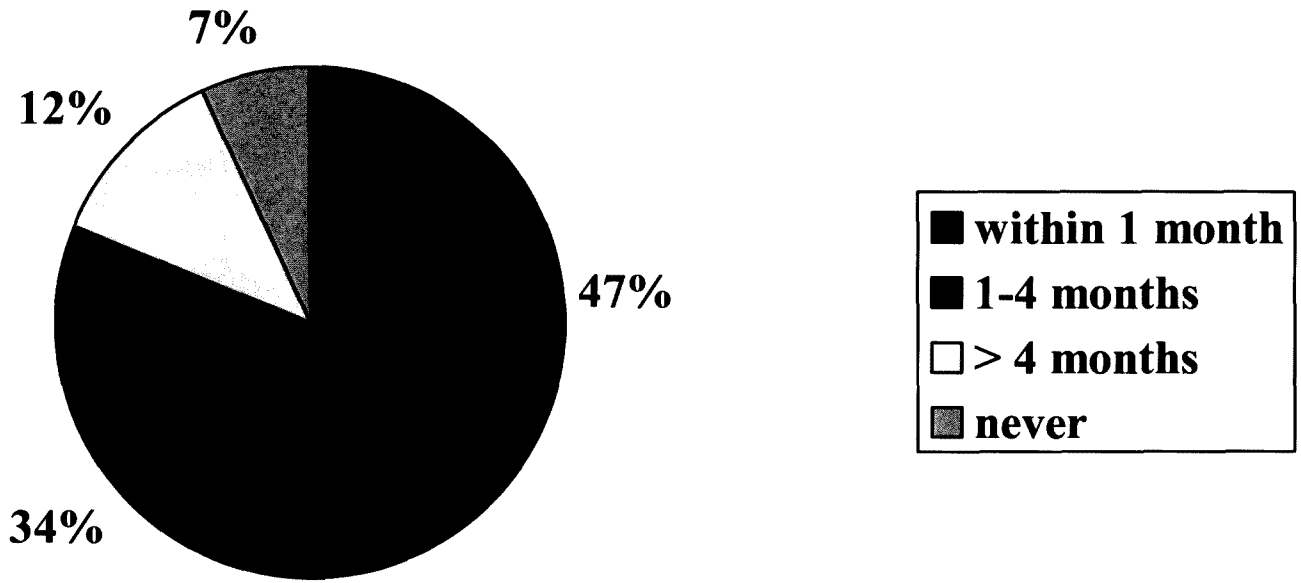
Infant formula

Of the total group of respondents (n=73), six of the mothers stopped participation in the study before they answered the question on the age when infant formula was first introduced to their infants' diets. Out of the remaining 67 respondents in the total group, 5 (7%) never fed any infant formula and gave only breastmilk (supplemented by complementary solid foods) during the period of the study. Thirty-one (47%) of the mothers in the total group fed infant formula for the first time before their infants were one month old (in addition to feeding breastmilk). Two mothers, however, who never breastfed but fed infant formula to their infants since birth. Twenty-three (34%) fed infant formula for the first time between one and four months and 8 (12 %) fed infant formula for the first time after their infants were four months old. (Figure 12)

As expected, there was a significant difference between the PBF, MF and PFF groups and the age when the first infant formula was given to the infants in these groups as p= 0.0221. Mothers in the PBF group started to add an infant formula to the diet of their babies at a later age than the mothers in the MF and PFF groups (Table 18).

Therefore breastfeeding was initiated in 71/73 cases (97%). Mothers reported retrospectively at the first interview that they did breastfeed during the two weeks after birth [(70 out of 73 respondents) (96%)]. Prospectively, at around two weeks after birth (during the first interview), breastfeeding still continued at a high rate of 91.7% (n=67). Mothers introduced mixed feedings at an early age i.e. 47% within one month after birth and 34% between one and four months.

FIGURE 12: THE AGE OF THE FIRST INTRODUCTION OF INFANT FORMULA



Reason to supplement infant formula

Only 48 mothers or caregivers gave a reason why they started with infant formula. Twenty of them (42%) said they used infant formula because they did not have enough milk (Table 19)

There was no significant difference between the PBF, MF and PFF groups for the reasons to have introduced infant formula to the infants' diets (p=0.8363).

Whole cow's milk only

Up until the age of eight months, none of the caregivers in the "non-compliers" group gave only whole cow's milk to the infants. At the age of six months after birth, one caregiver (6%, 11% and 7% respectively) in each one of the "compliers" groups (PBF, MF and PFF) gave whole cow's milk as the only source of the milk to the infants. At the age of 7 months, one caregiver (14%) in the MF group gave only whole cow's milk to the child. At the age of eight months, two caregivers (6% and 12% respectively), one each in the PBF and MF groups, gave only whole cow's milk and at the age of nine months, three caregivers (17% and 43% respectively) in each of the PBF and MF groups gave only whole cow's milk. None of the caregivers from the PFF group who were interviewed at nine months after birth gave only whole cow's milk at that age. At the age of ten months after birth, one (6%) from the PBF, two (15%) from the PFF, and three (33%) from the MF groups gave only whole cow's milk to the children. At the age of eleven months after birth, one (10%) caregiver from the PFF group, three (20%) from the PBF group and two (29%) from the MF group gave only whole cow's milk. At the age of one year, four (57%) caregivers from the PFF, two (15%) from the PBF and three (60%) from the MF groups gave only whole cow's milk. (It should be kept in mind that the results in this paragraph only pertain to the source of milk given to the infants at the mentioned age, and does not include the feeding of any other food to the infant at a certain age.)

Whole cow's milk and breastmilk

Very few mothers chose to combine whole cow's milk and breastmilk to feed their infants. Only 2 mothers in the PBF group and 1 mother in the PFF group

gave a combination of whole cow's milk and breastmilk from 10 months after birth and onwards. None of the mothers in the MF group combined whole cow's milk and breastfeeding.

Whole cow's milk and infant formula

One mother in the PFF group gave cows milk from six months in combination with formula. Another one started this combination at ten months after birth. At ten months after birth, one mother in the PBF and MF groups also gave a combination of whole cow's milk and infant formula.

Whole cow's milk, breastmilk and infant formula

Only one mother in the PBF group gave a combination of whole cow's milk, breastmilk and infant formula at the age of eleven months after birth. No one else fed whole cow's milk, breastmilk and infant formula in combination during the period of the study.

When interpreting the results in Table 18, it should be kept in mind that the original definition of groups PBF, MF and PFF was based on the *mean daily infant formula intake of each individual infant* ***over the first six months*** *after birth.* This was calculated from data that was reported every month (retrospectively for the previous month) by the caregiver over a time period of 6 months. Table 18 indicates the percentage of caregivers in the PBF, MF and PFF groups who fed **only** breastmilk, **only** infant formula or a **combination** of breastmilk and infant formula at each interview during the follow-up period.

At birth, 19 (95%) of mothers in the PBF group and eight (89%) of mothers in the MF group, compared to seven (47%) of mothers in the PFF group gave only breastmilk to their infants. The incidence of feeding breastmilk only dropped drastically within one month after birth as eight (50%) of PBF mothers and five (56%) of MF mothers gave a combination of breastmilk and formula within one month after birth. At this age, seven (54%) of the mothers in the PFF group gave only formula and no breastmilk, and four (27%) gave a combination of breastmilk and formula. At the age of six months, only four (21%) of the mothers in the PBF group still gave breastmilk as only milk to their infant and

eleven (58%) gave a combination of breastmilk and infant formula. One mother (11%) in the MF group and none in the PFF group was still feeding only breastmilk in combination with complementary foods. This mother fed a combination of breastmilk and an infant formula from the age of one month after birth up until five months after birth. At the age of six months after birth, she didn't feed any infant formula but only breastmilk. Therefore, it could seem as if she should be in the PBF group, but since she gave a combination of breastmilk and infant formula before that age, she was grouped in the MF group.

The following summarises the choice of milk feeding for each group (PBF, MF and PFF) during the period of the study:

- The incidence of giving only breastmilk for the first 6 months after birth was very low in this study population. Only four (21%) mothers in the PBF group and one (11%) in the MF group fed only breastmilk at the age of six months. (This was not exclusive breastfeeding for six months as all the mothers have introduced complementary foods by the age of four months after birth.)
- Even though some mothers gave *predominantly* breastmilk during the first six months after birth (PBF group), breastmilk was given in combination with infant formula in more than 50% of this group (PBF) from the age of one month after birth (Table 18: see column with heading "*Breastmilk & formula*" under the PBF group). Some of the mothers in the PBF group (10%) stopped breastfeeding completely at the age of five months after birth. Only 21.1% of the mothers in the PBF group were still giving breastmilk as only milk at the age of 6 months after birth.
- All the mothers in the MF (*Mixed feeding*) group initiated breastfeeding at birth but one (11%) combined it with an infant formula within one month after birth. At the age of one month after birth, one (11%) gave **only** an infant formula, and five (56%) **combined** infant formula with breastmilk. Only three (33.3% were still feeding breast milk as only milk at the age of one month after birth. The rate of breastfeeding **at all** (as breastfeeding only, or in combination with an infant formula) dropped to

one at four months (1 mother), with seven mothers (88%)feeding **only** infant formula at this age.

- Of all the mothers in the PFF (predominantly formula-fed) group, eleven (73%) initiated breastfeeding at birth. This consists of seven (47%) feeding only breastmilk, and four (27%) feeding breastmilk and infant formula in combination. Four (27%) fed only infant formula within one month after birth. More mothers fed only infant formula as the infants grew older and at the age of 4 months, 14 (93%) of the PFF group fed only formula, and 1 (7%) fed breastmilk and infant formula in combination.

There was a significant difference between the PBF, MF and PFF groups in the type of milk that was fed during the period of follow-up from birth to twelve months, which could be expected since this was the basis for grouping infants in PBF, MF and PFF. This could indicate that the early introduction of infant formula to breastfeeding decreased the duration of breastfeeding.

TABLE 18: THE NUMBER OF CAREGIVERS IN THE PBF, MF AND PFF GROUPS (PERCENTAGE IN PARETHESIS) WHO FED BM (BREASTMLIK) ONLY, F (FORMULA) ONLY OR BM AND F FROM BIRTH TO TWELVE MONTHS

Age in months	PBF (n=20)			MF (n=9)			PFF (n=15)			p value
	BM only n (%)	F only n (%)	BM & F n (%)	BM only n (%)	F only n (%)	BM & F n (%)	BM only n (%)	F only n (%)	BM & F n (%)	
Birth-1	19 (95)	0 (0)	1 (5)	8 (89)	0 (0)	1 (11)	7 (47)	4 (27)	4 (27)	0.0090
1	8 (50)	0 (0)	8 (50)	3 (33)	1 (11)	5 (56)	2 (15)	7 (54)	4 (27)	0.0078
2	9 (50)	0 (0)	9 (50)	1 (11)	4 (44)	4 (44)	1 (7)	9 (64)	4 (31)	0.0011
3	6 (33)	0 (0)	12 (67)	0 (0)	4 (57)	3 (13)	1 (7)	13 (87)	1 (29)	<0.001
4	4 (22)	0 (0)	14 (78)	0(0)	7 (88)	1(13)	0 (0)	14 (93)	1 (7)	<0.001
5	5 (25)	2 (10)	13 (65)	0(0)	8 (89)	1 (11)	0 (0)	12 (86)	1 (7)	<0.001
6	4 (22)	2 (11)	11 (58)	1 (11)	7 (78)	0 (0)	0 (0)	11 (79)	1 (7)	<0.001
7	4 (25)	4 (25)	8 (50)	1 (14)	5 (71)	0 (0)	0 (0)	10 (91)	0 (0)	0.0019
8	5(29)	4 (24)	7 (41)	1 (12)	6 (75)	0 (0)	0 (0)	11 (85)	1 (8)	0.0034
9	6 (33)	1 (6)	8 (44)	0 (0)	4 (570	0 (0)	0 (0)	11 (85)	1 (8)	<0.001
10	6 (38)	2 (13)	4 (25)	1 (11)	4 (44)	0 (0)	0 (0)	7 (58)	0 (0)	0.0061
11	2 (13)	1 (7)	4 (29)	0 (0)	3 (43)	0 (0)	0 (0)	7 (70)	0 (0)	0.0263
12	4 (31)	1 (8)	2 (17)	1 (20)	0 (0)	0 (0)	0 (0)	2 (33)	0 (0)	0.1603

* p-value indicates the significance of differences between PBF, MF and PFF for the percentage of the group who fed various types of milk at each monthly interview

TABLE 19: THE REASONS WHY MOTHERS/ CAREGIVERS STARTED TO GIVE AN INFANT FORMULA TO THE INFANTS AND THE NUMBER OF MOTHERS WHO STATED THE REASON (N=48)

Reason	Number of mothers	Percentage
Not enough milk	20	42
Mother went back to work	9	19
Convenient to the mother	4	8
Infant refused the breast	3	6
A health care worker advised her to	2	4
Other *	10	29

*mom/baby hospitalised, mom was curious to see whether infant would take bottle, nipple infection, inverted nipples

3.4.2 Breastfeeding practices

3.4.2.1 Frequency of feeds

The majority of mothers in the total sample who breastfed, practiced demand feeding (Table 20). Generally, in the "compliers" group, more mothers breastfed on demand in the PBF group than the MF and PFF groups for the full duration of follow-up. Mothers in the MF and PFF groups gave more on-demand-feeds in the first 4 months. The mothers in these 2 groups who continued with breastfeeding after 4 months, did so on demand (MF group) and scheduled feeding (PFF group). Only mothers in the PBF group gave night time breastfeeding only. Only some mothers in the PBF group did not know the frequency of breastfeeds which could indicate that they fed on demand. The differences between the PBF, MF and PFF groups in practising on-demand-breastfeeding vs scheduled breastfeeding was significant only at the age of 2 months after birth, when more mothers from the PBF group as compared to the MF and PFF groups breastfed on demand. At all the other monthly interviews during the study, no significant differences with regard to the frequency of breastfeeds were found (Table 20) The frequency of feeds did, therefore, not influence the duration of breastfeeding in this study population.

3.4.2.2 Duration of a feed

Most of the mothers in the total sample practised demand feeding. Almost half of the mothers (43%) timed their feeds and thus restricted time on the breast (Table 21). The majority of mothers in the PBF group fed on demand and thus did not restrict time on the breast. As less mothers in the MF and PFF groups breastfed, the percentages of mothers in these groups who fed on demand are higher than in the PBF group. The differences between the PBF, MF and PFF groups in practising on-demand-breastfeeding (unlimited time to the breast) vs limited time to the breast was significant only at the age of 1 month after birth, when more mothers from the PBF group as compared to the MF and PFF groups breastfed on demand. At all the other monthly interviews during the study, no significant differences with regard to the duration of a breastfeed were found (Table 21) The duration of **a breastfeed** did, therefore, not influence the full duration of breastfeeding in this study population.

3.4.2.3 Expressed breastmilk:

Very few of all the mothers (total sample) expressed breastmilk. The mothers who expressed their breastmilk ranged from one (at 9 months) to thirteen (within two weeks after birth) and the median was 2.5 [(mean: 3.9) (SD: 4.01)]. No mothers expressed breastmilk after the age of nine months after birth. All the caregivers used a bottle to feed the expressed breastmilk to their babies, except in one case where the caregiver (grandmother) did not know how the mother fed the baby the expressed breastmilk.

Ten out of thirteen mothers (77%) who expressed their milk at the first interview stored the expressed milk in the fridge. All the mothers (range: 1-3) who expressed milk at the interviews after four months stored it in the fridge. At the first interview, two (15%) of the thirteen monthers who expressed breastmilk, stored the breastmilk at room temperature and one (out of 6) (17%) at the fourth interview. Of the "compliers", there were statistically significant differences between the PBF, MF and PFF groups at the 3rd and 4th interview (p= 0.01 and 0.04 respectively). The mothers in the PBF group who expressed their breastmilk at these two interviews (five mothers at the 3rd interview and 3 mothers at the 4th interview) stored the expressed milk in the fridge, and the mother in the MF group (one mother at the 3rd and 4th interview) stored it at room temperature. No mothers in the PFF group expressed their milk at these interviews. Too few data was available at other interviews to calculate the p value as only one mother in the PBF group expressed her milk after the 4th interview.

TABLE 20: THE FREQUENCY OF BREASTFEEDS (INTERVAL BETWEEN BREASTFEEDS) BY THE RESPONDENTS WHO RESPONDED IN THE TOTAL SAMPLE AND THE PBF, MF AND PFF GROUPS (n=number of subjects, percentage in parenthesis)

Age in months	Number of respondents who responded to the question				On-demand-breastfeeding n (%)				Scheduled breastfeeding n (%)				Breastfeeding at night only n (%)				p value between PBF, MF and PFF
	Total	PBF	MF	PFF	Total*	PBF	MF	PFF	Total	PBF	MF	PFF	Total	PBF	MF	PFF	
Birth-1	67	20	9	11	43 (64)	15 (75)	6 (67)	5 (45)	24 (36)	5 (25)	3 (33)	6 (55)	0(0)	0(0)	0(0)	0(0)	0.2545
1	52	16	8	6	38 (73)	14 (88)	5 (63)	3 (50)	14 (27)	2 (13)	3 (38)	3 (50)	0(0)	0(0)	0(0)	0(0)	0.1501
2	44	18	5	5	32 (73)	16 (89)	2 (40)	3 (60)	12 (27)	2 (11)	3 (60)	2 (40)	0(0)	0(0)	0(0)	0(0)	0.0573
3	36	18	2	2	22 (61)	11 (61)	1 (50)	2 (100)	9 (25)	3 (17)	1 (50)	0(0)	3 (8)	2 (11)	0(0)	0(0)	0.8236
4	33	17	1	1	14 (42)	9 (53)	1 (100)	0(0)	12 (36)	4 (24)	0(0)	1 (100)	4 (12)	2 (12)	0(0)	0(0)	0.7037
5	27	17	1	1	13 (48)	10 (59)	1 (100)	0(0)	11 (41)	5 (29)	0(0)	1 (100)	2 (7)	1 (6)	0(0)	0(0)	0.8155
6	27	16	1	1	12 (44)	8 (50)	1 (100)	0(0)	11 (41)	5 (31)	0(0)	1 (100)	3 (11)	3 (19)	0(0)	0(0)	0.5474
7	20	12	1	0	11 (55)	6 (50)	1 (100)	0(0)	8 (40)	5 (42)	0(0)	0(0)	1 (5)	1 (8)	0(0)	0(0)	0.6286
8	18	12	1	1	10 (56)	7 (58)	1 (100)	0(0)	7 (39)	4 (33)	0(0)	1 (100)	0(0)	0(0)	0(0)	0(0)	0.5196
9	16	14	0	1	8 (50)	7 (50)	0(0)	0(0)	5 (31)	4 (29)	0(0)	1 (100)	3 (19)	3 (21)	0(0)	0(0)	0.4812
10	15	12	1	1	10(67)	8 (67)	1 (100)	0(0)	4 (27)	3 (25)	0(0)	1 (100)	1 (7)	1 (8)	0(0)	0(0)	0.5341
11	11	9	0	1	3 (27)	3 (33)	0(0)	0(0)	3 (27)	2 (22)	0(0)	1 (100)	5 (45)	4 (44)	0(0)	0(0)	0.2735
12	11	8	1	0	8 (72)	6 (75)	1 (100)	0(0)	0(0)	0(0)	0(0)	0(0)	2 (18)	2 (25)	0(0)	0(0)	0.5708

The *Total Sample* includes both *"compliers"* (for the full duration of the study) as well as "*non-compliers"* (until the age of 8 months).

TABLE 21: THE DURATION OF A BREASTFEED (LENGTH OF TIME OF A FEED) BY THE RESPONDENTS WHO RESPONDED IN THE TOTAL SAMPLE AND THE PBF, MF AND PFF GROUPS (n=number of subjects, percentage in parenthesis)

Age in months	Number of respondents who responded to the question				Unlimited time (on demand) n (%)				Limited time n (%)				p value between PBF, MF and PFF for duration of a feed
	Total*	PBF	MF	PFF	Total*	PBF	MF	PFF	Total*	PBF	MF	PFF	
Birth-1	67	20	9	11	31 (46)	11 (55)	3 (33)	5 (45)	29 (43)	9 (45)	6 (66)	5 (45)	0.4185
1	52	16	8	6	29 (56)	12 (75)	2 (25)	2 (33)	17 (33)	4 (25)	5 (63)	4 (67)	0.0753
2	44	18	5	5	25 (57)	13 (72)	2 (40)	2 (40)	12 (27)	5 (28)	3 (60)	3 (60)	0.2468
3	35	17	2	3	23 (66)	11 (65)	1 (50)	2 (66)	11 (31)	5 (29)	1 (50)	1 (33)	0.9630
4	32	17	1	1	19 (59)	9 (53)	1 (100)	1 (100)	12 (38)	7 (41)	0 (0)	0 (0)	0.8042
5	26	17	1	1	18 (69)	13 (76)	1 (100)	1 (100)	5 (19)	3 (18)	0 (0)	0 (0)	0.9635
6	23	16	1	0	16 (70)	12 (75)	1 (100)	0 (0)	8 (35)	2 (13)	0 (0)	0 (0)	0.8492
7	21	12	1	1	16 (76)	11 (92)	1 (100)	1 (100)	5 (24)	1 (8)	0 (0)	0 (0)	0.9142
8	17	12	1	1	13 (76)	9 (75)	1 (100)	1 (100)	3 (18)	2 (17)	0 (0)	0 (0)	0.9589
9	15	13	0	1	11 (73)	10 (77)	0 (0)	1 (100)	3 (20)	1 (8)	0 (0)	0 (0)	0.9424
10	13	11	1	1	12 (92)	10 (91)	1 (100)	1 (100)	0 (0)	1 (9)	0 (0)	0 (0)	0.9062
11	10	9	0	1	9 (90)	8 (89)	0 (0)	1 (100)	1 (10)	0 (0)	0 (0)	0 (0)	0.7253
12	10	8	1	1	7 (70)	6 (75)	1 (100)	0 (0)	1 (10)	1 (13)	0 (0)	0 (0)	0.1104

*The *Total Sample* includes both *"compliers"* (for the full duration of the study) as well as *"non-compliers"* (until the age of 8 months).

3.4.3 Formula feeding practices

(Statistical comparisons between PBF, MF and PFF for formula feeding practices were not calculated in this section as numbers in the different groups within PBF, MF and PFF were too small. Therefore formula feeding practices were only ***described*** *for the total sample and* ***not compared*** *between PBF, MF and PFF)*

3.4.3.1 Type of infant formula

About half of all the mothers in the total sample who fed an infant formula to their infants gave a casein-predominant formula and the remainder gave a whey predominant formula within the first two months after birth (Table 22). From 4-6 months, slightly more mothers chose the casein-predominant formula, and from six months onward, at least 65% of the mothers who gave formula (n= 43), gave a cow's milk based formula as a follow-on formula. One mother started at two months with a follow-on formula, and 15 (33%) had started at five months with a follow-on formula. Only one mother gave a soy formula. One mother gave an acidified formula because her child was on the Health Facility Based Nutrition Programme and received it via the programme. A hypo-allergenic formula was given at one instance only. (Statistical comparisons between PBF, MF and PFF were not calculated due to small numbers in the different groups within PBF, MF and PFF)

3.4.3.2 Preparation methods: Ratio of powder to water

Although the majority of the caregivers in the total sample who gave an infant formula prepared the formula in the correct ratio of powder to water, a great number of caregivers prepared it to be either too weak or too strong according to the instructions on the tin (Table 23). More caregivers prepared the formula to be too weak and these numbers increased as the infants grew older. There was one caregiver at the 3 and 4 months interview, and two caregivers at the 5 months interview who did not know how they prepared the formula.

3.4.3.3 Preparation methods: Type of water to prepare formula

All the caregivers that were interviewed during the study (total sample) who prepared an infant formula used cooled boiled water to prepare the formula. At the first, fifth and sixth month, there was one caregiver who did not know what the mother used to

TABLE 22: THE TYPES OF FORMULA FED TO ALL INFANTS AT DIFFERENT AGES FROM BIRTH TO ONE YEAR
(n=number of subjects receiving the formula, percentage in parenthesis)

Age in months	Number of infants who received formula	Casein starter formula n (%)	Whey starter formula n (%)	Follow on cow's milk based formula n (%)	Soya based formula n (%)	Acidified formula n (%)
Birth-1	16	7 (44)	9 (56)	0	0	0
1	39	18 (46)	20 (51)	0	0	0
2	43	20 (47)	20 (47)	1 (2)	1 (2)	0
3	46	20 (43)	23 (50)	1 (2)	1 (2)	0
4	50	24 (48)	18 (36)	6 (12)	1 (2)	0
5	46	17 (37)	15 (33)	12 (26)	1 (2)	0
6	43	7 (16)	6 (14)	28 (65)	1 (2)	0
7	34	3 (9)	2 (6)	27 (79)	1 (3)	0
8	32	1 (3)	0	29 (91)	1 (3)	1 (3)
9	26	1 (4)	0	22 (85)	1 (4)	1 (4)
10	22	1 (5)	0	18 (82)	1 (5)	1 (5)
11	22	1 (5)	0	19 (86)	1 (5)	1 (5)
12	9	0	0	7 (78)	1 (11)	0

TABLE 23: THE PERCENTAGE OF CAREGIVERS PREPARING FORMULA ACCORDING TO INSTRUCTIONS ON THE TIN (n= number of subjects, percentage in parenthesis)

Age in months	Number of infants who received formula *	Correct n (%)	Too weak n (%)	Too strong n (%)
Birth-1	16	13 (81)	2 (10)	2 (10)
1	39	31 (80)	5 (13)	3 (8)
2	43	33 (77)	6 (14)	4 (9)
3	46	32 (68)	6 (14)	7 (16)
4	50	37 (74)	5 (10)	7 (16)
5	46	35 (76)	4 (10)	7 (14)
6	43	29 (67)	10 (24)	4 (9)
7	34	22 (65)	8 (24)	4 (12)
8	32	17 (53)	12 (38)	3 (9)
9	26	14 (54)	9 (35)	3 (12)
10	22	14 (62)	6 (33)	2 (10)
11	22	13 (60)	6 (25)	3 (15)
12	9	5 (50)	3 (38)	1 (11)

***Due to rounding, all the numbers do not add up to the total of infants who received formula**

prepare the formula. After twelve months, one mother reported that she used tap water.

3.4.3.4 Preparation methods: Frequency of preparation of formula

The caregivers in the total sample, who prepared formula, usually prepared the formula before a feed (Table 24). At the first, fifth and last interview, 6%, 2% and 13% of the caregivers could not give an answer to the question on the frequency of preparation of the formula. This is indicated in the last column in table 24 as "Don't know".

3.4.3.5 Preparation methods: Storage of prepared formula

Very few of the caregivers reported that they stored the prepared formula before they fed it to the infant. All the caregivers in the total sample, who reported that they fed prepared formula that was stored, usually stored the prepared formula either at room temperature or in the fridge (Table 25). None of the caregivers who stored prepared formula used a freezer to store the prepared formula.

3.4.3.6 Preparation methods: Duration time of storage of prepared formula

The number of caregivers, who reported that they stored prepared formula in the previous question, did not correspond with the number of caregivers who gave an indication of the number of hours that they stored the formula in this question.

The number of caregivers who gave information on the duration time of storage of prepared formula, varied from 2-11 at different interviews. The mean duration time of storage of prepared formula was between 0.75(SD: 0.35) and 4.85 (SD: 4.05) hours at different interviews. The median for the duration time of storage of prepared formula ranged from 0.75 – 4.5 hours at different interviews. Time of storage of prepared formula ranged from less than 1 hour to 24 hours (Table 26). It seemed as if caregivers tend to store the prepared formula for longer periods, as the infants grew older.

TABLE 24: THE FREQUENCY OF PREPARATION OF FORMULA AS A PERCENTAGE OF ALL THE CAREGIVERS WHO PREPARED FORMULA

Age in months	Before a feed (%)	Once a day (%)	2-3 times daily (%)	Don't Know (%)
Birth-1	81	6	6	6
1	80	10	10	0
2	88	7	5	0
3	89	11	0	0
4	867	12	2	0
5	89	9	0	2
6	93	7	0	0
7	91	9	0	0
8	94	6	0	0
9	100	0	0	0
10	100	0	0	0
11	95	5	0	0
12	88	0	0	13

TABLE 25: PLACE OF STORAGE OF PREPARED FORMULA AS PERCENTAGE OF ALL MOTHERS WHO STORED FORMULA BEFORE FEEDING IT TO THE INFANTS

Age in months	Number of caregivers who stored formula	Room temperature (%)	Fridge (%)	Don't know (%)
Birth-1	4	50	25	25
1	7	43	57	0
2	6	50	50	0
3	9	56	44	0
4	11	55	46	0
5	9	44	56	0
6	11	60	40	0
7	9	75	25	0
8	9	71	29	0
9	6	100	0	0
10	6	100	0	0
11	6	67	33	0
12	8	67	0	33

TABLE 26: THE MEAN (SD), MEDIAN AND RANGE OF THE DURATION TIME (IN HOURS) OF STORAGE OF PREPARED FORMULA

Age in months	Number of caregivers who stored formula	Mean (SD) (hours)	Median (hours)	Range (hours)
Birth-1	2	0.75 (0.35)	0.75	0.5-1
1	7	3.00 (1.68)	2.50	1-6
2	5	2.33 (1.94)	2.00	0.17-5
3	7	2.79 (2.23)	2.00	1-7.5
4	11	3.05 (2.40)	1.50	1-8
5	9	4.72 (7.32)	2.00	1-24
6	11	2.72 (1.60)	2.5	0.5-4.5
7	9	2.44 (1.83)	2.5	0.5-5.5
8	7	4.85 (4.05)	3.5	1-12
9	6	1.83 (1.69)	1.00	0.5-5
10	4	1.13 (0.63)	1.00	0.5-2
11	5	2.90 (2.51)	2.00	1-7
12	3	4.17 (0.58)	4.50	3.5-4.5

3.4.4.Other fluids

3.4.4.1 Water

In the total sample (all the mothers), 74% (n=54) gave water (in addition to breastmilk or formula) to their infants when they were younger than one month of age (Table 27). This percentage reached a maximum at four months after birth as 93% of all the caregivers who were interviewed at four months after birth fed water in addition to breastmilk or infant formula to the infants. The caregivers who were interviewed for the full duration of the study (until twelve months after birth), continued giving water to the infants for the total period of the study. The daily volume of water that they gave to their infants increased with age (Table 28).

More than 50% of all the caregivers in the PBF, MF and PFF groups started at an early age to give water to the babies (Table 29). The mean daily volume of water intake increased as babies got older. The PFF group had a higher mean daily water intake than the PBF and MF groups, and from 11 months, the MF group got more water than the other two groups (Figure 13). These differences were not statistically significant (p values > 0.05 for all the values) (Table 29).

TABLE 27: THE PERCENTAGE OF CAREGIVERS WHO FED FLUIDS OTHER THAN MILK AS PERCENTAGE OF TOTAL CAREGIVERS IN THE TOTAL SAMPLE IN THE PBF, MF AND PFF GROUPS

Age in months	% of caregivers who fed water				% of caregivers who fed tea				% of caregivers who fed juice				% of caregivers who fed cold drink			
	Total sample*	"compliers"			Total sample*	"compliers"			Total sample*	"compliers"			Total sample*	"compliers"		
		PBF	MF	PFF		PBF	MF	PFF		PBF	MF	PFF		PBF	MF	PFF
Birth-1	74	70	56	93	0	0	0	0	0	0	0	0	0	0	0	0
1	86	94	89	85	0	0	0	0	2	0	0	8	0	0	0	0
2	85	78	89	86	0	0	0	0	8.2	0	0	14	0	0	0	0
3	92	83	100	100	0	0	0	0	15	6	0	13	0	0	0	0
4	93	89	100	93	2	0	0	0	28	22	13	33	0	0	0	0
5	89	85	89	100	0	0	0	0	33	30	11	43	0	0	0	0
6	85	84	78	93	8	11	11	0	40	21	22	43	0	0	0	0
7	86	81	71	91	21	13	29	9	61	56	86	36	2	5	0	0
8	77	82	63	69	16	12	25	15	49	35	50	54	5	5	0	7
9	90	94	86	85	26	28	29	23	59	44	71	69	10	10	0	13
10	84	88	78	83	32	31	44	25	62	50	79	67	11	10	11	7
11	81	86	86	80	53	50	57	60	66	71	86	70	19	15	11	13
12	80	83	80	100	36	42	60	17	52	50	80	50	12	10	0	13

* The total sample refers to all the caregivers who were interviewed at the mentioned monthly interview. It includes the "compliers" and "non-compliers"

TABLE 28:THE MEAN (SD), MEDIAN AND RANGE IN MILLILITRES OF VOLUME OF FLUIDS GIVEN DAILY (IN ADDITION TO MILK) FROM BIRTH TO TWELVE MONTHS TO THE TOTAL SAMPLE*

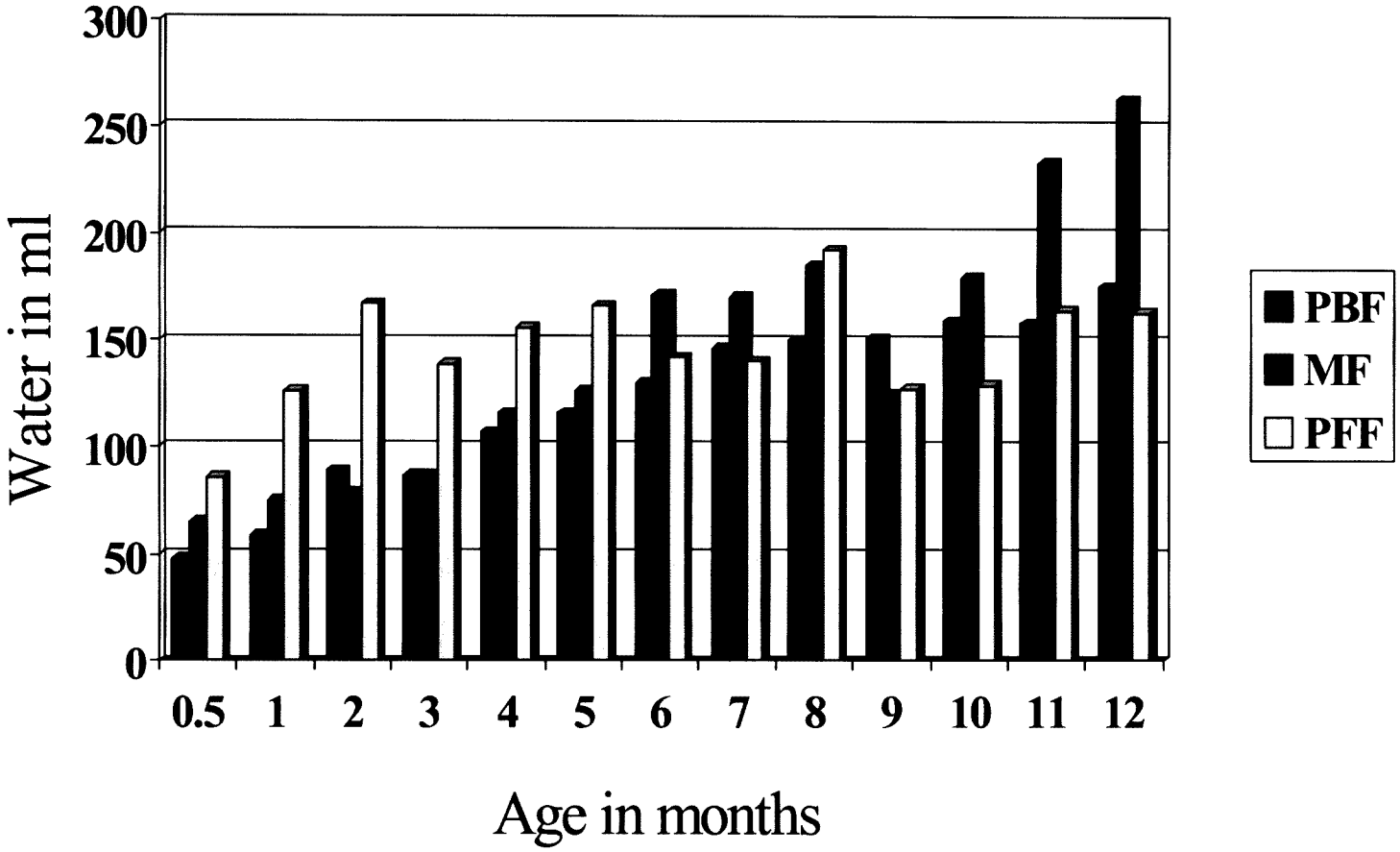
Age in months	Water (mℓ/day)			Tea (mℓ/day)			Juice (mℓ/day)			Cold drink (mℓ/day)		
	Mean (SD)	Median	Range	Mean (SD)	Median	Range	Mean (SD)	Median	Range	Mean (SD)	Median	Range
Birth-1	15 (20)	5	2-75	-	-	-	-	-	-	-	-	-
1	19 (24)	5	3-75	-	-	-	5 (-)	5	5-5	-	-	-
2	19 (36)	5	2-225	-	-	-	15 (12)	15	5-25	-	-	-
3	20 (22)	825	2-75	-	-	-	27 (26)	25	5-75	-	-	-
4	28 (59)	25	2-375	-	-	-	30 (27)	25	2-75	-	-	-
5	30 (60)	25	2-375	-	-	-	18 (18)	25	2-75	-	-	-
6	40 (69)	25	2-375	12 (12)	5	5-25	20 (22)	5	2-75	-	-	-
7	31 (24)	25	2-75	17 (11)	25	2-25	25 (26)	25	2-225	5 (-)	5	5-5
8	39 (74)	25	2-375	20 (28)	5	2-75	41 (55)	25	2-75	64 (87)	64	2-125
9	30 (17)	25	5-75	27 (26)	25	2-75	20 (20)	25	2-75	47 (58)	35	2-125
10	26 (14)	25	2-75	19 (18)	25	2-65	37 (25)	25	2-75	34 (36)	35	2-65
11	23 (9)	25	2-45	45 (87)	25	2-375	92 (47)	125	2-125	35 (50)	6	2-125
12	26 (6)	25	2-35	26 (39)	25	2-125	76 (32)	75	2-125	88 (32)	75	65-125

* The total sample refers to all the caregivers who were interviewed at the mentioned monthly interview. It includes the "compliers" and non-"compliers"

TABLE 29: THE MEAN (SD), MEDIAN AND RANGE OF VOLUME OF WATER IN MILLILITRES (IN ADDITION TO MILK) GIVEN DAILY AT MONTHLY INTERVALS FROM BIRTH TO TWELVE MONTHS IN THE PBF, MF AND PFF GROUPS

Age in months	PBF			MF			PFF			p value
	Mean (SD) (mℓ/day)	Median	Range	Mean (SD) (mℓ/day)	Median	Range	Mean (SD) (mℓ/day)	Median	Range	
Birth-1	48 (32)	50	10-125	65 (34)	50	25-100	86 (66)	75	5-250	0.2925
1	59 (43)	50	50-150	75 (72)	50	25-250	126 (138)	75	35-500	0.6266
2	89 (94)	50	25-350	79 (41)	87.5	10-125	167 (130)	112.5	50-500	0.0978
3	87 (62)	70	5-250	87 (37)	100	10-125	139 (95)	125	25-400	0.3110
4	107 (67)	100	10-250	116 (60)	100	50-250	156 (131)	125	25-500	0.8479
5	116 (63)	100	10-250	126 (74)	125	5-250	166 (127)	125	25-500	0.6212
6	130 (46)	125	75-250	171 (62)	200	100-250	142 (89)	125	25-375	0.4166
7	146 (65)	125	75-250	170 (74)	125	100-250	140 (83)	125	25-250	0.8967
8	150 (75)	125	75-375	185 (93)	250	50-250	192 (105)	200	50-400	0.4281
9	151 (68)	125	65-250	125 (69)	125	50-250	127 (70)	125	25-250	0.6783
10	159 (60)	125	100-250	179 (62)	200	100-250	129 (73)	125	20-250	0.2773
11	158 (61)	125	100-250	223 (120)	225	125-450	164 (75)	125	60-250	0.5481
12	175 (65)	125	125-250	263 (63)	250	200-350	163 (68)	125	100-250	0.1807

FIGURE 13:THE MEAN VOLUME OF WATER IN MILLILITRES GIVEN DAILY FOR PBF, MF AND PFF FROM BIRTH TO TWELVE MONTHS



3.4.4.2 Tea

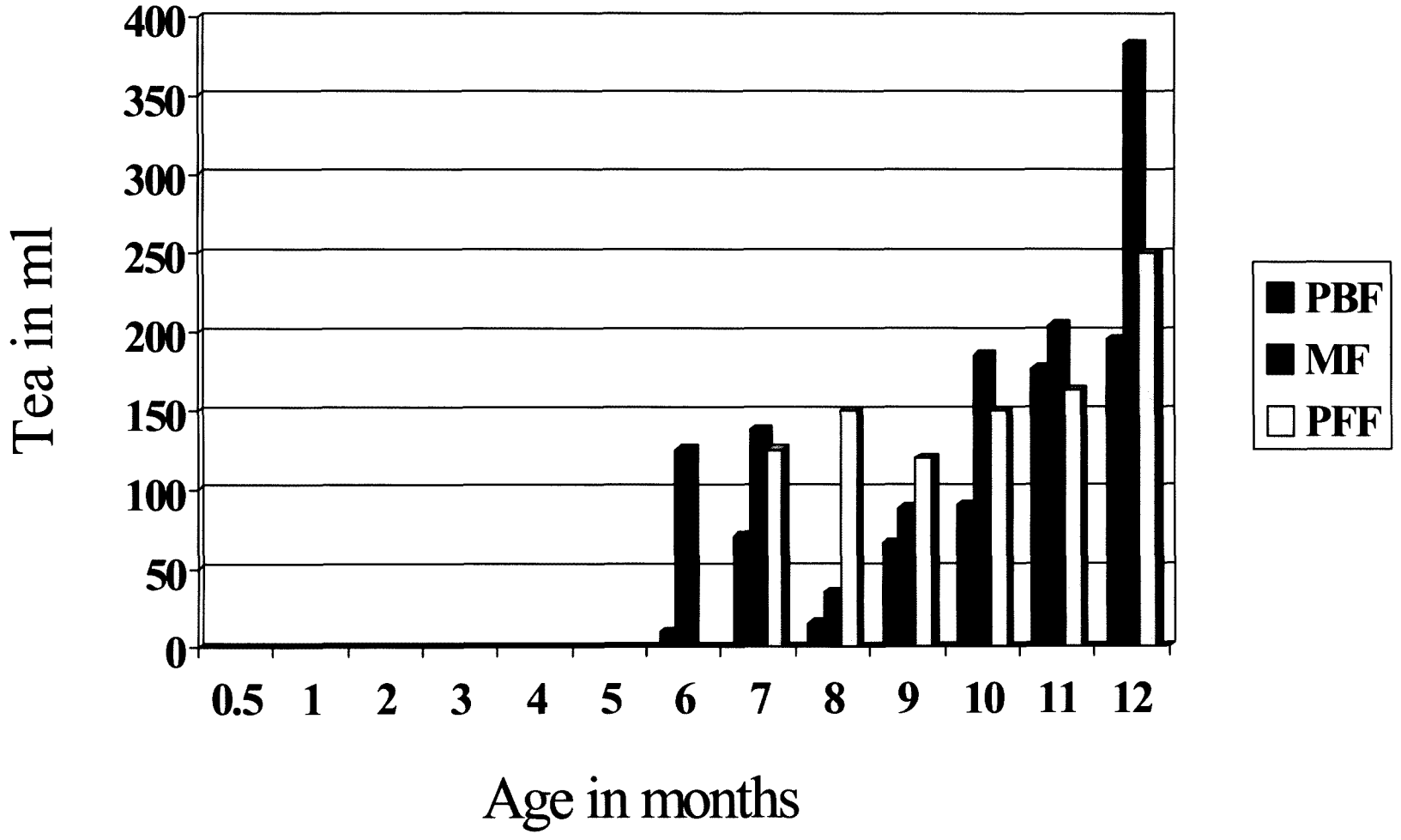
Only a few of the caregivers in the total sample introduced tea to the babies at an early age (Table 26). The first time that tea was introduced to a baby was at four months after birth. One in three caregivers of all the caregivers who were interviewed (total sample) gave tea after the age of 6 months after birth. The mean daily volume of tea intake increased slightly as the babies got older from 12mℓ per day to 46mℓ per day at eleven months after birth (Table 28).

All the caregivers from the "compliers" group introduced tea at seven months (Table 30). The daily volume of tea that was fed to the infants increased with age (Figure 14). The caregivers in the MF group fed larger volumes of tea to the infants than the caregivers in the PBF and PFF groups (Figure 14). The caregivers in the PBF group fed lower volumes of tea per day. These differences were not statistically significant (Table 30).

TABLE 30: THE MEAN (SD), MEDIAN AND RANGE OF VOLUME OF TEA IN MILLILITRES (IN ADDITION TO MILK) GIVEN DAILY AT MONTHLY INTERVALS FROM BIRTH TO TWELVE MONTHS IN THE PBF, MF AND PFF GROUPS

Age in months	PBF			MF			PFF			p value
	Mean (SD) (in mℓ)	Median	Range	Mean (SD) (in mℓ)	Median	Range	Mean (SD) (in mℓ)	Median	Range	
Birth-5	-	-	-	-	-	-	-	-	-	-
6	10 (7)	10	5-15	125 (-)	125	125-125	-	-	-	0.3796
7	70 (78)	70	15-125	138 (18)	138	125-150	125 (-)	125	125-125	0.4705
8	15 (0)	15	15-15	35 (21)	35	20-50	150 (35)	150	125-175	0.1662
9	66 (40)	65	15-125	88 (53)	88	50-125	120 (82)	125	36-200	0.8060
10	90 (95)	60	15-250	185 (212)	95	50-500	150 (43)	125	125-200	0.3074
11	177 (118)	125	50-375	204 (400)	125	65-500	163 (86)	163	30-250	0.6276
12	195 (76)	250	100-250	383 (535)	100	50-1000	250 (-)	250	250-250	0.2349

FIGURE 14:THE MEAN VOLUME OF TEA IN MILLILITRES GIVEN DAILY FOR PBF, MF AND PFF FROM BIRTH TO TWELVE MONTHS



3.4.4.3 Fruit juice

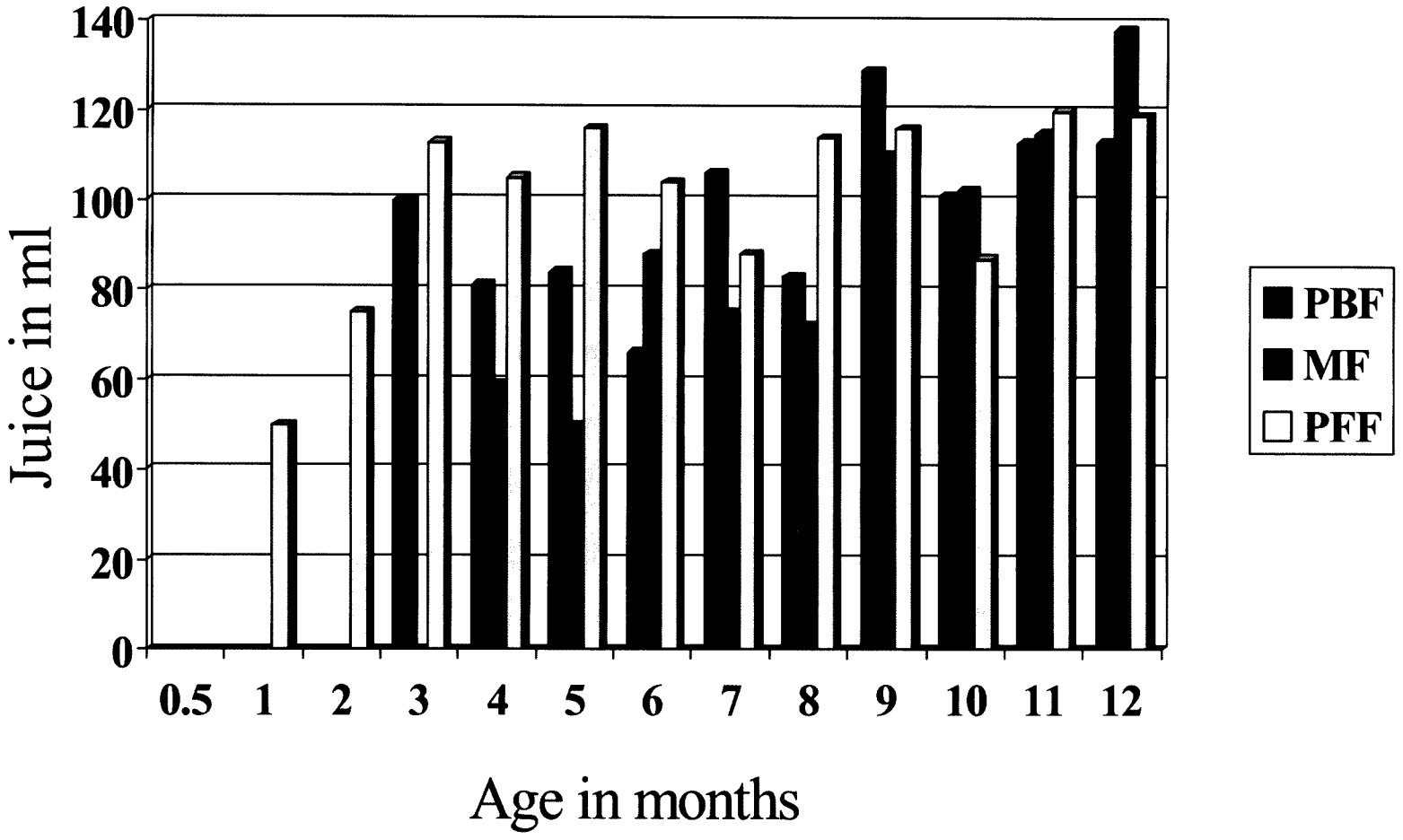
Some caregivers in the total sample introduced juice to the babies' diet at a very early age. The first incidence when a caregiver gave juice was between 1 and 2 months (Table 26). After that, the number of all the caregivers who gave juice increased to a maximum of 65% at one year (Table 26).

The caregivers in the PFF group fed larger volumes of fruit juice to the infants in the group throughout the period of the study. The caregivers in the PBF group fed the smallest volumes of juice. These differences were not statistically significant (Table 31).

TABLE 31: THE MEAN (SD), MEDIAN AND RANGE OF VOLUME OF JUICE IN MILLILITRES (IN ADDITION TO MILK) GIVEN DAILY AT MONTHLY INTERVALS FROM BIRTH TO TWELVE MONTHS IN THE PBF, MF AND PFF GROUPS

Age in months	PBF			MF			PFF			p value
	Mean (SD) (in mℓ)	Median	Range	Mean (SD) (in mℓ)	Median	Range	Mean (SD) (in mℓ)	Median	Range	
Birth-1	-	-	-	-	-	-	-	-	-	-
1	-	-	-	-	-	-	50 (-)	50	50-50	0.3719
2	-	-	-	-	-	-	75 (35)	75	50-100	0.3992
3	100 (-)	100	100-100	-	-	-	113 (18)	112.5	100-125	0.6232
4	81 (43)	88	25-125	59 (-)	50	50-50	105 (48)	125	25-150	0.5989
5	84 (90)	40	25-250	50 (-)	50	50-50	116 (61)	125	25-200	0.6751
6	66 (56)	68	5-125	88 (53)	50	88-125	104 (43)	125	50-150	0.5912
7	106 (29)	125	75-150	75 (32)	50	63-125	88 (43)	88	50-125	0.1646
8	83 (39)	78	20-125	72 (50)	75	14-125	114 (59)	125	50-225	0.4387
9	129 (79)	103	50-250	110 (34)	125	50-125	116 (74)	125	50-250	0.4179
10	101 (22)	100	75-125	102 (42)	125	21-125	87 (32)	70	50-125	0.1201
11	113 (18)	125	80-125	115 (24)	125	65-125	120 (63)	125	65-250	0.2512
12	113 (21)	125	75-125	138 (83)	125	50-250	119 (115)	71	36-250	0.3339

FIGURE 15:THE MEAN VOLUME OF JUICE IN MILLILITRES GIVEN DAILY FOR PBF, MF AND PFF FROM BIRTH TO TWELVE MONTHS



3.4.4.4 Cold drink

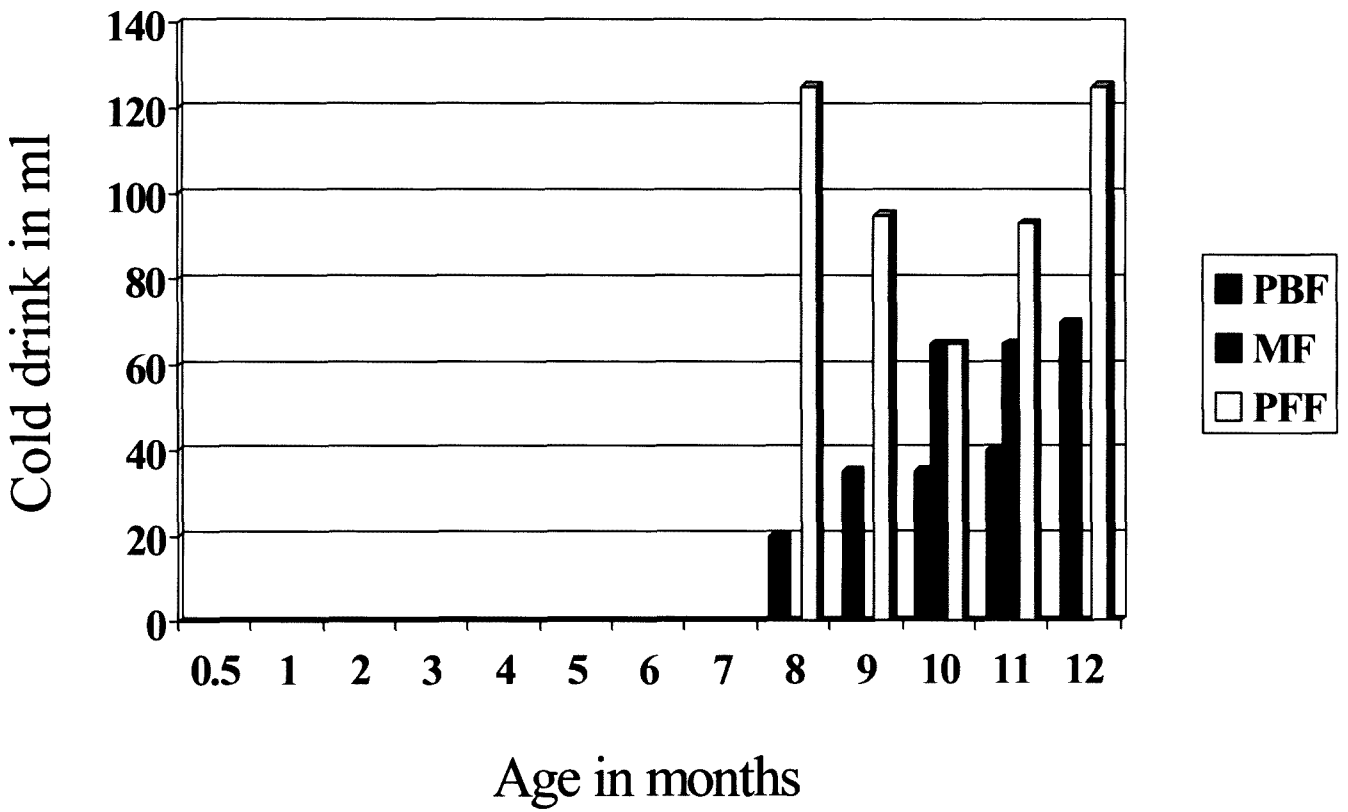
Very few of the caregivers amongst the total sample gave cold drink to their babies before the age of one year (Table 26). One mother gave cold drink to her baby at seven months at 5mℓ per day. From nine months after birth, at least one in ten caregivers gave cold drink to the infants. This doubled to one in five caregivers who gave cold drink to the infants at eleven months.

Amongst the "compliers", cold drink was introduced at eight months for the first time in the PBF and PFF groups at volumes of 20 and 125mℓ (mean) respectively (Table 32). In the MF group, mothers started at ten months to give cold drink. The caregivers in the PFF group fed larger volumes of cold drink to the infants (Figure 16). These differences were not statistically significant (Table 32).

TABLE 32: THE MEAN (SD), MEDIAN AND RANGE OF VOLUME OF COLD DRINK IN MILLILITRES (IN ADDITION TO MILK) GIVEN DAILY AT MONTHLY INTERVALS FROM BIRTH TO TWELVE MONTHS IN THE PBF, MF AND PFF GROUPS

Age in months	PBF			MF			PFF			p value
	Mean (SD) (in mℓ)	Median	Range	Mean (SD) (in mℓ)	Median	Range	Mean (SD) (in mℓ)	Median	Range	
Birth-7	-	-	-	-	-	-	-	-	-	
8	20 (-)	20	20-20	-	-	-	125 (-)	125	125-125	0.5314
9	35 (21)	35	20-50	-	-	-	95 (42)	95	65-125	0.6047
10	35 (21)	35	20-50	65 (-)	65	65-65	65 (-)	65	65-65	0.6326
11	40 (17)	50	20-50	65 (-)	65	65-65	93 (46)	93	60-125	0.3297
12	70 (7)	70	65-75	-	-	-	125 (-)	125	125-125	0.6627

FIGURE 16:THE MEAN VOLUME OF COLD DRINK IN MILLILITRES GIVEN DAILY FOR PBF, MF AND PFF FROM BIRTH TO TWELVE MONTHS



3.4.5 Solid foods

3.4.5.1 Age of introduction of complementary foods

Introduction of complementary foods started at a very early age in this community. At the second interview, at the age of one month after birth, 15 (24%) of the 62 caregivers in the total sample had started to give porridge to the infants. At the age of two months, this figure doubled to 29 (48%) out of 60 caregivers who had given porridge to the infants. At the age of four months after birth, 54 of the 57 (95%) caregivers in the total sample had given porridge to the infants.

At the age of three months, 50% of the caregivers in the PBF group had introduced porridge to the infants' diets. At the age of two months, 50% of the caregivers in both the MF and PFF groups had introduced porridge to the infants' diets. These differences in age of introduction of porridge to the infants' diets were statistically significant (p=0.003). Therefore, the early introduction of porridge to the diet might have contributed to a shorter duration of breastfeeding.

At the third interview, at the age of two months after birth, 15% of the caregivers in the total sample had started to give vegetables to the infants. At the age of three months, this figure more than doubled to 40% (n=23) of the caregivers in the total sample who had given vegetables to the infants. At the age of four months after birth, the percentage increased to 75 and at six months after birth to 96.

At the age of four months, 50% of the caregivers in the PBF group had introduced vegetables to the infants' diets. At the age of three months, 50% of the caregivers in both the MF and PFF groups had introduced vegetables to the infants' diets. These differences in age of introduction of vegetables to the infants' diets were statistically significant (p=0.0262). The early introduction of vegetables to the diet might have contributed to a shorter duration of breastfeeding.

At the second interview, at the age of one month after birth, 3% of the caregivers in the total sample had started to give fruit to the infants. At the age of two months after birth, 15% (n=9) of the caregivers had given fruit to the infants. At the age of three months after birth, the percentage increased to 40 and at six months after birth to 96.

At the age of 5 months, 50% of the caregivers in the PBF, MF and PFF groups had introduced fruit to the infants' diets. The differences in age of introduction of fruit to the infants' diets were not statistically significant ($p=0.3213$).

The age at which complementary foods were given did not affect the growth of the infants.

Time significantly affected HAZ ($p<0.0001$) but not WAZ ($p=0.7805$) when the age at which complementary foods was given, was considered.

3.4.5.2 Feeding practices associated with porridge

The majority of the caregivers in the total sample who fed porridge to the infants, started off by giving porridge more than once a day. At one month after birth, the caregivers fed porridge once a day [(mean: 1.1) (SD: 0.35)] with a range of 1–2 times daily. This increased up until 5 months after birth, when the mean number of daily meals that consisted of porridge exceeded once a day [(mean: 1.5) (SD: 0.67)] with a median of 1 and a range of between 1 and 3 times daily. Thereafter, presumably as the variety of the diet increased, the frequency of giving porridge to the infants decreased to a mean of about once a day (Table 33).

The mean number of times that the caregivers gave porridge in the PFF group was 1.7. The caregivers in the PBF and MF groups who fed porridge to the infants, did so only once a day and it differed significantly between the PFF and MF and PBF groups [(p=0.0309) (Table 34)]. At two months, caregivers in all three groups gave porridge once to twice daily and at three months, caregivers in the PBF and MF groups gave porridge about twice daily, and caregivers in the PFF group gave porridge about once a day [(p=0.0012) (Table 34)]. After three months, the frequency of giving porridge to the infants was about once a day in the PBF, MF and PFF groups with no significant differences between the three groups (Table 34).

The majority of mothers in the total sample prepared the porridge correctly (according to directions on the package). Although not the majority of caregivers, a large number of caregivers prepared it wrongly (i.e. used water instead of milk, or used milk instead of water) (Table 33). From nine months of age onwards, more than 40% of mothers prepared the porridge incorrectly. At eleven months, only 40% prepared the porridge correctly and at twelve months, only 25% of caregivers prepared the porridge correctly.

The caregivers did not add extra fat to the porridge which was fed to the infants before the age of three months. At all age intervals and compared to fat, a greater percentage of caregivers added sugar to the porridge. Of the caregivers who gave porridge to the infants, the number of them who added sugar to the porridge increased as the infants grew older. Less than a third of the caregivers who fed porridge to the infants added fat to the porridge (Table 33).

TABLE 33: FEEDING PRACTICES ASSOCIATED WITH PORRIDGE FED BY CAREGIVERS IN THE TOTAL SAMPLE*

Age in months	Number of caregivers who fed porridge	Daily frequency of feeding porridge Mean (SD)	Median (range)	Preparation of porridge: n (%) correctly prepared according to directions on the package	Adding energy to the porridge: n (%) of total sample* who fed porridge	
					Sugar	Fat
Birth-1	1	1.1	1 (1-1)	1 (100)	1 (100)	0
1	15	1.5 (0.35)	1 (1-2)	14 (93)	6 (40)	0
2	29	1.5 (0.63)	1 (1-3)	25 (86)	11 (38)	0
3	41	1.5 (0.55)	1 (1-3 0	35 (85)	5 (12)	2 (5)
4	54	1.5 (0.66)	1 (1-3)	41 (76)	10 (19)	4 (7)
5	52	1.4 (0.67)	1 (1-3)	40 (77)	13 (25)	3 (6)
6	51	1.4 (0.67)	1 (1-4)	36 (71)	15 (29)	2 (4)
7	42	1.3 (0.62)	1 (1-3)	32 (76)	12 (29)	2 (5)
8	42	1.1 (0.50)	1 (1-3)	29 (69)	21 (50)	5 (12)
9	37	1.1 (0.32)	1 (1-2)	21 (57)	22 (59)	8 (22)
10	34	1.1 (0.31)	1 (1-2)	15 (44)	24 (71)	11 (32)
11	30	1.1 (0.20)	1 (1-2)	12 (40)	19 (63)	6 (20)
12	20	1.1 (0.25)	1 (1-2)	2 (10)	8 (40)	7 (35)

* The total sample refers to all the caregivers who were interviewed at the mentioned monthly interview. It includes the "compliers" and "non-compliers"

TABLE 34: THE DAILY FREQUENCY (IN NUMBER OF PORRIDGE MEALS) OF FEEDING PORRIDGE TO THE INFANTS IN THE PBF, MF AND PFF GROUPS FROM BIRTH TO TWELVE MONTHS AS MEAN (SD) AND MEDIAN (RANGE).

Age in months	PBF		MF		PFF		p value
	Mean (SD)	Median (range)	Mean (SD)	Median (range)	Mean (SD)	Median (range)	
Birth-1	0		0		0		n/a
1	1.0 (0.0)	1 (1-1)	1.0 (0.00)	1 (1-1)	1.7 (0.58)	2 (1-2)	0.0309
2	1.3 (0.50)	1 (1-2)	1.4 (0.53)	1 (1-2)	1.4 (0.53)	1 (1-2)	0.0567
3	1.6 (0.53)	2 (1-2)	1.8 (0.45)	2 (1-2)	1.2 (0.43)	1 (1-2)	0.0012
4	1.5 (0.72)	1 (1-3)	1.6 (0.53)	2 (1-2)	1.3 (0.59)	1 (1-3)	0.1130
5	1.5 (0.70)	1 (1-3)	1.4 (0.53)	1 (1-2)	1.2 (0.58)	1 (1-3)	0.4217
6	1.4 (0.61)	1 (1-3)	1.6 (0.73)	1 (1-3)	1.2 (0.38)	1 (1-2)	0.6622
7	1.4 (0.65)	1 (1-3)	1.3 (0.76)	1 (1-3)	1.2 (0.40)	1 (1-2)	0.6543
8	1.2 (0.40)	1 (1-2)	1.1(0.35)	1 (1-2)	1.3 (0.48)	1 (1-2)	0.8033
9	1.1 (0.240	1 (1-2)	1.0 (0.00)	1 (1-1)	1.2 (0.44)	1 (1-2)	0.3021
10	1.0 (0.00)	1 (1-1)	1.1 (0.42)	1 (0.5-2)	1.2 (0.40)	1 (1-2)	0.4437
11	1.0 (0.13)	1 (1-1.5)	1.0 (0.00)	1 (1-1)	1.1 (0.33)	1 (1-2)	0.6638
12	1.0 (0.15)	1 (1-1.5)	1.0(0.00)	1 (1-1)	1.2 (0.45)	1 (1-2)	0.6479

3.4.5.3 Feeding practices associated with vegetables

When the caregivers in the total sample introduced vegetables to the infants' diets, the majority of the infants (67%) received the vegetables at least once a day. A third of the caregivers did so only 1 to 3 days per week, but the older the babies grew, they were given their vegetables more regularly, once a day (Table 35). From 6 months of age onwards, there were still about 10% of the infants who did not receive vegetables on a daily basis.

The caregivers in the PBF, MF and PFF groups who fed vegetables daily to the infants increased gradually from two to nine months of age after birth. Thereafter the percentage of caregivers in all three these groups who gave vegetables on a daily basis to the infants dropped to less than 50% in all three the groups with the PFF group being the least with 33% of caregivers who gave vegetables daily. None of these differences between the three groups were statistically significant throughout the twelve-month period of follow-up (Table 36).

Only three caregivers gave vegetables to the infant at the age of 1 month after birth. These caregivers also added sugar to the vegetables. From six months after birth and onwards, at least half of the caregivers who gave vegetables, added sugar and fat to the vegetables (Table 35).

At first, caregivers did not add any salt when they prepared the babies' vegetables (Table 35). From the age of 2 months after birth and onwards, more caregivers added salt to the babies' vegetables. At one year, 87% of mothers who gave vegetables, added salt to the vegetables.

TABLE 35: THE NUMBER OF INFANTS FROM THE TOTAL SAMPLE WHO RECEIVED VEGETABLES AND THE FREQUENCY OF FEEDING VEGETABLES AND ADDING ADDITIONAL SALT AND ENERGY TO VEGETABLES AS A PERCENTAGE OF THE INFANTS IN THE TOTAL SAMPLE* WHO RECEIVED VEGETABLES FROM BIRTH TO TWELVE MONTHS

Age in months	Number of infants who received vegetables	Frequency		Adding salt n (%)	Adding energy	
		Daily n (%)	Less than once a day n (%)		Sugar n (%)	Fat n (%)
Birth-1	0	0	0	0	0	0
1	3	2 (67)	1 (33)	0	3 (100)	0
2	9	7 (78)	2 (22)	3 (33)	4 (44)	4 (44)
3	23	19 (83)	4 (17)	7 (30)	8 (35)	9 (40)
4	43	35 (81)	8 (19)	15 (34)	18 (42)	25 (59)
5	47	37 (79)	10 (21)	19 (41)	19 (41)	28 (59)
6	51	46 (90)	5 (10)	25 (49)	31 (61)	36 (71)
7	43	37 (86)	6 (14)	25 (58)	24 (56)	31 (72)
8	42	39 (93)	3 (7)	26 (62)	29 (70)	32 (76)
9	38	36 (95)	2 (5)	28 (74)	25 (66)	31 (82)
10	36	32 (89)	4 (11)	29 (81)	25 (70)	28 (79)
11	31	28 (90)	3 (10)	15 (84)	20 (63)	21 (69)
12	24	19 (76)	5 (12)	21 (87)	19 (78)	21 (87)

- The total sample refers to all the caregivers who were interviewed at the mentioned monthly interview. It includes the "compliers" and "non-compliers"

TABLE 36: THE NUMBER (percentage in parenthesis) OF CAREGIVERS IN THE PBF, MF AND PFF GROUPS WHO FED VEGETABLES DAILY FROM BIRTH TO TWELVE MONTHS AND THE MEAN (SD) OF NUMBER OF TIMES THAT THE INFANTS IN THE PBF, MF AND PFF GROUPS RECEIVED VEGETABLES PER DAY.

Age in months	PBF		MF		PFF		p value
	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)	
Birth-1	0	0	0	0	0	0	n/a
1	0	0	1 (11)	0.4 (1.01)	0	0	0.0863
2	3 (15)	0.2 (0.37)	1 (11)	0.4 (1.01)	1 (7)	0.2 (0.56)	0.3796
3	5 (25)	0.5 (1.14)	1 (11)	0.3 (0.70)	8 (53)	0.7 (0.62)	0.2004
4	11 (60)	0.7 (0.57)	2 (22)	0.4 (0.73)	8 (53)	1.5 (1.19)	0.0674
5	14 (70)	1.2 (0.87)	5 (56)	1.4 (1.01)	9 (67)	1.4 (0.91)	0.8270
6	14 (80)	1.1 (0.60)	7 (78)	1.0 (0.50)	12 (87)	1.1 (0.59)	0.8864
7	10 (60)	1.1 (0.76)	5 (78)	0.8 (0.44)	7 (67)	0.8 (0.56	0.7636
8	14 (80)	0.9 (0.45)	6 (78)	0.8 (0.44)	10 (80)	0.9 (0.460	0.9289
9	15 (85)	1.0 (0.39)	4 (56)	0.9 (0.93)	11 (87)	0.9 (0.35)	0.2288
10	12 (75)	0.9 (0.49)	6 (67)	1.2 (0.83)	9 (70)	0.9 (0.70)	0.7001
11	11 (75)	0.8 (0.44)	4 (56)	0.9 (0.93)	5 (50)	0.8 (0.68)	0.1875
12	7 (54)	1.4 (0.87)	2 (44)	1.4 (0.89)	2 (33)	2.0 (1.73)	0.3260

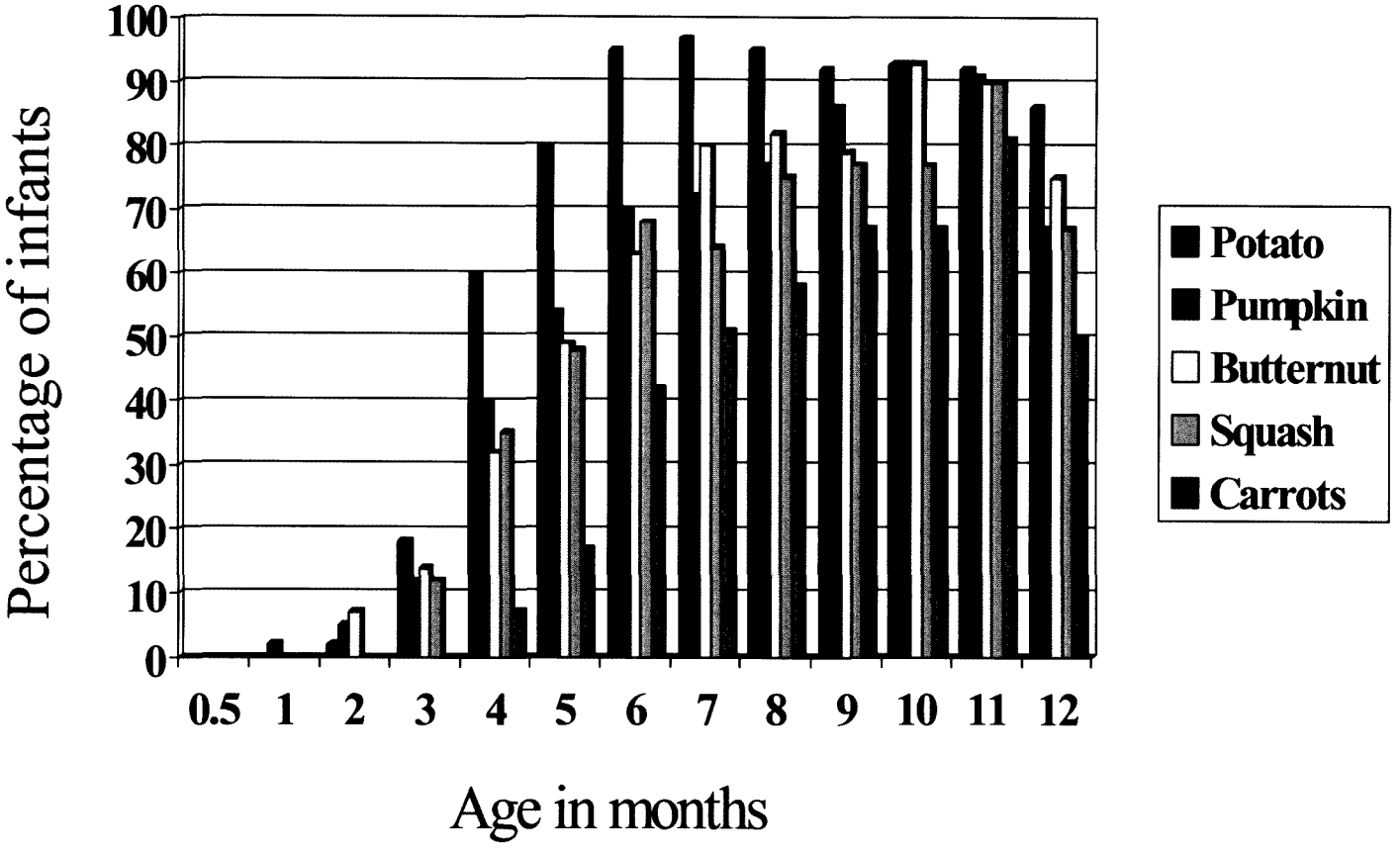
At one and two months after birth, the infants who had been introduced to vegetables, received pumpkin and butternut. From the age of four months after birth and onwards, potatoes were given by more than half of the caregivers in the total sample at each interview (Table 37) (Figure 17). Pumpkin, butternut and squash were given by the caregivers in more or less equal percentages from the age of three months after birth, and onwards. Very few of the caregivers gave carrots to the infants before six months after birth. For the duration of the study, carrots were always the vegetable that was fed by the least of the caregivers and potatoes was fed more than any other vegetable by most of the caregivers in the total sample.

TABLE 37: THE PERCENTAGE OF INFANTS IN THE TOTAL SAMPLE* WHO RECEIVED THE VARIOUS VEGETABLES FROM BIRTH TO TWELVE MONTHS

Age in months	Number of respondents interviewed	Potato (%)	Pumpkin (%)	Butternut (%)	Squash (%)	Carrots (%)	Jars (%)	Family meals (%)
Birth-1	73	0	0	0	0	0	0	0
1	62	0	2	0	0	0	3	0
2	60	2	5	7	0	0	3	0
3	59	18	12	14	12	0	25	0
4	57	60	40	32	35	7	40	0
5	54	80	54	49	48	17	48	0
6	53	95	70	63	68	42	43	0
7	44	97	72	80	64	51	43	14
8	43	95	77	82	75	58	32	48
9	39	92	86	79	77	67	31	64
10	38	93	93	93	77	67	30	62
11	32	92	91	90	90	81	22	66
12	25	86	67	75	67	50	4	80

* The total sample refers to all the caregivers who were interviewed at the mentioned monthly interview. It includes the "compliers" and "non-compliers"

FIGURE 17: THE PERCENTAGE OF INFANTS IN THE TOTAL SAMPLE* WHO RECEIVED THE VARIOUS VEGETABLES FROM BIRTH TO TWELVE MONTHS



3.4.5.4 Feeding practices associated with fruit

When the caregivers in the total sample introduced fruit to the infants' diets, more than half of the infants received the fruit less than once a day until the age of twelve months after birth, except at two, three and five months (Table 38). Only about 45% of the infants in the total sample who ate fruit, received a portion of fruit once a day from the age of six months after birth and onwards. Although mothers introduced fruit at an early stage to the babies' diets, they did not feed it to them frequently.

The caregivers in the PBF, MF and PFF groups gradually increased the daily feeding of fruit to the infants from around four to nine months of age after birth. The caregivers in all three of these groups who fed fruit daily to the infants, gradually decreased to less than 30% at the age of twelve months after birth. Differences between the PBF, MF and PFF groups in the daily frequency of feeding fruit were statistically not significant (Table 39).

Bananas were the caregivers' first choice of fruit to introduce to the babies' diets as 11 (20%) of the infants in the total sample at the age of four months received bananas compared to 1 (2%) who received oranges and 3 (5%) received apples at this age. Throughout the period of the study, it seemed as if bananas were given more than any other fruit. During the winter season, more caregivers started to feed oranges. Naartjies and guavas were also given during the winter season, but not by many caregivers. Very few babies ate a variety of fruit at the age of one year. Caregivers also liked to feed from jars. At the age of 4 months, 28 (50%) of the caregivers fed fruit from jars, but at 9 months, 15 (40%) of the caregivers fed the babies from jars (Table 40).

TABLE 38: THE NUMBER OF INFANTS FROM THE TOTAL SAMPLE WHO RECEIVED FRUIT AND THE FREQUENCY OF FEEDING FRUIT AS A PERCENTAGE OF THE INFANTS IN THE TOTAL SAMPLE* WHO RECEIVED FRUIT FROM BIRTH TO TWELVE MONTHS

Age in months	Number of infants who received fruit	Daily n (%)	< 1/day n (%)	Don't know n (%)
Birth-1	0	0	0	0
1	2	2 (100)	0	0
2	7	5 (71)	2 (29)	0
3	16	9 (56)	4 (25)	3 (19)
4	34	15 (44)	18 (51)	1 (3)
5	37	22 (59)	14 (39)	1 (3)
6	44	19 (43)	24 (55)	1 (2)
7	42	19 (45)	21 (50)	0
8	41	20 (49)	20 (49)	0
9	39	15 (38)	24 (61)	0
10	35	13 (37)	22 (63)	0
11	30	14 (47)	16 (53)	0
12	25	11 (44)	13 (52)	1 (4)

* The total sample refers to all the caregivers who were interviewed at the mentioned monthly interview. It includes the "compliers" and "non-compliers"

TABLE 39: THE NUMBER OF CAREGIVERS IN THE PBF, MF AND PFF GROUPS WHO FED FRUIT DAILY FROM BIRTH TO TWELVE MONTHS AND THE MEAN (SD) OF NUMBER OF TIMES THAT THE INFANTS IN THE "COMPLIERS" GROUP RECEIVED FRUIT PER DAY.

Age in months	PBF		MF		PFF		p value
	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)	
Birth-2	0	0	0	0	0	0	n/a
3	1 (5)	0.3 (0.80)	0	0.2 (0.67)	4 (27)	0.4 (0.63)	0.3346
4	5 (25)	1.0 (0.89)	3 (33)	0.3 (0.50)	4 (27)	0.8 (0.86)	0.3851
5	7 (35)	1.0 (0.83)	4 (44)	0.9 (0.78)	7 (53)	0.9 (0.70)	0.8707
6	6 (35)	1.2 (0.81)	4 (44)	1.1 (0.78)	5 (33)	1.1 (0.83)	0.9873
7	6 (35)	1.3 (0.79)	2 (33)	1.2 (0.83)	4 (40)	0.8 (0.77)	0.5368
8	4 (25)	1.4 (0.81)	4 (44)	1.1 (0.78)	8 (60)	1.1 (0.64)	0.3136
9	5 (30)	1.5 (0.69)	2 (33)	1.2 (0.83)	5 (40)	1.3 (0.72)	0.8513
10	2 (15)	1.4 (0.89)	5 (56)	1.4 (0.53)	4 (33)	1.1 (0.83)	0.1557
11	5 (30)	1.1 (0.85)	3 (44)	1.1 (0.78)	3 (27)	0.9 (0.88)	0.8568
12	3 (25)	1.1 (0.89)	1 (22)	0.9 (0.93)	2 (27)	0.7 (0.96)	0.5740

TABLE 40: THE PERCENTAGE OF INFANTS IN THE TOTAL SAMPLE* WHO RECEIVED THE VARIOUS FRUITS FROM BIRTH TO TWELVE MONTHS

Age in months	Number of respondents interviewed	Banana (%)	Orange (%)	Apple (%)	Pawpaw (%)	Jars (%)	Naartjie (%)	Guava (%)	All (%)
Birth-1	73	0	0	0	0	0	0	0	0
1	62	0	0	0	0	3	0	0	0
2	60	0	0	2	0	10	0	0	0
3	59	2	0	2	0	24	0	0	0
4	57	20	2	5	0	50	0	0	0
5	54	30	2	4	0	53	4	0	0
6	53	64	15	6	0	48	8	0	0
7	44	72	49	23	2	54	14	0	2
8	43	76	64	12	2	45	0	2	5
9	39	82	74	42	3	40	16	3	11
10	38	67	72	53	22	8	14	3	11
11	32	81	74	74	0	16	3	3	13
12	25	75	67	50	0	4	0	0	17

* The total sample refers to all the caregivers who were interviewed at the mentioned monthly interview. It includes the "compliers" and "non-compliers"

3.4.5.6 Age of introduction of other complementary foods to the diet

A few of the caregivers in the total sample started between five and six months to introduce protein and iron sources to the weaning diet (Table 41). As the infants grew older, more variety was added to the diet in terms of protein and iron sources. At the age of one year, 96% of the infants in the total sample ate meat, chicken and eggs regularly. About 90% of all the caregivers gave fish regularly to the infants.

In the total sample, brown bread and pasta were given to the infants by two caregivers from as early as the first interview, which was within two weeks after birth (Table 41). Almost one in four infants in the total sample had white bread to eat at the age of five months after birth. White bread was the most popular grain used by the caregivers in the total sample to feed the infants. Pasta was the second choice of grains that the caregivers used to feed the infants. Brown bread was the least popular choice by the caregivers in the total sample to feed the infants.

A few of the caregivers (4%) in the total sample started giving peanut butter from before the age of one month after birth (Table 41). The other caregivers in the total sample only started giving peanut butter at the age of six months after birth. An increasing number of mothers gave peanut butter after the age of six months after birth and at the age of one year after birth, 71% of the caregivers gave peanut butter to the infants.

The caregivers in the total sample gave sweets, chips and biscuits to the infants at a very early age (Table 42). The earliest introduction of these products to the diets of the infants was at the age of three months after birth. At the age of five months after birth, more than one in three infants already ate chips. At the age of six months after birth, more than 60% ate chips and biscuits as part of their weaning diet. At the age of one year after birth, 100% of the infants in the total sample ate chips, biscuits, chocolate and sweets regularly.

TABLE 41: THE PERCENTAGE OF INFANTS IN THE TOTAL SAMPLE* WHO RECEIVED PROTEIN SOURCES AND GRAINS AS PART OF THE WEANING DIET FROM BIRTH TO TWELVE MONTHS

Age in months	Number of respondents interviewed	Protein sources (%)						Grains (%)			
		Meat	Chicken	Fish	Egg yolk	Egg white	Peanut butter	White bread	Brown bread	Rice	Pasta
Birth-1	73	0	0	0	0	0	4	0	1	0	1
1	62	0	0	0	0	0	5	0	1	0	1
2	60	0	0	0	0	0	5	1	0	0	0
3	59	0	0	0	0	0	5	1	0	0	1
4	57	2	0	0	4	0	4	2	1	1	1
5	54	4	2	9	17	17	8	13	0	2	0
6	53	30	28	26	34	30	23	28	4	10	10
7	44	50	59	41	57	55	30	25	8	10	12
8	43	58	63	56	65	67	50	35	23	22	26
9	39	69	69	74	77	77	61	51	45	45	46
10	38	82	82	82	87	87	78	64	54	59	58
11	32	97	97	91	97	97	81	57	53	54	57
12	25	96	96	96	96	96	71	76	72	72	74

The total sample refers to all the caregivers who were interviewed at the mentioned monthly interview. It includes the "compliers" and "non-compliers"

TABLE 42: THE PERCENTAGE OF INFANTS IN THE TOTAL SAMPLE* WHO RECEIVED SWEETS AS PART OF THE WEANING DIET FROM BIRTH TO TWELVE MONTHS

Age in months	Number of respondents interviewed	Sweets %	Chips %	Chocolate %	Biscuits %
Birth-1	73	0	0	0	0
1	62	0	0	0	0
2	60	0	0	0	0
3	59	0	2	2	3
4	57	4	9	0	7
5	54	2	36	21	19
6	53	29	65	33	71
7	44	51	74	47	81
8	43	86	76	67	88
9	39	84	92	82	97
10	38	83	97	83	97
11	32	94	94	94	97
12	25	100	100	100	100

* The total sample refers to all the caregivers who were interviewed at the mentioned monthly interview. It includes the "compliers" and non-"compliers"

3.4.6 Meals

3.4.6.1 Number of daily meals and mealtimes

There was a question on the different times during the day that the infant had his/her meals. Table 43 summarises the times of day that more than 50% of the infants in the total sample, who received solid foods, received their first, second, third, fourth and fifth meals during the day from birth to twelve months. It was only realised during the analysis of the data that the format of the question was not appropriate to determine the number of meals that the infant had received per day. However, Table 43 indicates (with the exception of the age of three and four months after birth) that more than 50% of the caregivers who fed solid foods to the infants gave the first meal after 9 am and before 11 am. The second meal of the day was usually between 11 am and 2 pm. The third meal of the day was usually between 2 pm and 4 pm and the fourth meal between 4 and 7 pm. Before the age of one year, none of the infants received a fifth meal.

At the last interview, one respondent did not know how many times per day and at what time the baby ate. This person was not the caregiver and could therefore not give accurate information.

TABLE 43: THE TIMES OF DAY AT WHICH MORE THAN 50% OF THE INFANTS IN THE TOTAL SAMPLE* WHO RECEIVED SOLID FOODS HAD THEIR DAILY MEALS

Age in months	Time of 1st meal	Time of 2nd meal	Time of 3rd meal	Time of 4th meal	Time of 5th meal
Birth-1	6-9 am	none	none	none	none
1	9-11 am	4-7 pm	none	none	none
2	9-11 am	11-2 pm	4-7 pm	none	none
3	6-9 am	11-2 pm	2-4 pm and 4-7 pm	4-7 pm	none
4	6-9 am	11-2 pm	2-4 pm	4-7 pm	none
5	9-11 am	11-2 pm	2-4 pm and 4-7 pm	4-7 pm	none
6	9-11 am	11-2 pm	2-4 pm	4-7 pm	none
7	9-11 am	11-2 pm	4-7 pm	4-7 pm	none
8	9-11 am	11-2 pm	2-4 pm	4-7 pm	none
9	9-11 am	11-2 pm	2-4 pm	4-7 pm	none
10	9-11 am	11-2 pm	4-7 pm	4-7 pm	none
11	9-11 am	11-2 pm	4-7 pm	4-7 pm	none
12	6-9 am	11-2 pm	4-7 pm	4-7 pm	2-4 pm

* The total sample refers to all the caregivers who were interviewed at the mentioned monthly interview. It includes the "compliers" and "non-compliers"

3.4.6.2 Place of meals

In the majority of cases, meals were eaten at home at least twice daily (Table 44). As the babies grew older, more of them had their meals with the family. Some started having meals at the day care center at the age of 2-3 months after birth.

3.4.6.3 Person feeding the baby

In the majority of cases, meals were given by the parents (Table 45), which was in line with information in the above paragraph, that meals were eaten at home. As the babies grew older, more of them were fed by various people: a combination of parents, family and day care. Siblings did not feed any of the babies during the study. At the final interview, someone other than the usual caregiver brought the baby for follow-up, and did not know who fed the baby.

TABLE 44: THE PLACE AT WHICH AT LEAST TWO DAILY MEALS WERE EATEN AS A PERCENTAGE OF THE TOTAL SAMPLE* AT EACH AGE INTERVAL

Age in months	Number of respondents interviewed	Home (%)	Family (%)	Day care (%)
Birth-1	73	50.0	0.0	0.0
1	62	21.4	0.0	0.0
2	60	50.0	3.3	6.7
3	59	60.0	6.7	6.7
4	57	71.7	7.5	7.5
5	54	75.0	9.6	7.7
6	53	78.8	9.6	9.6
7	44	78.3	15.2	6.5
8	43	77.8	17.8	4.4
9	39	71.8	23.1	5.1
10	38	73.7	18.4	7.9
11	32	66.7	24.2	9.1
12	25	66.7	22.2	11.1

* The total sample refers to all the caregivers who were interviewed at the mentioned monthly interview. It includes the "compliers" and "non-compliers"

Percentages do not add up to 100 for the interviews between birth and one month and 7 months after birth because not all the respondents ate at least two meals per day at the time of those interviews.

TABLE 45: THE PEOPLE RESPONSIBLE FOR FEEDING THE INFANT AT EACH INTERVIEW FROM BIRTH TO TWELVE MONTHS AS A PERCENTAGE OF INFANTS IN THE TOTAL SAMPLE*

Age in months	Number of respondents interviewed	Parents	Family	Day care	Combination
Birth-1	73	75.0	25.0	0.0	0.0
1	62	75.0	16.7	8.3	0.0
2	60	79.3	3.4	13.8	3.4
3	59	57.8	17.8	8.9	15.6
4	57	63.0	13.0	13.0	11.1
5	54	56.6	17.0	13.2	13.2
6	53	52.8	20.8	13.2	13.2
7	44	56.8	20.5	13.6	9.1
8	43	51.2	20.9	7.0	20.9
9	39	43.6	23.1	7.7	25.6
10	38	43.2	24.3	5.4	27.0
11	32	34.4	21.9	9.4	34.4
12	25	45.8	20.8	8.3	25.0

* The total sample refers to all the caregivers who were interviewed at the mentioned monthly interview. It includes the "compliers" and "non-compliers"

CHAPTER 4

DISCUSSION

4.1 INTRODUCTION

The aim of this study was to identify feeding practices in a poor socio-economic status community that could contribute to the development of malnutrition. Most of the socio-economic and demographic factors did not influence the growth or the feeding practices of the infants. However, the number of people per house and the number of children of the mother were significantly lower amongst the mothers in the MF group. There was also a significant correlation between the father's education and the HAZ over time. Descriptive statistics showed that breastfeeding and weaning practices were not in line with national and global recommendations, but compared well with other local studies on breastfeeding and weaning practices. Weight-for-age Z-scores dropped significantly within subjects from birth to twelve months after birth, with the decrease in WAZ beginning at around four months after birth. At this age, almost all the infants had been introduced to complementary foods already, despite the national recommendation that weaning should only start at about six months after birth.[73] The incidence and duration of exclusive breastfeeding was extremely low. The duration of feeding breastmilk only (with or without complementary foods) was limited. Many of the mothers thought that they did not have enough breastmilk and therefore they began to feed an infant formula in addition to breastmilk. About 20% of mothers were feeding breastmilk only (with or without complementary foods) after the age of four months after birth. Weaning started from within one month after birth and by the age of four months after birth, all the infants, with the exception of two (4%), had received some kind of complementary food. None of the infants had received five daily meals at the age of one year after birth in order to ensure an adequate energy and nutrient intake at this critical stage of fast growth and development in an infant's life. Complementary foods were not always prepared correctly (according to instructions on the package) and choices of complementary foods were often not nutrient dense. This could therefore have contributed to an inadequate dietary intake, which is also known as an immediate cause of malnutrition. Mothers' knowledge or attitudes were not determined in this study, but one could assume that inadequate mother and child care, (which include mothers' lack of knowledge) could possibly be the underlying causes that could lead to an inadequate dietary intake and eventually contribute to the development of malnutrition in this community.

4.2 STUDY DESIGN

Because there was a hypothesis to be tested, it was decided to make use of a cohort study design. The data that was collected referred to different points in time, and therefore this study was longitudinal. The cohort study design can be applied to investigate causes of disease, as well as to test various causes of disease (causes of malnutrition in this case). Furthermore, the chosen design is very good at measuring time relationship and incidence directly.[71] The subjects were selected on the basis of whether they were exposed to the "risk factor" (various feeding practices and different socio-economic circumstances that could contribute to the development of malnutrition) and were then followed to determine the growth of the infants. In this case, the initial independent variables (also known as risk factors) were feeding practices (including choice of feeding, duration of breastfeeding, age of introduction of complementary foods and type of complementary foods) and socio-economic factors (including access to water and electricity, household income, size of the family, mother's age, mother's marital status, mother and father's level of education and mother's smoking status). The dependent variables (also known as outcome or response variables) were weight-for-age, weight-for-height and height-for-age Z-scores from birth to twelve months. The Repeated Measures of Analysis of Variance Test of Hypothesis for Within Subjects made it possible to look at changes that took place *during* the follow-up period (also referred to as changes *within subjects* in the results section). This was one of the greatest advantages of the chosen study design. Cohort studies provide the best information about the causation of disease and the most direct measurement of the risk of developing disease.[71] Another advantage of the cohort study design, was that data on exposures to the outcome variables were measured as they occurred, i.e. a prospective design and accuracy of information that was gathered on feeding practices, did not have to rely to any great extent on the mother's memory.[72]

Unfortunately, one of the major disadvantages of the cohort study design, is the likelihood to lose touch with respondents. As cohort studies start with exposed and unexposed people, the difficulties of measuring exposure or finding existing data on individual exposures are important in determining the ease with which this type of study can be carried out. If the disease is rare in the exposed as well as the unexposed group there may be problems in ensuring a large enough study group.[71] The

mentioned problems were duly experienced by the researcher. This study had a drop out rate of 40%. However, every possible attempt was made to do monthly follow-up interviews. In the area where it was considered to be safe, from the violence point of view, for the fieldworker or researcher to make home visits, home visits were made for the purpose of the interview. Interestingly, the drop out rate in the areas where home visits were made was lower (30%) compared to 49% in areas where no home visits were made. Because of this high drop out rate and eventually small numbers, the initial independent variables were divided amongst small groups.

Costs remain a major limitation on large cohort studies, and the time required to finish the study is another disadvantage of the study design.[71] It took a long time to finish the follow-up interviews in this study, whereas a cross sectional study design could have been completed in a shorter time, but then changes within subjects, or measurement of time relationships, could not have been measured and accuracy of data would have been depended to a much greater extent on the mother's memory.

A single set of measurements which could be used for screening may be used in populations or individuals to identify abnormal nutritional status and priority for treatment.[41] This was not the aim of this study, and therefore several anthropometric measurements were made over time. A decline in anthropometric indices from one point to another could be an indication of illness and/or nutritional deficiency. [41]

4.3 STUDY POPULATION

The area where the study was completed is known as a poor socio-economic status area with a high crime rate. There were many formal houses with "Wendy houses" in the backyard, maisonettes and flats in the area. There were two nearby squatter camps, namely Malawi Camp and Freedom Farm. Only one of the respondents resided in a squatter camp, and this respondent dropped out of the study after the 4th interview. The study population originally consisted of 73 mother-infant pairs who visited one of the four clinics in the Tygerberg West II area within one month after birth. Only healthy, full term, new-born infants with a birth weight of more than 2 500g were included in the study. This study population was chosen to ensure that prematurity, disease, ethnic differences and extreme differences in socio-economic factors could be excluded as contributing factor to the growth of the infants, and

therefore, more emphasis could be placed on the influence of feeding practices *per se* on growth.

4.4 SOCIO-ECONOMIC AND DEMOGRAPHIC FACTORS

Of all the socio-economic and demographic factors that were investigated, only the level of education of the father had a significant influence on the growth of the infants in terms of HAZ over time. Infants of fathers with a secondary school education had a significant increase in HAZ over time. This indicates that as children grew older, their HAZ increased or got better over time. It could be argued that a father with a higher level of education could earn a higher salary, resulting in an improvement in household food security, and eventually an improved dietary intake. This argument could not be substantiated because the extent to which the father contributed to the care of the infant was not investigated. Steyn et al[66] found no difference in paternal education level between children who were underweight and a control of normal weight children in a cross sectional study where effects over time could not have been determined.[66] Of all the socio-economic and demographic factors which were investigated, only the number of people per house and the number of children that the mother had previously related significantly to the feeding practices that the caregivers practised. There were less people per house as well as less children by the mother in the MF group and most people per house and more children in the PBF group. The reasons as to why socio-economic and demographic factors did not correlate in most cases with growth or feeding practises, could be explained by the fact that the entire study population came from an area with very little variation in socio-economic and demographic circumstances. Although the determination of the influence of certain socio-economic factors on feeding practices and growth patterns was included in the objectives, the aim of the study was to identify **feeding practices** relating to the development of malnutrition during the first year of life in a poor socio-economic area. Therefore, socio-economic and demographic information was collected and correlated with growth and feeding practices to ensure that any differences in growth that were to be found were not related to differences in socio-economic and demographic factors. However, this should not be regarded as implying that socio-economic and demographic factors do not influence growth or feeding practices, as the literature is very supportive of the relationship between adverse socio-economic factors and growth. Mother's height and weight, father's height, social class and

income correlated with the growth in pre-school coloured children in Cape Town.[2] Environmental factors also have been reported to have an effect on growth.[18] Earlier studies have found that the educational status of the mother relates directly to the nutritional status of the child, with illiteracy being associated with malnutrition.[75, 76] Steyn et al[66] indicated a high risk of underweight children when the father was unemployed. It was also speculated that the unemployed father lived at home and placed a further constraint on limited food resources.[66] In the present study there were no significant differences in feeding practices or growth in terms of the mother's age or marital status and similar findings were been reported by Steyn et al. [66]. Other researchers found that marital status does play a significant role in undernutrition and that undernutrition is more likely among children whose mothers are unmarried.[75, 77]

In a review on the reversibility of stunting, the conclusion was made that subjects who remain in the setting in which they have become stunted experience little or no catch-up growth later in life. Improvements in living conditions, as through adoption, trigger catch-up growth.[6] According to the UNICEF Conceptual Framework on the causes of malnutrition, all the underlying causes of malnutrition include various socio-economic factors.[3] The fact that the group of respondents in the MF group had significantly less people per house and a lower number of children born to the mother, created the impression of the mother who is prone to using mixed feedings more frequently instead of using either predominantly breastmilk or infant formula feeding. Mixed feedings are strongly discouraged in an HIV-positive mother who wants to breastfeed.[78] When compared to the other two groups (although not significantly different) mothers in the MF group were younger than the other two groups, had less access to inside running water, fewer were known to have a monthly household income, even fewer were married when their babies were born, all of them had a secondary education and only one of them smoked. The impression of a young unmarried mother, probably living in a "Wendy house" (with no running water), and maybe a boyfriend or parents who support her to buy infant formula as she is not working (although having a good education) springs in one's mind. Added to this, more mothers in this group (although not significantly so) gave birth to their infants in provincial and private hospitals than any of the other two groups. More mothers (not significantly so) in the PFF group gave birth in a tertiary hospital. Mothers with a high-risk pregnancy are usually referred to a tertiary hospital to give birth. The

possibility exists that these infants had to stay in hospital after the mother was discharged and therefore breastfeeding did not continue for very long because breastfeeding on demand could not be continued for 24 hours per day. Unfortunately, it was not asked during the interviews whether the mothers had received any ante-natal education on breastfeeding. Breastfeeding practices in hospital were also not investigated in order to determine whether exclusive breastfeeding was promoted and practised before discharge. Therefore, the place of birth cannot be evaluated as a contributory factor to any association between the place of birth and feeding practices.

It is of greater concern that more than a third of the mothers smoked at the first interview, when the breastfeeding rates were still very high at 91%. There was no difference between the mothers in the PBF, MF and PFF groups regarding smoking practices. Therefore smoking did not affect their choice to breastfeed or not. However, smoking is associated with a shortened duration of breastfeeding and it has been reported to decrease milk volume.[79, 80]

4.5 ANTHROPOMETRY

4.5.1 Mother's anthropometry

Mother's BMI was calculated within one month after birth. The mothers tended to be slightly overweight (BMI above 24.9) but it could be due to their weight gain during pregnancy. The mother's BMI did not correlate with growth as reported elsewhere in a coloured community.[2] It is often observed that malnourished children have overweight mothers.[36] Nevertheless, in the NFCS women have been reported to sacrifice the quality of their diets and limit the amount of food eaten by the adults in a household in order to preserve the amount of food available to their children.[11] It is unfortunate that follow-up BMIs of the mothers were not recorded as it could have given a more accurate indication of the mother's nutritional status later on after the birth of her child.

4.5.2 Infant's growth

Anthropometry at birth was obtained from the infant's growth chart and not directly measured. It could, therefore, not be assumed that methods used for recording birth weight were within the standards as prescribed by the protocol. According to the

protocol, no low birth weight infants were included in the study. According to the road to health cards all infants were above the median of the reference population.

WAZ for the "compliers" and "non-compliers" dropped to below zero within two weeks after birth. It is known that infants tend to lose weight after birth and to catch up within two weeks after birth. This did not occur in this study but measurement techniques and materials (scales) might have differed from those used in this study. At one month after birth, WAZ was above zero and stayed above zero until ten months after birth, with a slight deviation at eight months in the total sample. WAZ kept on increasing after two weeks after birth, until the age of four months, when it started to decrease significantly with age amongst the "compliers" ($p=0.0015$). This could be due to the introduction of complementary foods which was around the age of three months after birth. This supports, at least to some extent, the WHO and National recommendation to delay the introduction of complementary feeding to 6 months to allow adequate breastmilk intake until this age. WAZ was not affected by the feeding practices according to choice of milk feeding (PBF, MF and PFF). It is well known by this time that differences in growth exists between breastfed and formula fed infants.[48, 81, 82,] The Centers for Disease Control and Prevention 2000 growth charts include anthropometric measurements of breastfed infants proportional to their distribution in the USA population during the past 30 years. The previous 1977 National Center for Health Statistics growth charts are based on infants who were primarily formula fed.[27] None of the groups in this study received exclusive breastfeeding or only infant formula. This could explain why no significant differences in growth were found between the three groups of PBF, MF and PFF. If the sample sizes were larger, significant weight differences might have been identified.

HAZ was above zero at birth and dropped to below zero within two weeks after birth, and never returned to above zero for the duration of the study. Stunting is a major problem in South Africa, and it was found that stunting peaked within the ages of 12-23 months.[10] In this case, HAZ never reached a value of less than –2, in fact the minimum HAZ was –1 at six months for the "non-compliers". HAZ increased for the "compliers" as the infants grew older, and the increase with age (within subjects) was statistically significant ($p=<0.0001$). However, HAZ for the "compliers" was never

above zero, the median of the reference population. Genetic influences could partially explain these findings since genetic influences have been reported by Molteno *et al* in an almost similar study population.[2] However, the influence of genetic differences on growth potential has been rejected as a factor contributing to poor growth patterns by Habicht.[18] Feeding practices were strongly and significantly associated with HAZ in a study in Latin America, but the population studied was children above twelve months of age.[83]

4.6 FEEDING PRACTICES

The current WHO recommendation on breastfeeding has extended the exclusive breastfeeding period to a firm six months (since April 2001). This was done after a review of the literature on the growth patterns of children who were mainly predominantly breastfed (rather than exclusively breastfed, due to the low frequency of exclusive breastfeeding) as compared to those of children with other feeding practices.[74] Because the study population under discussion was a free living population in which paediatric recommendations and maternal practices in infant feeding were not controlled, clear-cut differences in feeding practices were difficult to establish. Therefore, it was decided to group respondents according to the **predominant** way of feeding as very few mothers stayed within national recommendations of breastfeeding and complementary feeding, a common problem experienced in other countries and reported in a number of studies.[64, 84]

The incidence and duration of exclusive breastfeeding (feeding breastmilk only, with no addition of any water or other fluids, except vitamins or minerals) was extremely low in this study population. Retrospectively, 97% of mothers initiated breastfeeding at birth but at four months. Only 12% of mothers were still giving breastmilk only (with or without additional water, and with or without complementary foods) to their babies. More mothers gave breastmilk in combination with other milk (formula or less frequently whole cow's milk). The prevalence of breastfeeding (with or without formula or cow's milk, and with or without complementary foods) decreased gradually from 91% at two weeks to 40% at nine months, and levelled more or less at that point until the age of one year. The incidence of giving breastmilk only for the first six months after birth was very low in this study population with 21% in the PBF group. (This was not exclusive breastfeeding for six months as all the mothers had

introduced complementary foods by the age of four months after birth, except for two mothers). Croucher *et al* reported that 99% of mothers in a study completed in Khayelitsha initiated breastfeeding, but none of them breastfed exclusively. Breastfeeding was ceased by 89.9% of these mothers when babies were two months of age.[28] In Wellington, a rural area in the Western Cape, only 9% of 302 mothers were still breastfeeding exclusively at the age of four months after birth. Ninety (31%) of the mothers never breastfed exclusively.[31] In Pretoria, 86% and 81% of infants in the Kafalong Hospital respectively were receiving breastmilk at six and twelve months. At 15 months, 80% were still receiving breastmilk.[27] National data indicates that nine out of ten children three years of age, have been breastfed for a varying length of time. The national tendency was for children to be breastfed for less than three months.[10]

The exclusivity of breastfeeding may have been compromised by the early introduction of infant formula and complementary foods. This impression supports the WHO and national recommendation to delay the introduction of complementary feeding to 6 months to allow adequate breastmilk intake until this age. Almost 70% of mothers introduced formula before the age of two months. The percentage of mothers feeding only formula (with or without complementary foods), decreased as the babies grew older because mothers started to feed cow's milk together with formula. The first incidence where only whole cow's milk was given to the infant, was at the age of six months after birth. At the age of eleven months after birth about 20% of mothers gave whole cow's milk as the only milk to their babies. The administration of whole cow's milk to infants younger than a year should be discouraged due to the low intakes of iron, linoleic acid, and vitamin E as well as excessive intakes of sodium, potassium and protein[85]

Breastfeeding practices were not optimal as recommended by the "Ten Steps to Successful Breastfeeding" or the "South African Breastfeeding Guideline for Health Workers."[73] Less than 75% of mothers practised unrestricted or "on-demand-breastfeeding". The frequency of feeds as well as the duration of a feed did not differ significantly between the PBF, MF and PFF groups. However, one could have expected that mothers who breastfeed on demand would breastfeed for a longer duration in time. Scheduled breastfeeding could decrease breastmilk production as the

prolactin synthesis decreases if the baby is not allowed to feed on demand. Prolactin is synthesised and secreted, amongst others, when the baby sucks on the breast.[86] Almost half of the mothers (45%) timed their feeds and therefore their infants had a limited time on the breast.

Working mothers often did not continue further participation in the study when they started working after their maternity leave came to an end. It could be expected that if more working mothers had been included in the study, the statistics would have reflected that more mothers expressing breastmilk. The information on the expression of breastmilk in this study may not be a true reflection of the actual prevalence and practices on expression of breastmilk in this community. Very few mothers expressed breastmilk, but if they did, none of them practised cup feeding as recommend by the "South African Breastfeeding Guideline for Health Workers" as an alternative feeding method.[73] All the mothers used a bottle to feed the expressed milk. Mothers usually stored the expressed breastmilk in a fridge, but about 10% stored it at room temperature. Breastmilk can be stored at room temperature for up to eight hours. Mothers should be educated that if they do store breastmilk at room temperature, they should use it within eight hours. If it has to be stored for longer periods, it must be stored in a fridge for a maximum of 24 hours.[73]

Forty two percent of the mothers introduced infant formula because they said that they did not have enough milk. This is one of the most common reasons given by mothers all over the world for stopping breastfeeding or introducing complementary foods early.[28, 31, 87, 88] Sometimes, however, a baby does not get enough breastmilk. Usually this is because the baby is not suckling enough, or is not suckling effectively. Irrespective, mothers who think that they do not have enough breastmilk need the help and support of a skilled person. If the baby is not getting enough breastmilk, various steps can be followed to increase the mother's milk supply as well as to maintain breastmilk production. If milk production can be increased, the duration of breastfeeding could be prolonged.[88]

Formula feeding practices were often not optimal. The mothers who gave infant formula, started in most of the cases with a whey predominant formula and switched over to a casein predominant formula at around four months. Mothers are usually

advised to continue with the same type of formula and only change if the infant experiences any problems using a specific formula. A casein predominant formula takes longer to digest and keeps the baby satisfied for longer lengths of time. Mothers could have realised that infants want to feed more often and switched over to a casein predominant formula to stretch the time between feeds.

A quarter of the mothers had already started with a follow-on formula at five months. Infants should switch to follow-on formulas from six months after birth. Follow-on formulas differ from starter formulas in that all follow-on formulas are casein predominant, and have a higher protein and energy level as well as a higher renal solute load for the older, bigger infant.

All the mothers reported that they used cooled boiling water to prepare formula and they usually prepared the formula just before a feed. There were a minority of mothers who prepared the feeds beforehand, and more than 50% of them kept it at room temperature for less than three hours. Only acidified infant formula can be kept safely after preparation for a maximum of eight hours at room temperature. Prepared infant formula should be fed immediately after preparation or stored in a refrigerator. If kept at room temperature, bacterial contamination could occur and cause diarrhoea in the infant with an immature gut. Mothers should be taught that infant formula should be handled hygienically and part of the recommendations should include that infant formula should be prepared just before the administration thereof, and if it needs to be stored, to store it in a fridge.

More than 20% of mothers prepared the formula to be too weak or too strong and as the infants grew older, more mothers prepared the formula incorrectly. Similar findings were reported by Croucher *et al.* Over-dilution of infant formula took place in 42.9% of cases and 14.2% of feeds were over-concentrated .[28] Infants should not be fed high volumes of fluid with a low nutrient density. If infant formula are prepared too weak, the infant's nutrient intake will not meet his/her requirements. Furthermore, the infant has a limited gastric capacity and therefore cannot consume large enough volumes of milk to meet his/her high nutrient requirements. An infant grows very fast during the first year of life and therefore nutrient requirements per kg body mass are higher during this stage of life than it will ever be again during the lifecycle. Over

concentrated formula will result in an increased renal solute load and could cause constipation or diarrhoea in the young due to sub-optimal nutrient interactions. Diarrhoea could cause malabsorption of nutrients. The young infant's kidneys has a limited concentration capacity and needs enough fluid to excrete waste products.[89, 90] Eventually, an inadequate dietary intake will occur and this is one of the immediate causes of malnutrition.

Only two mothers in this study switched back to giving breastmilk only after the initiation of formula feeding. This was done in combination with breastfeeding support by a health care worker. In all the other cases, once a mother started to feed infant formula, she never switched back to exclusive breastfeeding. Mothers need to be educated on optimal formula feeding practices **before** they make the choice to formula feed.

Theron *et al* reported that many mothers in Wellington gave water to their infants while they were breastfeeding.[31] Fifty-four of the mothers in this study gave water to the infants together with the milk diet within the first month. At the age of four months after birth, 50 of the 54 mothers gave water in addition to other foods and milk to the infants. Later on, other fluids e.g. tea, fruit juice and cold drink were fed together with milk and complementary foods. The daily volume of water that they gave to their infants increased with age. It is well documented that infants who receive breastmilk, do not need additional water, even in a very hot climate.[91] All the infants were healthy at birth, and therefore it was unlikely that there could have been a medical reason for the administration of water. Giving water in combination with breastfeeding could reduce the benefits of breastfeeding. Any other substance that is fed in combination with breastmilk, will reduce the volume of breastmilk intake. Eventually, breastmilk production can be decreased, as breastmilk is produced by the prolactin reflex and this reflex is dependant on stimulation thereof. A reduced breastmilk intake could contribute to an inadequate dietary intake. This same argument goes for feeding water or other fluids with a low nutrient density to infants who are on formula. Due to a limited stomach capacity, formula intake could be reduced if the infant received high volumes of other fluids. Furthermore, the risk of infections is also increased in the case of contaminated water or feeding equipment.

The practice of feeding tea to the infants also needs more discussion. Unfortunately, mothers in this study were not asked to specify whether they gave rooibos tea or Indian tea. It is known that tea contains a lot of tannins, which decreases the absorption of iron.[92] The Adequate Intake (AI)* for iron for infants from birth to 6 months is 0.27 mg per day, and the Tolerable Upper Intake Level (UL)** is 40mg per day. From 6-12 months, the UL for Iron is also 40mg per day, and the Reccomended Dietary Allowance*** is 11mg per day for boys and girls. [93] Only pregnant women, women in childbearing age and teenage girls have a higher RDA for iron than infants. Furthermore, tea is not dense in nutrients and this practice should be strongly discouraged for infants as they have high nutrient requirements and a limited gastric capacity. Since the aim of this study did not include these aspects of feeding, the basis of this feeding practice cannot be determined.

When an infant receives high volumes of fluid, or if there is an over-consumption of milk, it could be expected that the food intake is reduced due to a limited gastric capacity. Therefore, the risk of infections as well as inadequate dietary intake, both immediate causes of malnutrition, is increased when an infant receives high volumes of non-nutrient dense fluids, especially during the age when exclusive breastfeeding is recommended.

* The Adequate Intake is used in cases where the scientific evidence is inadequate to set an Estimated Average Requirement. In such cases, the AI is used instead of the Recommended Dietary Allowances (RDA).[94]

** The Tolerable Upper Intake Level is defined as the maximum nutrient intake by an individual, which is unlikely to pose risks of adverse health effects in almost all (97-98%) individuals in a specified group.[94]

*** The Recommended Dietary Allowance is defined as the intake that meets the nutrient needs of almost all (97-98%) individuals in that gender group, at the given life stage. It is the goal for dietary intake by individuals.[94]

The National Policy on infant feeding recommends exclusive breastfeeding for six months and thereafter, complementary foods should be fed together with breastmilk (or formula if not breastmilk). None of the caregivers followed this recommendation. Introduction of complementary foods started at a very early age in this community and the age at which mothers started with weaning supports the findings of other studies in the country. At the age of three months, more than half of the mothers had started givinge porridge to their babies. Between four and five months, 50 of the 54 (94%) infants started eating porridge. At the age of 4-5 months, more than half of the mothers had already introduced vegetables to their babies' diets. Between four and five months, more than half of the mothers had already added fruit to their babies' diets. Pedi mothers in Lebowa, have been reported to have introduced complementary foods to their children's diets by the age of three months.[65] Mothers in Ndunakazi (KwaZulu Natal) and Khayalitsha (Western Cape) have similarly been reported to have introduced complementary foods to their children at a mean age of 2.8 and 2.9 months respectively.[29] In Khayamandi (Western Cape), 32.5% of infants have been reported to have received solid foods before they were three months old.[30] In the Moretele District (Gauteng, South Africa), mothers introduced food at two to three months after the birth in their babies' diets. [32] By the age of three months, 78% of infants in the Kafalong study had received complementary foods.[27]

In this study, when mothers started to give porridge, they usually gave it once to twice daily and once to three times daily at the age of five months after birth. Thereafter, the frequency decreased as the baby grew older to once daily, possibly as the variety in the diet increased and the baby got other foods as well. In the Khayamandi study, porridge also played a prominent role in the children's diet, as they consumed porridge 2-3 times per day up to age of 9 months. [30] In this study, caregivers in the PFF group gave porridge significantly more often per day than the caregivers in the PBF group before the age of three months after birth. This could indicate that the early intake of porridge by the infants affected the milk feeding practices, as mothers who fed porridge less frequently as part of the daily meals were in the group who predominantly breastfed. This finding, although not statistically significant, partly supports the concept that the intake of other fluids and complementary foods in addition to breastmilk could contribute to a decrease in stimulation of breastmilk

production and eventually a decrease in breastmilk intake, and subsequently leading to the early cessation of breastfeeding.

Caregivers also did not prepare the porridge correctly according to the instructions on the package in many cases. Adding water to a brand that should be prepared with milk, again contributes to an inadequate dietary intake, an immediate cause of malnutrition. Adding milk to a brand that should be prepared with water, increases renal solute load and it could also interfere with nutrient absorption. Some mothers added additional energy (sugar or fat) to the porridge. Before the age of eight months, less than 20% of mothers added sugar to the porridge. The addition of sugar was more common than the addition of fat to the porridge. At the age of one year, only one third of the mothers added fat to the porridge and all the mothers added sugar at that age to the porridge. The reason(s) for this practice were not determined in this study. However, sugar and fat are relatively cheap sources of energy and moderate use of sugar and fat to increase energy density of culturally accepted weaning foods could be encouraged.

Vegetables were consumed regularly by most of the infants. As the infants grew older, they were given vegetable feeds more regularly from 1-3 times a week to once a day. The consumption of vitamin A-rich vegetables such as pumpkin and butternut were frequently used in the weaning diet. These are not expensive vegetables and are easy to prepare for an infant. The use of pumpkin and butternut in the weaning diet should be further promoted, above the use of squash. The use of sweet potato (a very good source of beta carotene) should also be encouraged. Carrots were not a favourite probably because the texture of carrots is as such that it is not smooth when mashed with a fork instead of a food liquidiser. Mothers' first choice vegetable for their infants' diet was potatoes. Potatoes are readily available all year round and although prices increased quite much recently, it stays good value for money compared to some other sources of carbohydrates. Potatoes are also easy to prepare and does not need a lot of fuel to cook. From 6-7 months onwards, at least half of the mothers who gave vegetables, added sugar and fat to the vegetables. At first, mothers did not add any salt when they prepared the babies' vegetables. From 2-3 months on, more mothers added salt to the babies' vegetables. At one year, 87% of mothers who gave vegetables, added salt to the vegetables. In the study amongst mothers in a rural and

an urban low socio-economic status area on breastfeeding and weaning practices, 80.9% of mothers in the rural area, and 29.1% of mothers in the urban area reported that they believed that an infant's food should be sweet. In the same study, 80.9% of mothers in the rural area and 15.5% of mothers in the urban area said that they thought an infant's food should be salty. At the age between six and nine months, 84.6% of rural mothers and 48.7% of urban mothers added salt to the infant's food. At this age, 53.8% of rural and 46.1% of urban mothers added sugar to the infants' food and 38.5% of rural and 41% of urban mothers added fat to the infants' food. [29] If infants eat salty foods regularly, a taste for salty foods may be established and if this habit is maintained, it may have a cumulative effect that may result in ill health (e.g. hypertension) in later years in life. [83]

Although mothers introduced fruit at an early stage to the babies' diets, they did not feed it to them frequently or in any variety. Fruit was usually the type of food from the range of all the complementary foods that was introduced last to the infants' diet by most of the caregivers in the total study population. Very few babies ate a variety of fruit at the age of one year. Seasonal variations were seen in the variety of fruit used by some of the caregivers. The majority of caregivers fed bananas to the infants from the age of six months after birth and onwards. Many of the caregivers bought ready-to-feed fruit from jars as part of the weaning diet during the early months after birth. At around nine months, this practice was seen less frequently. Although these products are very convenient to use and the possibility of food contamination is small, they are expensive products, and this could be the reason why less mothers fed these products as the infants grew older. It is much cheaper to buy fresh food and feed the infant from family meals.

This community had a high consumption of protein-rich foods as compared to findings of other studies on this aspect of feeding.[27, 29] As the infants grew older, more variety was added to the diet in terms of protein and iron sources. Protein and iron sources were added to the diet from around five months after birth. This is the age when the process of weaning should start, and sources of protein and iron should be an important part of the weaning diet, as milk becomes a smaller part of the diet. However, the introduction of potentially allergenic foods, such as whole cow's milk, at a very early age is a cause of concern. Whole cow's milk as well as fish, egg white

and peanut butter are potentially allergenic and should not be added to the infants' diet before the age of one year, especially where a family history of allergies is known.[95] Protein and iron sources (meat and chicken) are usually expensive to buy. Eggs, peanut butter and whole cow's milk are cheaper protein sources compared to meat, chicken and fish. This could be the reason why these cheaper foods are fed to infants at early ages. However, the portion sizes of protein and iron sources that should be fed to infants in order to supply their daily requirements of protein and iron, are not very large and should therefore not be very expensive to buy, provided of course that one can afford to do so.

Almost one in four babies had white bread to eat at the age of five months after birth. White bread was the most popular grain to feed the babies, followed by pasta. Brown bread was the least popular choice by the caregivers to feed to the infants. There was a trend in this community to prefer to buy white bread instead of brown bread, even though brown bread is cheaper. Brown bread could be bulky to feed in the weaning diet, but healthy eating habits should be learned from a young age. Mothers could be encouraged to feed a variety of brown and white bread to their infants.

Mothers introduced sweets, chips and biscuits to the diets of the infants at a very early age. At one year, all the infants ate chips, biscuits, chocolate and sweets regularly. The weaning stage is known to be a stage of fussy eating.[86]. If mothers include these less nutrient-dense and relatively expensive foods at such high rates to infants, it will only contribute to inadequate dietary intake, again an immediate cause of malnutrition, and such a practice should be discouraged. Although cases of failure to thrive were not identified in this study (except for the one infant who was placed on the Health Facility Based Nutrition Programme), dietary intake of children with failure to thrive in this same community has been studied by van Staden *et al.*[33] These authors reported that children with failure to thrive consumed a diet of lower quality than the control group, when their diet was evaluated in terms of the five basic food groups.[33]

Infants in this study usually received four or less meals per day. If an infant does not receive regular meals, it will be almost impossible to meet the high nutrient requirements of the fast growing infant due the small stomach capacity. Van Staden *et*

al found that children with failure to thrive had a less favourable meal intake pattern than the control group with the majority of children not consuming three main meals per day. [33] Respondents in this study usually had their first meal between nine and eleven in the morning, the second between 11 and 2 pm, the third meal between 2 and 4 pm and the fourth meal between 4 and 7 pm. It seemed as if none of the infants received more than four meals per day before the age of one year. If mothers could give the first meal before nine in the morning, there would be enough time to feed at least five meals per day and eventually increase dietary intake.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS AND RECOMMENDATIONS

The aim of the study was to identify feeding practices relating to the development of malnutrition during the first year of life in a low socio-economic status area and the null hypothesis is accepted. There was no relation between feeding practices and growth patterns in infants in their first year of life. Due to the low prevalence of exclusive breastfeeding, and the short duration of breastfeeding in this study population, differences in growth between breastfed and formula fed infants were inconclusive. The age at which solids were introduced did not affect growth patterns. Nor did the type of weaning foods result in differences in growth patterns. The duration of breastfeeding also did not affect growth patterns. Of the socio-economic factors that were investigated, only the level of education of the father related to growth of the infants in HAZ over time. Socio-economic factors did not influence feeding practices.

The loss of respondents contributed a great deal to the limitations of this study as it resulted in the small sample sizes. Although the statistical methods that were chosen are indicated for use in studies of small sample sizes, a larger sample size could have provided more significant results. Furthermore, working mothers could have played a significant role in the results, if they had continued in the study for its full duration. The role of ante-natal education was not obtained and could have assisted in the conclusions on breastfeeding practice as well as future education to address breastfeeding and weaning practices. As the level of parental education, the father's education was the only socio-economic factor that was related to growth.

In conclusion, the results have implications for the design of interventions to improve child-feeding practices. The Department of Health: Directorate Nutrition has published guidelines (2001) for nutritional interventions at health facilities to manage and prevent child malnutrition. The provision of nutrition education on, amongst others, breastfeeding and complementary feeding, is the first primary intervention strategy identified to manage and prevent child malnutrition. Furthermore, to protect, support and promote breastfeeding and to encourage appropriate complementary feeding of young children were also identified as important priorities in the management and prevention of child malnutrition as part of the nutrition education programme.

In this regard, mothers often visit primary health care centres for growth monitoring of their infants within the first month after birth. Many of them have started with additional formula or complementary foods by this age, and should thus receive nutrition education at an earlier stage of their pregnancy. The high incidence of breastfeeding initiation could be a useful opportunity for promoting exclusive and prolonged breastfeeding. However, weaning practices are still not in line with national recommendations, and need to be addressed.

The following aspects regarding breastfeeding should be addressed in any nutrition education programme:

- Exclusive breastfeeding for the first six months
- The role of cup feeding if breastmilk is expressed
- Breastfeeding on demand
- The "insufficient milk syndrome"
- No additional fluids need to be fed to the exclusive breastfed infant

Infant formula feeding practices need to be addressed. As general education sessions on formula feeding are not allowed to groups of people of the public according to the Code of Ethics on the marketing of breastmilk substitutes, health care personnel should address these topics in one to one consultations with mothers or caregivers. When infants attend clinics for immunisations and growth monitoring, a history on formula feeding practices should be obtained from the caregiver and the following should be discussed:

- Choosing the correct formula for the infant according to age
- Methods of preparation of infant formula – avoid over concentration and over dilution of formula
- Hygiene during the process of formula feeding
- Duration and place of storage of prepared infant formula

The introduction of complementary food also needs to be addressed. The earlier this could be done, the better, as many mothers in this study introduced complementary foods around three months after birth. Mothers could be targeted for information sessions on weaning when they attend the clinic for their infant's immunisations and

growth monitoring sessions. The following should be discussed:

- The physiological development of the infant and the age when complementary foods should be introduced to their diets
- Preparation methods of weaning food e.g. according to the containers
- The prevention of feeding low nutrient density foods during the weaning stage and beyond
- How to increase nutrient density of weaning food
- Feeding a variety of weaning foods
- Preventing the use of potentially allergenic foods within the first year of life
- Improving the meal time plan to five small meals per day from around nine months

In conclusion then: infant feeding practices in this community were not in line with national or global recommendations, despite various attempts by health care workers to improve infant nutrition practices to manage and prevent child malnutrition. The improvement of this unfortunate situation can only be improved by socio-economic upliftment and appropriate, in content and timing, nutrition education of the caregiver.

CHAPTER 6

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APPENDIX A

1. **Approval by the Research Sub Committee C, University of Stellenbosch**

2. **Letter written to obtain approval by the City of Tygerberg**

UNIVERSITEIT VAN STELLENBOSCH
UNIVERSITY OF STELLENBOSCH

26 Mei 1999

Mev RA Beukes
Dept Menslike Voeding

Geagte mev Beukes

NAVORSINGSPROJEK: "THE GROWTH PATTERNS OF INFANTS FROM BIRTH TO TWELVE MONTHS IN RELATION TO FEEDING PRACTICES"
PROJEKNOMMER : 99/052

Dit is vir my aangenaam om u mee te deel dat Subkomitee C van die Navorsingskomitee bogenoemde projek goedgekeur het op 26 Mei 1999, ook wat die etiese aspekte daarvan betref.

Die projek is nou geregistreer en u kan voortgaan met die werk. U moet asseblief in verdere korrespondensie na bogenoemde projeknommer verwys.

Ek vestig graag u aandag daarop dat pasiënte wat deelneem aan 'n navorsingsprojek in Tygerberg-hospitaal nie gratis behandeling sal ontvang nie aangesien die PAWK nie navorsing finansieël ondersteun nie.

Die verpleegkorps van die Tygerberg-hospitaal kan ook nie omvattende verpleeghulp met navorsingsprojekte lewer nie weens die swaar werkslading waaronder hulle reeds gebuk gaan. Dit kan dus van 'n navorser verwag word om in sulke gevalle privaat verpleegkundiges te verkry.

Die uwe

CJ VAN TONDER
n ADJUNKREGISTRATEUR (TYGERBERGKAMPUS)

CJVT/ev

C:\DOCUMENTS\NAVC\PROJEKTE\1999\99-052-001.DOC

Universiteitskantoor • University Office, Tygerbergkampus • Tygerberg Campus
✉ 19063, 7505 Tygerberg
☎ (021) 938 9207, Fax. (021) 931 7810, Suid-Afrika / South Africa

UNIVERSITEIT VAN STELLENBOSCH
UNIVERSITY OF STELLENBOSCH

January 26, 2000

Dear Mrs. Mtwazi,

RESEARCH PROJECT: GROWTH PATTERNS OF INFANTS FROM BIRTH TO TWELVE MONTHS IN RELATION TO FEEDING PRACTICES

I refer to our telephone conversation on January 26, 2000 regarding the above-mentioned research project.

I am a registered post-graduate student at the University of Stellenbosch for a Masters Degree in Nutrition. I plan to do a research project on the above-mentioned topic as part of my studies. The proposal for the project has been approved by the Research Sub-committee regarding ethical aspects. This project is registered as project number 99/052. A summary of the proposal is attached.

I hereby request permission to do my project in the following 5 clinics:
Bishop Lavis
Valhalla Park
Bonteheuwel
Netreg
Matroosfontein

I would like to start as soon as possible with the collection of the data, preferably no later than March 1st 2000. Wwith the help of fieldworkers, I myself will collect all the data. I requirre the personnel at the clinics to refer all the new babies who visit these 5 clinics during the month of March to me and/or the fieldworkers. We will do the necessary measurements (height and weight) and collect the data. Mothers usually bring their babies back for immunisations every 4 weeks up to 14 weeks of age. Thereafter we will ask them to come back to the clinics for monthly follow-up visits up to one year of age and will pay any additional transport costs that they might have if they come for the purpose of the project only.

I am willing to come and present the proposal to the staff of the clinics and discuss the project with them, as well as answer any questions that they might have. I will appreciate it if you can inform the Sisters-in-charge and let me know as soon as possible.

You can contact me at Bishop Lavis Clinic in the mornings at tel. 934 1018/ 934 6050 or at the office in the afternoons at tel. 938 9175/259.

Yours' sincerely

RBeukes

Ronel Beukes
Dietitian: University of Stellenbosch
Department of Human Nutrition

Fakulteit Geneeskunde • Faculty of Medicine
Departement Menslike Voeding • Department of Human Nutrition
Posbus / P O Box 19063, 7505 Tygerberg, Suid-Afrika / South Africa
Tel. (27) 021 - 9389259, Fax: (27) 021 - 9332991

APPENDIX B

1. Pilot study

PILOT STUDY

1. Objectives

The objectives of the pilot study were:

1. To pilot the procedure of recruiting respondents
2. To pilot the procedure of follow-up of the respondents
3. To test the use of the adapted questionnaire
4. To train fieldworkers and examine their ability to collect data.

2. Area

The following clinics within the Tygerberg West II were used in the pilot study and were the same clinics that were used in the research study:

1. Bishop Lavis Clinic
2. Matroosfontein Clinic
3. Netreg Clinic
4. Valhalla Park Clinic

3. Sample

All new-born infants who attended one of the aforementioned four clinics within the Tygerberg West II area during May 2000 were screened to take part in the study. The same including and excluding criteria for the research study also applied to the pilot study.

4. Procedure

4.1 Training of fieldworkers:

Four fieldworkers were recruited for an agreed fee, and trained during March and April 2000. At that stage, a fieldworker for the Bonteheuwel Clinic was also included in the training. Fieldworkers had to live within the areas and had to be able to read, write and speak the local languages which were Afrikaans and English. All the fieldworkers were South African National Tuberculosis Association (SANTA) voluntary workers. The researcher herself performed the data collection in the Bishop Lavis area. The protocol of the study was explained and discussed with the fieldworkers, and practical training and standardisation on the measurement of weight and length in infants and adults was provided. The fieldworkers wrote a test on the

knowledge and skills components acquired from the training and had to obtain at least 60% to pass before they were accepted for data collection.

4.2 Data collection

Infants were screened for participation at their visit to the clinic during May 2000. If they qualified according to including criteria, the consent information document was discussed with the mother, and if she was in agreement she was requested to sign it. During the process of the pilot study, a set of twelve questionnaires (one questionnaire per interview, one month between interviews) was part of the procedure of data collection. The questions in questionnaire number 1 were then administered. The mothers' weight and height were measured as well as the infants' weight and length. The date for the baby's first immunization was then recorded and an appointment was made with her for a follow-up interview, one month later When the caregiver brought the infant for his/her six weeks immunization, the procedure was repeated. It was repeated again when the infants was brought for his/her ten weeks immunization.

4.3 Times and dates

Infants were recruited at the times when the clinics had their "Well Baby Clinics" which was every day at Bishop Lavis and Valhalla Park, Monday to Thursday at Netreg and Monday, Wednesday, Thursday and Friday at Matroosfontein. "Well Baby Clinics" were in the mornings from 8:00 – 12:30.

Follow-up interviews were usually when infants came back for their immunizations, in the afternoons from 13:30 until 15:30. Follow-up interviews were conducted every day of the week during May, June and July 2000. It was not necessary to continue with the pilot study for a longer period because the objectives of the pilot study were met within this time frame.

4.4 Results and discussion

It became clear after the appointments were made that respondents did not come to the clinic on the dates that were given for follow-up appointments and immunizations. This made follow-up very difficult as the fieldworkers were not continuously present at the clinics, but only at the time of the follow-up appointments. Many respondents

were lost during this period due to non-attendance. In the research study, it was decided to make home visits in the safer areas and recalls (to recall patients implicates that a note was left at the door or in their mailbox to ask the patient to visit the clinic on a given date and time) in the areas regarded as not so safe.

Two fieldworkers dropped out of the study at the time of the pilot study. The one fieldworker got permanent work and the other was no longer interested in participating. Another fieldworker was trained in her place, but never started with data collection, as she also not interested in participating. In view of theses difficulties, it was decided to make use of a qualified dietitian in the place of the voluntary workers and to pay a fixed rate per hour. The protocol of the study was explained and discussed with her, and practical training and standardisation on the measurement of weight and length in infants and adults was provided.

The use of twelve questionnaires per respondent became a tedious way of administrating the follow-up interviews. The twelve questionnaires were condensed into one single questionnaire per respondent for the total study.

It was also decided to ask the questions on socio-economics during the first interview, and repeat some questions only at the 4^{th}, 8^{th} and 12^{th} interview. It became clear during the pilot study that housing circumstances, number of children, or household income, marital status and smoking did not change between visits. The condensed questionnaire was adapted accordingly.

APPENDIX C

1. Consent information document

2. Questionnaire

Konsep inligtings en toestemming dokument

Titel : Groeipatrone in babas vanaf geboorte tot twaalf maande met betrekking tot voedingpraktyke.

Verwysingsnommer : | | | | | |

VERKLARING NAMENS DIE BABA:

Ek, die ondergetekende, _____ (ID _____) in my hoedanigheid as _____ van die baba (naam: _____) van _____ (adres)

A Ek bevestig dat:

1. My/die baba uitgenooi is om deel te neem aan bogemelde navorsingsprojek wat deur die Departement van Menslike Voeding van die Universiteit van Stellenbosch onderneem word.

2. Daar aan my verduidelik is dat

- Hierdie projek gaan ondersoek instel om te kyk of die kos/melk wat my/die baba eet of drink en wanneer hy/sy dit eet of drink sy/haar groei beïnvloed.
- Ek vrae gevra sal word oor die tipe kos/melk wat my/die baba eet/drink en dat my/die baba se gewig en lengte met elke besoek geneem sal word, totdat my/die baba een jaar oud is.
- Daar ongeveer 120 persone aan die projek gaan deelneem.

3. Ek ingelig is dat ek elke maand 'n besoek sal ontvang deur die navorser/veldwerker vir die invul van die vraelys en metings op my/die baba.

4. Daar verder aan my verduidelik is dat gereelde weeg van my/die baba voordelig is vir die monitering van my/die baba se vordering in die eerste jaar.

5. Ek meegedeel is dat die inligting wat ingewin word as vertroulik beskou sal word, maar wel as volg aangewend sal word : vir graad doeleindes vir die Meestersgraad in Voeding asook vir publikasie in 'n wetenskaplike tydskrif.

6. Dat ek/die baba na afloop van die projek op aanvraag sal toegang hê tot die bevindinge aangaande hom/haarself wat tydens hierdie projek gevind word.

7. Ek meegedeel is dat ek mag weier om deel te neem/die baba te laat deelneem aan hierdie projek asook dat ek/die baba te enige tyd deelname mag staak. Sodanige weiering of staking sal nie op enige manier my of die baba se behandeling by hierdie inrigting benadeel nie. Ek verstaan ook dat die navorser my/ die baba mag onttrek van die projek indien dit in my/die baba se belang geag word deur hom/haar

8. Die inligting wat hierbo weergegee is deur _____ aan my in _____ verduidelik is en dat ek die taal goed magtig is en dat ek die geleentheid gegee is om vrae te vra en dat al my vrae bevredigend beantwoord is.

9. Daar geen dwang op my geplaas is om toe te stem tot my/die baba se deelname aan hierdie projek nie en dat ek besef dat ek/die baba deelname te enige tyd mag staak sonder enige benadeling.

10. Deelname aan die projek sal geen finansiële voordele vir die baba of die familie van die baba inhou nie.

11. Deelname aan die projek gaan geen addisionele koste vir my inhou nie. Indien vervoerkostes aanggegaan moet word vir besoeke aan die kliniek vir die doeleindes van hierdie projek alleenlik, sal dit deur die navorser betaal word.

B Ek stem hiermee vrywillig in om my/die baba te laat deelneem aan die bogenoemde projek

Geteken/bevestig te _____ *op* _____*(datum)*

_____ _____

Verteenwoordiger van baba se handtekening of regterduimafdruk *Getuie*

Verklaring deur of namens die navorser:

Ek, _____verklaar dat ek :

1. Die inligting vervat in hierdie dokument aan _____ en /of sy/haar verteenwoordiger verduidelik het.

2. Hom/haar versoek het om vrae aan my te stel indien daar enige onduidelikhede is.

3. Dat hierdie gesprek in Afrikaans/Engels plaasgevind het en dat geen tolk gebruik is.

Me_____

Geteken te _____op _____(datum)

_____ _____

Navorser/verteenwoordiger Getuie

Nommer | | | | | | Lêernommer | | | | | | |

Datum: 1: _____ 2: _____ 3: _____ 4: _____
5: _____ 6: _____ 7: _____ 8: _____
9: _____ 10: _____ 11: _____ 12: _____

1. BABA:

Naam en van: _____ Geslag: ☐

Adres : _____

_____

Geboortedatum | D | D | M | M | J | J | J | J |

Gestasie ouderdom: _____weke

Geboortegewig | | | | | gram

Geboorte lengte | | | cm

Kopomtrek by geboorte | | | cm

Waar is die baba gebore? _____

2. MOEDER

Naam en van: _____

Adres : _____

_____

Geboortedatum | D | D | M | M | J | J | J | J |

3 SOSIO EKONOMIES

3.1 Hoogste kwalifikasie: (merk af soos van toepassing)

Moeder	Geen skoolopleiding	Laerskool	St 6-8	St 9-10	Tersier	Weet nie
Vader	Geen skoolopleiding	Laerskool	St 6-8	St 9-10	Tersier	Weet nie

3.2 Aantal kinders:

1	2	3	4	5	6	Ander

3.3 Hoeveel slaapkamers het die huis waar u tans bly?

☐

3.4 Hoeveel mense slaap in die huis vir ten minste 4 nagte per week?

3.5 Is daar lopende water waar u bly? (merk soos van toepassing)

Binnenshuis	
Buitenshuis	
Glad nie	

3.6 Het u elektrisiteit in die huis?

Ja	Nee

4. SOSIO EKONOMIES *(voltooi tydens 1e, 4e, 8e en 12de besoek)*

4.1 Moeder se LMI:

	1e besoek	4e besoek	8e besoek	12e besoek
Gewig	kg	kg	kg	kg
Lengte(slegs eenmalig)	m			
LMI	kg/m^2	kg/m^2	kg/m^2	kg/m^2

4.2.1 Is u op die oomblik gesond?

	1e besoek	4e besoek	8e besoek	12e besoek
Ja				
Nee				

4.2.2Indien Nee, spesifiseer die aard van die siekte

	1e besoek	4e besoek	8e besoek	12e besoek
Respiratories				
Diarree				
Ander				
(spesifiseer)				

4.2.3 Vir hoe lank is u al siek?

	1e besoek	4e besoek	8e besoek	12e besoek
< 1 maand				
1 - 3 maande				
3 - 4 maande				

4.3 Huwelikstatus van die moeder:

	1e besoek	4e besoek	8e besoek	12e besoek
Getroud				
Ongetroud				
Geskei				
Vervreemd				
Weduwee				
Bly saam				
Ander (spesifiseer)				

4.4 Huidige huishoudelike inkomste per maand:

	1e besoek	4e besoek	8e besoek	12e besoek
Geen				
R100-500				
R501-1000				
R1001-3000				
R3001-5000				
Meer as R5000				
Weet nie				

4.5 Rook U?

	1e besoek	4e besoek	8e besoek	12e besoek
Ja (spesifiseer hoeveel per dag)				
Nee				

4.6.1 Wie versorg die baba bedags?

	1e besoek	4e besoek	8e besoek	12e besoek
Moeder				
Vader				
Ouma/Oupa				
Broer/Suster				
Oom/Tannie				
Ander(spesifiseer)				

(Voltooi slegs4.6.2 en 4.6.3 indien dit nie die moeder is nie)

4.6.2 Voltooi in verband met die versorger:

	1e besoek	4e besoek	8e besoek	12e besoek
Naam en van Adres				
Geboortedatum (versorger)	/ /	/ /	/ /	/ /

4.6.3 Hoogste kwalifikasie van die versorger:

	1e besoek	4e besoek	8e besoek	12e besoek
Geen skoolopleiding				
Laerskool				
St 6-8				
St 9-10				
Tersier				
Weet nie				

5 BABA

5.1 Antropometrie:

Datum	Ouderdom	Gewig	Lengte	WAZ	HAZ	WHZ
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

5.2.1 Was die baba al siek sedert vorige besoek?

Besoek/Datum	Ja	Nee	Weet nie / Onseker
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

5.2.2 Indien ja geantwoord op 5.2.1, merk ook asseblief:

Besoek	Diarree	Respira-tories	Weet nie / Onseker	Ander (spesifiseer)	**Tipe behandeling ontvang en duurte**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

6 VOEDINGPRAKTYKE VAN DIE BABA

Melk:

6.1. Merk af watter melk die baba huidig drink: *(u mag meer as een opsie kies indien van toepassing)*

Besoek	Borsmelk	Baba formulemelk	Koeimelk	Weet nie	Ander (spesifiseer)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Indien die baba tans borsmelk ontvang, voltooi ook asb6.2 - 6.5:

6.2 Hoe gereeld drink die baba borsmelk?

Besoek	Op aanvraag	3-4 uurliks	> 4 uurliks	< 3 uurliks	Weet nie
1					
2					
3					
4					
5					
6					
7					

6.2 Hoe gereeld drink die baba borsmelk? (vervolg)

Besoek	Op aanvraag	3-4 uurliks	> 4 uurliks	< 3 uurliks	Weet nie
8					
9					
10					
11					
12					

6.3 Hoe drink die baba die borsmelk? *(u mag meer as een opsie kies indien van toepassing)*

Besoek	Bors	Bottel	Koppie/Teelepel	Weet nie	Ander (Spesifiseer)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

6.4 Indien die baba borsmelk uit 'n koppie / bottel of met teelepel drink, waar word die uitgemelkte borsmelk gewoonlik gestoor?

Besoek	Buite die yskas /kamertemperatuur	In die yskas	In die vrieskas	Weet nie / onseker	Ander (spesifiseer)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

6.5 Hoe lank drink die baba per voeding wanneer hy/sy geborsvoed word?

Besoek	Onbeperk / Op aanvraag	Weet nie	Nooit dieselfde	15-30 minute	< 15 minute
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Indien baba tans formulemelk, koeimelk of ander melk ontvang, voltooi ook asb.

6.6 Wanneer het u baba formulemelk, koeimelk of ander melk begin drink? (antwoord 6.6 en 6.7 slegs eenmalig)

Besoek _____	Sedert geboorte	< 1 week na geboorte	1-2 weke na geboorte	2-4 weke na geboorte	Ander (spesifiseer)

6.7 Hoekom het u besluit om vir u baba formulemelk / koeimelk / ander melk te gee?

Datum	Geen melk in my borste	Te min melk in my borste / baba bly honger	Baba weier my bors	Ek moet / moes terug gaan werk toe	Ek wil nie bors-voed	Ek kan nie bors-voed (gee rede)	Ma / skoon-ma / ander het gesê ek moet	Die dokte r / suster het gesê ek moet	Baba tel nie genoeg gewig op	Ander. Spesifiseer

Gee rede indien nie kan borsvoed: _____

6.8 Watter tipe formule melk drink u baba?

Besoek	Lact 1	Lact 2	Nan 1	Nan 2	SMA	S26 1	S26 2	Pelargon	Weet nie	Ander (spesifiseer)
1										
2										
3										
4										
5										
6										
7										

6.8 Watter tipe formule melk drink u baba?(vervolg)

Besoek	Lact 1	Lact 2	Nan 1	Nan 2	SMA	S26 1	S26 2	Pelargon	Weet nie	Ander (spesifiseer)
8										
9										
10										
11										
12										

6.9 Dui ook die volgende aan :

	Aantal voedings per 24 uur	Volume formule / voeding	Volume formule / 24 uur	Volume formule / kg/24 uur	Aantal maatlepels / voeding	Volume water /voeding	Verhouding
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

6.10 Watter tipe water gebruik u om die melk mee aan te maak?

Besoek	Afgekoelde kookwater	Kraanwater	Weet nie / Kan nie onthou	Ander (Spesifiseer)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

6.11 Hoe gereeld maak u gewoonlik die formule aan?

Besoek	Voor elke voeding	Een keer per dag	2 tot 3 keer per dag	Weet nie /kan nie onthou	Ander (Spesifiseer)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

6.12 Indien u nie voor elke voeding die formule melk aanmaak nie, waar word die melk gebêre wanneer die baba nie drink nie?

Besoek	Buite die yskas / Kamertemperatuur	In die yskas	In die vrieskas	Weet nie / onseker	Ander (Spesifiseer)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

6.13 Hoeveel uur word die aangemaakte melk ongeveer gehou voordat die baba dit drink?

Besoek	Hy /sy drink dit dadelik	Aantal uur gehou voor gedrink word
1		
2		
3		
4		
5		
6		
7		
8		

6.13 Hoeveel uur word die aangemaakte melk ongeveer gehou voordat die baba dit drink? (vervolg)

Besoek	Hy /sy drink dit dadelik	Aantal uur gehou voor gedrink word
9		
10		
11		
12		

6.14 Toon aan indien die baba die volgende vloeistowwe drink. Indien wel, dui ook aan hoeveel ml per dag in elke geval:

Besoek	Water (ml/dag)	Tee (ml/dag)	Vrugtesap (ml/dag)	Koeldrank (ml/dag)	Ander(ml/dag) (Spesifiseer)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Pap:

7.1 Eet die baba tans gereeld pap?

	1	2	3	4	5	6	7	8	9	10	11	12	13
Ja													
Nee													
Weet nie													

7.2 Indien wel,voltooi ook:

Besoek	Spefiseer tipe pap	Waarmee word dit aangemaak	Voeg u gewoonlik suiker by? (Ja/nee)	Voeg u gewoonlik margarine/botter/ olie by ? (ja/nee)	Hoeveel keer per dag eet baba pap
1					
2					
3					
4					
5					
6					
7					

7.2 Indien wel,voltooi ook: (vervolg)

Besoek	Spefiseer tipe pap	Waarmee word dit aangemaak	Voeg u gewoonlik suiker by? (Ja/nee)	Voeg u gewoonlik margarine/botter/ olie by ? (ja/nee)	Hoeveel keer per dag eet baba pap
8					
9					
10					
11					
12					

Groente:

8.1 Eet die baba tans gereeld groente?

	1	2	3	4	5	6	7	8	9	10	11	12
Ja												
Nee												
Weet nie												

8.2 Indien wel, watter soorte?

Besoek	Aartap -pels	Pam- poen	Butter- nut	Skorsie	Wortels	Potjies baba kos	Ander (spesifiseer)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

8.3 Hoe gereeld eet die baba groente?

Besoek	1 X per dag of meer	4 – 6 dae per week	1 – 3 dae per week	Minder as 1 keer per week	Weet nie
1					
2					
3					
4					
5					
6					

8.3 Hoe gereeld eet die baba groente? (vervolg)

Besoek	1 X per dag of meer	4 – 6 dae per week	1 – 3 dae per week	Minder as 1 keer per week	Weet nie
7					
8					
9					
10					
11					
12					

8.4 Merk af indien u gewoonlik die volgende by die groente voeg

Besoek	Margarien/botter/olie	Suiker	Sout
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

Vrugte

9.1 Eet die baba tans gereeld vrugte?

	1	2	3	4	5	6	7	8	9	10	11	12
Ja												
Nee												
Weet nie												

9.2 Indien wel, watter soorte?

Besoek	Piesangs	Lemoen	Appel	Papaja	Potjies babakos	Ander (spesifiseer)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

9.2 Indien wel, watter soorte? (vervolg)

Besoek	Piesangs	Lemoen	Appel	Papaja	Potjies babakos	Ander (spesifiseer)
11						
12						

9.3 Hoe gereeld eet die baba vrugte?

Besoek	1 X per dag of meer	4 – 6 dae per week	1 – 3 dae per week	Minder as 1 keer per week	Nooit	Weet nie
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Ander vaste kosse

10.1 Dui aan indien die baba ook al van die volgende vaste kos eet:

	1	2	3	4	5	6	7	8	9	10	11	12
Vleis												
Hoender												
Vis												
Eiergeel												
Eierwit												
Witbrood												
Bruinbrood												
Rys												
Pasta												
Margarien												
Grondboontjiebotter												
Lekkers												
Chips												
Sjokolade												
Koekies												
Ander.												

10.2 Spesifiseer ander:

Besoek	Ander
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Indien baba al begin het om vaste kos (melk en ander vloeistowwe uitgesluit) te eet, antwoord ook die volgende vrae:

11.1 Op watter tye van die dag eet die baba die vaste kos soos vooraf genoem (let wel: melk en ander vloeistowwe uitgesluit)

Merk meer as een keuse indien van toepassing

Besoek	6 – 9 vm	9 – 11 vm	11 – 2 nm	2 – 4 nm	4 – 7 nm	7 – 10 nm	Ander	Weet nie

11.2 Dui aan waar eet die baba sy/haar maaltye soos genoem elke dag
(maak 'n keuse uit die volgende opsies: huis,crèche, dagmoeder, by famile, weet nie, ander-spesifiseer)

Besoek	Eerste maaltyd	Grootste maaltyd	Ligter maaltyd
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

11.3 Dui aan wie gee vir die baba sy/haar maaltye soos genoem elke dag
(maak 'n keuse uit die volgende opsies:
ma.pa,broer,suster,oupa,ouma,crèche,dagmoeder,weet nie,ander-spesifiseer)

Besoek	Eerste maaltyd	Grootste maaltyd	Ligter maaltyd
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			

KOMMENTAAR