ABSTRACT

Thesis submitted for the degree of Doctor of Philosophy

University of Oxford

Aspects of the Growth and Health of the Suckling and Weanling Infant in Ethiopia

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Hilary Term 1991

This thesis examines inter-relationships between the feeding, health, and growth of infants (aged 0-24 months) in low-income households in Addis Ababa, Ethiopia. Mixed-longitudinal data were collected from a sample of 113 infants and their mothers in Kebele 11, Keftegna 24 from November 1987 to April 1988.

Breastfeeding is the culturally esteemed mode of infant feeding. The culture-specific concept of weaning places the emphasis on the termination of breastfeeding, with little consideration of the quality and quantity of weaning foods. As a result, weaning foods are basic and monotonous. Survival data analysis shows that weaning is commenced at the mean age of 9.2 months, and completed at the median age of 20 months. A probabilistic model is proposed that includes a set of inter-related 'infant-centred', 'mother-centred', and other factors such as the seasonal availability of weaning foods influencing the process of weaning. Culturally-prescribed norms appear to play little or no part in the timing of weaning, in particular, the infant's age is of secondary importance.

Direct observations of suckling behaviour and infant care reveal that 'on demand' breastfeeding was practised, and the mean duration of suckling sessions was 10.96 minutes. The duration of breastfeeding was influenced significantly by maternal body-mass index. Seasonal patterns were detected in the prevalence of fever, coughing, and vomiting in the infants. Associations between morbidity and other data using log-linear models suggest that infant's diarrhoea is closely linked to the level of household hygiene, maternal education, and mother's morale. Infant's ilnesses caused appreciable deficits in weight, but not in stature. Processes of 'catch-up' and 'catch-down' growth are demonstrated by the seasonal effect of diarrhoeal illness on weight. Avenues for further research and policy reform suggested by the findings of this study are discussed.

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To the memory of my aunt, Mile'te-Tsegga Yacob Ra'ssu
(1929-1982).

CONTENTS

Chapter 3: Infant Feeding

Chapter 4: Infant Care

Chapter 5: Maternal Well-being

Chapter 6: Infant Health

Chapter 7: Infant Growth

Chapter 8: Conclusions

APPENDICES

Published Papers and Abstracts of Papers pending Publication

1. 'Short-term variation in stature growth among Ethiopian and English children.' Annals of Human Biology **17**:407-416 (1990).

2. 'Constraints on weaning: Evidence from Ethiopia and Sudan.' Journal of Biosocial Science **22**: 489-500 (1990).

3. 'Infant feeding among urban low-income households in Ethiopia: I. The weaning process.' Ecology of Food and Nutrition (in press).

4. 'Infant feeding among urban low-income households in Ethiopia: II. Determinants of weaning.' Ecology of Food and Nutrition (in press).

List of Figures

List of Tables

Preface

This thesis is based upon field research carried out in Addis Ababa, Ethiopia, during 1987-88. The duration of fieldwork was originally planned for 12 months. However, due to the prevailing political conditions in the country, the length of fieldwork had to be shortened. I spent a total of eight months in Addis Ababa, six months of which were spent in intensive data collection.

I would like to thank Professor Geoffrey A. Harrison for his support and encouragement at the beginning of this study, and for his painstaking supervision throughout its progress. Dr. Tony Boyce gave valuable advice on methods before I started my fieldwork. I would also like to thank Sir Claus Moser, Dr. Dick Passingham, and others at Wadham College for their support and encouragement.

Many have assisted me in setting up my fieldwork. I should like to mention Dr. John Seaman of the Save the Children Fund in London, Ato Getahun, and Ato Teshome, of the Addis Ababa City Council's International Coordinating Committee for Welfare and Development, and the kebele and keftegna authorities in the study site who provided practical assistance. The Save the Children Fund staff offered the use of their office facilities in Addis Ababa from time to time. In particular, I would like to thank Dr. Sarah Atkinson for her moral support.

My deepest thanks go to my father, Mesghenna Almedom, who met me in Addis Ababa, and as a staunch educator, took a personal interest in my work and provided much encouragement and tireless assistance. I would also like to thank Miriam, my mother, and Mikal, my sister, for their support.

Special thanks are due to Woizero Senbätu Abraham for her competence, helpful insight, and conscientious work as my research assistant. Ato Abraham Nerayo Almedom, Woizero Mebrat Nerayo and family, Ato Joseph Jacob and family, Woizerit Senait Seyoum, Woizero Abeba Fessaha and family, Ato Tamrat Samuel, Ato Tekie Ghebre-Hiwot, Ms. Angela Raven-Roberts, and many others in Addis Ababa provided hospitality, and moral support.

When analyzing the data I have benefited from valuable statistical advice from Drs. Gerry Brush, Dave Rossiter, Paul Griffiths, Bob Hiorns, Zia Mehta, Ms. Glynis Edwards, and Mr. Clive Payne. Dr. Bent Juel-Jensen provided advice on child health and epidemiology in Ethiopia. Sir David Cox (Nuffield College), and Professor Stig Wall (University of Umeå, Sweden) gave specific statistical advice and commented on my results at different stages of the analyses. Discussions of my work at various seminars and conferences in Oxford, Paris, and Amsterdam have helped me clarify my ideas along the way. Gerry Brush, Lyliane Rosetta, Philip Stewart, Catherine Panter-Brick, Stan Ulijaszek, Matthew Lockwood, Helen Lambert, Liesbeth Heering, and Duane Quiatt read and commented on particular sections of the draft manuscript. Gillian Downing of the Radcliffe Science Library provided tireless assistance. Val de Newtown, Tamsin Jewell, Beniam, Muzit, and Ermias Mesghenna Almedom, Lynne Munro, Ana-Maria Ells, John de Waal, Ahmed and Salma Karadawi, Susanna Helfer, Lula Kinnaird, Joan Ma, Rosamund Miller, Tessa Pollard, Jo Catling, Giles Ungpakorn, Paul Smithson, Adam Steinhouse, Edmund de Waal, and Woizero Zeinab Karrar gave practical assistance, and moral support.

Alexander de Waal, my husband, read critically earlier drafts of this thesis and made constructive comments and suggestions. He also took the photographs and prepared the maps included.

I would like to extend my gratitude to all in Kebele 11, especially the women who participated in this study. They provided warm hospitality, and gave freely of their time and knowledge.

Finally, Hiroë Benedict, my baby son, whose timely arrival gave the completion of this work a sense of urgency, deserves a note of appreciation.

This work was funded mainly by the Foreign Scholarship Scheme at Wadham College, Oxford. The fieldwork was financed by the Wenner-Gren Foundation for Anthropological Research (New York), and the Royal Anthropological Institute (London). The Department of Biological Anthropology, Wadham College, and the Committee for Graduate Studies provided travel grants. I am grateful to all of these for their generous support.

Chapter 1

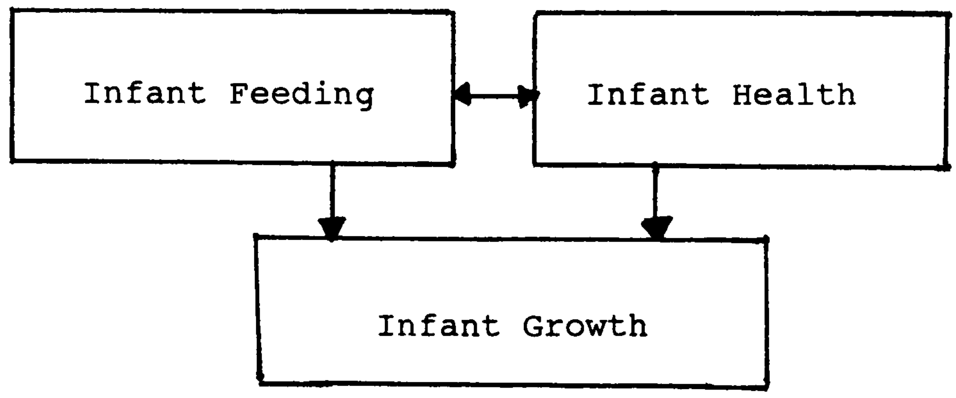
Literature Review and Theoretical Framework

1.1 Introduction

This thesis sets out to investigate aspects of infant health and growth, and the influence of feeding practices on both. The data presented were collected from a selected sample of infants and their mothers in low-income households in Addis Ababa, Ethiopia, from November 1987 to April 1988.

While the level of enquiry is the household, with a modest study sample of mother-infant pairs, the scope of information gathered and analyzed is relevant to the wider community. It is also likely that conclusions drawn from the results of this study will be applicable to populations in comparable ecological and socio-economic settings elsewhere.

The overall structure of this thesis may be summarized by the following diagram, representing the three major parts in relation to each other.



Studies on each of these three topics have been widely reviewed in the last decade (Underwood et al., 1981; Winikoff, 1981; Forman, 1984; Huffman, 1984; Kovar et al., 1984; Seward and Serdula, 1984; Underwood, 1985; Kramer, 1988; Dewey et al., 1989; Winikoff and Laukaran, 1989; Van Esterik, 1989; Maher, 1990). This introductory chapter re-examines the literature with the aim of assessing the interrelationships between infant feeding, health, and growth.

The first part of this chapter comprises a review of the literature on infant feeding in which relevant works from the existing wide range of published material are evaluated. Considerations of comparability of study populations, study design and methods, as well as significance of major findings, have been employed in selecting examples. Attention is focused on studies carried out in less-developed countries, mainly in Africa, and specifically in Ethiopia, although works from other parts of the world are also cited, whenever considered relevant.

The second part of this chapter looks at studies of infant health and morbidity. These studies often discuss infant health in relation to feeding regime or growth performance, or both. Therefore this section serves as a bridge between the first and the third part, which deals with infant growth.

1.2 Infant Feeding

Research on infant feeding has undergone several changes of approach and emphasis over the past decades. This section outlines the background and main issues of debate.

1.2.1 Historical Background

Infant feeding first became an issue of vigorous debate in the 1960s and early 1970s when commercial infant formula foods were promoted aggressively by manufacturing companies from the western world in and around urban centres of many less-developed countries.

The first debate was concerned with whether breast or bottle feeding was more effective in promoting optimal health and growth of the infant. In many parts of Africa, Asia, and Latin America, it was found that the introduction of formula foods was seriously detrimental to the infant (Mata, 1978a; Rowland et al., 1978; Barrell and Rowland, 1980; Black, 1984). The main problem was the way in which these foods were prepared rather than their constituents. Lack of knowledge on the part of mostly non-literate mothers regarding the preparation of commercial infant formula foods, often with instructions in a foreign language, resulted in the over-dilution of feeds, causing the infant to be undernourished. Moreover, very often, the utensils used (especially bottles and teats) lacked cleanliness and contaminated the food, exposing the infant to gastrointestinal infections and subsequent malnutrition (Black, 1984). Added to the unhygienic methods of preparation, such as the use of unboiled, contaminated water for mixing preparations, insanitary conditions of storage of prepared foods aggravated the problem (Rowland et al., 1978; Barrell and Rowland, 1979; 1980). Storing food correlated with dramatic increases in the bacterial content of infant foods. In contrast, breastfeeding provided a nutritionally balanced, and immunologically sound mode of infant feeding (Mata, 1978b; Rowland et al., 1980).

The use of formula foods as supplements to breastmilk early in the infant's life also proved hazardous because it caused the supply of breastmilk to dwindle as suckling frequency decreased.

By the late 1970s, this debate was resolved in favour of the breast (Jelliffe and Jelliffe, 1977; 1978b; Ebrahim, 1978; Mata, 1978b). All of these studies strengthened the view that breastfeeding is nutritionally, immunologically, and psychologically the best mode of feeding, at least for the first few months of life. The superiority of breastfeeding became particularly clear in the less-developed countries where breastfed infants seemed to thrive despite the lack of proper sanitation and inadequate weaning foods.

As a result, campaigns were launched in many countries to prevent commercial infant food producing companies from advertising their products (WHO, 1981b). Moreover, substantial funds from infant formula food manufacturers and distributors, such as the Nestlé Foundation, were redirected to promoting research and academic discussion on issues related to infant feeding (Williams and Baum, 1984), health (Lebenthal, 1984), the process of weaning (Ballabriga and Rey, 1987), and growth (Waterlow, 1988) with a particular focus on the situation in less-developed countries. In the western world breastfeeding has subsequently gained increasing popularity, notably among middle-class educated mothers whose determination defeats all counter-forces.

However, the promotion of breastfeeding without due considerations of the nutritional costs incurred on the mother have recently come under serious criticisms. The critics, anthropologists who have carried out micro-level studies among mothers in less-developed countries, have pointed out that the phenomenon termed 'maternal depletion syndrome' (Jelliffe and Maddocks, 1964; Jelliffe and Jelliffe, 1978b) has been little understood by policy makers (Maher, 1990). Following multiple pregnancies and prolonged periods of lactation, maternal depletion syndrome is manifested by osteomalacia (due to the drainage of calcium and vitamin D from the mother's body), protein-energy malnutrition (PEM), progressive weight loss, and a prematurely aged appearance. The consequences of maternal depletion on infant well-being and survival include reduced birth-weight.

1.2.2 Current Issues of Debate

Three main questions form the basis of current debate. These are:

1. Is modernization in less-developed countries the cause of a decline in breastfeeding?
2. Are the reasons why individual women decide not to breastfeed worthy

of investigation?

3. Is breast always best?

A number of reviewers have rightly challenged the assumptions made by many studies that prolonged breastfeeding was universally practised by mothers in traditional societies, and that observed decline in breastfeeding is therefore due to the influences of industrialization and modernization (Underwood et al., 1981; Notzon, 1984). These critics have pointed out that many such studies fall short of a firm quantitative base of evidence at a previous point in time from which change is documented. The assumption is made, with little or no hard evidence, that at some previous time prolonged breastfeeding had been universal, and that their findings of shorter durations must, ipso facto, indicate a decline.

Several objections are made. First of all, it is erroneous to suggest that breastfeeding has always been universal in non-industrialized societies. Archaeological evidence has indicated that infant-feeding artifacts were in use in ancient societies, and so alternatives to breastfeeding did exist. Early ethnographic accounts have also shown that mothers in some traditional cultures were unwilling to breastfeed beyond the first month postpartum (e.g., Linton, 1939). Even today, breastfeeding beyond the first few months is actively discouraged among pastoralist societies where infants are fed mainly on non-human milk and paps made of the staple crop, using traditional feeding 'bottles' (Knutsson and Mellbin, 1969; Pan American Health Organization, 1976).

Secondly, at least two points in time are needed in order to monitor change in the practice of breastfeeding. A common feature in these studies is that the data are collected cross-sectionally, and past trends are discussed by inference from present findings, rather than by direct longitudinal observation. Longitudinal studies documenting change in infant feeding practice over time are scarce. Moreover, trends of decline in breastfeeding are often not uniform between, or even within countries (Van Esterik, 1982).

However, some studies have produced hard evidence of dramatic declines in breastfeeding. Two of these studies illustrated well the effect of exposure to modernization, and to alternatives for infant feeding. These were carried out in the United Kingdom, among immigrant women from India and Pakistan (Aykroyd and Hossain, 1967; Evans et al., 1976). Most of the women studied either did not breastfeed at all, or they breastfed for very short durations compared to what would have been the case had they remained in India or Pakistan. The reasons given included the lack of support and encouragement by the medical staff upon hospital deliveries, the absence of experienced relations and friends to support them in the early stages of suckling, and the psychological pressures of living in a new environment. Interestingly, the change in infant-feeding practice was not due to the effect of modernization per se. These women did not abandon breastfeeding because they preferred bottle-feeding but because their new environment did not provide them with the support and encouragement necessary to maintain breastfeeding. Although these women had switched to bottle feeding, the adult diet in their households and communities remained unchanged, and many of them did not even speak English.

Other studies conducted among low socio-economic groups in semi-urban and urban environments in a number of less-developed countries also reported changing patterns in infant feeding. Among the reasons for change were the explosive migration of these groups from rural areas to peri-urban 'squatter' settlements and urban slums, their increased interaction with 'urban' influences including the availability of commercial products, health services, job opportunities, and the breakdown of social networks (Gussler and Mock, 1983; Tekçe and Shorter, 1984; Reichenheim and Ebrahim 1986; Dettwyler, 1986; Sogunro, 1987; Giugliani et al., 1987; Tekçe, 1990).

Most of these studies have concluded that shorter durations of exclusive breastfeeding in less-developed countries are generally associated with higher socio-economic status, increased education, urban residence, use of oral contraceptives, and employment away from home among women.

However, a recent study in which Turkish mothers in Istanbul were compared with Turkish immigrant mothers in Stockholm showed that breastfeeding practice did not change in the latter group (Koctürk, 1988). Both groups of mothers were asked to state the advantages and disadvantages of breastfeeding. The most important advantages of breastfeeding reported by mothers in Istanbul included its nutritional value and its contraceptive effect. The most important disadvantage was the insufficiency of breastmilk, making it difficult for the mothers to maintain prolonged breastfeeding. Turkish immigrant mothers in Stockholm believed that the only advantage of breastfeeding was nutritional, and they did not mention any disadvantage. In Sweden, where breastfeeding is esteemed highly and encouraged, the immigrant Turkish women did not feel the need to switch to bottle-feeding, even though their new environment was a highly modernized and industrialized one.

Some studies have also identified reasons why individual women stop breastfeeding. These reasons include breastmilk insufficiency, maternal or infant ill-health, maternal employment away from the home, and the infant's rejection of the breast (Akin et al., 1981a and b; Van Esterik, 1982; Huffman, 1984; Koctürk, 1988).

So far, these studies have tended to identify socio-demographic groups or categories, and to look at the statistically prevalent mode of breastfeeding present. There are two shortcomings in the approaches of enquiry taken: firstly, effects of the introduction of supplementary/weaning foods have not been rigorously investigated, and secondly, variations between individual women within a group have been overlooked.

Within country variations in breastfeeding practice are well documented. Illustrations of this include studies from Tanzania (Bornstein, 1973), Senegal (Cantrelle, 1971), Nigeria (Maclean, 1966;

Orwell and Murray, 1974), and Ethiopia (Knutsson and Mellbin, 1969). These studies demonstrated differences in infant feeding regime according to ethnic affiliation, culture, and ecology.

However, while important factors have been identified, the reasons why a mother may decide that her child needs to be supplemented, have not been closely investigated. A common implicit assumption runs through many of these studies that there are socio-culturally defined norms, relating to the age at which infants should be introduced to supplementary/weaning foods. These norms may, however, be affected by factors such as maternal education or employment, and the extent to which they can be fulfilled may be affected by physiological factors associated with the mother's supply of breastmilk. A thorough examination of the decisions regarding what, why, and when to wean will be found in Chapter 3. The relative merits of the 'normative' versus 'probabilistic' (that is, individualistic and interactive) approaches to the study of weaning will be considered.

While differences between socio-economic or cultural groups are of great importance, and 'failures' due to illness or inability to breastfeed are also important, they explain little of the variation within populations. A few studies have gone beyond this view, and have suggested that individual factors may be important: for example, infant-initiated weaning from the breast (Clarke and Harmon, 1983), and the bio-cultural explanations of the 'insufficiency of milk syndrome' (Gussler and Briesemeister, 1980). These studies, which are behaviourial and anthropological in approach, contrast sharply with the majority of studies on breastfeeding, in which nationally representative trends have been described. It is necessary to counterbalance the two approaches for an integrated study of the subject. Data generated by anthropological studies are different in that they incorporate individual variations.

Finally, it is important to note that there is the beginning of a reaction against the view that breast is always best. Maher (1990) has noted that prolonged breastfeeding may carry high nutritional costs for the mother, where she is malnourished on account of poverty and/or gender discrimination. She cites examples of greater malnutrition among breastfed infants compared to bottle-fed infants in certain circumstances, generally those in which mothers are themselves undernourished. She also cites a shorter life-expectancy for women in the less-developed world, associated with the cost of progressive depletion brought about by childbearing and prolonged breastfeeding.

In summary, the main issues of current debate are related to reported declines in breastfeeding practice, to what extent they are widespread, whether industrialization/modernization does play a role in bringing them about, and an enquiry into the appropriateness of the 'Breast is Best' dictum in policy formulations for less-developed countries. Each issue will be examined in the light the data presented in this thesis.

1.2.3 Sources of Data

Data on infant feeding can be found in three different kinds of studies. The differences lie in the aim of study and methods used to collect information. The first kind consist of large-scale demographic surveys, most notably, the World Fertility Survey (WFS) studies. These were designed to collect general-purpose demographic information focusing mainly on the measurement of fertility and the use of contraceptives among varying social and economic strata in populations worldwide.

The method of collecting data on breastfeeding in the WFS surveys was by structured interview schedules in which a sample of respondents considered to be nationally representative were asked to provide information on the duration of breastfeeding of infants born during the 4 years preceding the survey. Comparisons were then made between the demographic characteristics of those who never breastfed and those who ever breastfed. The usefulness of the data yielded by the WFS studies for the purposes of this thesis is limited in three ways.

Firstly, the accuracy of recall information over 4 years is difficult to establish. The effect of recall bias is apparent in the way that information on the duration of breastfeeding tended to be 'heaped' by multiples of 6 months.

Secondly, no definition or definitions of breastfeeding were provided in the WFS studies so that no distinction could be made between 'full or exclusive breastfeeding', and 'partial or supplemented breastfeeding'. Interpretations of results regarding fertility have simply assumed that the duration of breastfeeding relates to full breastfeeding (e.g., Ferry, 1981). Such assumptions can be highly misleading. For example, the Sudan Fertility Survey (WFS, 1979) reported that for women of all ages, the average duration of 'breastfeeding' was 6.7 months. This figure increased from 5.8 months for women aged less than 20 years to about 7 months for women over 40. Because it is unclear whether or not replies embraced both types of breastfeeding, it is difficult to interpret these figures. We cannot, for instance, explain why the duration of breastfeeding apparently increased with increasing maternal age.

Thirdly, the WFS data include little or no account of supplementation and weaning (Akin et al., 1981a and b, Ferry, 1981, Lightbourne et al., 1982). Data on infant feeding are therefore incomplete on account of being restricted to breastfeeding.

The second kind of studies which provide data on infant feeding are nutrition studies. Researchers on human nutrition have concerned themselves with maternal and child nutrition for the past two decades. The on-going field research of the Medical Research Council's Cambridge based Dunn Nutrition Unit in the Gambian village of Keneba (Whitehead et al. 1978; Prentice et al., 1980; 1981; 1983; Lunn et al., 1980; 1984; Lunn, 1985; Prentice and Prentice, 1988), and the nutritional and growth studies carried out in a number of African countries by researchers from the London School of Hygiene and Tropical Medicine (Waterlow et al. 1977, Zumrawi et al., 1987a and b) are good examples.

The Centers for Disease Control (CDC) in Atlanta, and the Nutrition

Assessment Unit of UCLA also carried out nutrition surveys in five African countries (Cameroon, Egypt, Liberia, Sierra Leone, and Togo) in the mid-1970s. These surveys collected data on breastfeeding as well as supplementary feeding. Although the studies from the five countries were not easily comparable, Popkin et al. (1982) have concluded that the main finding common to all was that breastfeeding was universal and the dominant mode of infant feeding for most of the first year of life. The proportion of infants aged 6 to 11 months who were at least partially breastfed ranged from 99.9 per cent in Togo to 89.0 per cent in Liberia. Information on supplementary foods showed great variation both within and between populations on the timing of introduction and types of weaning foods used.

In Ethiopia, the Swedish-founded Children's Nutrition Unit (now the Ethiopian Nutrition Institute) in Addis Ababa has been engaged in investigations of maternal and child nutrition since the early 1960s. These studies included clinical measurements of breastmilk output among mothers of different socio-economic groups, mainly in Addis Ababa (Gebre-Medhin et al., 1976b), documentation of dietary practices in different parts of the country (Selinus et al., 1971a, b, and c), anthropological studies of breastfeeding practice in different ecosystems (Knutsson and Mellbin, 1969), and studies of traditional weaning foods leading to the formulation of an appropriate, nutrient-balanced weaning food consisting of locally produced ingredients (Ågren et al., 1969; Selinus, 1970; Abrahamsson et al., 1972; Svanberg et al., 1987).

Cross-study comparisons between the nutritional studies are beset by methodological problems related to the selection and the size of samples, techniques of measurement, methods of analysis, or a combination of these. There is as yet no consensus on the most reliable methods of measurement of dietary-intake, breastmilk output, and mother-child energy requirements (Underwood et al., 1981; Seward and Serdula, 1984; Waterlow, 1988).

The third kind of studies which provide a source for extensive data on infant feeding are breastfeeding studies. Many of these have been carried out by individual researchers who have documented breastfeeding practices at and soon after birth (Grantham-McGregor and Back, 1970; Ojofeitimi, 1981; Kimati, 1983). These were prospective studies based in hospitals, and have contributed useful information on the social and biological determinants of breastfeeding among sections of urban women who had hospital deliveries. However, they neither describe their methods of analysis nor define some of the terms they use such as 'abnormal delivery'.

The most cited breastfeeding study, however, is the World Health Organization collaborative study (WHO, 1981). Nine countries collaborated in this study: Sweden and Hungary represented the developed nations and seven less-developed countries were included: Ethiopia, Nigeria, Zaïre, Chile, Guatemala, India, and the Philippines. In contrast with the WFS studies, this study was designed to produce nationally representative data on infant-feeding practices using relatively small samples. In most of the countries studied, the proportion of children ever breastfed was greater than 90 per cent for all age-groups studied. The proportion of children ever breastfed was particularly high in the African countries where initiation was almost universal for all sub-groups. The most notable deviations from this pattern were the high-income urban households in the Philippines (68 per cent) and Guatemala (77 per cent). The findings for Ethiopia showed that a small proportion (35 per cent) of the infants born to middle and high income women in Addis Ababa were being breastfed at 6 months of age, compared to 81 per cent of the infants born to low-income women, and 100 per cent of the infants born to rural women. The findings and limitations of the WHO study are discussed further in Chapter 3 (see Sub-section 3.1.3).

More recent studies have emphasized the need for detailed descriptions of infant feeding practices throughout the world. These studies identified cultural and socio-economic factors which related to different breastfeeding regimes (Huffman et al., 1980; Van Esterik and Greiner, 1981; Winikoff, 1981; Gussler and Mock, 1983; Kimati, 1983; Huffman and Lamphere, 1984; Millard and Graham, 1985a, 1985b; Raphael and Davis, 1985; Conton, 1985; Panter-Brick, 1987; Dettwyler, 1987; 1988; Koctürk, 1988; Morrow-Tlucak et al., 1988). The data generated by these studies include quantitative information on time allocation and suckling patterns, as well as qualitative reports pertaining to the socio-economy and ethnography of the study populations. These studies have exposed the complexity of factors that determine infant health and growth, and highlighted the need for an integrated approach to current problems.

1.3. Infant Health

The interrelationships of infant feeding and infections are crucial in the study of infant growth and health. Two main points are outlined at the outset:

1. The synergism between infant feeding and health is important.
2. Growth performance is the outcome of this synergistic interaction between feeding and health.

Nutrient quality and quantity, and the hygienic conditions of preparation, serving, and storage of food are key factors determining the health of the suckling and weanling infant. The well known synergism involves infections hampering the ability of the infant to consume enough food, causing malnutrition; and malnutrition in turn depressing the immune system, rendering the infant prone to repeated and more severe or prolonged infection episodes (Ulijaszek, 1988), resulting in growth failure (Mata et al., 1967; 1977; Martorell et al., 1979; 1980; Martorell and Ho, 1984).

The outcome of the synergism between infection and malnutrition is often evaluated through physical growth performance. Many studies have reported growth 'faltering' in infants of the 6 to 12 months age range (Antrobus, 1971; Mata, 1978a; Asha et al., 1980; Khan, 1980; Whitehead and Paul, 1981; Zumrawi et al., 1987b). This has been associated with the introduction of supplementary foods in the diet of the breastfed infant, and with the incidence of infections which limit the infant's uptake of energy and nutrients. Hence the phrases the suckling's (or weanling's) dilemma (see below - page 18).

Three main factors determine the effect of the introduction of supplementary/weaning foods and/or early termination of breastfeeding on infant health and growth. These are,

1. the adequacy of weaning foods provided,
2. the effect of introducing these foods on breastmilk output, and
3. the prevalence of infection.

1.3.1 Adequacy of Weaning Foods

The types of supplementary/weaning foods used and the reasons for choosing them vary and depend on several interrelated factors including cultural preferences, availability or cost of food, socio-economic status, and health of the mother-infant pair. Ideally, weaning foods should be nutrient-balanced and free from infective agents. In reality, however, these requirements are seldom fulfilled, especially in less-developed countries where weaning foods tend to be bulky with low caloric density (Karlsson and Svanberg, 1982; Svanberg et al., 1987), and sanitary facilities are poor or non-existent (Rowland et al., 1978; Barrell and Rowland, 1979; Rowland and Barrell, 1980; Barrell and Kolley, 1982; Imong et al., 1989).

Bulky foods of low caloric density make it difficult for an infant to consume the volume needed to satisfy energy requirements (Lauber and Reinhardt, 1979; Khan, 1980). A number of studies have shown that enormous amounts of poor quality weaning foods need to be consumed if the child is to be well nourished. For example, in Uganda, a child needs to consume about twice the weight of food consumed by a European child to fulfil energy requirements (Rutishauser, 1972). In Nigeria, a child needs to consume 3 to 4 Kg per day of eko, a weaning pap made from maize, to meet calculated energy requirements (Naismith, 1973). Eko contained little more than 70g solids per kilogramme, the bulk of which consisted of carbohydrate, providing only 290 kcal per kilogramme. During preparation of maize eko, 81 per cent of the fat and 41 per cent of the protein was lost. The proportion of the total metabolizable energy available from fat was thereby reduced from 11 per cent in raw maize to 2 per cent in the infant food. Moreover, eko and other infant foods prepared by Yoruba mothers such as amala (cooked cassava) and eba (yam) lacked essential fatty acids (EFA), rendering the infants EFA deficient. In the highlands of Papua New Guinea, pre-school children could not consume enough of the bulky staple, sweet potato to provide energy requirements of 80 calories per kilogramme body weight per day (Binns, 1976). Many traditional weaning foods such as yam, plantain, cassava, and banana may provide adequate calories but not enough protein (Rutishauser, 1972). This causes malnutrition, namely, protein-energy malnutrition (PEM) which in turn renders the child susceptible to severe infections. Poor appetite associated with illness was a major factor in restricting intake of energy and nutrients in Rutishauser's sample of Ugandan children.

In Ethiopia, the Children's Nutrition Unit (CNU) which is now part of the Ethiopian Nutrition Institute produced a nutritionally balanced weaning food called Faffa from locally grown ingredients, at a relatively low cost (Ågren et al., 1969; Abrahamsson et al., 1972). The constituency of Faffa has been improved over the years to make it less bulky and more nutritious for Ethiopian children (Svanberg et al., 1987). However, mothers' awareness of the benefits of Faffa, and the use of it in the low-income sections of the population is limited. For example, very few mothers in the Kebele 11 study sample weaned their infants on Faffa (see Chapter 3).

1.3.2 Effect of Early Supplementation on Breastfeeding

While breastfeeding is no longer disputed as the best mode of infant feeding, the length of time an infant can be sustained on breastmilk alone is far from certain. At first, nutritionists were concerned that prolonged breastfeeding, without supplementation, would endanger physical growth through undernourishment and susceptibility to infection. Supplementation was therefore recommended to start at 3 to 4 months (Underwood and Hofvander, 1982).

Later, it was found that early supplementation had serious drawbacks. These included the introduction of infective agents through the improper handling of supplementary foods (discussed in the next sub Section). It also became apparent that early supplementation could lead to a reduction in the infant's appetite for breastmilk, which in turn would lead to the decline in breastmilk secretion (Auerbach and Eggert, 1987; Winikoff and Laukaran, 1989).

Early supplementation may thus result in increased infant morbidity through the introduction of infective agents and the decrease in suckling frequency and/or intensity which in turn inhibits breastmilk secretion.

1.3.3 Prevalence of Infection

The most common infections among suckling and weanling infants in less-developed countries are gastro-intestinal. The majority of studies of infectious illness demonstrate lower rates of gastroenteritis among breastfed infants compared with bottle-fed infants. This protective association persists in those studies in which potentially confounding variables such as housing conditions, quality of hygiene, and level of maternal education were controlled for (Kannaneh, 1972; Fergusson et al., 1978; 1981; Chandra, 1979). There are two separate points: (1) the possible introduction of infective agents with the introduction of weaning foods, and (2) the loss of protection provided by mother's milk. It seems likely that researchers with an over-simple conception of weaning may well equate or confuse the two. The question of breast versus bottle feeding is also a separate point though linked to the above two.

The findings with regard to respiratory infection are, however, conflicting. Studies conducted in developed countries found little or no effect (Paine and Coble, 1982; Frank et al., 1982), while infants breastfed for longer periods were reported to suffer significantly less from respiratory infections compared to those breastfed for shorter periods, in less-developed countries (Chandra, 1979; Watkinson, 1981). Some researchers have suggested that the association between duration of breastfeeding and reduced risks of respiratory illness may be an indication of a superior child-rearing environment, rather than a direct causal relationship (Fergusson et al., 1981).

The effects of season and quality of environment are also important. The contamination of weaning foods, a common cause of gastroenteritis, increases with elapsed time since preparation (Capparelli and Mata, 1975; Rowland et al., 1978; Barrell and Rowland, 1979). The method of feeding - i.e. utensils used such as bottles - may increase the likelihood of contamination. In the Gambian village of Keneba, a high proportion of weaning foods showed bacterial growth at a level considered hazardous. The proportion of contaminated infant foods increased during the wet season according to elapsed time since preparation. During the wet season, the proportion of foods contaminated in the first hour after preparation was 34 per cent of 43 samples, and by 6 to 8 hours, 96.2 per cent of 26 samples. In the dry season, only 6.8 per cent of 73 samples were contaminated in the first hour, compared to 70.7 per cent of 41 samples by 8 hours. Massive increases in water pollution (as measured by faecal coliforms and streptococci) were associated with the onset of rains. Gruel showed less contamination immediately after preparation, than cow's milk served with contaminated containers did, but bacterial overgrowth in gruel was as great several hours after preparation in gruel as it was in cow's milk (Barrell et al., 1979).

When morbidity data from breastfed and bottle-fed infants in a North American rural medical centre were compared, it was found that the development of significant illness was delayed in infants who were breastfed for prolonged periods of time: peak incidence appeared to occur during the weaning period (Cunningham, 1977). These lower rates of infection could be due either to protection provided by maternal antibodies contained in breastmilk, or to the fact that children who did not consume supplementary foods were not exposed to sources of infection contained in contaminated foods, although the risk of contamination may not have been as great as it might have been in a low-income setting of a less-developed country. This is an example where the two separate points seem to be equated/confused.

Rowland et al. (1978) have described the 'weanling's dilemma' as comprising two possible paths the weanling infant in a poor quality environment of a less-developed country might be forced to take before s/he faces untimely death. One path starts with the encounter of infective agents in insanitary conditions leading to malnutrition, and malnutrition leading to subsequent death. The other path starts with malnutrition due to the inadequacy of breastmilk and/or weaning foods leading to the susceptibility to infection which in turn leads to death. That is,

Infection ⟶ Malnutrition ⟶ Death

or,

Malnutrition ⟶ Infection ⟶ Death

This was later re-defined as the suckling's dilemma (Waterlow, 1981). The first path referring to early introduction of supplementary/weaning foods in insanitary conditions bringing about infection. When infection sets in, the infant's appetite deteriorates and the food given to the infant may also be bulky and poor in nutrient content. Malnutrition is assessed by anthropometric indicators that detect the occurrence of growth 'faltering'. Severe malnutrition leads to increased vulnerability to diseases which cause death. The second path relates to the late introduction of supplementary/weaning foods again leading to the malnutrition (undernourishment) infection spiral.

The most important debatable point in the concept of the suckling's dilemma concerns the assumption that early 'faltering' in growth (including low birth-weight) is deleterious to the infant. Significant evidence has been forwarded in support of 'Small is beautiful' not only with reference to birth weight, but also to perinatal somatic growth. This issue will be taken up in Section 1.4 below, and later on in Chapter 7.

Within a given unfavourable environment, some infants suffer from infections more than others. This aspect of variation relating to differential morbidity levels will be examined in Chapter 6.

1.4 Infant Growth

This section reviews major studies on the effect of infant-feeding practices on growth performance. Considerable research has been carried out on the duration of time breastmilk may be expected to satisfy the infant's nutrient and energy requirements, particularly in less-developed countries. The adequacy of breastmilk and how that is evaluated will be discussed first. The main methodological problems encountered in the literature will then be considered.

1.4.1 Adequacy of Breastmilk

As the review of studies of infant feeding has shown (Section 1.2 above), the superiority of breastmilk over any other infant food in promoting health and growth of the neonate is no longer disputed. Breastmilk provides the newborn infant with adequate nutrition and passive immunity against common infections early in life (Mata, 1978b). Breastfeeding also serves to establish the maternal-infant bond providing both partners with emotional security and psycho-physiological well-being (Harfouche, 1970; Jelliffe and Jelliffe, 1971; 1978b; Schaffer, 1977, Ebrahim, 1978).

The issue for debate was 'How long can breastfeeding sustain satisfactory growth and health of the infant?' Two approaches were taken in order to find an answer to this question. One was to match theoretical estimates of infant energy and protein requirements for adequate growth with the actual amount and quality of breastmilk produced. The other was to assess the growth performance of breastfed infants in different populations by comparing them with internationally recognized reference data.

1.4.1.1 Theoretical Estimates

Theoretical estimates indicate that a well-nourished mother who produces 1,000 ml of milk/day can only provide enough energy and nutrients for growth for the first 3 to 4 months postpartum. These estimates are largely based on assumptions about breastmilk volume, energy content, as well as energy and protein requirements for growth in infancy. Growth 'faltering' is said to start when the infant reaches 3 or 4 months (Waterlow and Thompson, 1979; Waterlow et al., 1980; Waterlow, 1981; Underwood and Hofvander, 1982).

However, the concept of minimum requirements is highly contentious. Some researchers argued that previously suggested minimum requirements might have been exaggerations of the actual needs, and it was suggested that an infant could meet the energy requirements for most of the first year of life solely from breastmilk (Whitehead and Paul, 1982).

Both maternal and infant factors influence breastmilk output and its measurement. These include the feeding schedule (i.e., whether the infant is fed 'on demand' or according to a timetable), the infant's health, gestational age, birth-weight, ability to suck, the mother's health, pregnancy status, and level of psychosocial stress.

Dietary intake during pregnancy may affect breastmilk output through the build-up of fat stores (Paul et al., 1979; Prentice et al., 1981). These longitudinal studies from rural Gambia suggested that the level of concentration of fat in breastmilk correlated with subcutaneous fat deposited during the last trimester of pregnancy rather than with the dietary intake during lactation (Prentice et al., 1981).

The work of the Dunn Nutrition Unit in the Gambia has demonstrated the complexity of the interrelationships of maternal nutrition and suckling performance. At first, supplementation of maternal diet during pregnancy was expected to result in increasing breastmilk intake by increasing birth-weight, because infant's breastmilk intake and birth-weight were significantly positively correlated (Whitehead et al., 1978). However, it was later found that other factors such as maternal workload and season also influenced breastmilk output. In one longitudinal study of 80 infants aged 1-18 months, the volume of breastmilk (2 to 6 months postpartum) dropped from a peak of 850 g/day in the dry season to a minimum value of 550 g/day in the wet season. During this time, maternal food intake dropped from 1,736 Kcal/day in the dry season to 1,351 Kcal/day in the wet season, while agriculturally related physical activity increased (Prentice, 1980). Similar seasonal differences were reported also from Kenya (van Steenbergen et al., 1981). Later, supplementation of the diet of lactating Gambian women in a strictly controlled study showed no effect on the quantity and quality of breastmilk produced (Prentice et al., 1983a). A recent report from the same study population in the Gambia has shown that normal birth-weights could be achieved despite very low maternal dietary intakes during pregnancy (Prentice and Prentice, 1988).

In Ethiopia, no attempt has been made to match breastmilk quantity with growth performance. However, one study has shown that the quality of breastmilk from well-to-do Ethiopian mothers may be superior to that of

Swedish mothers: samples of breastmilk from high income Ethiopian mothers were found to have higher contents of ß-carotene compared to those from Swedish mothers (Gebre-Medhin et al. 1976b).

1.4.1.2 The Use of Growth 'Standards'

Various sets of anthropometric data have, in the past, served as 'standards' for assessing growth performance. These include the Harvard (Vaughan, 1969), the Iowa (Jackson and Kelly, 1945), Tanner and Takaishi (Tanner et al., 1966), and the more recent National Centre for Health Statistics (NCHS) data (Hamill et al., 1979). In the late 1970s, the NCHS data were adopted by the World Health Organization and recommended for international use in order to make inter-study comparisons easier.

The earlier data sets such as the Harvard (longitudinally obtained) and the Iowa (cross-sectionally obtained) were based on small numbers of healthy children (less than 100 in each age group) from white upper social classes who were predominantly fed on cow's milk or formula food with the early addition of solid foods. The advantage of the NCHS data over these was that they were collected (longitudinally) relatively more recently (1960 to 1970), with large sample sizes (1000 children in each age group), and the outer percentiles are defined more accurately.

However, this advantage does not apply to the 0 to 23 month age-group. The NCHS data for this age-group were obtained from the Fels Institute longitudinal study in which 200-300 infants per age group were measured from 1929 to 1972. They are therefore old data with less accurately defined percentiles. The study population for the Fels Institute growth data were infants from white, predominantly middle-class families, and were predominantly bottle-fed, with early introduction of solid foods. The validity of the NCHS data for assessing growth performance of infants in less-developed countries has therefore been duly questioned on three major grounds: date of data collection, feeding regime, and applicability to other populations (Whitehead and Paul, 1981;

1984; Ahn and McLean, 1980; Eveleth and Tanner, 1976). Other critics of the NCHS data have focused on the skewness of distribution and fitting smoothed curves (Cole et al., 1981; Cole, 1985; 1988; 1989).

Underlying the use of growth 'standards' was the notion that 'the greater the growth, the healthier the child', i.e. 'Big is beautiful'. However, this proved too simplistic and in some cases even wrong since field research showed that being big was not crucial in order to achieve optimal health, if health is broadly taken to mean the ability to thrive. Many researchers have thus questioned this notion (Goldstein and Tanner, 1980; Hitchcock et al., 1981; Taitz, 1971, Walker and Walker, 1981; Crittenden and Baines, 1986).

Very important differences were found in growth performance between breastfed and bottle-fed infants, as well as within breastfed infants. Chandra (1981; 1982) studied healthy breastfed infants in Canada and suggested that physical growth slightly less than the average NCHS reference data may be optimal for infants who are exclusively or predominantly breastfed. In environments with good sanitary and health facilities, exclusively breastfed infants have a slower rate of growth than bottle-fed infants who are introduced to solid foods early.

In one study, bottle-fed infants doubled their birth weights earlier than breastfed infants (Taitz, 1971). Furthermore, it was found that bottle-fed infants gained disproportionately more weight than length compared to breastfed infants when their birth weight doubled (Neumann and Alpaugh, 1976). However, when two groups of bottle-fed infants, one group fed on low-solute formula and the other fed on cow's milk were compared with breastfed infants, no differences were found in weight gain between breastfed and formula-fed infants, but infants fed on cow's milk had higher weight gains (Saarinen and Siimes, 1979). This suggests that there may be no difference in the growth performance of breastfed and bottle-fed infants, provided that low-solute formula milks are used instead of unmodified milks. Present day formula milk is prepared to resemble breastmilk as much as possible and so the physical growth of infants fed on formula milk is not very different from that of breastfed infants, other things being equal.

The length of time infants can achieve optimal growth on breastmilk alone is best determined by examining the growth curves of exclusively breastfed, healthy infants of healthy, well nourished mothers. Wallgren (1945) carried out a semi-longitudinal study of 183 male exclusively breastfed infants born to healthy Swedish mothers, from birth to 6 months. His findings suggested that under optimal conditions, exclusive breastfeeding could support normal growth for six months.

Ahn and Maclean (1980) studied 96 infants of mothers in La Leche League International from the Washington D.C. - Baltimore area who had exclusively breastfed their infants for at least 6 months within the previous two years. The weight and length curves of these infants during the period of exclusive breastfeeding remained above the 50th percentile of the NCHS reference for at least the first 6 months, and above the 25th percentile until 9 or 10 months. There was no significant difference between weight and length curves of infants who were exclusively breastfed for 6 months or less and those of infants who were exclusively breastfed for more than 6 months.

Lauber and Reinhardt (1979) prospectively followed 19 infants starting from age 1-3 months until 16 months in an Ivory Coast rural community. Most infants were exclusively breastfed until 6 months, when supplementation was introduced. Milk samples from 33 women showed comparable quality to that of western countries. Mean weight for age was at or above 100 per cent of the Harvard median initially; it then slowly declined from the fifth month onward and levelled off at 85 per cent of the Harvard Median at 10 months. Mean height for age remained at 94 per cent of the Harvard median from 0 to 16 months. These researchers concluded that satisfactory growth was achieved in these infants until 5 to 6 months without supplementary feeding.

Similarly Juez et al. (1983) concluded that breastfeeding is adequate for 6 months (in a Chilean sample), and supplementation should begin at 7 months.

Gopalan (1956) followed the growth of 14 infants in India who were exclusively breastfed for the first 6 months. Mothers belonged to the poor socio-economic group, and their total daily calorie intake ranged from 1,500 to 1,850 calories between the 4th and 6th month of lactation. The mean weight of the infants at 1 week of age was 2.78 kg and although the body weights for age in the first 6 months were lower than the Harvard median, Gopalan considered growth rates satisfactory, as judged by the criterion of average time it took the infants to double their birth weights (on average at 20 weeks). But he observed that growth was progressively slowing down beyond the sixth month. He concluded that breastmilk alone was not able to support growth at an adequate level beyond about 20 weeks.

Mata (1978a) collected longitudinal data in a Guatemalan village from 430 singleton live-births. The mean birth weight was 2.55 kg, 32 per cent of the infants being small for their gestational age (SGA). Using the Iowa standards, he detected that faltering began from 3 months onwards. However, the interpretation was different when other standards were used. For instance, using the Denver references, Mata found that severe growth faltering did not occur until after 6 months. Weight for age of most of the 18 month old infants fell so far below the Denver percentiles that at 18 months, the majority of children were below the 16th percentile.

Hitchcock et al. (1981) reported that weight increments of healthy breastfed Australian infants in the second 3 months of infancy were well below British standards and more closely resembled data from less-developed countries. Their study sample included 104 boys and 101 girls born to Australian mothers of various ethnic origins excluding Aborigines in Perth. These infants were all breastfed 'on demand'.

Growth of infants in urban low-income households in Sudan exceeded the reference data during the first 3 months of life, but decreased to below the reference from 3 to 6 months (Zumrawi and Dimond, 1988).

In sum, the growth performance of breastfed infants is strikingly different from that of bottle-fed infants who were given cow's milk or unmodified formula, whereas the growth of infants fed on low-solute formulas seems to resemble that of breastfed infants. Assessing growth performance by using reference 'standards' is strictly speaking inappropriate because the reference data come from infants who were fed unmodified non-human milk whose growth performance is different from that of breastfed infants, and not better.

However, the use of reference standards has continued despite all their shortcomings and subsequent uncertainties as to how meaningful the exercise is. Recently, human nutritionists have agreed that the widely used NCHS standards should certainly not be called 'optimal standards' or even 'standards' at all, but they should continue to be used as international 'reference' data for practical reasons, because 'we need a reference' (Waterlow, 1988: 87).

Recently, Dewey et al. (1989) have started a longitudinal study in Davis California with the aim of documenting growth patterns and total nutrient intake of breastfed and formula-fed infants, with 40 to 60 infants in each group. A report of the first 12 months of this study, named 'DARLING (Davis Area Research on Lactation, Infant Nutrition and Growth) Study', indicates that under optimal conditions (i.e. favourable environment and complementary feeding), energy intake of breastfed infants is lower than reference levels and so is growth velocity at 6 to 12 months. The deviation from NCHS data was more pronounced for weight than for length indicating that these infants were leaner than the mean reference at 10 to 12 months. Weight gain from 6 to 12 months was positively correlated with the proportion of energy intake from breastmilk, whereas stature gain was not. This report also showed that earlier introduction of solid foods (at 6 months) had the effect of substituting breastmilk compared to the later introduction of solid foods (at 9 months) the effect of which was to supplement breastmilk. Interestingly, levels of infant morbidity, activity, and time spent sleeping were unaffected by lower energy intake and growth velocity.

The 'DARLING Study' strengthens the view that deviation of growth of breastfed infants from current reference data has no deleterious effect, and must be expected since previous studies have shown that growth performances may differ according to the types of feeding. Dewey et al. (1989) have argued that growth per se is not the most important outcome measure, i.e. bigger is not necessarily better. Moreover, the slower growth velocity of breastfed infants may be a normal outcome even under optimal conditions, rather than an indication of growth 'faltering'.

Therefore, it is clear that the growth performance of breastfed infants cannot be meaningfully discussed by comparison to the NCHS reference data. The highly variable point at which 'faltering' has been said to occur in populations of the less-developed world may be indicative of normal within and between population variability which is to be expected.

Since infants seem to take different paths to achieve the same goal (growth), it may be more meaningful to approach the study of growth in less than optimal settings in terms of the environmental factors that modulate that path such as season, availability of food, and bouts of illness. The most striking feature in the analysis of growth data from poor quality environments is the sizable variance (Harrison and Schmitt, 1989; Harrison et al., 1990). A thorough examination of variability is incompatible with the use of reference data since by definition, reference data are meant to standardize and ignore variability rather than to account for it. A more detailed discussion of this issue will be found in Chapter 7.

1.4.2 Methodological Issues

Growth in early infancy is so rapid that very frequent longitudinal measurements are necessary to produce growth curves that accurately represent growth velocity changes. The deficiencies of commonly used growth standards in their representation of these changes have been pointed out by Whitehead and Paul (1984), and Poskitt (1987).

Waterlow et al. (1980) pooled data from longitudinal and semi-longitudinal studies on growth in the first 6 months in less-developed countries where monthly measurements had been taken. They reported that monthly incremental weight gain which is considered to be independent of birth weight falls off substantially compared with the 1959 U.K. references (obtained longitudinally) between 3 and 4 months. These researchers suggested that the growth faltering in these populations may be caused by inadequate breastfeeding, infection, or both. They pointed out that there were problems of design in many of the studies (small numbers and non-representative samples). Furthermore, exclusive breastfeeding was not documented in most of the studies.

This report has generated considerable discussion, especially regarding growth faltering as measured by monthly incremental weight gains, and the appropriateness of the 1959 U.K. references for predominantly breastfed infants and for monthly incremental weights (Cooper, 1980; Hitchcock et al., 1981; Schaefer, 1981; Whitehead and Paul, 1981). Although birth-weight data are not given in the pooled studies of Waterlow et al. (1980), the highest weight gain in the first month may reflect 'catch-up' growth in small-for-gestational-age (SGA) infants. As Cooper (1980) noted, at 4 months, infants from less-developed countries had achieved the same mean weight gain but had arrived there by a different trajectory when compared with the U.K. reference group. Their most rapid increase occurred during the first month of life. The U.K. references used by Waterlow et al. are higher than other references, especially in the first 4 months (Whitehead and Paul, 1981).

Whitehead and Paul (1981) found that male infants who were exclusively breastfed or predominantly breastfed from four studies in industrialized countries had growth similar to that of the male infants in the pooled data of Waterlow et al. These male infants gained 2.66 Kg in the first three months and 1.61 Kg from 3 to 6 months, compared to 2.47 and 1.55 Kg for the same quarters in Waterlow's combined low socio-economic group data. This suggests either that the growth of breastfed infants in both developed and less-developed countries is inadequate for 3-6 months postpartum, or that current growth references are too high; normal growth for breastfed babies may be somewhat lower.

Seward and Serdula (1984) have shown that when mean 3- month incremental weight data for infants who were exclusively or predominantly breastfed were calculated (including both sexes where data were available), from the longitudinal studies reviewed from developed and less-developed countries, no significant growth differences were found. Infants from low-income Pakistani families in Dempsey's study (1981) had incremental weight gains (1.24 Kg) similar to that of Canadian infants from middle and upper socio-economic levels (1.27 Kg) in Chandra's study (1981; 1982). In general, there was no marked difference in the incremental weight gained from birth to 6 months in breastfed infants of both sorts of countries (though infants from less-developed countries often gain more weight in the first three months).

More recently, comparative studies of ethno-nutrition have advocated the necessity to examine ideas of what are acceptable levels of dietary intake, acceptable levels of functioning, and the interrelationships between nutrient intake and social performance and health as part of the nutrition knowledge of any cultural group. These beliefs and attitudes form part of the larger cultural picture of what land, human, and nutritional resources are available, and how they should be managed (Messer, 1986).

The anthropological approach of studying these aspects in an integrated manner without being confined to statistical means and standard deviation around a reference norm, provides more meaningful insights. The question of variability which lies at the heart of growth studies in and between populations is best addressed by comparing growth performances of infants within the study population by looking at biological, ecological and health differentials.

1.5 Study Rationale and Layout

As the above sections have shown, infant feeding, growth, and health cannot be examined in isolation from each other. In addition, they cannot be examined without also considering the ecology, socio-economy, mothers' health, child care patterns, and other aspects of the environment. Rather than examining and testing one particular hypothesis, therefore, this thesis sets out to describe and analyze these different aspects of and influences on the infant's first two years of life, with the aim of developing an integrated account.

Two main questions provide the framework to this thesis:

I. How do infants fare in a low-income, poor quality environment during their first two years of life?

II. What are the main problems that need to be addressed in order to promote a better understanding of maternal and child well-being in the community?

The first one is broken down into the following six specific questions each of which is discussed in a corresponding chapter.

1. What is the quality of the environment?

This question is addressed in Chapter 2 where the study site is described in relation to the ecological, social, economic, and demographic characteristics of the city of Addis Ababa. The conditions and characteristics of the households in which the study sample of mother-infant pairs live are described.

2. What is the prevalent mode of infant feeding?

Chapter 3 describes the patterns of infant feeding observed, and relates them to the current issues of debate regarding the duration of breastfeeding, the timing of supplementation, and weaning. The statistical techniques of survival data analysis and Cox's proportional hazard models are applied in order to examine relationships between weaning patterns and other variables. A 'probabilistic' rather than a 'normative' model is chosen to describe the factors that influence maternal decisions as to when to commence and when to complete weaning. Mother-centred, infant-centred, and outside influences are shown to interact with each other in the process of weaning.

3. How do mothers allocate time for feeding and child care?

Since infant-feeding practices belong to the wider context of child care, Chapter 4 presents quantitative data on maternal activities and time allocation obtained through minute by minute observation of a sub-sample of mothers during daylight hours.

4. How well do mothers fare in this environment?

This question is tackled in Chapter 5 in which maternal well-being is assessed by using measures of morbidity, anthropometry, number of offspring, and duration of lactation and post-partum amenorrhoea. The aim of this chapter is to explore further the wider context of infant feeding, health and growth in relation to maternal characteristics.

5. How well do the infants fare?

Chapter 6 addresses issues of infant health. Prevalences of symptoms of illness and infection are examined in detail. In much the same way as

Chapter three, the factors that determine infant health are analyzed in relation to maternal and environmental factors. Morbidity data are analyzed in conjunction with maternal socio-economic factors and outside factors such as seasonality of infection. All the available measures of factors that influence health are explored by using log-linear models.

6. What is the growth performance of these infants?

Infant growth is examined in Chapter 7 where the feeding regime, and morbidity patterns discussed in preceding chapters are brought to bear upon the outcome of growth performance. Current issues of 'faltering', 'catch-up', and 'catch-down' growth are discussed in detail. Most importantly, the question of variability is further discussed by analyzing the infants' anthropometry in relation to individual feeding and infection histories with case studies.

The second main question that provides the framework to this thesis is addressed in the final chapter, Chapter 8, in which the main findings of this study are drawn together. The study design and methods are assessed. The policy implications of the main findings are considered. Finally, issues for further research are outlined.

Chapter 2

The *Kebele* 11 Study

2.1 Introduction

The selection of a site suitable for field-work is often a matter of compromise. This is especially the case in Ethiopia, where strict control of information is enforced at all levels. Once the researcher has identified the issues to be investigated at a particular location, official permission is required to conduct one's study. National and local authorities vary in their attitudes towards independent research and in the degree of cooperation they provide. In Ethiopia, research permits are harder for individuals to obtain than they are for groups or organizations that are formally recognized by the Government.

In 1986-87, attempts were made to plan collaborative field-work with the 'Ethiopia WHO/UNICEF Joint Nutrition Support Programme (JNSP)', in Sidamo region. The JNSP was a five-year comprehensive programme which included the study of regional dietary habits and the nutritional state of populations. I travelled to Ethiopia for a period of five weeks in order to assess the possibilities of conducting my study in Sidamo region. This included visits to the JNSP field-station in Awassa, and the research site of a separate study that was investigating energy intake and expenditure among women in the village of Shafina, near Yirga-Alem. However, the formal processes required in order to be attached to a programme such as the JNSP, under the auspices of the Ethiopian Nutrition Institute in Addis Ababa, proved lengthy and unpromising. Attention was then shifted to non-governmental organizations (NGOs) such as Oxfam and the Save the Children Fund who are well established in Ethiopia, with the prospect of conducting independent research under the umbrella of one of them. Such an arrangement was reached with the Save the Children Fund (SCF), who kindly obtained formal research permission for me to conduct fieldwork in Addis

Ababa in September 1987.

The Save the Children Fund had no intervention programmes in the city. The main field-stations of the organization were located in the famine-prone regions of the north (Wello) and south-east (Hararghe). These localities did not fulfil the requirements of my study which aimed to look at the situation of infant health and growth where there was no intervention in terms of infant feeding, and where acute shortage of food was not widespread. The latter requirement could be met in Addis Ababa, but not all parts of the city satisfied the former requirement, because a number of NGOs were involved in feeding and health programmes in many low-income localities.

A pilot study was conducted in September-October 1987 to assess the composition, socio-economic and other characteristics of the kebeles of Addis Ababa (see Appendix I). Information provided by the 1984 census and the officials of the Ministry of Health and the City Council was used for this purpose. The results showed that the kebeles of keftegna 24 would provide possible locations for data collection (see Sub-section 2.3.3.1 for definitions of Kebele and Keftegna). An application was then made to the City Council authorities for permission to start field-work in Keftegna 24. These authorities gave their approval and made formal requests on my behalf to the keftegna and subsequently the kebele authorities to cooperate. The latter assisted by making their records available and assigning the kebele Health Representative to accompany my assistant and I during the initial house-to-house enquiries, when we introduced ourselves and explained the nature of the study to the adult household members. Research was conducted in Kebele 11, Keftegna 24 between October 1987 and April 1988. This Chapter has two main sections. The first section describes the sampling techniques used, and methods of data collection. The second section describes the study site. The history of Addis Ababa is discussed from the perspectives of human ecology, by way of setting Kebele 11 in the wider ecological and socio-political context.

A number of old descriptions of the city, mainly from travellers' records, are quoted at some length because the character of the city and its inhabitants remain essentially unchanged. The extent of urbanization in Addis Ababa and the implications thereof in defining the ecology of health and disease are outlined. The study sample is described in general terms, specific details being presented in the relevant chapters that follow.

2.2 Methods

2.2.1 Choice of Study Site

The aim of this study was to investigate the growth and health of the suckling and weanling infant in a situation where there was no nutritional intervention. Kebele 11 in Keftegna 24 had no intervention by foreign agencies, most notably, no feeding programmes. It was therefore chosen as a suitable site for this study. Kebele 11 did, however, enjoy the influence of the national under-fives immunization programme, and some urban facilities such as the use of electricity and piped water supply.

2.2.2 Selection of Sample

A sample of households was selected for the study of infant growth and health, using the following criteria:

1. Income level. 'Low-income' households were selected. These were categorized as such by the Kebele authorities on the basis of poor physical conditions, that is, housing and sanitation, and a monthly income of Eth. Birr 150 or less (up to about US$ 70.00), per household head. In the informal economic sector in Addis Ababa, maximum monthly earnings did not usually exceed Eth. Birr 100, except in the case of traders whose earnings varied from day to day and from month to month. All low-income households were visited on the first round.
2. Age of infant(s). Low-income households with infants under two years

of age were selected. The operational definition of infants used in this study includes children up to 24 months of age. The birth date of each infant in _Kebele_ 11 was recorded on the immunization card and in some cases also on the christening card, both of which were kept by the mothers. This date was later confirmed upon interviewing the mothers as they recalled the infant's birth date, often in relation to specific dates and months in the Ethiopian calendar (see Appendix III). The age range of the infants in the sample was 0 to 19 months at the beginning of data collection.

3. The women's willingness to participate in the study. The aim of the study and what was required from the participants was fully explained to each woman on the first visit.

Such a study demands good-will on the part of respondents. It would have been difficult to obtain reliable data from people on whom coercion had been applied to get them to participate. Such practices are not uncommon in Ethiopia. The majority of the mothers took kindly to the home visits. The weighing of infants was particularly welcomed with interest. Most mothers wanted to know whether their child had gained or lost weight each month. This was a good starter for conversations that often led to answering questions in the structured interview schedule. The rate of cooperation was 96 per cent.

The households in the sample (a total of 115 households with 119 infants recruited at the outset) consist of about 8 per cent of the total number of households in _kebele_ 11.

A sub-sample of twenty mothers was further selected for the collection of intensive observational data. The selection criteria were,

1. Consent of the mother to visits involving spot-check recording of her activities in the home (sometimes also outside the home). The duration of observations ranged from three to eight hours on each occasion.
2. An approximately proportional representation of the ethnicity and

religion of the mothers in the main sample. This was done in order to minimize possible effects of ethnicity-specific bias in child feeding, child care and other maternal activities.

Visits to the home of the mothers in the sub-sample yielded minute-by-minute observational data on nursing behaviour, infant care, and other maternal activities. These mothers provided detailed information concerning beliefs about child care, feeding and child rearing, birth-spacing, attitudes towards contraceptives, as well as some of the harmful traditional practices such as the removal of the uvula of the new-born and female circumcision among some ethnicities.

2.2.3 Collection of Data

Households were visited at least once every month. During each visit a number of anthropometric measurements were taken (see Appendix IV), and questions were asked concerning the infant's health, the mother's health, the mother's attitude towards child illness and her management of disease. Other questions asked included the mother's work, location of her work, whether or not she took her baby with her when she went to work, and so on (see Appendix II).

The data collected are mixed-longitudinal. That is, the age of infants at the beginning of observation was mixed. Infants dropped out of the study due to death (two), migration (four), my own decision on advice from the kebele office (one: a woman who had been accused of the illegal practice of fortune-telling/witchcraft), and parental decision not to continue cooperation (two). Infants were added to the sample through birth (younger siblings of infants already in the sample - two) and parental request to be included (one).

In addition, cross-sectional surveys were carried out at various stages of the study (see Appendix III) in order to collect data on household income, water-supply, waste disposal system and other details to supplement the information obtained by the longitudinally-designed structured interview schedule.

2.2.4 Conduct of Study

The majority of conversations and interviews were conducted in Amharic, a second language to 81 per cent of the women. Amharic is a second language to the majority of Ethiopians whose first languages may be Orominya, Tigrinya, or Guraginya among several others. There are over 70 different ethnic-groups in Ethiopia, each with its own language(s). Tigrinya was used in the case of four sample women who had originally come from Tigray. My assistant (a mother of four) and I speak Tigrinya as a first language and are fluent in Amharic. This provided appreciable ease of communication with the women studied and others in Kebele 11. In the absence of any major culture and sex barriers, good relations with the women were quickly established and easily maintained.

The women were, on the whole, very forthcoming. They exhibited a 'mothering' attitude not only towards their children, but also towards me. As is customary for Ethiopians, they were very hospitable, often expressing concern for my health and providing me with traditional medicinal herbs for the common cold, influenza, or mitchi, (sun-stroke). These herbs included tena-Adam - rue (Ruta graveolens), damakisse - a green mint-like leafy herb (genus Origanum), and fresh eucalyptus twigs.

Many of the women regarded me and my assistant as trainees of the Ministry of Health. They expressed surprise at our repeated visits to their homes, stating that in the past, they had been told to attend at the Kebele offices or the clinic when information was required on their children's health and other related matters. They had seldom been visited in their homes. Our approach appeared different and popular in this respect.

However, in common with the experience of other researchers in the field, I was faced with serious complaints from time to time, for being unable to give practical and/or financial assistance to the women I visited frequently, having learnt all about their needs and problems.

2.3 Study Site

Addis Ababa, the capital city, is situated in the heart of Ethiopia. It has a population of about 1.4 million (Central Statistical Office, 1987). The study site, Kebele 11 Keftegna 24, lies on the western side of the city. A detailed description of the city follows.

2.3.1 Altitude and Climate

Ethiopia is a large country with a variety of ecosystems which are defined according to relief and altitude. There are three altitude-related climatic zones: qolla, hot low-land zone (up to 1500 metres above sea level), wäyna-déga, warm middle-land zone (1500-2400 metres above the sea), and déga, cool high-land zone (above 2400 metres).

Mean annual temperatures range from 23-33°C in the qolla, 16-29°C in the wäyna-dega, and 10-16°C in the déga zones. Mid-day temperatures along the Red Sea coast and in the Danakil Depression (down to 100 metres below sea-level) often reach 50°C. Frosts and hailstorms often occur in the déga regions. Altitude related physiological hazards range from heat-stroke in the qolla zones, to hypothermia in the déga zones (Harrison *et al*., 1969).

Mean annual rainfall is highest in the south-western highlands, above 2200mm on the plateaux of Illubabor, Wellega, and Kaffa. Most of the rest of the highland regions get 1000-1400mm of rainfall during the average year, with a declining trend from south-west to east and north. While most lowland regions below 1500 get about 300-1000mm, those in the south-west may get up to 1600mm of rain each year.

Addis Ababa encompasses both déga (Entoto and surrounding areas), and wäyna-dega (Finfiné and surroundings) zones, with large areas in between.

Total rainfall in Addis Ababa during 1987-88 (September to August) amounted to about 750mm, August being the wettest month, and November the driest (see **Figure 2.1**). The amount of rainfall in 1987-88 was the lowest in five years. Maximum temperature averaged 23.45°C in 1987-88, March being the hottest month (27.3°C) and December the coldest (see **Figures 2.2** and **2.3**).

The effect of altitude on the biology of human populations in Ethiopia has been well documented (Harrison et al., 1969; Clegg et al., 1972; Stock and Miller, 1976). The most important effects of altitude and climate for Addis Ababa include the absence of malaria and the relative severity of cold and intense solar radiation, particularly in the déqa regions of the city. Kebele 11 Keftegna 24 lies in between the déqa and Wäyna-déqa zones, and has therefore, a relatively agreeable climate. Malaria is non-existent and hypothermia is rare, although in the low-income sections of the Kebele, poor housing conditions may contribute towards exposure and hypothermia during the coldest months.

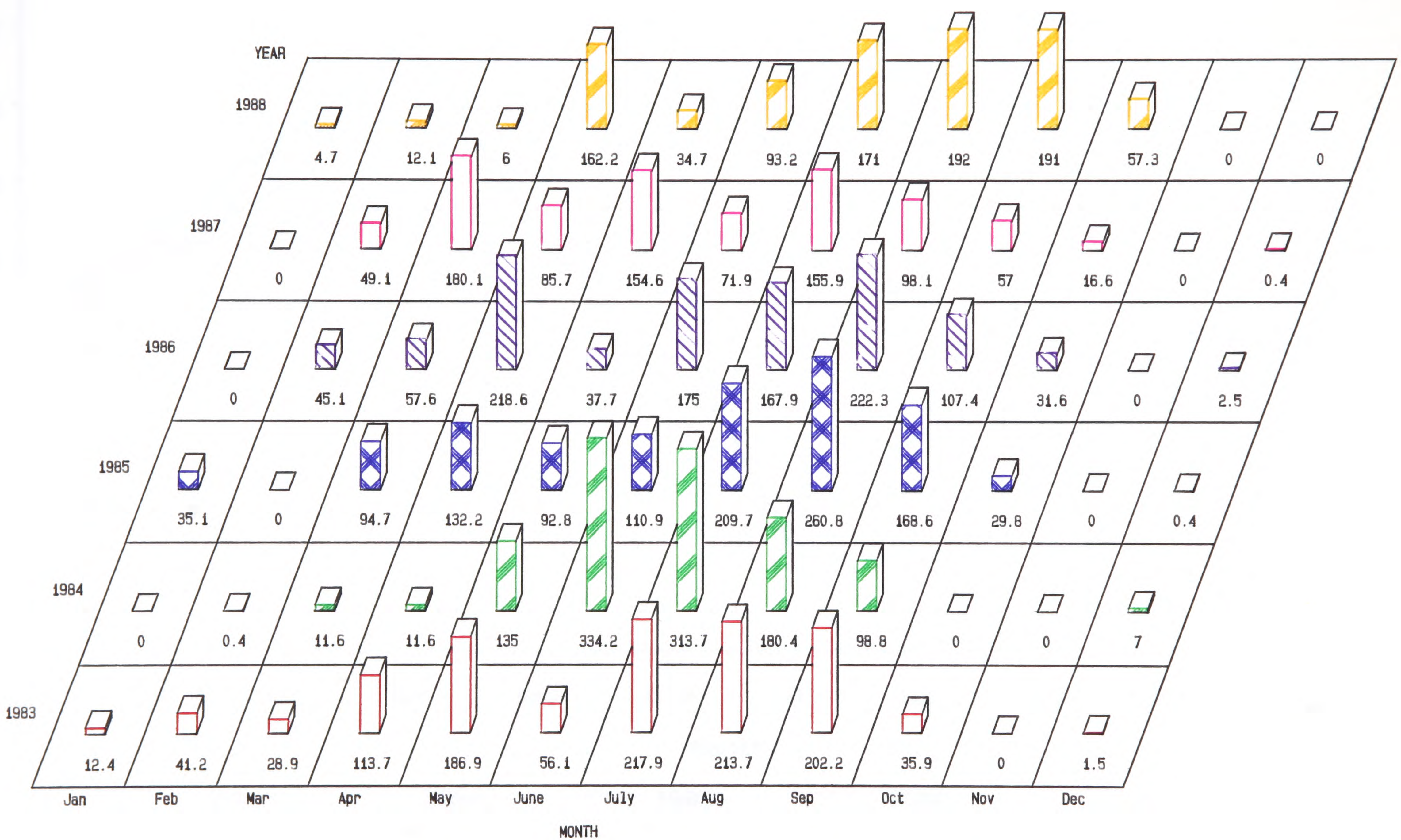
Ethiopia lies in the 'meningitis belt' of Africa that stretches across the Sahelian countries and there is a trend of regular epidemics in some regions including Shoa. The peak of the epidemic usually occurs in March-April (Estifanos et al., 1988). Such an epidemic occurred during February and March 1988 in Addis Ababa. The impact of this on the Kebele 11 study population is discussed in Chapter 6.

2.3.2 History and Economics

Addis Ababa is the most permanent capital of Ethiopia. It was founded around 1886-7 by Menelik (King of Shoa 1878-1913, and Emperor of Ethiopia 1889-1913). Following the tradition of Ethiopian kings and emperors having peripatetic capitals, Menelik had moved his court four times: from Letche to Ankobar, Debre Berhan, Entoto, and Addis Ababa successively (see **Figure 2.4**).

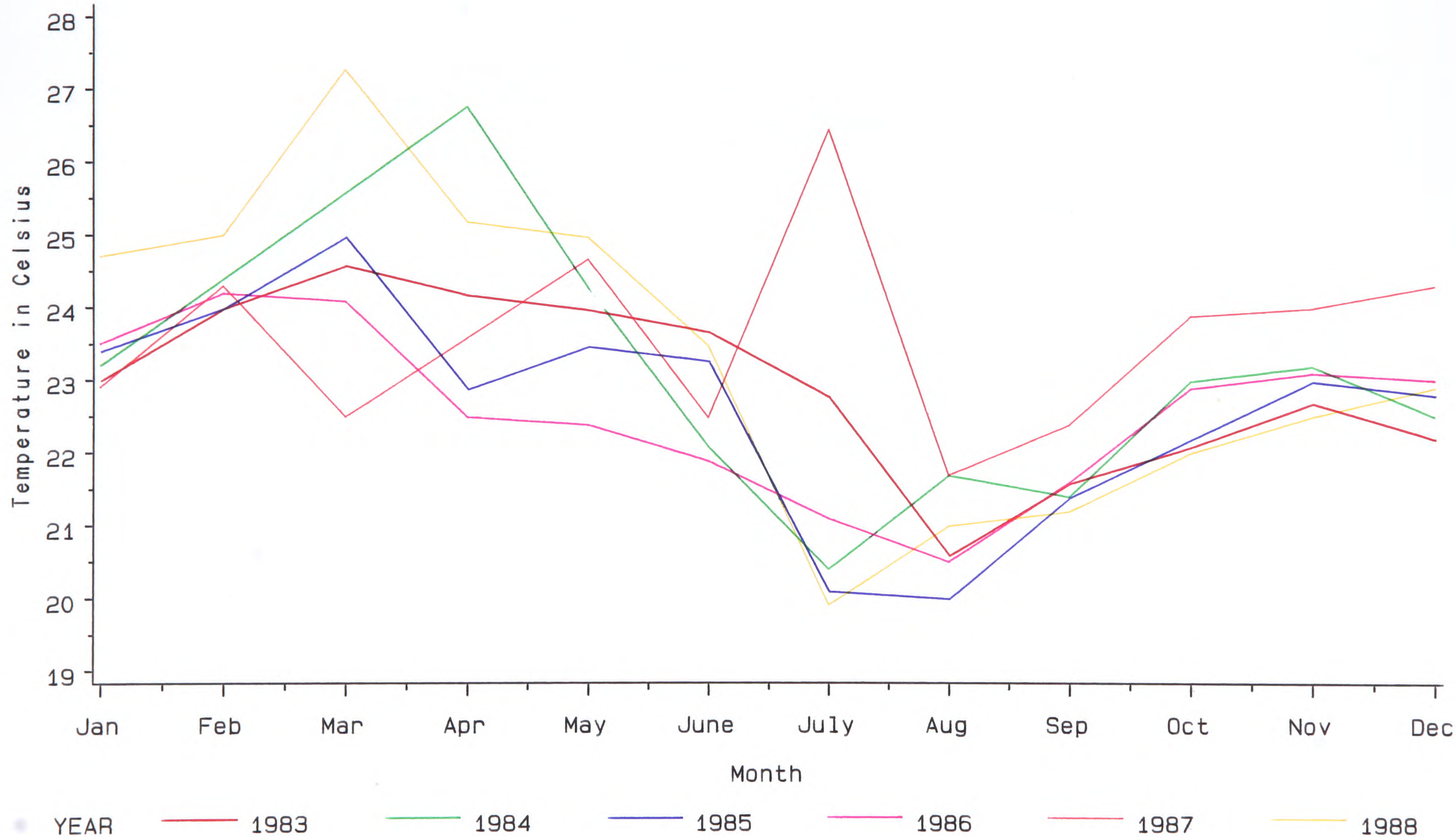
Before the beginning of the nineteenth century, Ethiopian capitals

Fig. 2.1 Rainfall in Addis Ababa in mm.(Black Lion Hospital & surroundings)



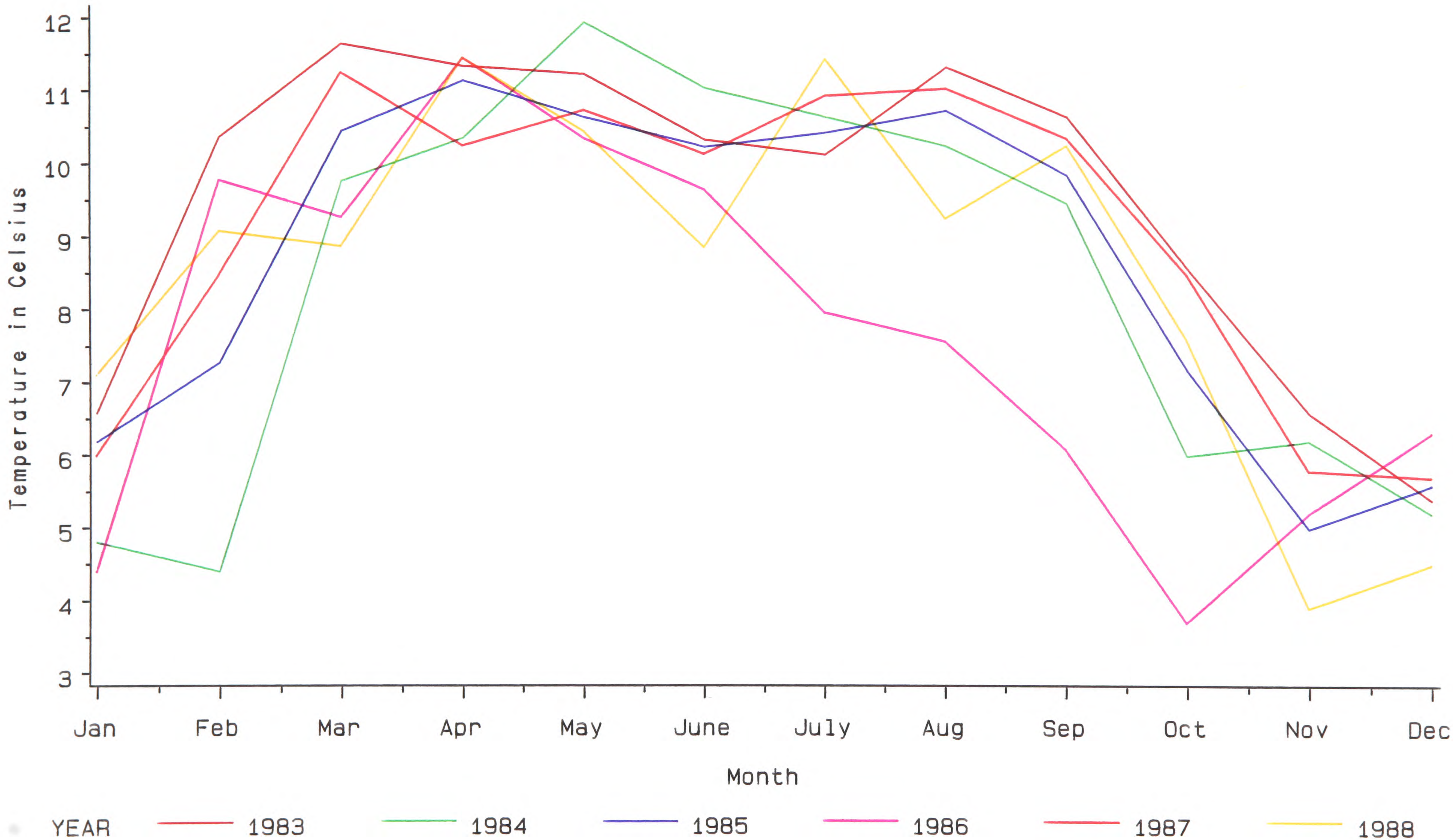
Source: National Meteorological Services Agency, Addis Ababa (1989)

Fig. 2.2 Average monthly maximum temperature in Addis Ababa (Black Lion Hospital & surroundings)



Source: National Meteorological Services Agency, Addis Ababa (1989)

Fig. 2.3 Average monthly minimum temperature in Addis Ababa (Black Lion Hospital & surroundings)



Source: National Meteorological Services Agency, Addis Ababa (1989)

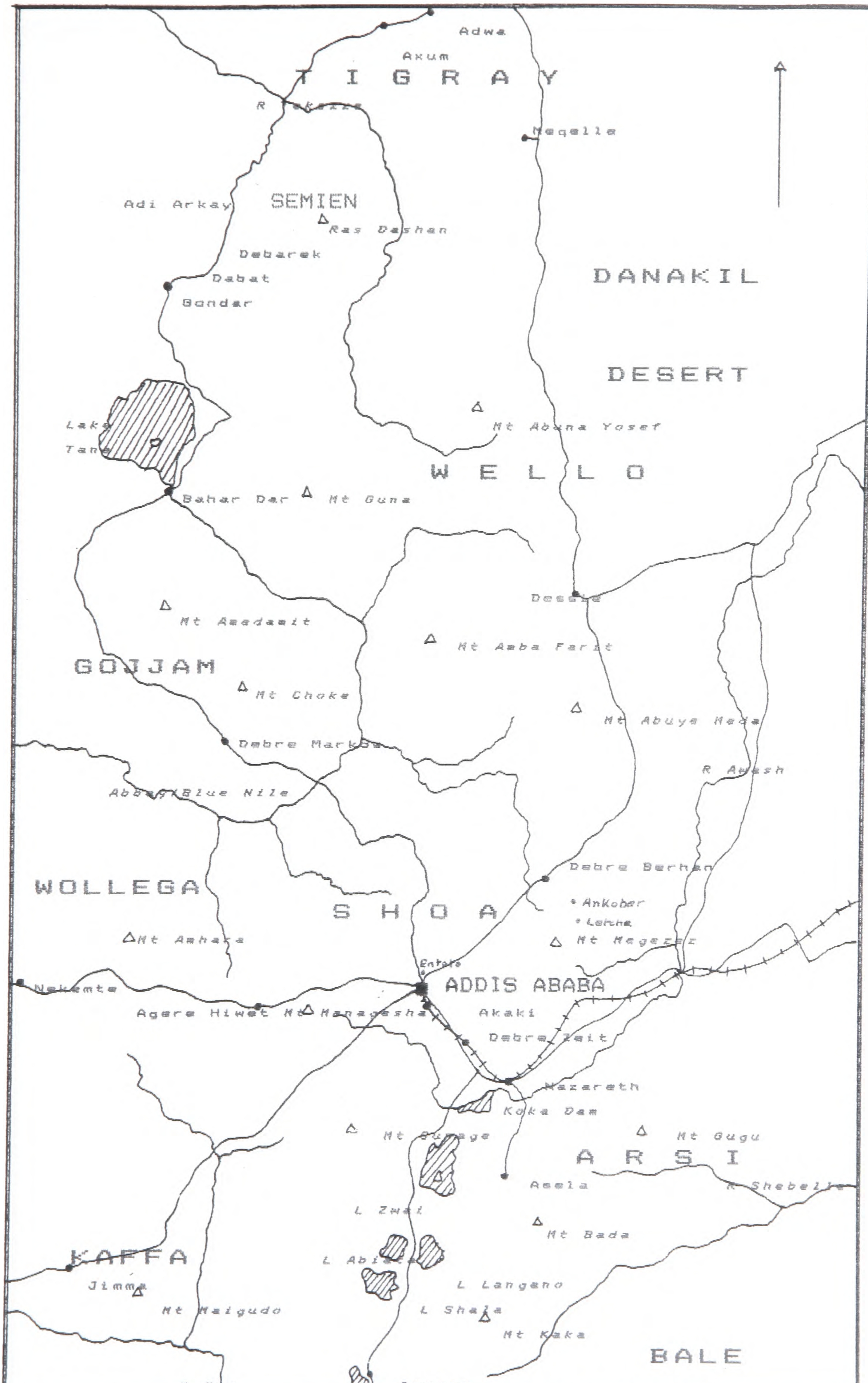
moved frequently. Political power alternated between the northern Habesha kings who had the Axum heritage (the oldest capital of Ethiopia dating to c.500 A.D.), and the southern kings of Shoa. Historical factors associated with the phenomenon of 'roving' capitals included dynastic changes, power struggle and strife amongst the northern kings, territorial expansion, and threats of invasion from external powers such as the Arabs, the Portuguese, the British, and the Italians. The overriding reason behind the 'wandering' capital was thus militaristic (Horvath, 1969).

However, despite the frequent moves, the capital was characterized by consistency of physical setting, uniformity of shape, and regularity of development (Akalou, 1967). The capital was, essentially, a military encampment situated on a plateau for strategic reasons. The royal tents were pitched on higher ground, ye-desta märét, with the king's private tents, ghebi, the queen's tent, ilfïgn, the royal treasury, eqa biet, the kitchen, wät biet, the reception, adarash, the church, bietä kristian, the tribunal, ferd biet, and the prison, esser biet, all surrounded by a newly transplanted hedge. Facing this inner-court were pitched the tents of the fitawrari, General of the advance guard. On the right-hand side were the tents of the kegnazmatch, Commander of the right wing, on the left-hand side were the tents of the grazmatch, Commander of the left wing, and on the rear was the dejjen séfér, the camp of the rear guard. The tents of smiths and prostitutes were pitched on the outskirts of the encampment (Akalou, 1967).

Less important reasons for moving the capital included seasonal factors: often, the king would move his residence temporarily to better climes, particularly during krémt, the rainy season. For instance, while Entoto was the capital, Menelik used to spend krémt at Finfiné where the royal encampment used to settle by the hot-spring baths, fil-wouha. King Menelik's wife, Taytu, who re-named Finfiné Addis Ababa, (Amharic for 'New Flower') is said to have persuaded her husband to move the capital, because she enjoyed Finfiné's natural hot baths and preferred its warm

Figure 2.4

CENTRAL ETHIOPIA



climate to that of Entoto which was much too cold (Akalou, 1967; Pankhurst, 1985). Menelik finally moved his capital to Finfiné, after consolidating his power in the Oromo territories of the immediate South.

Addis Ababa was at first merely a glorified military camp. However, when the Emperor Yohannes of Tigray died and Menelik became Emperor in 1889, he built a palace in it. By that time, Menelik had the most powerful army in the country, and his position was further secured both internally and externally after the defeat of the Italians at Adwa in 1896.

From the ecological point of view, the relationship of Ethiopian capitals with their hinterlands was always exploitative. There are numerous references which suggest that the settling of a capital in one area almost always left that area impoverished. Hence Horvath's justification for the label 'parasitic' to Ethiopian capitals in relation to their neighbourhood.

> 'The presence of the capital caused a drain on the food resources of an area equal to the immense drain on wood. Tradition required that peasants should provide food and shelter to soldiers in the service of the emperor. Soldiers could simply appropriate what food they needed. The proximity of a capital, particularly during a campaign, meant that peasants had to provide accommodation for soldiers. The emperor's needs were provided for from his own lands, which were widely spread throughout the empire, and in part through the taxation of local peasants. The cumulative result was rapid impoverishment.' (Horvath, 1969: 218)

The case of Addis Ababa was no different. In the first few years of the settlement, large numbers of trees were cut down for construction and fuel for Menelik's palace. Considerable concern was expressed, mainly by travellers of the time, regarding the rapid destruction of nearby forests and wooded areas. Many predicted that another move of capital would be inevitable.

> 'Some nine years ago, Menelik's capital was at Entoto... Now only two churches and a few brown ruins remain... The reason of its abandonment was that all the wood had been exhausted for building and fuel. The Abyssinians are most improvident in the matter of wood, cutting down forests in a haphazard way and never troubling to replant. The

consequences of this are already felt at Addis Ababa; wood is now brought thither from a distance of sixteen miles, and it is certain that in a very short space of time Menelik will be obliged to shift his capital once more to the neighbourhood of fresh woods.' (Herbert Vivian, 1901, cited in Pankhurst, 1985: 218)

The permanency of Addis Ababa was openly threatened in 1902 when Menelik showed interest in the neighbouring village of Addis Alem to which he paid frequent visits, and the surroundings of Mount Managasha (about 20 km. to the west) which provided the main wood supply for Addis Ababa, were rapidly being destroyed.

'The ever-increasing distance which separates the present settlement from the forests under Mt. Managasha will no doubt eventually entail another move.' (Rennell Rodd, 1923, cited in Pankhurst, 1985: 218.)

However, Menelik whose ambitions were to proceed with a southward expansion of the Empire and to implement his plans of modernization, decided to deal with the issue of deforestation. He imposed a ban on the cutting of trees without his permission, and gave orders to replant. Fast growing turpentine trees were soon imported and planted. Pankhurst (1985) documents that by 1905, at least three different types of eucalypti had been imported: the Tasmanian Blue Gum (Eucalyptus globulus), Red Gum (Eucalyptus rostrata), and Sweet Gum (Eucalyptus mellidora), the latter two being termite resistant. The afforestation programme took some time to succeed. Pankhurst notes that a foreign visitor had reported that in 1906, the tufts of young eucalyptus trees, mainly around European houses, were virtually the only trees to be seen in Addis Ababa. It took some time before the local population adopted these newly imported plants.

'Though the public was at first critical of their smell, which caused them to be called "etan", or incense, trees, it was converted when it saw that they grew rapidly: after five years they had reached a height of over 12m and had a diameter of 20 cm.' (Pankhurst, 1985: 219).

After the introduction of eucalyptus trees, Menelik ordered the partial restoration of land that had previously been taken from the local Oromo population. Addis Ababa was divided into large estates (séférs), which Menelik awarded to his military commanders. This followed the 'wandering capital' style of a military encampment described earlier. As Shack (1973) has noted, many parts of Addis Ababa retained the name of the General to whom the séfér was originally awarded. For example, a Gurage noble named Ras Habte-Giorgis, one of Menelik's staunch conservative generals, was awarded an estate which became known as Habte-Giorgis Séfér, with many Gurage serfs living in it.

Commercially, Addis Ababa benefited when trade routes with the Mediterranean and India were diverted to it after Menelik occupied the old town of Harar in 1887. Furthermore, the completion of the Franco-Ethiopian railway in 1917 made Addis Ababa the most important town. Other satellite towns like Akaki, Debre Zait, Mojo, Nazareth, and Dire Dawa, which started off as railway stations soon developed to form an 'urban-industrial' complex with Addis Ababa (Markakis, 1974). Light industry was promoted. Motor-cars were imported during Menelik's reign, increasing the size of the exploited hinterland. The first banking system was also installed at this time, with a copy of the Austrian Maria Terésa dollar as the unit of currency.

From very early times, inhabitants of the Ethiopian highlands have distinguished mender, village, from ketema, town or city (Akalou, 1967). However, in contrast with other African urban centres, the chief locus of the Ethiopian ketema was the ghebi, palace, seat of government, and not the gäbeya, market, or the biet kristian, church. There was usually no urbanization in the ketema in the sense of industrialization and developed technology. Akalou argues that the technical know-how of the old civilization of northern Ethiopia was lost after the Islamic conquests of the sixteenth century and during the period of the wandering capital. He claims that the only skill that remained was that of making tents, denquan.

The main function of the capital was to provide residence for the ruling power; and the constant move of camp prevented any one capital from developing technologically. Gondar, Lalibela, and Axum in the north were no more than large villages, compared to the southern towns of Harar and Jimma which were sizeable trade centres (Akalou, 1967; Fecadu, 1972; Salole, 1979). Menelik, through his pursuit of modernization, was the first monarch to establish a capital that served both as a seat of government and a centre of trade.

2.3.3 Population Dynamics

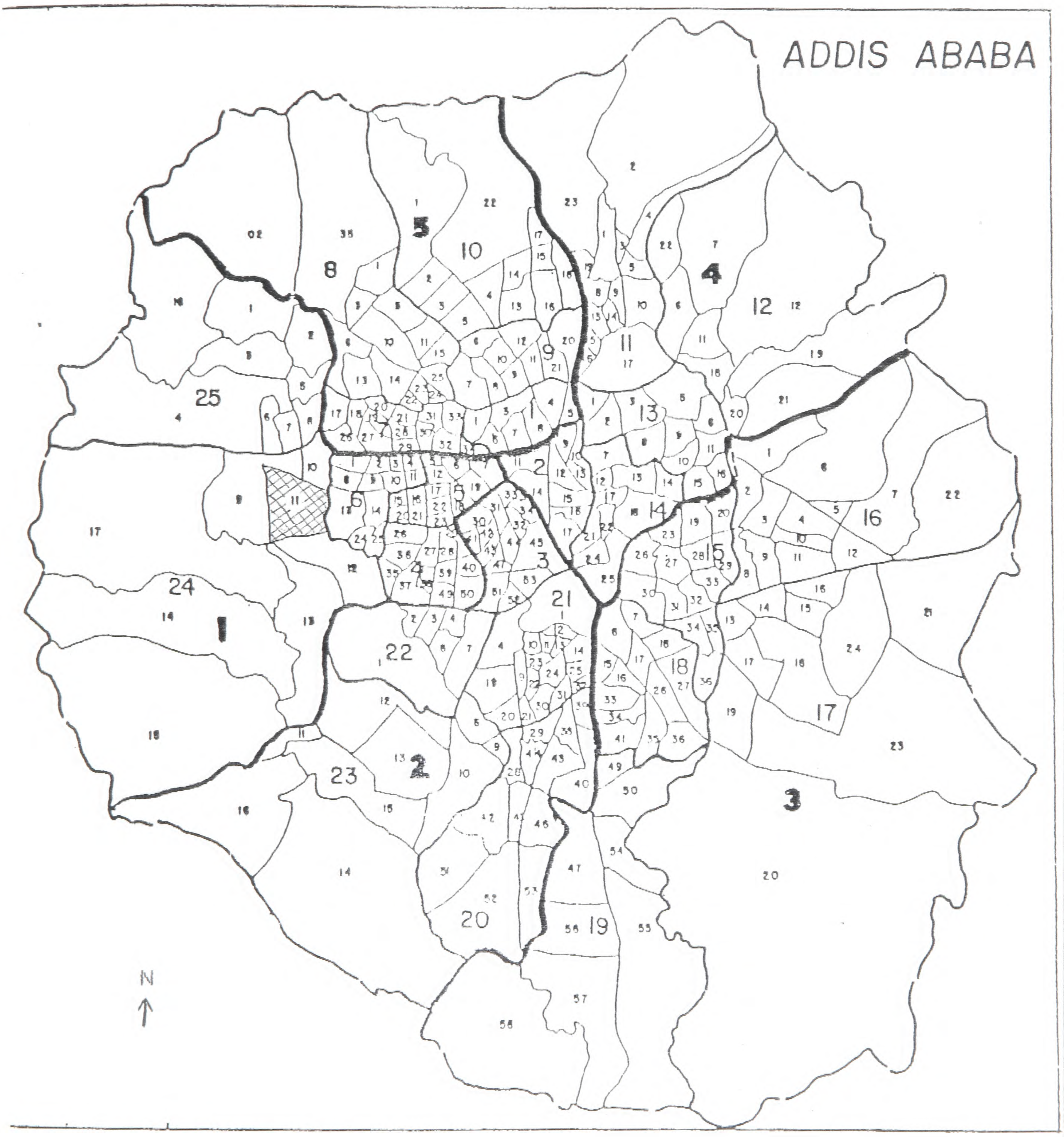
2.3.3.1. Size

At the beginning, the population of Addis Ababa grew rapidly, to an estimated size of 65,000 by 1910 (Laketch, 1978). Thereafter, there were relatively small spurts of growth until the 1930s, when the Italians invaded Ethiopia. After the Italian occupation, the population of Addis Ababa rose from about 140,000 in 1938 to about 180,000 by the end of 1946. By 1950, the Municipality of Addis Ababa estimated that the population had reached 400,000 (Central Statistical Office, 1969).

In the 1960s, two censuses were conducted in Addis Ababa: the first one was carried out in 1961, and the second one in 1967. Both censuses were, however, limited in coverage and description. They did not include detailed information on household composition, age and sex distributions. The first comprehensive and detailed enumeration of households was carried out no sooner than the early 1980s. According to this census, the total population of Addis Ababa had reached 1,412,992 by 1982 (Central Statistical Office, 1987).

The city was divided into 25 keftegnas, or higher divisions. Each Keftegna was further divided into kebeles, or sub-divisions (see **Figure 2.5**). Kebele 11 in Keftegna 24 is the second largest Kebele in Addis Ababa with a total of 10,556 inhabitants, the largest being neighbouring Kebele

Figure 2.5 MAP OF ADDIS ABABA



Scale: 1:75,000

Source: CSO, 1987.

Kebele 11, Keftegna 24.

13 in the same Keftegna (Central Statistical Office, 1987: 50).

2.3.3.2 Birth Rate

Table 2.1 shows measures of fertility in Addis Ababa, as estimated from census data from 1967 to 1984.

Table 2.1
Fertility Rates in Addis Ababa, 1967-1984.

Rates	1967	1978	1984
Crude Birth	35.90	32.30	23.20
General Fertility	132.90	118.20	91.40
Total Fertility	3.98	3.81	2.23
Gross Reproduction	2.00	1.90	1.60

Source: Population and Housing Census Commission, 1987: 188.

Fertility levels are both remarkably low and falling. The reason for this is not clear.

Table 2.2
Total Fertility Rates in Addis Ababa, by Marital Status.

Marital Status	Percent of adult female population	Total Fertility Rate
Single	32.3	0.9
Married	40.9	5.3
Widowed	14.8	1.9
Divorced/Separated	11.7	3.1
Total	100.0	3.2

Source: Population and Housing Census Commission, 1987: 192-3.

It may be inferred from **Table 2.2** that the major reason for the low levels of fertility in Addis Ababa could be the low proportion of married women in the city. The category of 'single' women includes prostitutes, among whom the total fertility rate is 1.8 (Central Statistical Office, 1987). However, even among married women, the fertility rate is lower in Addis Ababa than in Ethiopia as a whole, as shown in **Table 2.3**.

Table 2.3
Total Fertility Rates in Ethiopia.

	Addis Ababa	All Towns	Rural Areas
TFR	3.2	5.8	6.8

Source: Central Statistical Office, 1987.

The relatively high proportion of educated women in Addis Ababa may be one factor contributing to this lower fertility rate. Well-educated women consistently have lower fertility than their less well-educated counterparts (Caldwell and Caldwell, 1976; 1978; Caldwell, 1979; Ware, 1984).

However, in the _Kebele_ 11 selected study sample, the majority of women were married (see **Table 2.4**).

Table 2.4
Marital Status of Women in the _Kebele_ 11 Sample.

Status	N	%
married	98	86.5
single	9	8.1
divorced/separated	2	1.8
widow	2	1.8
no information	2	1.8

2.3.3.3 Death Rate

Mortality rates in Addis Ababa as presented in the 1984 census report are shown in **Table 2.5**.

Table 2.5
Mortality Rates in Addis Ababa, 1984.

Sex	Infant Mortality Rate	Life Expectancy at Birth	Crude Death Rate
Male	83.0	62.5	7.8
Female	67.6	64.2	7.2
Combined	75.4	63.3	7.5

Source: Population and Housing Census Commission, 1987: 213.

These mortality rates are lower than those prevailing in the recent past (see **Table 2.6**).

Table 2.6
Mortality Rates and Life Expectancy in Addis Ababa, 1967-1984.

Rates	1967	1978	1984
Infant Mortality	165-175	117.0	75.4
Crude Death	19-20	15.4	7.5
Life Expectancy (Years)	40.0	50.8	63.3

Source: Population and Housing Census Commission, 1987: 217.

These rates are also much lower than those found elsewhere in Ethiopia. This may be ascribed partly to the success of the national under-fives immunization programme, and partly to the relatively easy access to medical and public health facilities in the city compared to the rest of the country (see **Table 2.7**).

Table 2.7
Infant Mortality Rates and Life Expectancy in Ethiopia, 1984.

	Addis Ababa	All Towns	Rural Areas
Infant Mortality Rate	75.4	122.0	141.0
Life Expectancy (Years)	63.3	52.9	48.0

Source: Central Statistical Office, 1987.

However, these figures cannot be taken as fixed. Estimates of mortality rate vary according to the model life tables used for deriving them. For example, higher mortality rates in the rural areas have been reported, by applying different methods of analysis to the census data from which the official figures were derived. Genet (1989) estimated that the infant mortality rates in Gondar and Hararghe regions were 146 and 193 per thousand, respectively. The reason the official estimate is lower is that the 'North' model life tables were used. In these tables, infant mortality is low relative to child and adult mortality. If the Population Office had used, for instance, model 'West' or 'South' life tables, the estimates for infant mortality would have been higher than that shown in **Table 2.7**.

Researchers who have conducted their own surveys have also come up with higher figures. For example, surveys in Gondar have found infant mortality rates of 141-242 (Miller et al., 1976) and 202 (Shamebo, 1978). The enumeration of the 1984 census in the rural areas was of very variable quality. Many rural areas were inaccessible due to warfare, and only gross estimates of population are available. The estimates for Addis Ababa, where accurate enumeration was much easier, are much more likely to be accurate.

Therefore it is likely that the census estimates are on the low side for rural areas. It follows that the difference in mortality rates between

Addis Ababa and the rural areas is even greater than **Table 2.7** suggests.

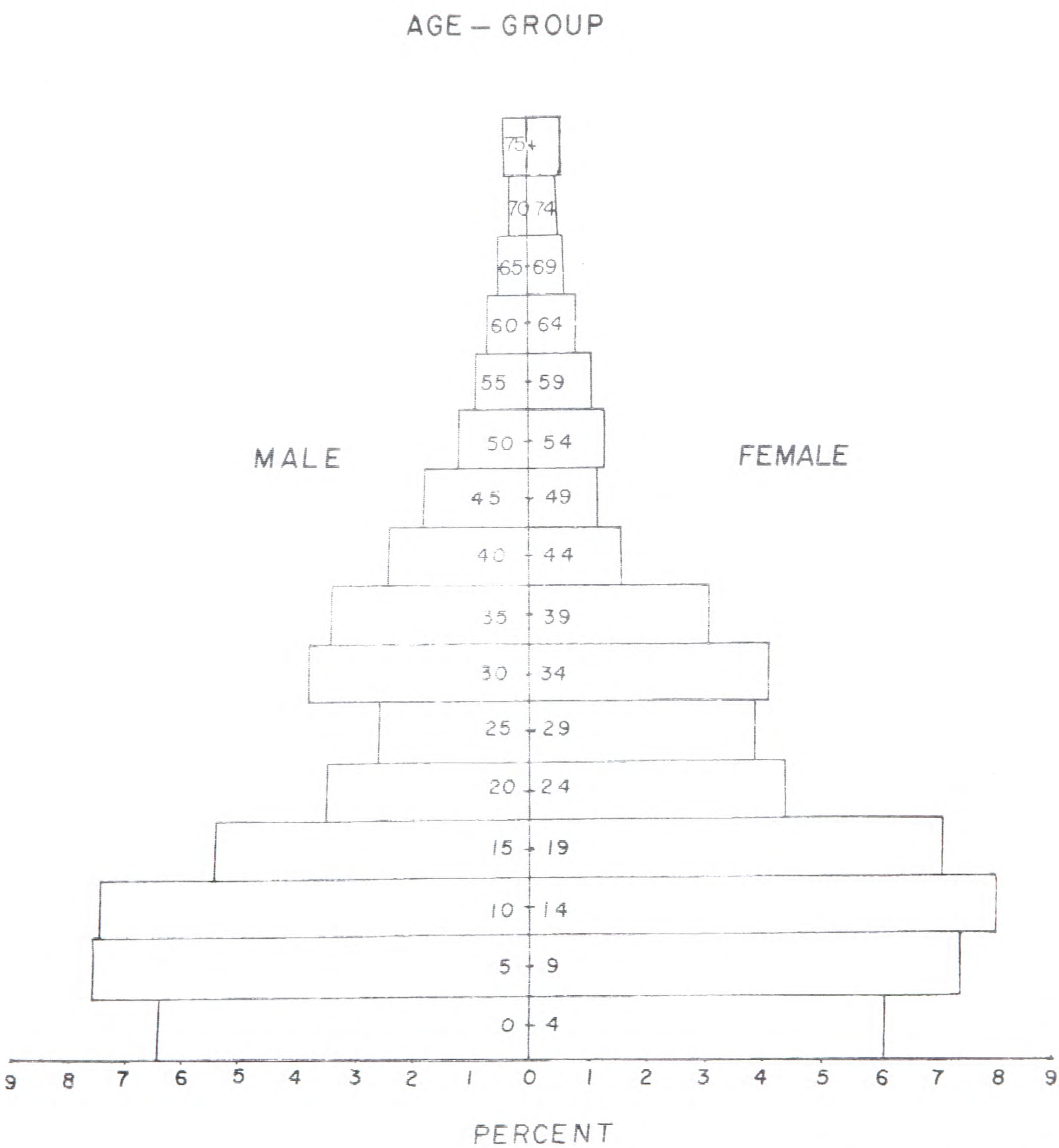
2.3.3.4 Migration and Sex-ratio

In most African towns, migrants to the city tend to be predominantly male labourers who have left their wives behind in the rural areas (Caldwell, 1969; Rosser, 1972; Southall and Gutkind, 1973; Little, 1974). There are therefore generally more men in towns and cities than there are women. The situation in Ethiopia is different to this. There have always been more women than men in the towns of highland Ethiopia, including Addis Ababa (see **Figure 2.6**). This is because traditionally, in the Ethiopian highlands where the majority are Orthodox Christian, people trace ambilineal inheritance, and family ties are relatively weak. The rate of divorce is high (Hoben, 1973; Levine, 1965). Divorced women who have not re-married often migrate to towns and engage in small trade, domestic labour, or prostitution. The men remain in the villages and re-marry. On the whole, they farm their land, with occasional trips to the towns where they sell their produce, and often spend their money on prostitutes. This causes disharmony with their wives in the villages who become angered not only by their husbands' infidelity but also by the economic hardship that this causes, resulting in more marriage break-ups (Hoben, 1973; World Bank and Ministry of Health, 1986).

More recently, the skewness of the sex-ratio in Addis Ababa and in other Ethiopian cities and towns has been due to the large number of men between 18 and 35 years of age who have been conscripted and mobilized to the war regions of the north and south-east. Compulsory conscription started during the Somali invasion of 1977 and was intensified in 1984-85, and again in 1988 until the present day. Over 100,000 men and boys have been conscripted in each of the last three years (Africa Watch, 1990). Some of the implications of this for the well-being of mothers and infants in Kebele 11 are discussed in Chapter 6.

Recent trends show that the rate of urbanization in Addis Ababa is

Figure 2.6 Population Pyramid of Addis Ababa



Source: CSO, 1987

slowing down (Solomon, 1988). The city is not growing as fast as it has done in the past. Clapham (1988) ascribes this to the land-reform which attracted people to the rural areas, and to the decline in the standard of living in Addis Ababa since the Revolution of 1974. However, a major reason for the decline in rural to urban migration has to be that movement from rural to urban areas is strictly politically controlled. At the village level, the gäbéré mahaber, farmers' association, (the rural equivalent of the kebele), enumerates all inhabitants and makes sure that those who should be in the army do not evade conscription. Unemployed migrants to towns are also likely to be forcibly conscripted. As a result, the city's rate of growth has slowed down.

According to the 1984 Census, the population of Kebele 11 was 10,556 with a sex-ratio of exactly 1:1. The comparatively high number of men in the Kebele is probably related to the large number of Gurage, among whom family ties are strong and marriages relatively stable, compared to the Amhara (Shack, 1966; 1974; World Bank and Ministry of Health, 1986). The records of Kebele 11 offices showed that the population in 1987/88 totalled about 12,000. This figure included absentee males who were serving in the army. It is likely, therefore, that the sex ratio is no longer 1:1.

2.3.3.5 Birth-intervals and the Use of Contraceptives

The use of modern contraceptives is not widespread in Ethiopia. A recent study conducted by the World Bank and the Ministry of Health in Addis Ababa (1986) showed that out of 494 male and female respondents in five different regions of the central highlands, only 5.1 per cent of the women, and none of the men reported the use of contraceptives. However, traditional means of birth-control such as *coitus interruptus*, and the effect of lactational amenorrhoea are prevalent.

Many mothers in the Kebele 11 sample knew about modern contraceptives. The majority expressed disapproval of the oral kind, believing that it could cause unacceptable changes in the body and subsequent ill-health. However, the majority said that they did not use any contraceptives. The reasons ranged from the woman's belief that it was harmful and/or wrong to use contraceptives (particularly among the Moslems), to the lack of cooperation on the part of the men (mainly concerning the sheath). Six women used the intra-uterine device (IUD) which was provided by the hospital where they had their last delivery (see **Table 2.8**). The mean last closed birth-interval in the study sample was 20 months. Associations between the birth-interval, duration of breastfeeding, lactational amenorrhoea, and other maternal factors will be discussed in Chapter 5.

Table 2.8
Contraceptive Use in the Kebele 11 Sample.

Type	N	%
none	98	86.73
sheath	3	2.65
IUD	6	5.30
no information	6	5.30

2.3.4 Spatial Organization

In most cities of Africa and indeed in other parts of the world, there is a clear spatial divide between the rich and the poor. The middle to high income residential areas are separate from the low-income or shanty town areas. However, this does not preclude movement. Through the dynamic processes of social and economic mobility, people who have previously lived in a low-income area may move to affluent areas. Others may stay in the same area but improve the quality of their housing and sanitary facilities, so that the shanty town is transformed into a better place (Little, 1974).

The situation in Addis Ababa is different. The affluent and the economically disadvantaged are not spatially segregated. Shanty towns will be found next to the skyscrapers and smart houses. For example, very poor quality housing and insanitary conditions can be seen just across the Ginfile stream from the grand corridors of the impressive United Nations Economic Commission for Africa (UNECA) building, which houses the Africa Hall. There are a number of well built villas in Kebele 11 too, next to the rickety mud houses of the study sample.

This arrangement derives from the origins of the city described earlier. In Menelik's time Addis Ababa began as the 'city of many villages' or encampments called séférs. Important nobles and army generals had large houses surrounded by the small huts of their retainers. This feature remained for many decades until the Revolution abolished the social reasons for it in 1974. However, the lack of investment in urban development has meant that the pattern has stayed, with the nobles removed and the big houses inhabited instead by party officials and middle-class citizens who can afford the reduced rent (by half the former rate) of these nationalized houses.

In Menelik's time, there was no recognizable urban planning system in Addis Ababa. Fecadu (1972) maintains that Addis Ababa remained essentially a military camp until the Fascist invasion of 1935. The various séférs were scattered all over the place with wänz (river or stream) and/or tchaka (woods or forest) separating them. This presented problems of transportation at that time.

> 'Streets there are none, and to go from one part of the town to the other you must simply bestride your mule and prepare to ride across country. Three-quarters of an hour at least are necessary for a pilgrimage from the British Agency to the Palace, and as much again to the market. On either of these journeys you must cross three or four deep ravines with stony, precipitous banks and a torrent-bed full of slippery boulders.' (Herbert Vivian, 1901, cited in Pankhurst, 1985: 213)

This description remains true, especially for the peripheral parts of

Addis Ababa which lack roads and bridges even today. The difference is that the forests have largely been replaced by buildings. Little change occurred after Menelik, during the Empress Zawditu's brief reign and the coronation of Ras Tafari Mekonnen, Emperor Haile Sellasie, in 1930.

In 1935, the fascists invaded Ethiopia. In 1941, a combined British and Ethiopian patriot force drove them out and restored Emperor Haile Sellasie. In the six years of Italian occupation, the development of Addis Ababa took a drastically different course. The Italians confiscated land which largely belonged to the nobility and divided the city into zones, built squares (e.g., Piazza), markets (e.g., Markato), residential quarters (e.g., Casa Inches), parks and offices (e.g., Casa Popolare). The Italians made land and property available for sale. Furthermore, they encouraged migration into the city from the surrounding rural areas. All-weather roads were built and industries and businesses were set up. A modern police force was established and a system of taxation introduced, marking this era with the imposition of considerable uniformity which was hitherto unknown in Addis Ababa.

Male labourers came to the city for work mainly in factories and on construction sites in exchange for cash (Fecadu, 1972; Bjerén, 1985), and many migrant women and widows engaged in prostitution (Laketch, 1978). The monetary economy thus expanded quickly. This was the start of urbanization in Addis Ababa in the sense that the cash economy expanded and large numbers of people began to migrate to the city from the surrounding rural areas, in search of waged labour. Before that, labourers in the city were slaves or serfs who lived on the estates of the land-lords.

On the return of the Emperor land was restored to the nobles, and there was a decline in urbanization for some time.

'A survey of the city's 212 square kilometres made much later in 1961 showed that 58 per cent was owned by 1,768 large proprietors, each with more than 10,000 square metres, or an average of 871,000 square metres per owner, whereas 24,590 small proprietors owning less than 10,000 square metres had only 7.4 per cent, the average such plots being a mere 150 square metres. 12.7 per cent of the land belonged to the Government and foreign embassies or legations, and a further 12 per cent to the Church, while the remainder, 9.9 per cent which was unaccounted for, was largely royal land.' (Pankhurst, 1985: 220)

In the late 1940s and 1950s, the momentum of urbanization picked up again. Addis Ababa became the seat and the symbol of Pan-Africanism where the Organization of African Unity (OAU) and the United Nations Economic Commission for Africa (UNECA) Headquarters were built. There was increased urban development such as the construction of more roads, houses, and big hotels, but the provision of public services such as water supply and waste-disposal system remained rudimentary.

By the 1960s voluntary associations such as idir, iqub, and mahaber flourished, and other new 'urban' networks such as sports clubs, professional associations, and organizations like the Young Men's Christian Association (YMCA) started (Fecadu, 1972). The social, economic, and political functions of Idir (neighbourhood mutual aid association) and iqub (rotating credit associations) have been well documented (Fecadu, 1972; Lewis, 1988). The third main type of voluntary association, mahaber has a distinct religious function in which feasts are held to commemorate particular Saint's days (see Appendix V). Idir and mahaber are thought to have a close relationship with the customs of the Ethiopian Orthodox Church (Levine, 1973; Markakis, 1974), although it has been argued that the voluntary associations in central Ethiopia evolved from traditional and rural forms of rotating credit associations indigenous to the Gurage (Shack, 1966; Fecadu, 1972).

At the same time, large numbers of women began to work in industrial establishments (Laketch, 1978). However, the position of women remained largely subservient, except for the courtesan prostitutes ('Madames') who were materially very well off, commanded considerable respect among the public, and had access to political power comparable to that of the queens (Laketch, 1978).

The physical appearance of Addis Ababa remained largely unchanged. In the absence of street plans and/or street names (except for the few major roads), inhabitants of the city described their addresses according to their proximity to well known places such as the Market (Markato), the various churches and cathedrals, the palace, schools and hospitals. Very often embassies of foreign governments, which were great in number, served (and they still do) as landmarks.

Kebele 11 is located in the western part of Addis Ababa, and it lies between two valleys: the Kataba and the Tinishu Akaki (see **Figure 2.7**). Keftegna 24 is a peri-urban quarter that is a considerable distance away from the various 'centres' of the city. The city 'centres' include Piazza, Addis Ketema (the Market) and Abiot Square (Revolution Square).

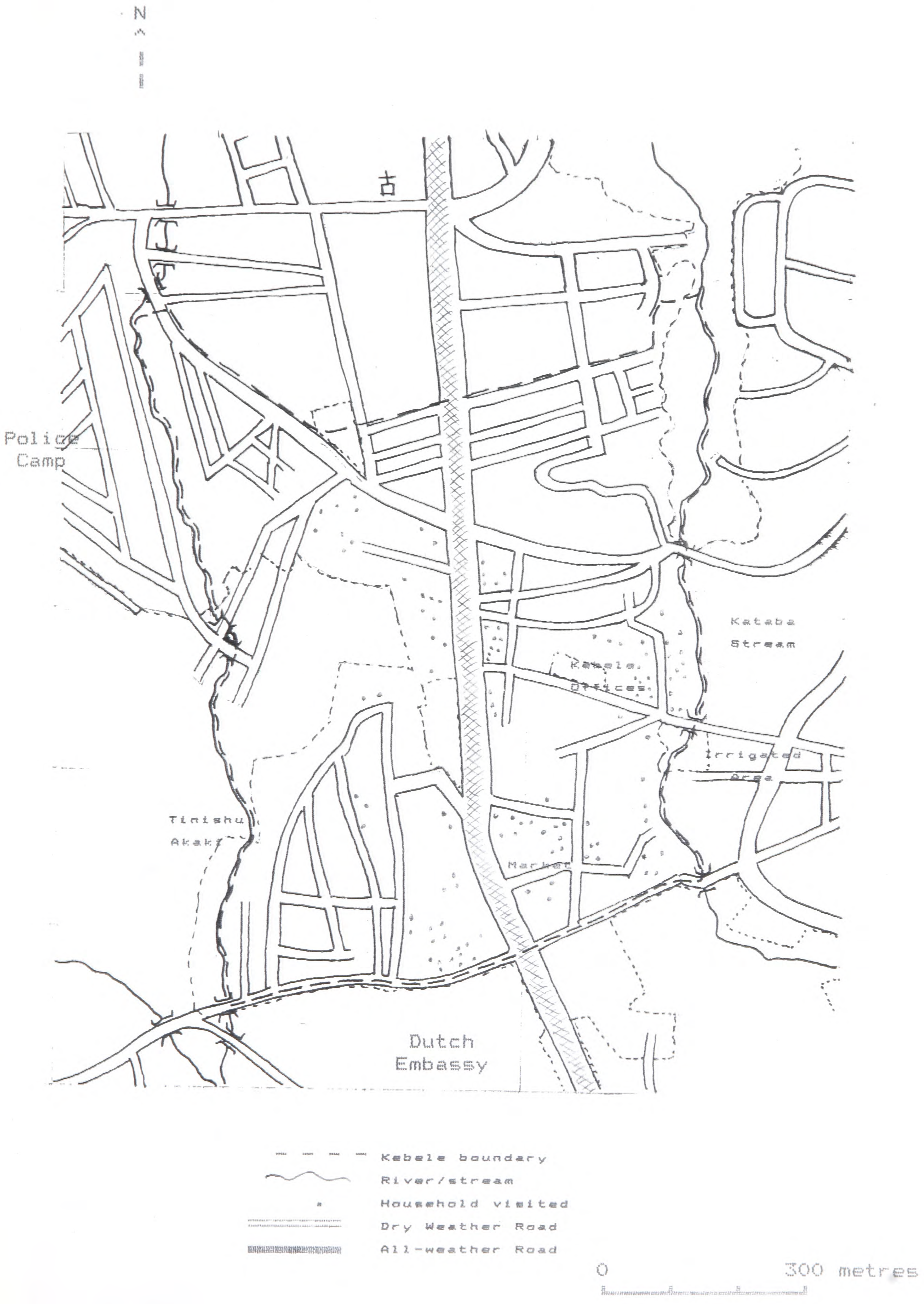
2.3.5 Housing

Traditionally, houses in Addis Ababa consisted of wooden frames with Chika (a mixture of mud and straw) walls, and earthen or wooden floors - depending on the owner's socio-economic status. Stone and brick houses are still in the minority in Addis Ababa. The first brick houses were built after the use of cement (produced in Dire Dawa) was introduced in the late 1920s. The use of corrugated-iron roofing also developed at that time.

Pre-revolutionary housing in Addis Ababa was described as 'broadly adequate in quantity, though grossly inadequate in quality' (Clapham, 1988). While the building of villas for lease to foreigners and the growing Ethiopian middle-class was the most profitable use for investment capital, overcrowding in the majority of sub-standard quality houses was a common feature. Clapham cites the figures from a housing census carried out in August 1978 as largely reflecting the pre-revolutionary conditions:

> '... 87 per cent of the houses had non-durable walls (mostly wattle-and-daub, known in Amharic as Chika), 53 per cent had earthen floors, and 45.5 per cent had no foundations.' (Clapham, 1988: 142)

Figure 2.7 Map of Kebele 11, Keftegna 24



Since the Declaration of the Nationalization of Urban Land and Extra Houses on July 26, 1975, ownership of house and land was restricted to one per household. Extra houses were nationalized, and the newly set-up Urban-Dwellers' Associations or Kebeles became the recipients of house rent from all houses whose monthly rent did not exceed 100 Eth. Birr. The rent of houses above 100 Birr, and income from the sale of nationalized property, went directly to the Housing Department. This represented a major break with the feudal past, when a few wealthy landlords had owned the majority of the land in Addis Ababa, and there had been no rent controls. Rents were now fixed at half the original rate. The military government, known as the Dergue, also fixed staple food prices at a low level. The fixing of rents and food prices represented a considerable improvement in the welfare of the urban poor.

However, the revolution did not change the housing conditions of the urban poor. There has been little change in housing development since 1974. Private individuals no longer build for letting out, the government has built little, and the extension of services to most areas of the city has been very slow. In 1980 the Ministry of Urban Development estimated that 91,700 new housing units were needed each year, approximately half of which were required in Addis Ababa. Official figures for the number of houses built in Addis Ababa from 1975 to 1981 range from 2,188 to 2,422 a year (Clapham, 1988:143). Clapham maintains that the Kebeles, to which the task of building low-cost houses for the mass of the urban population was delegated, have done very little.

In 1981, 79 per cent of the inhabitants of Addis Ababa were estimated to be slum dwellers (Donohue, 1982). This proportion is reputedly the highest in the world. However, the phrase 'slum dwellers' is inappropriate here since slum dwellers in Addis Ababa are not a homogeneous group, unlike in other cities Donohue compares with Addis Ababa. Although the majority of the inhabitants of Addis Ababa 'slums' (poor housing plus insanitary conditions) dwellers are in the low-income category, there are also middle-income people who work either in the formal sector, or are engaged in trade. Some of these middle-class categories have lived in low-income areas for a long time. Some of them have been on the waiting list to be rehoused by the Housing Department. Waiting on this list can take several years.

One's observations during the period of the field-research were that urban dwellers within the middle to high income range in Addis Ababa did not invest on long-term assets such as property any more. Instead, they spent more money on temporal enjoyment such as eating out, drinking, visiting leisure resorts such as Sodere, Langano, Awassa, and so on. The prevailing attitude seemed to be one of 'Eat, drink, and be merry, for tomorrow you die'. In the absence of a free-market economy, there are less incentives to save and to build houses. The Government is responsible for the improvement and maintenance of rented houses. However, seeing to this has not been the top priority of the present government which has invested heavily in its defence and armed forces, and ambitious programmes for rural transformation such as resettlement and villagization. Ethiopia has the largest army in Africa and a large proportion of its resources has been depleted by various military conflicts, especially by the ongoing war of the North.

In the 'low-income' sections of Kebele 11, the construction of houses is mostly of wood with mud-brick walls and corrugated iron or thatched roofs. The majority of the houses had earthen floors, except for a few which had wooden or tiled floors. The level of overcrowding was difficult to gauge because the mothers were reluctant to say how many people actually lived in the same house.

Some of the houses visited included two or more family units living under the same roof either through dependency (tiqeñnet) or through sub-letting (debalinet). Dependency was where a family is sheltered by another family free of charge. This arrangement is common between relatives and close friends and includes teenage single mothers who were still living with their parents. On the other hand, sub-letting was where a family lets part of the house to another family for a fee. Rent charged in this way was usually higher than normal, and the arrangement was illegal. The Kebele authorities would penalize the household head if they discovered that s/he was sub-letting (usually a room) within their house.

Houses were generally enclosed in compounds (surrounded by twigs or corrugated iron fences) closely packed along narrow passages. The passages and roads in Kebele 11 were cobbled. The only tarmac road was the main road that runs from Addis Ketema to the old airport across Kebele 11. Electricity was available to all households in the sample (reported payments of monthly rates ranged from 1.5 to 5.0 Eth. Birr, mean=2.13 Birr, s.d.=0.77, mode=2.0 Birr). These rates were affordable to most in the sample, and the supply was fairly regular.

2.3.6 Water Supply and Sanitation

At the beginning, Menelik's efforts of modernization started with the instalment of piped-water in the palace in 1894 by a Swiss engineer. This was a major innovation and a great wonder to the people who witnessed it. Pankhurst (1985) cites Cerulli, 1923-25, who had recorded Amharic poems about it such as the following,

> 'We have seen wonders in Addis Ababa
> Water worships Emperor Menilek
> O Dannaw [i.e. Menilek] what more wisdom will you bring?
> You already make water soar into the air.!' (p.206)

and Ghebre-Sellasie, the Royal Chronicler, who recorded the measures of hygiene taken and noted behaviourial changes in the people in and around the Palace.

'...Drinking water and water for washing was separated. Special laundries were made for the clothes of Ase [Emperor] Menilek, those of Etege [Queen] Taytu, and those of their favourites and the guards of the elfen [ilfign]. From that time onwards people were no longer seen going to the river to wash their clothes.' (p.207)

However, outside the Emperor's palace, there were no urban facilities to speak of. There was no piped water or special laundries for the rest of the inhabitants of Addis Ababa. Moreover, the ecological ills associated with poor sanitation which were evident 100 years ago still persist in many parts of the city. To date, plans for a central sewerage system covering the whole city have not been implemented.

'Street-cleaning and the collection of refuse, let alone electric light - except at the Palace - were in Menilek's day still things of the Future. Household garbage was merely dumped in each compound, or, if absolutely necessary, buried in holes dug in them. The consequences of the absence of organized sanitation were, however, mitigated by the dispersed character of the settlement, and the absence of a dense population, as well as by the monsoon rains. Bodies of dead mules and other large animals were normally dragged to neighbouring river beds, while those of the numerous canine population were left to be eaten by hyenas who every night efficiently performed the work of scavenging. As the city grew rapidly, there was an increase in illness, particularly smallpox, venereal diseases, typhus and trachoma.' (Pankhurst, 1985: 214).

For the most part, urban services and facilities still remain 'things of the Future'. The 19th century state of affairs improved only slightly when the city municipality organized a waste-disposal system. Municipality vans collect household refuse regularly only from the 'central', relatively more accessible parts of the city. Many parts of the city remain inaccessible by tarmac roads. In those parts, refuse tends to be heaped on waste ground in the periphery of residential areas.

A common feature of the city was that people used rivers and streams as refuse disposal sites. Surprisingly, most people in Kebele 11 did not distinguish between streams and sewage canals: they were both referred to as wänz, river or stream, and waste was indiscriminately disposed of in both.

Conditions in Kebele 11 exemplify the ecological problems of most parts of the city. Piped water was accessible to every household in the Kebele, and yet the observance of hygiene was inadequate. The majority of the households in the sample, 60.2 per cent, had a shared source of piped water (see **Table 2.9**). Samples of water from Tinishu Akaki river, and Kataba stream that flow on the western and eastern boundaries of Kebele 11

Table 2.9
Household Water Supply in the Study Sample.

Source	N	%
own tap	16	14.16
shared tap	68	60.18
public tap	21	18.58
shared tap + river	4	3.54
no information	4	3.54

respectively, were found to be highly polluted. A bacteriological examination of these samples, carried out at the National Research Institute of Health Bacteriology Division in Addis Ababa showed a coliform count of over 161/100 ml (upstream) during the dry season. The pollutants identified included E.Coli. Although the women in the sample said that they used river water for washing purposes only, children played in it and possibly drank it unsupervised.

The sanitation conditions were poor: 34.5 per cent of the households had no toilet facilities (see **Table 2.10**).

Table 2.10
Household Toilet Facilities in the Sample.

Type of Latrine	N	%
private pit latrine	22	39.82
shared pit latrine	45	19.47
none	39	34.51
no information	7	6.19

A nation-wide survey of toilet facilities in urban centres showed that 35 per cent of the inhabitants of big towns, including Addis Ababa, had no toilet facilities. Since 1977 when a modern sewerage system started in Addis Ababa, it has served only 16 per cent of the population with only 8 per cent of households having water closets (Zein, 1988).

Similarly, the waste-disposal system was poor. A large proportion of the sample, 34.5 per cent disposed of their waste by dumping it into the river (see **Table 2.11**). 6.2 per cent made no effort at all to dispose of it, so that the vicinity of the houses and alleyways remained littered.

Lack of a comprehensive sewage system in a city the size of Addis Ababa means that in areas where septic tanks are not commonly used, temporary pits that served as latrines in the past, and were covered up may inadvertently be opened from time to time causing serious contamination and pollution of the environment. Such problems become more acute in the rainy season when a distinction between faecal contaminants and muddy soil is difficult if not impossible. This is one of the main reasons why the prevalence of diarrhoeal diseases peaks during the rainy season (Claeson, 1988).

Table 2.11
Household Waste-disposal System in the Sample.

Means of Disposal	N	%
thrown in river	39	34.51
collected and burned	21	18.58
thrown off cliff	20	17.69
collected by municipality van	17	15.04
no effort made	7	6.19
no information	9	7.96

In summary, while the households studied enjoyed some urban facilities such as piped water supply, the contamination of the surroundings of the home remained high. Hence, many of the benefits of the provision of relatively clean water were negated by other factors in the environment that promoted infection and disease, particularly among young children.

2.3.7 Health Care

Keftegna 24 was one of the most deprived parts of Addis Ababa regarding public health facilities. There was no clinic in the *Keftegna*. The nearest clinic for the inhabitants of *Kebele* 11 was Kolfe Clinic in *Keftegna* 25. Kolfe Clinic was used mostly for child immunization, all of the women in the *Kebele* 11 sample had taken their children to Kolfe Clinic for vaccination.

The under-fives immunization programme included vaccines against six major childhood diseases - *viz*. tetanus, diphtheria, polio, whooping cough, tuberculosis and measles. Vaccines were usually given in clinics and hospitals. Where there was no clinic, outreach teams took vaccines to the *Kebele* offices and administered them there on a regular basis. The effect of this medical intervention on the health of infants in the *Kebele* 11 sample is discussed in Chapter 6.

2.3.8 Education

Education in traditional Ethiopia was monopolized by religious establishments. Most notably, the Ethiopian Orthodox Church maintained the education in Ge'ez (Ethiopic) of its clergy. Young boys were taken to Ques temhert beits (church schools) to learn the Ge'ez alphabet. Soon after they could master reading and writing, they were taught to recite the Psalms and other liturgical pieces.

Later, the Qoranic schools provided similar formal education for Moslem boys. In the late 1880s and 1900s some missionary schools were set up in the northern, central and southern parts of the country. However, it was not until the reign of the last Emperor, Haile Selassie I, that public education was introduced. State Schools in Addis Ababa started early in the 1930s. At the beginning, these schools were attended only by the sons of the nobility and favoured serfs, some of whom were then sent to Europe for further education. Later on, however, the number of government and missionary schools in Addis Ababa increased, and ordinary people could send their children to school.

Women's formal education did not start until after the Italian occupation. Girls then began to attend schools so that by 1967, 22.3 per cent of the city's female population (age 10 years and above) had some formal education (Laketch, 1978).

The census of 1984 showed the proportion of adult females who had never attended school in Addis Ababa to be 16.3 per cent, compared to 9.9 per cent for males. There were variations by zone in these proportions (i.e. for females) ranging from 11.9 per cent in zones 2 and 3 to 15.5 per cent in zone 1 where Kebele 11 Keftegna 24 is located.

In the Kebele 11 sample, the educational level of the mothers varied: 27.1 per cent had had no formal education and could not read or write, the majority, 65.4 per cent had recently achieved basic literacy -after the launch of the literacy campaign. 4.7 per cent had finished elementary school and 2.8 per cent had completed elementary school plus some vocational training including dress-making and machine-knitting.

The literacy campaign was first launched on July 8, 1979, and it targeted all non-literate citizens. All of the mothers in the sample who fell in this category had taken part in it. However, some were not successful in achieving literacy due to the lack of incentive and child care provisions.

2.3.9 Ethnicity

The question of ethnicity in Shoa region is a complex one. The view that the terms 'Amhara', 'Oromo', 'Gurage', and so on refer to discrete ethnic groups is simplistic. Two of the main ethnic categories in Shoa, namely, Amhara and Oromo, have been moulded over hundreds of years of political history. The Amhara were originally the inhabitants of the highland regions of Gondar, Wello and Gojjam. For centuries in these regions, Amharic has been the lisane-negus, the king's language. Amhara governors, soldiers, and settlers had spread out from the central highland regions and 'colonized' much of the southern regions. Amhara rule was imposed on the indigenous Oromo, Gurage, Adere, Sidama, Wellamo, Dorze, Shankilla and numerous other peripheral ethnic groups. However, ethnic identities were not permanent, people could change from one ethnicity to another if that seemed advantageous. For example, the fiefs of the 'periphery' could achieve transfer to the 'core' by adopting the rist system of land-tenure, by speaking Amharic and by converting to Orthodox Christianity. Thus a process variously termed 'Ethiopianization' (Knutsson, 1969), 'Amharization' (Shack, 1974), and 'Abyssiniazation' (Donham, 1986) occurred, whereby indigenous people became politically incorporated into the Ethiopian Empire and could 'become Amhara' by adopting some of the cultural traits of the Amhara. 'Amhara' became the most prestigious ethnicity to have. Consequently, Shack wrote, 'The name 'Amhara' defines situationally a 'socio-cultural' rather than an 'ethnic' category, as the term is understood according to strict usage. On the ground, in social interactions, this means that any person, whatever his origin, who claims to be an 'Amhara' and to whom others react behaviourally as though he were an 'Amhara' is sociologically an Amhara.' (Shack, 1975: 169)

Shack goes on to define the threefold criteria of being an Amhara as firstly, the use of the Amharic language, secondly, conversion into Christianity involving baptism and the adoption of a new (Christian) name, and thirdly, the ownership of land (not applicable since the Land Reform Act of 1975).

The implication is that the term 'Amhara' is ambiguous. On the one hand, it refers to the peasantry of the northern and central highland regions of Gojjam, Gondar, many parts of Wello and northern Shoa; and on the other hand it refers to an elite social category which was characterized by its associations with the Imperial government.

Shack's analysis has much to commend it. Many people who call themselves 'Amhara' have non-Amhara origins. The late Emperor Haile Sellasie's grandfather is said to have been an Oromo, forcibly converted to Christianity, thereby becoming an Amhara (Salole, 1979). In the urban context, these 'sociological Amhara' are particularly important, as towns are the points at which government and elites have their greatest impact. Cooper and Horvath (1973) have shown that between the years 1910 and 1967, a dramatic change had occurred in the ethnic composition of the population of Addis Ababa (see **Table 2.12**)

Table 2.12
Ethnic Composition of the Population of Addis Ababa.

Ethnic group	1910	1952	1967
Amhara	17.7	52.7	75.1
Oromo	42.7	18.5	6.8
Gurage	3.1	17.2	7.6
Tigre	1.5	2.0	5.0

Source: Cooper and Horvath, 1973.

The popularity of the 'sociological Amhara' identity had resulted in a dramatic increase in the Amhara category as large numbers of Oromo, and possibly some Gurage adopted it.

If we follow this analysis, the ethnic categories into which the Kebele 11 sample is divided should correspond to socio-economic differences. That is, the Amhara should be richer than the others. But a simple analysis of income and social status shows that this is not the case. All Amhara households in the sample are of the economically disadvantaged group.

In addition, Gerry Salole (1978) has argued convincingly that, until very recently, a 'Shoan' identity was more important to the inhabitants of Shoa than either an 'Amhara' or an 'Oromo' one. The history of contact between Amhara and Oromo peoples in Shoa, under one kingdom, has led to a high degree of mutual acculturation without complete ethnic assimilation. Many Shoans share the same culture. The ruling families of Shoa were as much Oromo as they were Amhara. This means that other Amhara from the North (Gondar, Gojjam, and Wello) consider Shoans to be 'Oromo' (or 'Galla', in the now abolished pejorative term commonly used until the Revolution), and other Oromo from the South and West (Arsi, Wellega, and Bale) consider all Shoans to be 'Amhara'. The reason why this Shoan identity has become submerged into the categories 'Amhara' and 'Oromo' is that it was politically important for the recent kings of Shoa (Menelik and Haile-Sellasie) to do so. By claiming to be Amhara, they could gain the crucial political support of the rulers of the northern Amhara kingdoms, and enlist their support in conquering the South. The Oromo rulers were not so prejudiced concerning their own culture and were prepared to make alliances with the Shoans without the latter claiming to be Oromo.

The strength of such local or ethnic ties is not confined to people living in rural areas; it extends to urban centres. For example, it is evident in Addis Ababa. The result of urbanization was not the loosening of ethnic affinities where urban centres become melting pots. On the contrary, ethnic ties in the cities are extensions of those in the villages (Mitchell, 1970; Shack, 1974). In Addis Ababa, Menelik had granted the nobility extensive tracts of land, while smaller plots were given to his royal servants, thus creating several military camps (_séfér_s) within the boundaries of the city. Each _séfér_ or neighbourhood was distinguished almost exclusively by the ethnic group which inhabited it; the _séfér_s bore such names as _Wellamo séfér_, _Gurage séfér_, and so on (Shack, 1974).

This analysis would suggest that almost all the people in the _Kebele_ 11 sample are Shoans (with a few exceptions of people from Tigray, Wello, Arsi and Sidamo), and are essentially similar, and that their avowed ethnicity is incidental to their culture and socio-economy. But this is also unsatisfactory. There are definite cultural and socio-economic differences between the groups.

For instance, the Gurage have on the whole a much greater tradition of observance of hygiene and cleanliness than the Amhara or the Oromo, and many Gurage are Moslem. Moreover, the discussion of ethnicity has so far been couched in terms of a simple distinction between Oromo and Amhara. This ignores the Gurage, who are somewhat independent of this process of mutual acculturation.

The Gurage are a cohesive ethnic group. Unlike the Amhara, they have a strong family structure, with low divorce-rates, and stable inheritance systems (Shack, 1966). The Gurage as a group specialize in trade: many are shop-keepers, middlemen, small craftsmen and so on. They have distinct traditions such as the religious chewing of _tchat_ or _khat_ (_Catha edulis_). Most Gurage do not 'become Amhara' in the way some Oromo do. However, some Gurage, notably the Soddo Gurage, have acculturated to the general Shoan pattern (Salole, 1979:22). In addition, some Oromo are similarly indifferent to the ideals of 'becoming Amhara'. They have community spirit, manifest in rotating credit associations (Lewis, 1988), and in recent years have organized a popular movement for independence from the central government.

This suggests that we should look to another level of ethnic identity in order to account for cultural and religious differences. This is the level of local identification. There are Menz Amhara and other Amhara; Soddo Oromo and Tulema Oromo; Soddo Gurage and thirteen other types of Gurage. This level of identification does not supplant the wider ethnic labels of Gurage, Amhara, and Oromo, or the regional identification as Shoan, or the socio-cultural identification of certain elite people as 'Amhara'. It is instead an alternative type of identification, illustrating the complex and multi-layered nature of ethnic identity in Shoa. Depending on the situation, and who they are interacting with, Amharic speaking elite Tulema Oromo may identify themselves as Tulema, Oromo, as Shoan, or as Amhara.

Therefore, we can describe the Kebele 11 sample in the following way:

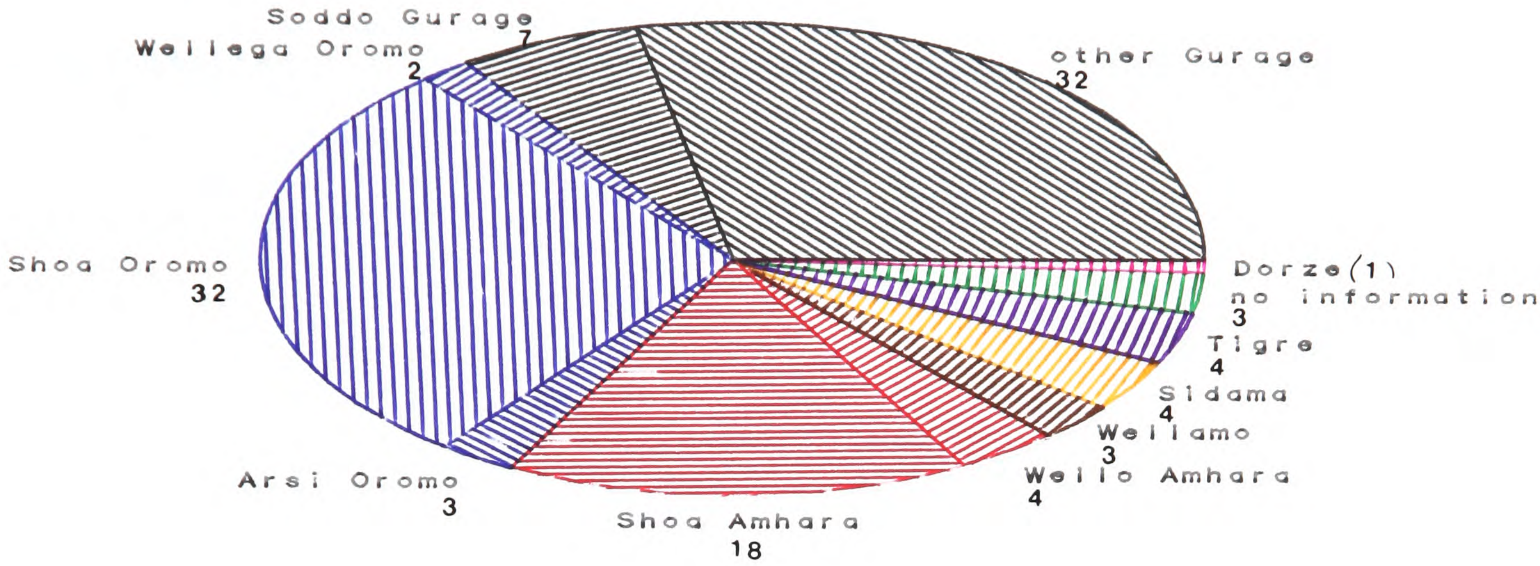
1. first language spoken,
2. region of origin (Shoa, Wello, Sidamo, Tigray, etc.),
3. locality of origin (Silte, Soddo, Sidama, Wellayta, Inderta, Tembien, etc.),
4. 'ethnic origin' (Gurage, Oromo, Amhara, Wellamo, Sidama, Tigre, etc.) and
5. religious affiliation.

However, the sample size is too small to enable us to investigate the cultural and socio-economic traits that correspond with these identifications. We can merely point out observed differences and look for explanations elsewhere.

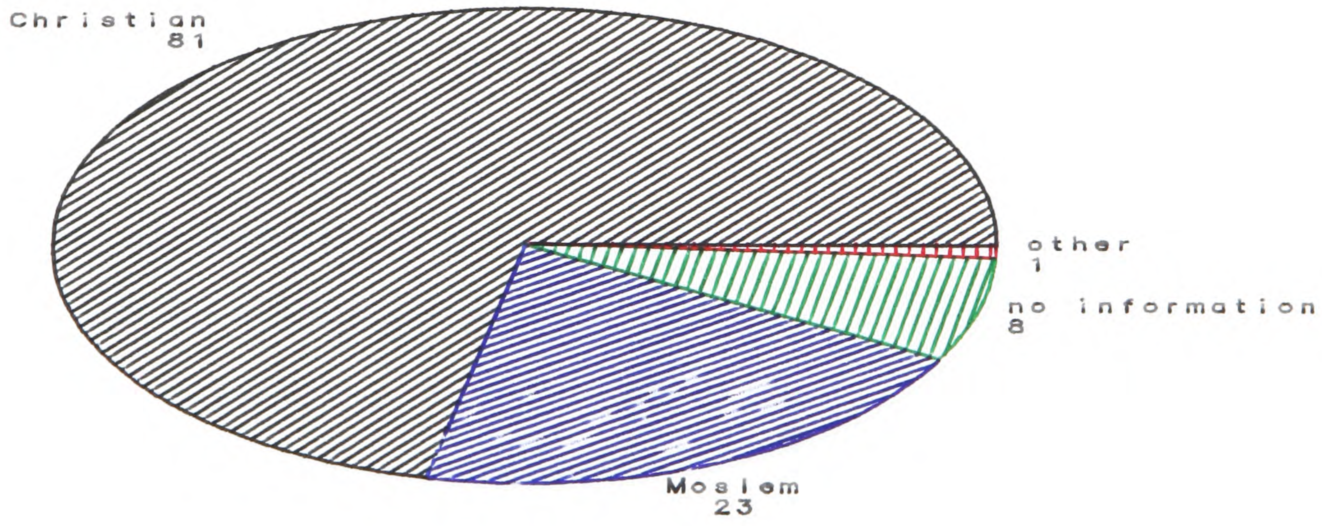
Figure 2.8 shows the ethnic and religious composition of the study sample. The first language of the women in the sample included Orominya, Guraginya, Amharic, Tigrinya, Wellamo, and Sidaminya. 81 per cent of the

Figure 2.8 Ethnicity and Religion of the Study Sample

Ethnicity



Religion



women spoke Amharic as a second language. As regards religion, 81 were Christian 23 were Moslem and one did not adhere to either (she was trying to earn her living by fortune-telling and witchcraft). **Table 2.13** shows religious affiliations of the sample women by ethnicity.

It is clear that the sample is composed of Shoa Oromo, Gurage, and Amhara with smaller numbers of other categories. However, in analyzing the data, larger groupings such as Gurage, Oromo, and Amhara have been used due to the smallness of the sample size.

Table 2.13
Religious Affiliation by Ethnicity.

Ethnicity	Christian		Moslem		other	no info.
	N	%	N	%	N	N
Soddo Gurage	7	6.20	0	0.0	0	0
other Gurage	10	8.85	21	18.58		2
Shoa Oromo	30	26.55	0	0.00		2
Arsi Oromo	3	2.66	0	0.00		2
Wellega Oromo	2	1.77	0	0.00		0
Shoa Amhara	15	13.27	1	0.90		2
Wello Amhara	3	2.66	1	0.90		0
Tigre (Inderta)	4	3.54	0	0.00		0
Sidama	3	2.65	0	0.00	1	0
Wellamo	3	2.65	0	0.00		0
Dorze	1	0.01	0	0.00		0
no information	-		-			3
Total	78	70.81	23	20.38	1	11

2.4 Summary

Like other capitals before it, Addis Ababa, the 'city of many villages', started off as a conglomeration of military encampments over a hundred years ago. Its original characteristics have changed very little in these years. There is no spatial segregation between the rich and the poor. Although the 1974 Revolution removed the social reasons for this, development of the city since has been slow. The slums or shanty towns are therefore inhabited by low-income sections of the population as well as middle-income sections who are unable to find better housing.

Total fertility rates are lower in Addis Ababa, than in Ethiopia as a whole. This may be due to the relatively larger proportion of educated women in Addis Ababa compared to the whole of the country. The association between women's education and lower fertility levels is well documented.

Although the infant and child mortality levels in Addis Ababa are almost half of those in the rest of the country, and in the whole of the country, they are still high compared to other countries. The existing infrastructure does not include a comprehensive sewage system leaving a large proportion of the city in rudimentary sanitary conditions. The ecological implications of this include the prevalence of diarrhoeal illness in the majority of infants and young children who are exposed to contaminated homestead, water, and food. The most common cause of infant and child mortality is gastro-intestinal infection which is rife in such environments.

Sociologically, the more the city changed, the more it has remained the same. For instance, the sex-ratio is still biased towards women due to the ongoing mass conscription resulting in the absence of men aged 18 to 35, who have joined the armed forces. Ethiopia now has the largest army in Africa, and the government is engaged in a continuous war against large sections of the population who seek autonomy.

The question of ethnicity in Addis Ababa is more complex than it appears at first sight. For a long time in the past, Amhara ethnicity has been regarded as desirable. As a result the category 'sociological Amhara' was created to accommodate those from other Shoan and southern ethnic backgrounds who had 'become Amhara'.

All of these aspects of the wider context of Kebele 11 have been discussed in order to provide as complete a background picture as possible of the ecological, cultural, and socio-economic setting in which this study was conducted. Specific features will be referred to when interpreting the findings in the chapters that follow.

Central Addis Ababa - Churchill Avenue with the City Council
at the top end.

Eucalyptus trees on heavily eroded soil by the main road in Kebele 11, Keftegna 24.

Typical housing in the low-income sections of Kebele 11.

The smallest house in _Kebele_ 11 - partitioned to make room for a shop and a bed-sit.

Chapter 3

Infant Feeding

3.1. Introduction

Practices of infant feeding take highly variable forms according to ecology, season, socio-economy and culture (Knutsson and Mellbin, 1969; Harfouche, 1970; Neihoff and Meister, 1972; Gussler and Mock, 1983; Raphael, 1984; Conton, 1985; Raphael and Davis, 1985; Underwood, 1985; Winikoff and Laukaran, 1989). Considerable differences are found not only between communities but also within communities.

A crucial aspect of infant feeding concerns the process of weaning. In many parts of the world, weaning is the most important threshold for child survival. How, when, and why a child is weaned all play a part in determining the well-being and survival of the child. Many studies have identified the weaning period, particularly in less-developed countries, with an increase in morbidity and mortality of young children (Martorell and Ho, 1984; Black, 1984; Rowland and Rowland, 1986; Rosetta, 1988).

In this chapter, the process of weaning will be examined in detail within the context of urban low-income households.

Three main questions are addressed.

1. What is the dominant infant-feeding practice?
2. What are the constraints on the prevailing infant-feeding regime?
3. What are the implications of this for our theoretical understanding of infant-feeding practices in general and weaning in particular?

The objectives of this chapter are therefore descriptive, analytical, and theoretical. Questions on the implications of infant feeding regime for infant health and infant growth are addressed in chapters 6 and 7, respectively.

3.1.1 Breastfeeding

Feeding in the period of infancy usually has three distinct stages: pre-weaning, weaning, and post-weaning. These are generally characterized by exclusive breastfeeding in the first stage; partial breastfeeding or 'mixed feeding' in the second stage when the diet of breastmilk is supplemented by weaning foods; and the complete withdrawal of breastmilk in the third stage, as other foods totally replace breastmilk.

Breastfeeding is the most accessible and biologically appropriate mode of infant feeding. The feeding regime (i.e., whether it is 'on demand' or scheduled), and its duration (i.e., length of time in terms of months post-partum), depend on maternal, infant, environmental, cultural, and socio-economic factors. The evidence on some of these factors will be examined in the sections that follow. Major studies on this field conducted in both rural and urban regions of Ethiopia will be reviewed and discussed in relation to the *Kebele* 11 study.

3.1.2 Breastfeeding in Rural Ethiopia

In most parts of rural Ethiopia, breastfeeding is the dominant mode of infant feeding. Rural women tend to breastfeed for longer periods of time than do their urban counterparts (WHO, 1981). The length of time postpartum a woman breastfeeds is influenced by cultural norms and expectations as well as ecological, socio-economic, and biological factors.

The practice of prolonged breastfeeding in Ethiopia is characteristic of the highlands of the north, central and southern regions. However, systematic studies of the subject are few in number and often limited in scope.

The attempt to conduct extensive scientific enquiry into infant feeding practices and their implications on child health at the regional and national levels was pioneered by the Ethio-Swedish Children's Nutrition Unit (CNU) based in Addis Ababa (e.g., Knutsson and Mellbin, 1969; Knutsson and Selinus, 1970; Selinus et al., 1971a, b, and c).

CNU's most valuable work on breastfeeding practices was done by Karl-Eric Knutsson, a social anthropologist, in collaboration with Tore Mellbin, a medical doctor (Knutsson and Mellbin, 1969). By comparing three different rural parts of the country, Knutsson and Mellbin found that women of the agricultural highland regions of Ethiopia practised prolonged breastfeeding to different degrees, while women from a pastoral community in the rift-valley region of Arsi practised only short-term breastfeeding (**Table 3.1**).

The first case study came from the northern highlands of Tigray. Amongst rural women in Tigray, breastfeeding often continued well into the third year post-partum. This was the longest duration of breastfeeding found: 64 per cent of infants were still being breastfed at the age of 19 months or more. The second case study came from the highlands of the southern province of Sidamo where 32 per cent of infants were being breastfed after 19 months of age. 38 per cent were breastfed for 7 to 12 months. In contrast, their findings from the third case study, the pastoral population of Arsi (then known as Arussi), showed that the duration of breastfeeding did not to exceed 6 months for a large proportion of the infants (47 per cent). Only 11 per cent were breastfed for more than 12 months.

Knutsson and Mellbin's interpretations of these findings are of interest. The three regions studied differed in ecology, socio-economy and culture. In the very traditional highlands of Tigray (2000 - 2500m above sea level), subsistence farming was the mode of life, the main crops were teff (Eragrostis abyssinicae), wheat, and barley. Heavy erosion had impoverished the land and so harvests were constantly meagre. Knutsson and Mellbin described the socio-economic conditions of Tigray as follows:

Table 3.1
Distribution of Weaned Children According to the Duration of Breast-feeding.

Area		Breast-feeding time, months						Total	
		3	4-6	7-12	13-18	19-24	25	n	%
TIGRE	no	0	0	13	46	100	3	162	
	%	0	0	8.0	28.4	61.7	1.9		100.0
SIDAMO	no.	0	2	58	45	40	9	154	
	%	0	1.3	37.7	29.2	26.0	5.8		100.0
ARUSSI									
boys	no.	11	25	54	7	8	1	106	
	%	10.4	23.6	50.9	6.6	7.5	0.9		99.9
girls	no.	21	33	47	3	4	0	108	
	%	19.4	30.6	43.5	2.8	3.7	0		100.0
Total	no.	32	58	101	10	12	1	214	
	%	15.0	27.1	47.2	4.7	5.6	0.5		100.1

Source: Knutsson and Mellbin, 1969:42.

'Living in densely settled villages made up of carefully constructed stone houses the farmers scratch out a bare living from their dry and stony fields. The power over the farmers is largely in the hands of the official administrators and the provincial noblemen. Within the villages, however, the basic values and norms are egalitarian. The limited produce must be distributed so that each one gets his fair, if not equal share. To this end the farming land is, in some areas, redistributed by a kind of lottery each seventh year.' (pp.43-44)

Households in the villages of Tigray were closely knit together by bonds of kinship and bilateral descent, making up a strongly traditional society where change, including in infant-feeding practice, was strongly resisted.

Sidamo, the second highland region studied, constituted a different ecosystem. The hills were green throughout the year with dense vegetation and thick layers of fertile soil. The people lived in huts surrounded by ensete (Ensete ventricosum) or 'false banana' gardens scattered on the hillsides. The homesteads lay close together in the cultivated areas forming settlements. Knutsson and Mellbin observed that although the traditional segmentary patri-clan and lineage structure and the intricate lua (Sidama system of social organization) prevailed, changes in the economic sphere were rapidly taking place.

'Originally growing coffee between the ensete plants for their own household consumption, they have increasingly expanded coffee cultivation into a cashcrop. This change has slowly opened up the area to the first forerunners of technical and organizational change. The old traditional homemade clothing is being abandoned in favour of tailor-made town clothes. The marketing of the coffee that was earlier completely in the hands of unscrupulous town tradesmen is being transferred to Sidamo-managed cooperative societies, thus increasing the cash return for the farmer. The same openness to influences and change can be observed in the ritual field where missionary efforts have succeeded in converting some segments into various Western Christian faiths while others are turning to Islam. The strength of the tribal segmentary descent structure, however, is such that the conversions are more often of whole lineages or other large segments than of individuals.' (p.45)

This openness to change in Sidamo, which is atypical by Ethiopian standards, has been discussed in detail more recently (Hamer, 1987).

Sidamo's openness to change included the readiness to adopt new infant-feeding practices (e.g, shorter durations of breastfeeding).

In contrast to the above, the mode of livelihood in Arsi was pastoral. In earlier days, the Arsi herdsmen moved their cattle in a transhumant fashion between the different levels of altitude - the lowlands of the Rift Valley on the eastern shore of Lake Zwai, and the highlands of the west. At the time of Knutsson and Mellbin's study, however, these herdsmen were almost completely restricted to the dry lowland savannah with its meagre pasture, due to the influx into the highlands of immigrant farmers from Central Ethiopia.

The social organization of the Arsi consisted in polygynous households belonging to the same descent group living in scattered homesteads. Although they had started to cultivate the dry lowlands, without much success, cattle herding remained central to their society and economy. Cattle also played a very important role in the sphere of infant feeding.

Infants in Arsi were weaned from the breast early. A large proportion of the sample, 42 per cent, had stopped breastfeeding before 7 months post-partum, although a larger proportion, 47 per cent, were breastfeeding up to 12 months. In those cases where breastfeeding had continued beyond 7 months, it was often either because the mother had limited access to cow's milk or because the child had refused to take cow's milk. Otherwise, the Arsi believed that a mother should not breastfeed beyond the first couple of months because that might prevent her from having more children and would therefore be counter-productive. Furthermore, as cattle provided the livelihood of a pastoralist society, the people believed cow's milk to be better for the baby than breastmilk. This exemplifies a striking difference of attitude towards, and belief about breastfeeding. The wish to discourage suckling was clearly influenced by socio-economic and cultural factors such as the availability of cow's milk and the desire for more children.

Other pastoralist societies in Ethiopia such as the Borana of southern

Sidamo are also characterized by the preferential feeding of livestock milk to young children (ILCA/RDP, 1985: 162-164). Similar practices of relatively brief durations of breastfeeding have been documented in the Polynesian islands (Linton, 1939), and in South America (Pan American Health Organization, 1976).

Another study carried out in the Simien region of Ethiopia reported breastfeeding duration similar to that of neighbouring Tigray. From their study of low-income women in the small, road-side town of Debarek, Wenlock and Wenlock (1981) concluded that breastfeeding was prolonged 'even by African standards' (p.261). In Debarek, 94 per cent of infants were being breastfed at 18 months of age, around 60 per cent were being breastfed at 25 to 30 months of age and 19 per cent at 31 to 36 months of age.

As in Tigray and Gondar, prolonged breastfeeding was widely practised in the central highlands of Shoa, particularly among the Gurage where breastfeeding continued for up to four years (Shack, 1969).

All of these studies make the implicit assumption that the overriding determinant of infant feeding practices, particularly the age of weaning, is a set of cultural norms. This view is expressed most clearly by Levine (1965) who attributes much of what he calls the 'Amhara orality' complex to culturally prescribed norms of 'severe' weaning (a term he does not define, see Levine, 1965: 220-1). This hypothesis of Levine's (who is neither a psychologist nor a nutritionist) has been generally rejected by Ethiopian scholars, and indeed was implicitly abandoned by Levine himself in a later work (Levine, 1974). The normative view of infant feeding, and of weaning in particular, is challenged in this Chapter.

3.1.3 Breastfeeding in Urban Ethiopia

Good data relating to breastfeeding practices in urban Ethiopia are limited. Wenlock and Wenlock's study (1981) was conducted in the small town of Debarek that had a strong rural influence, and is therefore not representative of urban areas. The WHO collaborative study of breastfeeding (1981) was the first one to investigate the practice of breastfeeding and supplementation among different income levels within the urban context. This study was based on a cross-sectional survey in which open-ended questions concerning the reasons for stopping breastfeeding were asked. The findings showed that the duration of breastfeeding was shorter among middle to high income women in Addis Ababa, compared to the 'urban poor' and rural women. Only 35 per cent of urban mothers in the middle to high income category were breastfeeding at 6 months post-partum compared to 81 per cent in the 'urban poor' category, and 100 per cent in the rural category. At 18 months post-partum, these figures decreased to 8 per cent in the urban middle to high income group, 70 per cent in the 'urban poor', and 97 per cent in the rural group (WHO, 1981: 37). In the WHO study, analysis of the reasons for stopping breastfeeding was not possible for Ethiopia because 'the question was not answered in a sufficiently high proportion of cases.' (p. 38). Nearly all supplements introduced in the first year were reported to include milk or milk-based products. Although the WHO study was designed to elicit information on what these foods exactly were, when they were introduced, and why, analysis of the reasons for regular supplementation was again not possible due to the small number of responses (p. 100).

3.2 Subjects and Methods

Data were collected by means of a structured interview schedule conducted in the homes of participants (see Appendix II). Each mother was visited once a month for a period of six months. At each visit, the mother was asked questions concerning her lactation and menses status, her infant's weaning status (i.e. whether supplementation had begun, what weaning foods were used, when they were first introduced, and whether and when breastfeeding had ceased), infant's appetite, her attitude towards the infant's eating capacity, and other relevant matters. In this way, any change in maternal lactation status, menses status, and infant's weaning status could be noted sequentially. Both aspects of weaning were entered in the analysis in terms of the infant's age to the nearest 0.5 month.

Complete data are available for a total of 113 infants. However, five adopted infants, and three who were never breastfed have been excluded (two of the sample mothers were unsuccessful in initiating breastfeeding, and the third one was unable to maintain it after the first few weeks). The effective sample size for the analyses that follow is therefore 105 mother-infant pairs.

3.3 Statistical Analyses

The age at weaning presents an example of analysis of current-status data. Statistical techniques available for the analysis of current-status data include 'Survival Analysis' (Cox, 1972; Cox and Oakes, 1984; Armitage and Berry, 1987). It is called 'Survival Analysis' because the variable of direct interest is the length of time that elapses before an event occurs: this event may be death, or death due to a particular disease, as is in most studies, or weaning, as is in the case of this study. This tool is most commonly used for estimating the life-expectancy of terminally ill patients diagnosed with diseases such as leukaemia. In this analysis, interest centres on a group or groups of individuals for each of whom there is a defined point event, called 'failure' that corresponds, for instance, to the point of death, occurring after a length of time called the 'failure time'. Failure can only occur at most once for any individual.

Three requirements need to be fulfilled in order to determine failure time:

1. a time origin must be unambiguously defined,
2. a scale for measuring the passage of time must be defined,
3. the meaning of 'failure' must be made clear.

The failure rate usually varies with time since the subject's entry to the study, **t**, and is denoted by h(**t**). h(**t**) is also referred to as the 'Hazard function'. If the probability density of survival time is $f(t)$ and the corresponding distribution function is F(t), then since the failure rate is the rate at which failures occur divided by the proportion of the population surviving, we have,

$$h(t) = f(t)/1-F(t) = f(t)/S(t)$$

where $S(t) = 1-F(t)$ is the proportion surviving and is referred to as the 'Survival function'.

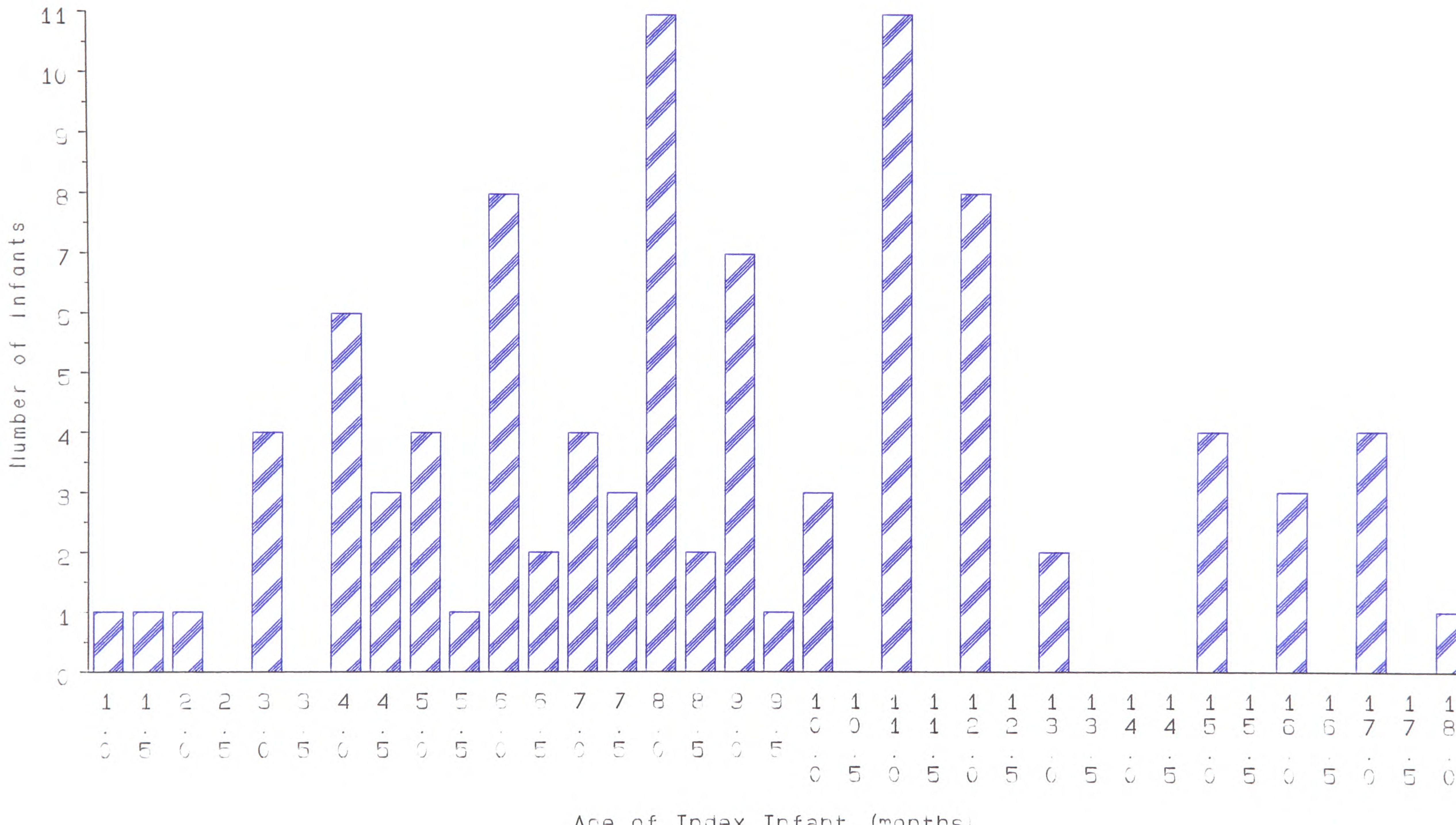
In the Kebele 11 study, the infant's birth is the time origin, the scale for measuring the passage of time is in months, and the failure time is (1) the age at which weaning foods are introduced, or (2) breastfeeding is terminated. When data collection ended, 95 infants had been introduced to breastfeeding (**Figure 3.1**) and 20 infants had stopped breastfeeding (**Figure 3.2**). Infants who had not been introduced to weaning foods, 10 out of 105, and infants who were still being breastfed at the end of data collection, 85 out of 105, constitute 'censored' cases.

The main reason for using this method of analysis is in order to take censored cases into account, since standard techniques for finding the mean age at completion of weaning are not applicable.

Survival analysis is properly thought of as a univariate rather than a multivariate technique because there is only a single response variable, failure time, even though there may be many explanatory variables. A useful characteristic of survival data analysis is its feature of handling censored data. When the proportion of censored cases is high, as is the case with the data on completion of weaning (as we shall see below), the median is a more meaningful estimate than the mean.

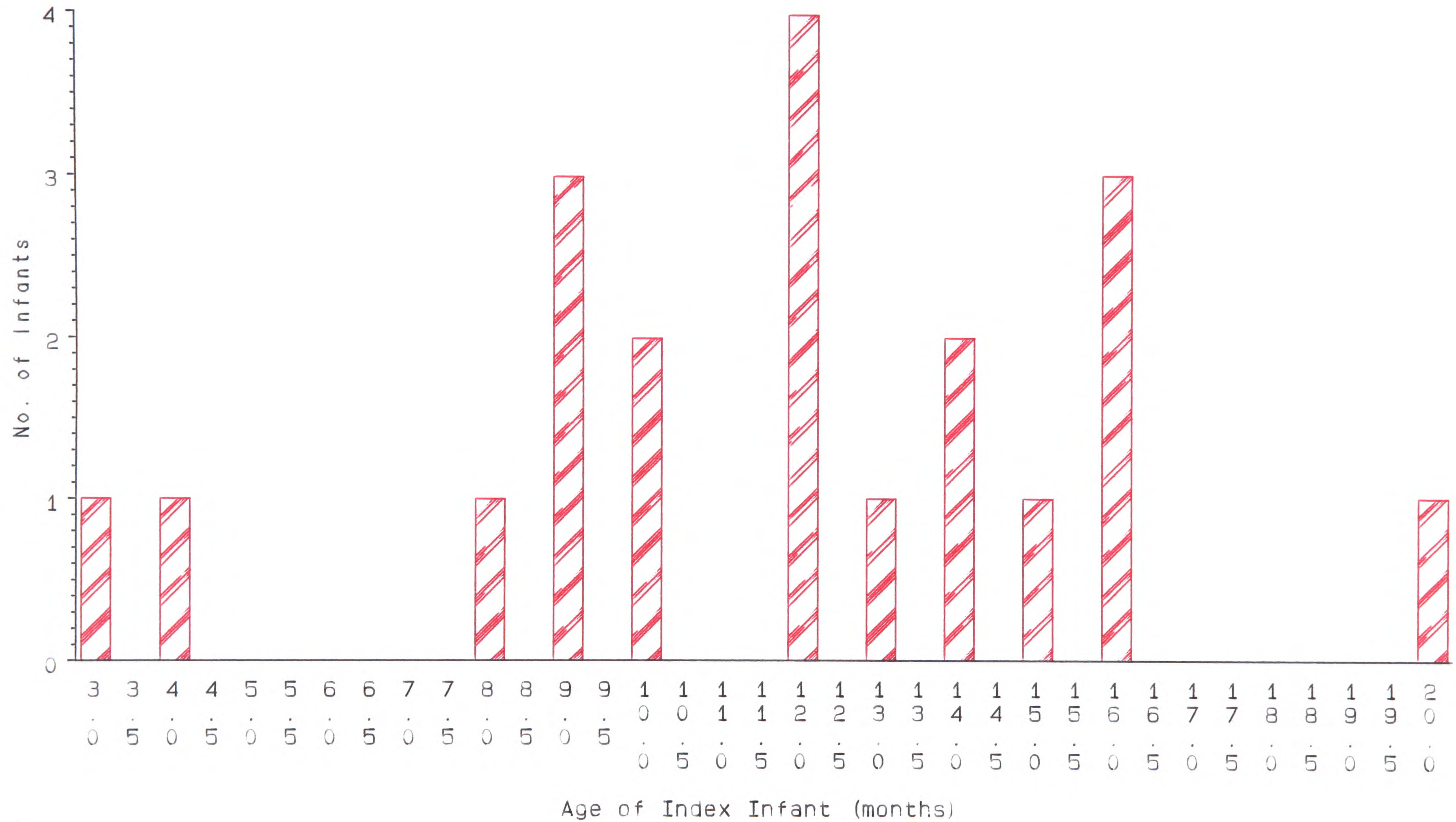
This analysis has been applied first, to determine the mean age at which weaning commences, taking into account the 10 infants who had not

Figure 3.1 Commencement of Weaning (N=95)



Coefficient of Variation = 45.33

Figure 3.2 Completion of Weaning (N=20)



Coefficient of Variation = 35.31

yet been introduced to weaning foods when data collection ended, and second, to estimate the median age at which weaning is expected to be completed, taking into account the 85 censored cases of infants who were still being breastfed at the end of data collection. The application of survival analysis for data relating to breastfeeding, post-partum amenorrhoea and related variables is now widespread (e.g., Diamond et al., 1986; Rosetta, 1989; Jones, 1988, 1989).

The 'product-limit estimate' method of survival analysis was used for obtaining the survival curve and the probability distribution (hazard function) for each aspect of weaning (**Figures 3.3** and **Figure 3.4**, respectively. The mean age at weaning commencement and the median age at which weaning is expected to be completed, were estimated. The influence of variables such as infant's sex, birth order and maternal age at birth on both aspects of weaning was also first explored in this analysis. The results are shown in **Tables 3.4** and **3.5**, respectively.

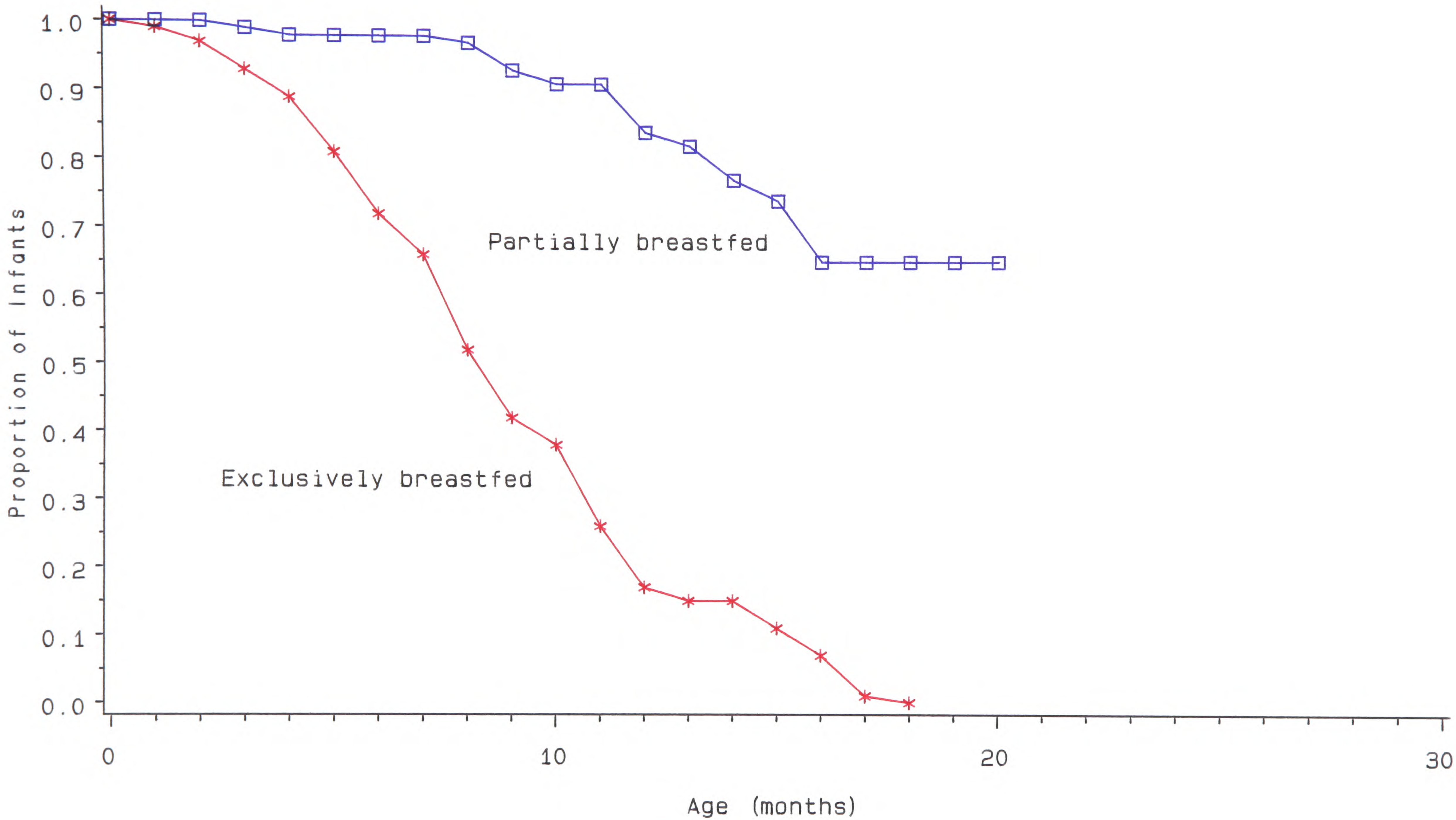
In addition, the significance of variables which were expected to be associated with both aspects of weaning was further examined by using Cox's regression models with covariates. This analysis is based on the Cox (1972) form of the 'proportional hazards' regression model which presumes that failure rates may be modeled as log-linear functions of the covariates. If we assume that $h(t;\mathbf{z})$ is the hazard function for an individual t with covariate vector $\mathbf{z}$, the proportional hazards model is given by

$$h(t;\mathbf{z}) = h_0(t)\exp(B'\mathbf{z})$$

where B is a vector of unknown regression coefficients and $h_0(t)$ is an unknown hazard function for an individual with covariate vector $\mathbf{z}=0$.

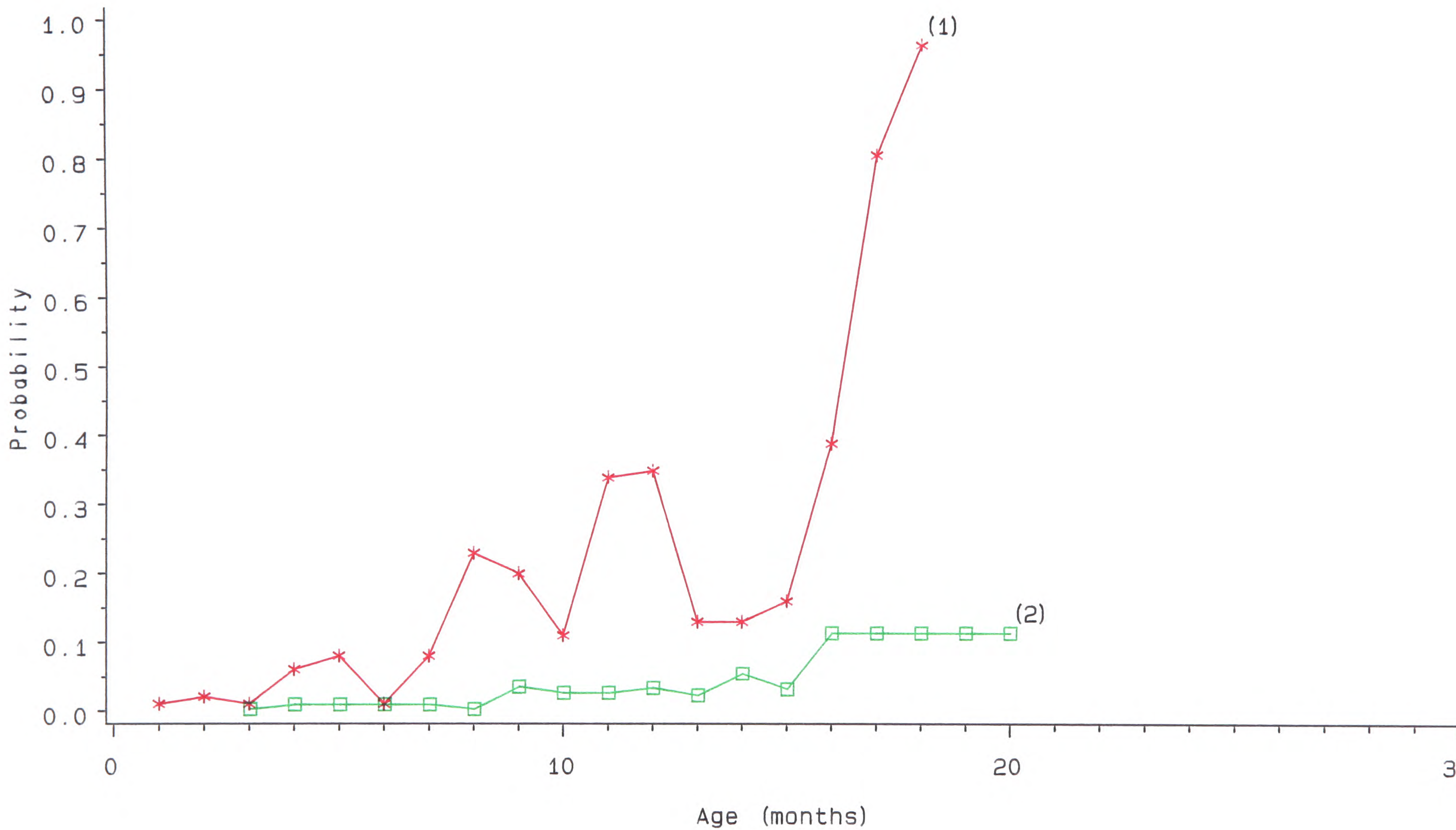
In this analysis, each infant's weaning status was categorized as 0=No or 1=Yes. As in the case of survival analysis, infants who have not commenced and/or completed weaning constituted 'censored' cases. Two separate regressions were done, one for the commencement and one for the completion of weaning. The regression covariates (dependent variables) of

Figure 3.3 Proportions of Infants in the Process of Weaning



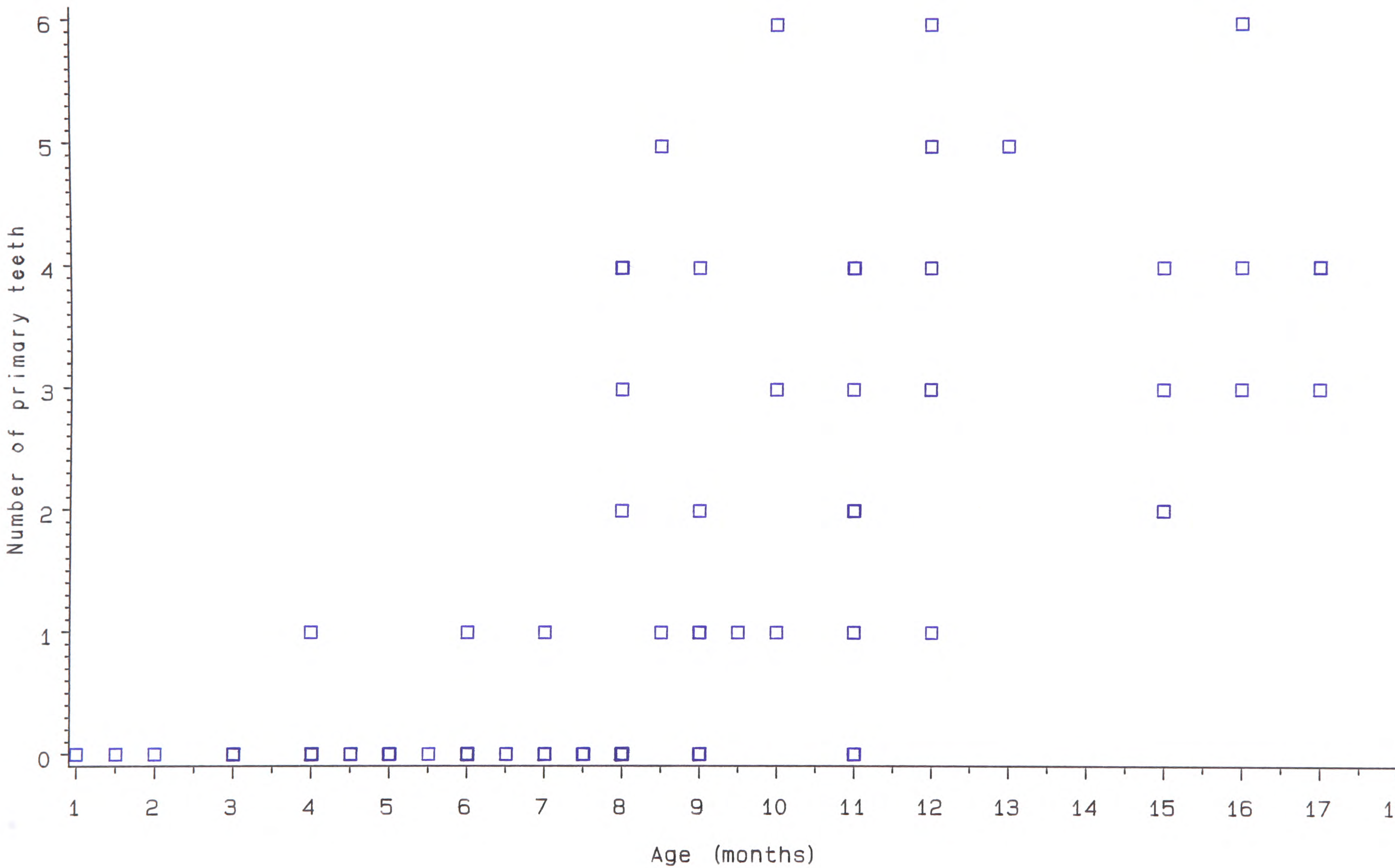
BMDP – 1L (Dixon, 1988)

Figure 3.4 Probabilities of Commencement (1) and Completion (2) of Weaning



BMDP – 1L (Dixon, 1988)

Figure 3.5 Scatter diagram of primary teeth at the commencement of weaning (N=48)



infant's weight (g), supine-length (cm), body-mass index (g/cm^2), and eleven others (described in Appendix VII) were entered one at a time in the first instance. Some of these covariates were 'time dependent', 'time' being the age of the infant at commencement or completion of weaning. Variables such as infant's weight and number of teeth in the mouth (which had a linear relationship with age) were specified 'time dependent' in the analysis. This specification renders the influence of the covariate on the outcome variable 'independent' of time. That is to say, at any 'given time' (i.e. age), the effect of teeth on transition from exclusive breastfeeding to partial breastfeeding, or from partial breastfeeding to the sole consumption of food other than breastmilk is estimated. So, the significant association observed of teeth (see **Table 3.6**) cannot be attributed to age. There can sometimes be problems with time-dependent covariates when there is a perfect linear relationship between covariate and time (the number of teeth in the infant's mouth and age at weaning commencement or completion), but this is not so in our case (see **Figure 3.5**).

All covariates were first put in the regression analysis one at a time. The results were confirmed when all variables were entered, and when only the significant effects were included in the model using stepwise regression with the maximum partial likelihood ratio (MPLR) procedure (Dixon, 1988: 689-742). The results are shown in **Tables 3.6** and **3.7.**

3.4 Results and Discussion

The majority of the households in the sample comprised a settled community: 89 per cent of the mothers had lived in the same house for more than 15 years, i.e. since before the 1974 Revolution. As we have seen in Chapter 2, the women represented predominantly Gurage and Oromo ethnicities with smaller numbers of Amhara, Tigre, Wellamo, Adere, Dorze, and Sidama. There were none representing the pastoral lowlands of Arsi or elsewhere.

The dietary patterns of the adult members of the households varied, in part according to ethnic background. In general, injera, thin leavened bread made from teff which constitutes the staple food of Ethiopian highlanders was consumed by all, to different degrees. Other staples were also consumed, for instance, the Gurage and some of the Oromo households used ensete frequently but not exclusively.

Prelacteal feeds were common among all ethnic groups with the exception of the four women from Tigray. Among the Gurage in the sample, these feeds were administered ritually in a manner similar to that reported from rural households:

> 'One hour after birth, the first feeding of a Gurage child is ritually administered. The "godmother" places a small amount of soft rancid butter in the infant's mouth, where it slowly melts and is swallowed. Several hours later he is given the breast. From this time on the feeding rhythm is determined by the infant's crying, which Gurage mothers interpret as a demand for the breast.' (Shack, 1969: 293)

Both Oromo and Amhara mothers also reported having administered pre-lacteal feeds such as butter 'to grease the guts', and warm water with sugar 'to clean the intestines' of the new-born.

Similar practices have been reported from rural Tigray, Sidamo and Arsi (Knutsson and Mellbin, 1969; Selinus, 1970) in Ethiopia, and other parts of Africa (Jelliffe and Bennet, 1970). The use of sweetened water as a pre-lacteal feed has also been reported in Greece, Iran, Malaya (Niehoff and Meister, 1972), Mexico (Millard and Graham, 1985), Papua New Guinea (Conton, 1985), and the Philippines (Erlinda et al., 1989).

Attitudes towards colostrum varied. Some of the Oromo and Amhara mothers thought that it should be discarded, being too 'heavy' for the infant, and initiated breastfeeding 2-3 days post-partum. The rest of the mothers believed colostrum to be good for the baby, and most succeeded in initiating suckling within 24 hours after parturition.

The majority of mothers had home deliveries with the help of a traditional midwife, the husband (in the case of Gurage couples), a relative, a neighbour, or even alone in cases where labour began unexpectedly. Only nine of the infants in the sample were born in hospital. After delivery, the mother was secluded in a dark room or part of a room that was partitioned by drawn curtains, looked after by relatives/neighbours who helped around the house and provided her with genfo (gruel made of wheat, barley or teff) served with spices, substantial amounts of butter and buttermilk or yoghurt if available, and other traditional lactogogues such as tella (home-made beer) and nefro (boiled and seasoned cereals). Among orthodox Christians, post-natal maternal seclusion lasted for 40 or 80 days depending on the baby's sex. Among Moslems, it lasted two months regardless of the baby's sex. In the Christian households, the end of the maternal seclusion period corresponded with the christening of the infant. According to the rules of the Ethiopian Orthodox Church, boys are christened 40 days and girls 80 days after birth. These rules are based on the Old Testament laws of purification after childbirth (Leviticus 12: 1-8).

Traditionally, boys are circumcised 8 days post-partum. At the time of data collection, female circumcision was actively being discouraged by the Ministry of Health and voluntary organizations. Nevertheless, a few cases of clitoridectomy were reported in the sample. An Oromo girl aged 18 months was unwilling to be weighed, crying ceaselessly, on one instance. It later transpired that that was the day after her grandmother had performed clitoridectomy on her, and the mother was trying to keep this secret. Other harmful traditional practices found in the sample included the removal of the uvula of the newborn by traditional practitioners. In one case, this led to tetanus infection and subsequent death.

Throughout infancy, the baby slept in the same room and often in the same bed as the mother. Babies were breastfed on demand, day and night, in both private and public places. Although there were no set feeding schedules, many mothers reported a consistent lactation rhythm provided that the infant remained in good health. They could predict roughly when the baby would be ready for the next feed, and how frequently they would breastfeed at night. The mean duration of daytime breastfeeding episodes (among 15 mothers observed in the sub-sample - see Chapter 4) was 10.96 $\pm$ s.d. 5.33 minutes. These mothers could distinguish between the baby's hungry demand and comfort-seeking demand for the breast.

When a mother decided to terminate breastfeeding, she put bitter substances on her nipples to discourage the infant from suckling. A common such substance used by some of the sample mothers was the juice of aloe (*Aloe africana*). Other studies have reported the use of pepper (in Korea), a bitter plant sap (among the Maoris of New Zealand), quinine (in Greece), and other bitter substances for the same purpose (Jelliffe and Bennet, 1970; Niehoff and Meister, 1972). Otherwise, the infant hardly ever 'goes off' the breast in conditions such as those of *Kebele* 11, where viable alternatives to human milk are scarce. Other researchers have observed that in infection-free environments where the supply of nutritious breastmilk substitutes is plentiful, infants 'wean themselves' (Clarke and Harmon, 1983). These researchers argue that this 'self-weaning' behaviour, observed in infants living in affluent environments in the West, is evolutionarily-deleterious and selectively-disadvantageous since breastmilk had evolved to be the best infant food. Such behaviour of self-weaning was not observed in *Kebele* 11.

Among the sample households, the adoption of 'urban' ideals and practices was limited due to the prevailing socio-economic constraints. For example, the supply and choice of weaning foods was limited as will be seen in the sections that follow.

3.4.1 Values Associated with Breastfeeding

Four distinct values associated with the practice of breastfeeding were identified.

Firstly, breastfeeding was the accepted and acclaimed mode of infant feeding. The younger women had been raised by older women who breastfed for prolonged periods, and they themselves expected to be successful at doing so. They believed breastmilk to be the best food for the baby. Some of the mothers thought that the lack of breastmilk could render the infant vulnerable to 'evil spirits'. A mother who did not succeed in initiating breastfeeding was thus encouraged to consume large amounts of lactogogues such as those mentioned in Section 3.2, and was advised to seek the help of a traditional doctor who would provide appropriate herbal remedies.

Secondly, breastfeeding was a socially-acceptable activity. In Ethiopia, the breasts of a mother are not considered to be private parts of her body, and so nursing in public does not cause embarrassment. People do not stop and stare when they see a woman breastfeeding. A mother may nurse her baby in front of visitors in her own home, and in other people's homes when she is visiting. She may breastfeed while she waits in the queue outside the kebele shop and even in the market place.

Thirdly, breastfeeding was not culturally defined as an activity that significantly constrains a woman's activities, and was also done in a way that did not physically prevent the mother from doing other things. For instance, a mother would let the baby suckle while she sits and spins cotton using both hands. In the case of a very young baby, the mother supported her/his head as she breastfed, but from the age of about four months onwards, the infant, lying across the mother's lap, was expected to find the breast, and the mother provided little physical support. This left both of her hands free for other tasks such as spinning and cleaning cereals and pulses. Thus nursing the baby needed not hamper the mother's work.

Fourthly, a common reason for nursing was to comfort the baby. Nourishment was not the only reason for suckling, as babies were given the breast every time they were upset, ill or frightened. Since the breast was always available to the baby, what has been termed 'nibbling' (Hennart,

1987) was widespread. Similar observations have been reported from an urban low-income population in Mali (Dettwyler, 1988). The importance of this aspect of breastfeeding in providing the infant with security and in developing the mother-infant bond, is widely recognized by a range of disciplines - anthropologists, nutritionists, medical workers and developmental psychologists all acclaim it (Schaffer, 1977; Jelliffe and Jelliffe, 1978b; Mata, 1978b).

In sum, breastfeeding remained the most popular mode of infant feeding. Women aspired to be able to do it, the society accepted and encouraged it, it did not interfere with the mother's work, and the psychological values of it were appreciated. It thus appears largely unnecessary for the Ministry of Health Maternal and Child Health section to allocate and spend considerable time, energy, and resources in running the 'Ethiopia Breast-Feeding Support Group'. This was based on the WHO understanding that breastfeeding is in decline in urban centres of less-developed countries. However, data from the WHO collaborative study of breastfeeding (1981) had also shown that this was not the case among the urban low-income groups in Addis Ababa who significantly outnumbered the middle and high income groups. The policy implications of this argument have been discussed elsewhere (Almedom, 1988b) and will be taken up later in Chapter 8.

3.4.2 Concepts of Weaning

The English term 'weaning' derives from the ancient Anglo-Saxon word wenian, which means 'to become accustomed to something different'. The Oxford English Dictionary provides two definitions of weaning: 'to accustom to food other than milk', and 'to disengage or cure from habit by enforced abstinence or counter-attractions'. They both imply a state of change of a habit, in particular, a dietary habit, although the second meaning is often used in the figurative sense.

In Amharic, weaning is expressed by the term tut talech (of the infant: 'she abandoned the breast') or tut astalech (of the mother: 'she caused the infant to abandon the breast'). The verb in the first case is intransitive, while it is transitive in the second case. Both expressions were used by the mothers in the sample, and the choice of verbs did not appear to correspond to the mother's report of whether she stopped breastfeeding because she wanted to, or whether her infant forced her to do so.

A remarkable feature of both expressions is that the emphasis is placed on the termination of breastfeeding alone, and there is no reference to the introduction of weaning foods, or to getting the infant accustomed to other foods. Supplementation or the introduction of weaning foods is not mentioned as part of the weaning process. The implications of this concept will be examined below.

In this chapter, the following technical definition of weaning is used. Weaning is a process of transition from one dietary regime, exclusive breastfeeding, to another, exclusion of breastmilk in the diet. This process is usually gradual and is marked by two distinct features, the commencement or initiation and the completion of weaning. That is, the weaning process includes:

1. Commencement, the introduction of supplementary/weaning foods which are provided daily on a regular basis while breastfeeding continues. This is also known as 'mixed feeding' or partial breastfeeding.
2. Completion, the total cessation of breastfeeding. The French word for weaning, sevrage, and indeed the Amharic terms of tut taletch and tut astalech are apt descriptions of this feature, rendering the infant the weaned status.

Ideally, the infant should be allowed to adjust to the new diet of weaning foods while mixed feeding continues over a period of time. The frequency of suckling decreases as time goes on, and so does the amount of breastmilk output due to the change in the prolactin reflex, until finally breastfeeding ceases. This is gradual weaning. It is less desirable when the infant is not given much time to be accustomed to the new diet. In this case, the commencement and the completion of weaning occur simultaneously, or the time lag between the two is very short, resulting in abrupt weaning. The effect of abrupt weaning is detrimental to the psychological development of the child (Jelliffe and Bennet, 1970) and it may impair growth (Martorell and Habicht, 1986).

3.4.3 Weaning Foods

Table 3.2 lists the weaning foods used by the study sample, their composition, method of preparation and serving. Atmit (45.7 per cent), and Ye-lam wetet (31.3 per cent), were the most common. In some cases more than one of these weaning foods were used, therefore the percentages in **Table 3.2** add up to more than 100. The range of home-made weaning foods was limited. Atmit and Ajja whose protein content is low (Selinus, 1972), were used more than Faffa which is a nutrient-balanced weaning food especially prepared for Ethiopian children using locally produced ingredients (Ågren et al., 1969), and could be purchased at relatively low cost.

Commercial breastmilk substitutes available in Addis Ababa included powdered infant formula, powdered whole milk, Cérélac (a commercial cereal milk combination), and pasteurized cow's milk. Powdered infant formulae (the Nestlé and related types) were sold in super-markets, pharmacies, and some shops. Only two of the small shops in Kebele 11 stocked powdered whole milk and Cérélac, and these shops sold them with a profit of 1.50 Eth. Birr per can compared to the Addis Ketema Market prices. Only two of the mothers in the Kebele 11 sample reported ever having purchased these items, and neither of these mothers used them exclusively.

Table 3.2
Weaning foods used by low-income mothers in Kebele 11.

Weaning food	Composition	Preparation	Consistency	Serving/feeding	% Use
Ye-lam wetet	cow's milk	diluted	liquid	bottle/cup	31.3
Abish	Fenugreek, *Trigonella faenum graecum*	water of boiled seeds	liquid	"	9.3
Atmit	barley flour	boiled with sugar or salt	liquid	"	45.7
Ayyib	soft cheese	home made/ bought	semi-solid	dish/ fingers	3.1
Faffa	commercially produced weaning food	boiled, cooked or baked	liquid/ semi-solid solid	cup/ bottle/ fingers	12.4
Enset	root of 'false banana', *Ensete ventricosum*	cooked/ baked	solid	dish/ fingers	15.8
Injera	teff *Eragrostis abyssinicae*)	leavened bread	solid	dish/ fingers	4.1
Wät	onion, pulses (occasionally meat)	hot, spicy sauce	semi-solid	"	4.1
Aletcha	includes potatoes, kale, carrots, onions, cabbage, pumpkin (rarely meat)	mild stew	solid	"	7.3
Eggs	poultry eggs	boiled/ scrambled	solid	"	3.1
Fruit	orange, banana	fresh	liquid/solid	"	1.0
Cérélac	Formula	diluted	liquid	bottle/cup	1.0

Cooking utensils used by the mothers in the sample included earthenware pots and aluminium saucepans, on charcoal or firewood stoves. Poor hygienic conditions prevailed in the kitchen areas of most households, to varying degrees. Most of the Gurage households were observed to have higher standards of personal and household hygiene compared to the Oromo and Amhara in the sample. This may be associated with the religious cleansing practices of the Gurage. A number of the Gurage mothers reported that cleanliness of the home as well as good personal hygiene were essential to being good Moslems. This was in contrast with the inadequate levels of hygiene observed in the Oromo and Amhara households. Signs of poor care and neglect of hygiene were observed in most of the Amhara households. In one case, the mother believed that washing everyday could make the infant slim (in her own words, '[washing] _sewenet yaketchal_', 'makes the body slim'). The Gurage women in the sample washed their infants every day and sun-bathed them in the mornings. These women had a bath twice weekly, on a Monday and Wednesday nights, 'in preparation for Nur-Hussein's day on Tuesday and Mohammed's day on Thursday'. They also abstained from sexual intercourse on these nights in preparation for the long hours of religious _tchat_ or _khat_ (_Catha edulis_) chewing. _Tchat_ is a mildly narcotic plant. The effect of _tchat_ chewing was cathartic: the women sat and chewed silently 'to purify their minds'. Talking was not allowed, in case it encouraged gossip and bad thoughts. The widespread use of _Khat_ in the countries surrounding the Red Sea is well documented (Abdul Ghani _et al_., 1987). _Khat_ chewing by pregnant mothers has been shown to result in reduced birth-weights. Traces of this substance have been found in the breastmilk of _Khat_-chewing mothers and the urine of one suckling infant (Kristiansson _et al_., 1987). However, the effect of _Khat_ on the growth and development of the suckling is, as yet unknown.

3.4.4 Timing of Weaning

Infants were introduced to weaning foods at different ages (**Figure 3.1**). Twelve infants were introduced to weaning foods very late (15 months of age and beyond). These infants appear to have pushed the biological limits to extremity, and might be considered 'breast-starved' (Jelliffe and Maddocks, 1964). Interestingly, however, none of them showed any signs of clinical malnutrition, and did not lie below the 5th weight-for-length percentile of the NCHS reference data (see Chapter 7, Sub-section 7.3.2.1).

Similarly, breastfeeding was terminated at different ages (**Figure 3.2**). The point of interest here is the absence of any apparent age pattern. Both the commencement and the completion of weaning seem to have occurred haphazardly with respect to age. The sizeable variances in infant age at the initiation and completion of weaning (with coefficients of variation at 45.33 and 35.31, respectively), render the concept of a standard age of weaning inapplicable for this population. In addition, no association was found between infant's size (weight, length, or body-mass index) and weaning (**Tables 3.6** and **3.7**). This is a very important point which will be returned to later.

There was no obvious age-specific pattern to the type of weaning foods given (see **Table 3.3**). For instance, Atmit and Abish, both liquids, were given to younger and older infants alike, although solids were generally given to older infants.

Season had an influence on the commencement of weaning. A large number of infants, 42.1 per cent of the sample, were introduced to weaning foods in December. The chief food introduced was Atmit (36.7 per cent), roasted barley pap prepared in liquid form. The harvest of barley is gathered in during November - December, and so barley was relatively more available and cheaper at this time. The second most common weaning food introduced in December was cow's milk (31.3 per cent). A number of households owned a cow each, and many other households bought milk from the cow owners. Cows were kept in the compound and fed straw bought in the market, unlike the rural cows that feed on grass. While rural cows have peak production of milk at the beginning of the rainy season (June-July) when green grass is plentiful, urban cows increase their milk production in the harvest season when straw is relatively cheap and more abundant.

Table 3.3
Use of Weaning Foods by Infants' Age-group.

Age-group (months)	N	Weaning Foods administered	N	%
< 3	25	-	6	24.0
		Cow's milk	12	48.0
		Atmit	3	12.0
		Faffa	1	4.0
		Abish	3	12.0
3 - 6	20	-	2	10.0
		Cow's milk	4	20.0
		Atmit	10	50.0
		Abish	1	5.0
		Atmit + Abish	1	5.0
		Faffa + Atmit	1	5.0
		Cow's milk + Faffa	1	5.0
6 - 12	32	-	2	6.3
		Cow's milk	11	34.4
		Atmit	7	21.9
		Faffa	3	9.4
		Injera + Aletcha	1	3.1
		Ayyib + Injera	2	6.3
		Cow's milk + Atmit	4	12.5
		Faffa + Atmit	1	3.1
		Cow's milk + potatoes + eggs	1	3.1
> 12	28	Cow's milk	3	10.7
		Atmit	4	14.3
		Faffa	5	17.8
		Abish	2	7.1
		Injera + Wät	2	7.1
		Aletcha + potatoes	5	17.8
		Faffa + Aletcha	1	3.6
		Cow's milk + Atmit	2	7.1
		Atmit + Abish	1	3.6
		Faffa + Atmit	1	3.6
		Cow's milk + Injera	1	3.6
		Atmit + Injera	1	3.6

Note: '-' = none.

Boys were introduced to weaning foods earlier, and breastfed for longer than girls, but these differences did not attain statistical significance (see **Tables 3.4** and **3.5**). The preferential feeding of boys was observed in some households, and some boys seemed to demand more food than girls of comparable age. This may account for the differences found. However, this was not a common trend. There was no systematic preferential treatment of boys in the households studied. In some cases, girls appeared to be more demanding than their brothers.

In contrast to the findings of other researchers (e.g., Rosetta, 1989) infant's birth order and maternal age showed no significant association with either aspect of weaning.

Table 3.4
Product-Limit Estimates of Age at Weaning Commencement (months).

Variable	N	no. of failures	no. censored	Mean	s.e.	Overall p <
Sex						
Girls	49	45	4	9.65	0.54	
Boys	56	50	6	8.80	0.60	n.s.
Combined	105	95	10	9.19	0.41	
Birth order						
1st	21	19	2	8.00	0.54	
2-8	71	64	7	9.00	0.53	n.s.
9-13	4	3	1	8.00	3.06	
Maternal age at birth						
<20 years	21	19	2	8.00	1.40	
20-30 years	49	46	3	8.00	0.52	n.s.
30-40 years	20	16	4	8.00	1.02	
>40 years	7	6	1	12.00	0.91	

BMDP - 1L (Dixon, 1988)

n.s. = not significant.

Table 3.5
Product-Limit Estimates of Age at Completion of Weaning (months).

Variable	N	no. of failures	no. censored	Median	s.e.	p <
Sex						
Girls	49	10	39	16.00	2.22	
Boys	56	10	46	20.00	1.86	n.s.
Birth order						
1st	21	3	18	21.77	2.02	
2-8	71	16	55	22.42	5.17	n.s.
9-13	4	0	4	.	.	
Maternal age at birth						
<20 years	21	4	17	.	.	
20-30 years	49	12	37	21.64	2.54	n.s.
30-40 years	20	3	17	18.47	1.97	
>40 years	7	0	7	.	.	

BMDP - 1L (Dixon, 1988)

'.' = not calculated.
n.s. = not significant.

Figure 3.3 shows the proportions of infants in the process of weaning. On the one hand, the proportion of exclusively breastfed infants decreases gradually until 18 months, by which time most infants had commenced weaning (there were 10 censored cases). On the other, a large proportion of infants in the sample, 60 per cent, were expected to be partially breastfed until 20 months.

Age-specific probabilities of commencement (1) and completion (2) of weaning show that while the probability of the commencement of weaning increases with age, that for the completion of weaning remains low (see **Figure 3.4**) The latter does not tell us very much, due to the smallness in numbers of infants who had completed weaning when observation ceased.

Tables 3.6 and **3.7** show the factors that may influence the commencement and completion of weaning, respectively. These were analyzed using Cox's regression models. The two explanatory variables that are significantly associated with the commencement of weaning are infant's appetite and the emergence of primary teeth. Infant's appetite is the only variable that showed a significant association with the completion of weaning.

Table 3.6
Factors that may influence the Commencement of Weaning.

Variable	N	No. Censored	No. of Failures	Regression Coefficient	s.e.	p <
weight (g)	62	0	62	0.001	0.00	n.s.
length (cm)	53	0	53	0.003	0.02	n.s.
bmi (g/cm²)	53	0	53	0.037	0.39	n.s.
appetite	88	10	78	-0.101	0.05	**0.026**
emer.teeth	94	10	84	-0.031	0.01	**0.001**
birth order	104	10	94	-0.187	0.22	n.s.
b-interval	105	10	95	-0.069	0.14	n.s.
m. age at b	105	10	95	0.005	0.01	n.s.
m.i.g.a	91	9	82	0.091	0.08	n.s.
locw.	94	10	84	0.120	0.09	n.s.
twb.	21	3	18	-0.088	0.08	n.s.
religion	92	9	83	0.382	0.28	n.s.
ethnicity	96	10	86	-0.087	0.06	n.s.
opp.	104	10	94	0.025	0.32	n.s.

key:
bmi = infant's body-mass index (g/cm^2)
emer. teeth. = emergence of primary teeth
b-interval = birth-interval
m. age at b = maternal age at birth of infant
m.i.g.a = mother's main income-generating activity
locw. = location of mother's work
twb. = time spent with baby (whether mother takes baby along when she goes to work)
opp. = mother's 'oppression of the soul'

Table 3.7
Factors that may influence the Completion of Weaning.

Variable	N	No. Censored	No. of Failures	Regression Coefficient	s.e.	p <
weight (g)	7	0	7	-0.001	0.00	n.s.
length (cm)	7	0	7	-0.007	0.08	n.s.
bmi (g/cm^2)	7	0	7	-1.070	1.42	n.s.
appetite	88	70	18	0.194	0.09	**0.023**
emer. teeth	94	77	17	0.018	0.02	n.s.
birth order	104	84	20	0.189	0.47	n.s.
b-interval	105	85	20	-0.246	0.29	n.s.
m. age at b	105	85	20	-0.019	0.03	n.s.
m.i.g.a	91	72	19	0.018	0.15	n.s.
locw.	94	75	19	-0.168	0.27	n.s.
twb.	21	18	3	0.042	0.12	n.s.
religion	92	73	19	-0.112	0.64	n.s.
ethnicity	96	77	19	0.013	0.13	n.s.
opp.	104	85	19	0.452	0.63	n.s.

key: same as **Table 3.6**.

3.4.4.1 Infant's Appetite

This variable was measured every month by recording the mother's reply to 'Does your child eat her/his food readily?' If the answer was no, the mother was asked what she did about it: did she force-feed the child? leave her/him alone? or try again by changing the type of food or its presentation.

Many mothers recognized the problem of monotony of the weaning foods. One mother reported that her daughter, aged 18 months, was a poor eater because the food (Ajja) was tasteless. She scarcely sweetened or changed this food. Eight mothers reported that they force fed their infants. There was no significant correlation between force feeding and the timing of either aspect of weaning.

Traditionally, the weanling child in Ethiopia is seldom given foods specially prepared for her/him (Gugssa and Carol, 1987). The infant is expected to consume adult food as and when s/he is ready for it. The same basic paps will be administered well into the third year of life. In the Kebele 11 study, women belonging to the Gurage ethnic group were an exception in this practice. They were more resourceful and provided their infants with relatively more varied weaning foods. More enquiry into these women's livelihood revealed that they had access to independent income, usually raised by petty trade, and therefore a greater purchasing power of food stuffs (see Section 3.5.1.2).

Other researchers have noted that sensory-specific satiety, that is, the failure of the physiological mechanisms underpinning appetite due to their 'saturation' by a limited variety of foods, was a striking feature of appetite among Ethiopian refugees in the Sudan (Rolls and de Waal, 1985).

3.4.4.2 Emergence of Primary Teeth

The emergence of primary teeth was recorded on each visit by direct observation of the child's mouth. On the whole, the findings of this study agree with those of most other studies. The general consensus is that there is considerable within-population variation both in the order and timing of primary tooth emergence, and markedly similar inter-population patterns (Falkner, 1957; McGregor et al., 1968; Billewicz et al., 1973; Robinow, 1973; Lavelle, 1976; Johnston, 1986). It is widely accepted that:

1. the emergence of primary teeth depends mainly on genetic factors.
2. there is no significant sex difference in the emergence of primary teeth.
3. prenatal and perinatal disorders cause minor delays in tooth emergence. Mild to moderate malnutrition has no significant effect, while severe protein-energy malnutrition seems to cause a measurable though short delay.

Most studies have shown that because of its relative autonomy and invulnerability, the emergence of primary teeth is useless as an index of past or present health and nutrition.

Table 3.8 shows the proportion of infants with a given complement of primary teeth observed at each age. Repeated observations of the same infants are represented at different ages, hence the numbers in the 'N' column add up to more than the actual sample size. The order of emergence is 1 or more for lower central incisors, 3 or more for upper central incisors, 5 or more for lower lateral incisors, 7 or more for upper lateral incisors, 9 or more for lower cuspid, 15 - 20 for up to the full complement of primary teeth.

Table 3.8
Percentage Distribution of primary Teeth

Age (mo)	1 or more	3 or more	5 or more	7 or more	9 or more	15 or more	N
0	0	0	0	0	0	0	11
1	0	0	0	0	0	0	15
2	0	0	0	0	0	0	19
3	0	0	0	0	0	0	28
4	0.03	0	0	0	0	0	34
5	0.08	0	0	0	0	0	38
6	0.13	0.02	0	0	0	0	41
7	0.22	0.07	0.05	0	0	0	44
8	0.40	0.09	0.05	0	0	0	44
9	0.50	0.26	0.05	0	0	0	40
10	0.66	0.32	0.08	0.05	0	0	38
11	0.81	0.38	0.08	0.11	0	0	33
12	0.91	0.62	0.12	0.11	0	0	29
13	0.91	0.86	0.16	0.15	0	0	25
14	0.99	0.90	0.40	0.19	0.04	0	25
15	-	0.95	0.49	0.28	0.13	0	22
16	-	-	0.71	0.37	0.22	0.04	23
17	-	-	0.81	0.47	0.22	0.15	19
18	-	-	-	0.52	0.36	0.25	22
19	-	-	-	0.57	0.56	0.25	20
20	-	-	-	0.65	0.71	0.25	13
21	-	-	-	-	0.82	0.36	9
22	-	-	-	-	0.82	0.54	11
23	-	-	-	-	1.00	0.74	5

There is no association between the number of primary teeth present in the mouth and attained weight and supine-length. There is considerable variation in the timing of emergence of teeth, and there are no sex differences. The suggestion that primary dentition is significantly delayed in Ethiopian infants (Zic, 1967) does not hold, and Zic's interpretation of delay as indicative of malnutrition can be rejected in the light of the consensus of the more recent studies mentioned above.

3.5 Constraints on Weaning

Clearly, several factors influence the timing of weaning, the reasons for weaning, and the way in which the infant is weaned. These factors will be assessed with respect to each aspect of weaning, and the inter-relationships between the two, since the two are not independent of each other.

3.5.1 Commencement of Weaning

The reasons for introducing weaning foods can be divided into three categories:

1. Changes in the infant (e.g., appetite, and emergence of teeth),
2. Changes in the mother (e.g., health, pregnancy, economic power), and
3. External factors (e.g., season and the availability of weaning foods).

3.5.1.1 Infant-centred Factors

It is clear from **Table 3.7** that the commencement of weaning and the emergence of teeth are related. It can be inferred that the mother probably decides to supplement the infant's diet when she sees that s/he has many teeth.

Similarly, there is an inferred link between reported infant's appetite, and observed number of teeth. The measure of baby's appetite was based on the mother's assessment. It was a composite measure of both food acceptability and appetite. In the pre-weaning period the amount of breastmilk produced is regulated by the 'demand' or appetite of the exclusively breastfed infant (Dewey and Lönnerdal, 1986).

There is a significantly positive association between appetite and the termination of breastfeeding in **Table 3.7** ($p < 0.023$) suggesting that mixed-fed infants have bigger appetites than those who are no longer breastfed. This probably indicates that infants for whom breastfeeding had ceased may have suffered a poor appetite due to the stresses of being weaned and poor adjustment to their diet of solids, while mixed-fed infants readily accepted breastmilk as well as supplementary foods. However, results regarding the completion of weaning must remain tentative, due to the large number of censored cases.

There is a highly-significant relationship between the emergence of primary teeth and the earlier commencement of weaning - $p < 0.001$ (**Table 3.6**). The number of teeth that emerge into the mouth denote an aspect of infant maturity. Although influenced by age, emergence of teeth does not occur at a fixed age. As has been seen in **Table 3.8**, infant age at the emergence of the first incisors ranges from 5 to 14 months. **Figure 3.5** shows the scatter diagram of the number of teeth in the mouth (for 48 infants who were observed to have an increase in the number of emerged teeth during the study period) against the time when weaning foods were introduced. There is no regular pattern of tooth emergence. This is largely because a considerable number of infants without teeth (15 out of 48) were introduced to weaning foods at different ages.

Rowan-Legg (1949) pointed out that young infants have poorly developed tongue reflex, so that they cannot push foods of thick consistency to the back of the mouth easily. Moreover, he stressed that weaning foods should never be introduced by age but only when the baby is still hungry after the breast (or bottle). Similarly, Beal (1957) reported that in a study conducted over a ten-year period (1946-1955) an increasing number of mothers had difficulty in feeding solid foods during the early months. The most common episode was one of eagerness on the part of the infant for the breast or bottle, and resistance to feeding of other foods with crying, or fussing, or spitting out until a time, usually between 4 and 6 months of age, when the infant begins to accept these other foods willingly. The findings of the Kebele 11 study substantiate these early observations.

3.5.1.2 Economic Factors

The Kebele 11 study supports the view that among urban women, it is only the middle/upper income group who would consider breastfeeding beyond the first couple of months post-partum an option rather than a norm (see Section 3.1.3 and Almedom, 1988a). Besides being culturally esteemed, breastmilk is often the only food available to infants in low-income households (Gugssa and Carol, 1987). Commercial breastmilk substitutes are not affordable for these households.

Observations showed that mothers' economic independence and spending capacity were important factors in determining the choice of weaning foods. Furthermore, the mother's income-generating activity (**Table 3.9**) was a better measure of her ability to provide adequate supplementary/weaning foods than was overall household income. Many mothers who engaged in one or more of these income-generating activities reported that they had full control of the income. Mothers who had a source of income (independent from the husband's income, for those who were married) used Faffa more regularly than those mothers who depended on their husbands wages (to which they reported having only limited access). Very few mothers used commercial baby foods of either the local type (Faffa) or the imported type (Cérélac).

This is in agreement with other studies on the subject. A Guatemalan study of the effects of maternal work for earnings (mainly petty-trade) on the infants' nutritional status has shown that infants in the weaning period (between 1 and 2 years of age) appeared to be better nourished if the mothers worked for earnings. The mothers' earnings were not accountable to the fathers, and the money was spent primarily on food for the children (Engle, 1989b; Engle and Pedersen, 1989).

Table 3.9
Mothers' Main Income-generating Activity.

Activity	N	%
Hand crafts	22	19.5
Domestic labour	18	15.9
Rotating credit association	18	15.9
Small trade	17	15.0
Small trade & domestic labour	2	1.8
None	23	20.4
no information	13	11.5

3.5.1.3 Seasonal Factors

An important factor related to the commencement of weaning was the seasonal availability of weaning foods. Not only were a large number of infants introduced to weaning foods in December, but also their mean age at this time was 7.2 months, two months earlier than the overall mean age for introduction of weaning foods. This is best accounted for by the relative abundance and low prices of barley and cow's milk in December.

3.5.2 Completion of Weaning

The termination of breastfeeding is indirectly influenced by all the factors that influence the introduction of weaning foods, since the two aspects are not independent of each other. For example, infant's appetite influences both aspects of weaning. The termination of breastfeeding may also bring about the introduction of weaning foods, as in the case of pregnant mothers who believed that their breastmilk will 'poison' their infant, or those whose breastmilk supply deteriorated. However, the principal factors directly associated with the completion of weaning include pregnancy, breastmilk insufficiency, and ill-health. These are all 'mother-centred'.

Table 3.10 shows the duration of the weaning process for the 20 infants who had completed weaning, and the reasons given for doing so.

Table 3.10
Reasons for the Termination of Breastfeeding and Number of Infants Weaned Abruptly.

Reason for Completion of Weaning	N	Mean Age of Initiation ± s.d. (mo)	Mean Age of Completion ± s.d. (mo)	No. Weaned Abruptly
Pregnancy	10	10.0 ± 2.2	12.0 ± 2.9	4
Breastmilk Insufficiency	7	10.9 ± 2.7	13.6 ± 3.8	1
Ill-health	3	6.0 ± 4.4	6.3 ± 4.9	3

3.5.2.1 Mother-centred Factors

3.5.2.1.1 Pregnancy

Out of the twenty mothers who stopped breastfeeding during the course of this study, 10 reported that the reason was a new pregnancy. Many of the sample mothers believed that the breastmilk of a pregnant woman could 'poison' the suckling. Niehoff and Meister (1972) have also reported that in Senegal, in many Arab countries, and among the Tepoztlan of Mexico, the milk of a pregnant woman was believed to be harmful to her suckling child, and yet many pregnant mothers continued to nurse their child as long as their milk lasted. It is probable that women in Kebele 11 similarly continued to breastfeed, despite the expressed belief. The interpretation of pregnancy as a reason for stopping breastfeeding is therefore not a straightforward one.

Another problem in assessing the reliability of pregnancy as a reason for ceasing to breastfeed is that in Ethiopia, it is not customary for a woman to announce her pregnancy during the first few weeks. This is because there are uncertainties surrounding the event at the beginning. Foetal loss and miscarriage are recognized as real possibilities during the first three months. Only after this period will a woman make her pregnancy known, and people can generally see it for themselves. Such behaviour has been reported in other studies where women were reluctant to let other people know they were pregnant until it was well established (e.g., Rosetta 1988c). There may thus be inaccuracies reported regarding the time when breastfeeding terminated.

In **Table 3.10,** where the reason for stopping breastfeeding was pregnancy, four infants were weaned abruptly, suggesting a strong likelihood that the mothers did in fact stop breastfeeding because of a new pregnancy. Jelliffe and Bennet (1970) have found that abrupt weaning, by means of sending the infant away to relatives was traditionally practised by Baganda and Zulu parents. There are some indications that similar abrupt weaning occurs also in parts of rural Ethiopia, where the infant is sent away to be looked after by grandparents or other relatives at the time of weaning (Bogalech, 1987). This however was not substantiated by observation. Bogalech did not provide data on such a practice, she merely added it to her list of 'harmful traditional practices' to be found in Ethiopia. In the Kebele 11 study, none of the mothers reported having sent their infants away to be weaned.

In the remaining six cases where weaning was completed due to a new pregnancy, it is not clear whether the mothers' report was accurate. Most probably, they did stop breastfeeding when they realized that they were pregnant, but it may have taken them time to realize it. It is not expected that mothers will be aware and certain of their pregnancy immediately, where pregnancy tests are normally neither sought nor accessible.

3.5.2.1.2 Breastmilk Insufficiency

Seven mothers reported that they stopped breastfeeding because of breastmilk insufficiency. Only one of these mothers was an abrupt weaner. Many of the sample mothers had reported that they suffered from Ye-menfäs _chinquet_, Amharic for 'oppression of the soul'. It is known that psychological stress in the mother may inhibit the let-down reflex and lead to a reduction of breastmilk output (Huffman, 1984), and 'maternal depression' has been associated with difficulties in initiating and maintaining breastfeeding (Tamminen, 1988). What the _Kebele_ 11 mothers called 'oppression of the soul' cannot, however, be identified with maternal depression. Rather, it was a state of low morale, the loss of the _joie de vivre_. This was not specific to mothers, as maternal depression is, but affected other women too (and probably men as well). The result was that the mothers did not bother to look after their infants and homes properly. In particular, the level of hygiene was low in these households. The consequence of this on infant health is discussed in Chapter 6. As regards weaning, however, no significant association was found between the mother's 'oppression of the soul' and the termination of breastfeeding (**Table 3.7**).

Gussler and Briesemeister (1980) have investigated the biocultural aspects of the 'insufficient milk syndrome' in considerable detail. They suggested that the causes of real or perceived milk insufficiency are strictly scheduled and widely spaced feedings. According to them, this feeding pattern is 'non-biologic'. They argue that since human milk is easily digested and absorbed, it is more appropriate for a baby to be fed 'on demand' at shorter intervals, following the 'biologic' pattern. Gussler and Briesmeister's model of the implications of 'non-biologic' pattern of breastfeeding indicates that long intervals between feeds means that the infant's crying lasts longer, exacerbating the problem as additional calories are burned.

> 'The anxious mother correctly interprets the cause of the cries as hunger, often assuming that her milk is inadequate or insufficient. Instead of increasing feedings, however, the mother either decides to use a supplementary bottle or is encouraged to do so by concerned friends, relatives, or health actors. Bottle feeding may satisfy and quiet the baby, confirming the mother's diagnosis.
>
> 'In any case, the reduction of suckling results in lower milk production, and the mother's anxiety inhibits or curtails secretions.

Nonbiological breastfeeding results in real or perceived milk insufficiency and often early termination of nursing.' (Gussler and Briesmeister, 1980: 161-162)

However, this explanation is hard to apply to the Kebele 11 sample, where breastfeeding was always 'on demand' rather than scheduled. Moreover, the mothers who reported breastmilk insufficiency as the reason for terminating breastfeeding did not wean 'early': the age of their infants at the completion of weaning was variable, ranging from 8 to 16 months. It is thus inappropriate to attribute the reported breastmilk insufficiency to the mothers' 'non-biological' breastfeeding practice. Instead, it may be that these mothers genuinely felt that their milk supply did not match up with the infant's needs. This is more likely, particularly in the case of those who ceased breastfeeding at 14 and 16 months post-partum.

3.5.2.1.3 Maternal Ill-health

Three mothers reported that they stopped breastfeeding due to ill-health. The specific reasons given included infection and soreness of the nipples. These mothers were all abrupt weaners, implying that this was a correctly-given reason.

None of the mothers stopped breastfeeding because of employment. The mothers who worked outside their homes were mostly engaged in paid domestic labour, and they mostly took their infants with them when they went to work. The infant was usually strapped to the mother's back as she went about doing her job, and whenever necessary, s/he could be suckled.

Although many of those who stopped breastfeeding during the period of data collection (8 out of 20) were abrupt weaners, the fact that most mothers who had initiated weaning were still breastfeeding at the end of the study suggests that abrupt weaning is not the normal practice. Further, those who had commenced weaning had continued breastfeeding for a mean duration of 4.0 $\pm$ s.d. 1.8 months when data collection ended. This provides evidence against abrupt weaning in the study sample.

3.5.2.2 Other Factors

The commencement of weaning undoubtedly influences the completion of weaning. This means that 'infant-centred' factors indirectly also influence the completion of weaning. The completion of weaning (particularly in the case of abrupt weaning) engenders the commencement of weaning. This interrelationship is discussed in the next section.

3.6 Theoretical Implications

In the *Kebele* 11 study, no significant ethnic differences were found in the commencement or in the completion of weaning. This contrasts with the rural Ethiopian communities studied by Knutsson and Mellbin (1969) in which cultural and ethnic norms appeared to determine different infant feeding practices. In the *Kebele* 11 sample, the introduction of weaning foods and the termination of breastfeeding were determined largely by different sets of factors.

Many studies have reported cultural and religious norms regarding when a child should be weaned (Niehoff and Meister, 1972). Sometimes, these norms are expressed in terms of the infant's age. For instance, some Islamic teaching requires the infant to be breastfed for a maximum period of two years (Harfouche, 1970). Often however, these norms relate to the infant's maturity rather than chronological age as such. For example, in Kerala, southern India, the infant qualifies for the weaning ceremony when s/he is able to walk; among the Maori of New Zealand, when the infant can turn her/himself over (Niehof and Meister, 1972); and in many Arab countries, the weaning ceremony is conducted at *snenieh*, or the appearance of teeth (Harfouche, 1970). Among the Gainj of Papua New Guinea, supplementation does not start until the child has cut two-four teeth, between 9-12 months of age (Wood *et al*., 1985a). The ability to walk is achieved around 12 months of age, allowing for individual variability. The emergence of teeth is even more variable: the age of the infant on the appearance of the lower incisors can range from 4 to 13 months, as we have seen in **Table 3.8.** Furthermore, there is no correlation between the number of teeth in the infant's mouth at the time of commencement of weaning and age at that time (see **Figure 3.5**).

In the Kebele 11 study, the age of the infants both at the time of introduction to weaning foods and the termination of breastfeeding was terminated was highly variable (**Figures 3.1** and **3.2**). In neither case was the fact that the infant was the 'right age' or 'old enough' observed to be the overriding factor. That is, no norms such as those mentioned above were observed.

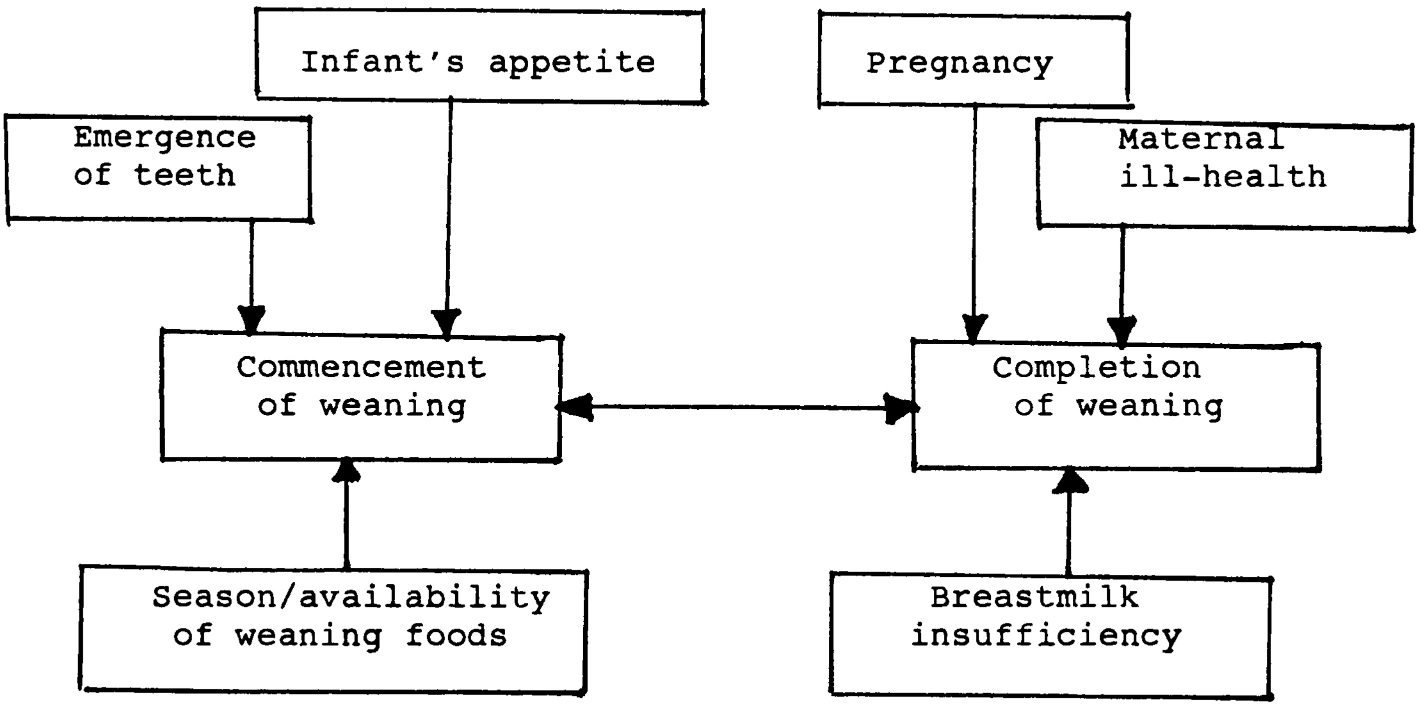
The findings of this Chapter suggest that on the one hand, the most important factors in the commencement of weaning are 'infant-centred'. The emergence of primary teeth is the clearest example of this, and infant's appetite is another mainly 'infant-centred' factor. Clearly, the mother would decide to supplement the infant's diet when she sees that the infant's appetite is bigger than breastmilk alone can satisfy, and the infant has numerous teeth which will make the efficient ingestion of semi-solids and solids possible. In addition, the mother would only be able to succeed in introducing weaning foods when the infant is ready to accept them.

On the other hand, the most important factors determining the completion of weaning or the termination of breastfeeding, are 'mother-centred'. The mother's pregnancy is the most important factor, followed by breastmilk insufficiency, and ill-health. Some mothers needed to stop breastfeeding, for example because of pregnancy, before their infants were ready and willing to take weaning foods. As termination of breastfeeding could not occur before the introduction of weaning foods (at least, not less than one feed before), it follows that some infants must have been introduced to weaning foods abruptly and of necessity. This might be termed 'involuntary' introduction of weaning foods, for 'mother-centred' reasons.

Clearly, the mother's behaviour varied according to her health, physiological state, availability of weaning foods, and the infant's ability (possession of teeth), and appetite to consume food other than breastmilk. Thus interactions between 'infant-centred', 'mother-centred', and external factors comprised the determinants of weaning.

These findings enable us to develop an integrated model of the constraints on weaning - **Figure 3.6.** This involves three sets of factors which interact to influence the two aspects of weaning which in turn influence each other.

Figure 3.6
A Probabilistic Model of Weaning



It is important to note the role played by the infant's age in this model. Age has only an indirect influence on weaning. It influences the emergence of teeth, the development of infant's appetite, and the mother's attitude towards the infant, and is also associated with the probability of the mother becoming pregnant again (due to decreased lactational amenorrhoea as breastfeeding is prolonged). In none of these cases is age of primary importance (with the partial exception of emergence of teeth). The sizeable coefficients of variation in age for both aspects of weaning (**Figures 3.1** and **3.2**) provide support for this.

This contrasts with the implicit models of weaning found in the literature. These usually refer to a supposed 'normal' or 'standard' age of the infant at which breastmilk should be supplemented, taking age as an independent variable. None of the mothers reported that weaning was completed because 'the child was old enough'; and no cases were found where 'the infant weaned her/himself' (Clarke and Harmon, 1983) on reaching a certain age.

Thus the findings of the Kebele 11 study suggest that supposed regularities of age at weaning have little meaning in their own right. They may be cultural ideals, reported to investigators. They are also likely to be the outcome of other factors, such as the fertility regime of the society in question. The model presented is consequently probabilistic rather than normative.

It may well be that the normative factors that were at work in Tigray and Arsi (Knutsson and Mellbin, 1969) are typical of the rural setting where social pressures to conform would override the probabilistic model of weaning and instead imply a normative one. People who have moved to towns, such as the Kebele 11 sample, are no longer subject to the same pressures of social conformity as their rural kin. A different pattern of pressures is exerted in the urban setting, and economic factors play a greater role. Urban women may be more open to change, but there are some things they preserve, such as the universal practice of breastfeeding, and other things they choose to, or are able to change. The result of this change may be weaning according to the probabilistic model in the Kebele 11 sample.

The implication of this is that normative determinants probably still operate in traditional rural areas such as those studied by Knutsson and

Mellbin (1969), with the exception of Sidamo where outside influences were causing change; whereas the probabilistic model operates in towns and other places where social change is rapid. At present however, empirical evidence to substantiate this argument is scanty. What we can conclude with confidence is that individual variability in the age of weaning is an important phenomenon.

Researchers in future should pay more attention to variability in the age of weaning, and in particular, study the full range of factors that influence weaning, such as those mentioned in this study, in detail. The design of educational and development intervention programmes could then be targeted at the specific infant-feeding and weaning constraints of a given population.

Variability in infant feeding among the women studied.

Chapter 4

Infant Care

4.1 Introduction

Good data on infant care and nursing behaviour are not as widely available as those on infant feeding. This hinders a full understanding of the factors influencing infant health and growth. Nursing behaviour and maternal time allocation to infant care are as important as the duration of breastfeeding, the timing of the introduction of weaning foods, the quality and quantity of weaning foods, and the timing of the termination of breastfeeding in determining optimal health and growth of the infant.

This chapter examines data on maternal time allocation to infant feeding and care in conjunction with domestic and other activities. The following questions are addressed:

1. What are the patterns of maternal time allocation to infant feeding and care among Ethiopian urban low-income households? What determines these patterns?
2. How does maternal time spent on infant feeding and care relate to infant health and growth?

While a number of studies have examined aspects of infant-care in various parts of the world (Shack, 1969; Jelliffe and Bennet, 1972; Gussler and Mock, 1983; Orwell et al., 1984; Raphael, 1984; Conton 1985; Raphael and Davis, 1985), very few have incorporated quantitative data on maternal time allocation to infant care and infant feeding, based on direct observation of maternal activities in the home. Several methodological problems have been encountered. These include the reporting of child care data based on mothers' recall (Popkin, 1980; Engle, 1989a), and the failure to describe methods used to collect data on maternal time allocation to child care (Katz, 1984). In extreme cases, recall data on 'number of minutes spent on suckling' as reported by 'non-literate rural women', have been used to describe suckling patterns; surprisingly, without any mention of recall error (Jones, 1988; 1989). Jones did not explain how non-literate rural women managed to time themselves in minutes every time they suckled their infants, and then report it to enumerators who carried out the research at a later date.

The few studies in which direct observation methods have been used to quantify maternal time allocation include those from southern Africa (Konner and Worthman, 1980), rural Bangladesh (Huffman et al., 1980), the highlands of Papua New Guinea (Wood et al., 1985b), rural Nepal (Panter-Brick, 1987; 1990), and the Peruvian altiplano (Vitzthum, 1989).

Konner and Worthman (1980) carried out a series of 15-minute long observations from dawn to dusk among 45 !Kung infants, and among 17 mother-infant pairs for 6 hours (for two-hour long periods on three separate days) in order to evaluate patterns of suckling. They found that nursing bouts were brief and frequent averaging 7.83 $\pm$ standard error 1.27 minutes per hour, with short intervals between nursing bouts averaging 13.19 $\pm$ 1.28 minutes. While the interval between bouts increased as the infant got older, the duration of nursing bout was unrelated to infant's age.

Huffman et al. (1980) observed suckling duration and frequency among 148 Bangladeshi mothers for a period of 8 hours at a time, every month for 18 months. These researchers reported a mean duration of about 10 minutes per feed. Suckling duration decreased as the frequency of suckling decreased. Seasonal variations in suckling time were also reported with a decrease during the months of November to February, and an increase thereafter. This trend was associated with the pattern of the women's agricultural activities, independently of the infant's age.

Wood et al. (1985b) observed 21 Gainj nursing mothers in the highlands of Papua New Guinea for a period of eight hours (8 a.m. - 4 p.m. of the same day), timing nursing episodes to the nearest second. Nursing episodes were frequent (about 2 per hour for young infants, declining to about 1 per hour in 3-year olds), and of short duration, mean 3.31 ± 0.40 minutes. In agreement with Konner and Worthman's findings, the mean interval between nursing episodes increased from about 24 minutes in newborns to about 80 minutes in 3-year olds.

Panter-Brick (1987) carried out continuous daytime observations of 16 Tamang and 8 Kami nursing mothers in rural Nepal for 1 to 3 non-consecutive days, recording suckling sessions to the nearest minute. Observations were carried out over a period of one year, covering three seasons: winter, spring, and monsoon. Mean durations of nursing sessions for repeated observations in the three seasons were 7.22 ± s.d. 1.28 minutes among the Tamang (core sample), and 7.23 ± 1.72 among the Kami (core sample). Mean nursing intervals were 66.36 ± 15.20 for the Tamang, and 91.24 ± 48.15 for the Kami. Panter-Brick found that nursing patterns were influenced by the type of maternal activity. For example, nursing intervals were shorter, averaging 47 minutes when the women were herding cattle, compared to a mean of 98 minutes when the women were engaged in agricultural work. When engaged in agricultural work, women initiated suckling during their lunch and mid-afternoon breaks ('opportunity feeds'). They also suckled infants when they cried ('regular feeds'). Panter-Brick's findings reinforced the view that 'on demand' feeds are not 'random' or 'sporadic' (Wood et al., 1985a), but 'structured', both by the infant's demands and the mother's activity.

Vitzthum (1989) observed 10 Quechua nursing mothers in Nuñoa for 3 to 4 hours in the morning and/or afternoon, recording nursing episodes and sessions to the nearest second. Six of these women were observed both in the morning and afternoon of the same day. The remaining four were observed only once in the morning or afternoon. By analyzing data from all women together, Vitzthum reported mean durations of morning and afternoon nursing sessions of 4.09 and 3.29 minutes, respectively. More nursing activity occurred in the morning, compared to the afternoon, and variation in nursing episodes and nursing sessions was not associated with infant's age, but with the availability of sibling-care. Older daughters attended school in the mornings, and helped their mothers by looking after their younger siblings in the afternoons when they were free from school.

In Ethiopia, previous data on time allocation of maternal activities have not been reported. The Kebele 11 study is the first to attempt a detailed investigation of this kind.

4.2 Subjects and Methods

A sub-sample of twenty mothers were observed minute-by-minute for periods ranging from 3 to 8 daylight hours. These mothers were selected to represent the ethnic composition of the main sample, in order to avoid ethnicity bias in maternal activity. Each mother was observed on three separate days at intervals of about 60 days between observations: for 3 to 4 hours in the morning or afternoon on the first day, for 8 hours (morning and afternoon) on the second day, and again for 3 to 4 hours in the morning or afternoon on the third day. The mothers were interviewed on night-time nursing behaviour and availability of other carers for their infant. Data were collected over a total time of 306.23 hours. All observations took place between December and April, during the dry season. The duration of maternal activities inside and outside the home (e.g., going to work or to the market) was recorded to the nearest minute.

The mothers were not fore-warned about these visits. However, their availability on a number of possible dates was ascertained prior to the visits. Observations appeared to interfere very little with the mothers' activities.

4.2.1 Definitions

Different researchers have used different definitions of terms such as 'nursing bouts', 'nursing episodes', and 'nursing sessions'. This makes cross-study comparisons difficult, if not impossible. In the _Kebele_ 11 study, the term used for each feed is a 'nursing session', and is defined as 'suckling at the breast for a minute or more', after Vitzthum (1989), and Panter-Brick (1990).

4.2.2 _Data Analyses_

The duration of activities, including simultaneously occurring ones, was recorded separately. Observed activities were differentiated between those associated with the infant's needs (feeding, washing/changing, and holding/carrying), the mother's priorities (heavy and light work, resting, grooming), and economic requirements, in particular, income-generating activities (hand crafts and paid domestic labour).

The following eleven categories of maternal activities were analyzed:

1. Breastfeeding/nursing.
2. Bottle-feeding (feeding of milk other than breastmilk, using a bottle and/or a cup).
3. Other feeding (administration of semi-solid and solid foods as meals and snacks).
4. Resting (including sitting for ceremonial coffee with friends and relatives).
5. Holding infant (including carrying infant around).
6. Light work (washing-up, sweeping floor, preparing and cooking meals).
7. Heavy work (washing clothes, husking grain, grinding _Enset_, baking _Injera_).
8. Hand crafts (spinning cotton, knitting, making carpets, basketry).
9. Paid domestic labour (mostly washing clothes, baking _Injera_, and cleaning in the well-off households of the neighbourhood).
10. Washing/bathing (mother).
11. Washing infant.

The duration of each activity was calculated as a proportion of the total time observed, and frequency of activity was noted as the number of occurrences of activity per total length of observation period. Duration and frequency of nursing activity were positively correlated ($p < 0.001$). That is, the longer the duration of suckling sessions the longer the interval between sessions and vice versa.

Activities were first examined separately by time of day in which observation took place, and by day of observation. Evening observations (undertaken between 5 and 8 p.m.) were excluded as they were very few. Attention was focused mainly on breastfeeding/nursing activity and variables relating to maternal and infant characteristics, weaning, incidence of illness, and growth.

Associations between two or more activities combined, such as 'infant feeding' (i.e., proportion of time spent on all feeding activities), 'infant care' (i.e., proportion of time spent holding, carrying, and washing the infant), and proportion of time spent on all of the other activities were explored. The significance of the effect of these on infant growth was also examined using correlation and regression analyses.

Five women out of the twenty had stopped breastfeeding before data collection began. These were excluded from the analyses concerned with nursing activity.

As Wood et al. (1985b) and Vitzthum (1989) have pointed out, the calculation of the mean duration of inter-suckling intervals is hampered by truncation bias. This is because the beginning and the end of the first and the last intervals, respectively, are not known as a result of the observer's arrival and departure. Wood et al. (1985b) corrected for this bias by assuming a Poisson distribution of the mean episodes per hour. However, as was the case with Vitzthum's data (1989), such corrections were not justified because the Kebele 11 the data did not approximate a Poisson distribution.

4.3 Results

Among the 15 lactating women, the mean duration of nursing sessions was 10.96 $\pm$ standard deviation 5.33 minutes, and the mean nursing interval was 67.87 $\pm$ 43.34 minutes. The mean length of daytime observation was 221.37 $\pm$ 64.01 minutes (3 hours and 41 minutes $\pm$ 1 hour and 4 minutes).

Individual characteristics of the 15 nursing mother-infant pairs, mean duration, frequency, and suckling interval according to time of day (from the morning and afternoon observations carried out on the same day) are presented in **Table 4.1.**

In most cases, infants suckled more frequently in the mornings than in the afternoons. Infants usually slept in the afternoons. In the morning observations, nursing intervals were relatively short in two cases (No. 70 and No. 82). In the first case, the infant was ill and irritable throughout the morning, and slept in the afternoon. In the second case, the infant demanded the breast at relatively short intervals in the morning, and not in the afternoon even though she was not sleeping. No illness or irritability was noted in this case.

In the case of infants who had commenced weaning, it was observed that weaning foods were not given just before or just after breastfeeding. Instead, they were administered at separate feeding sessions as snacks or meals (at family meal times).

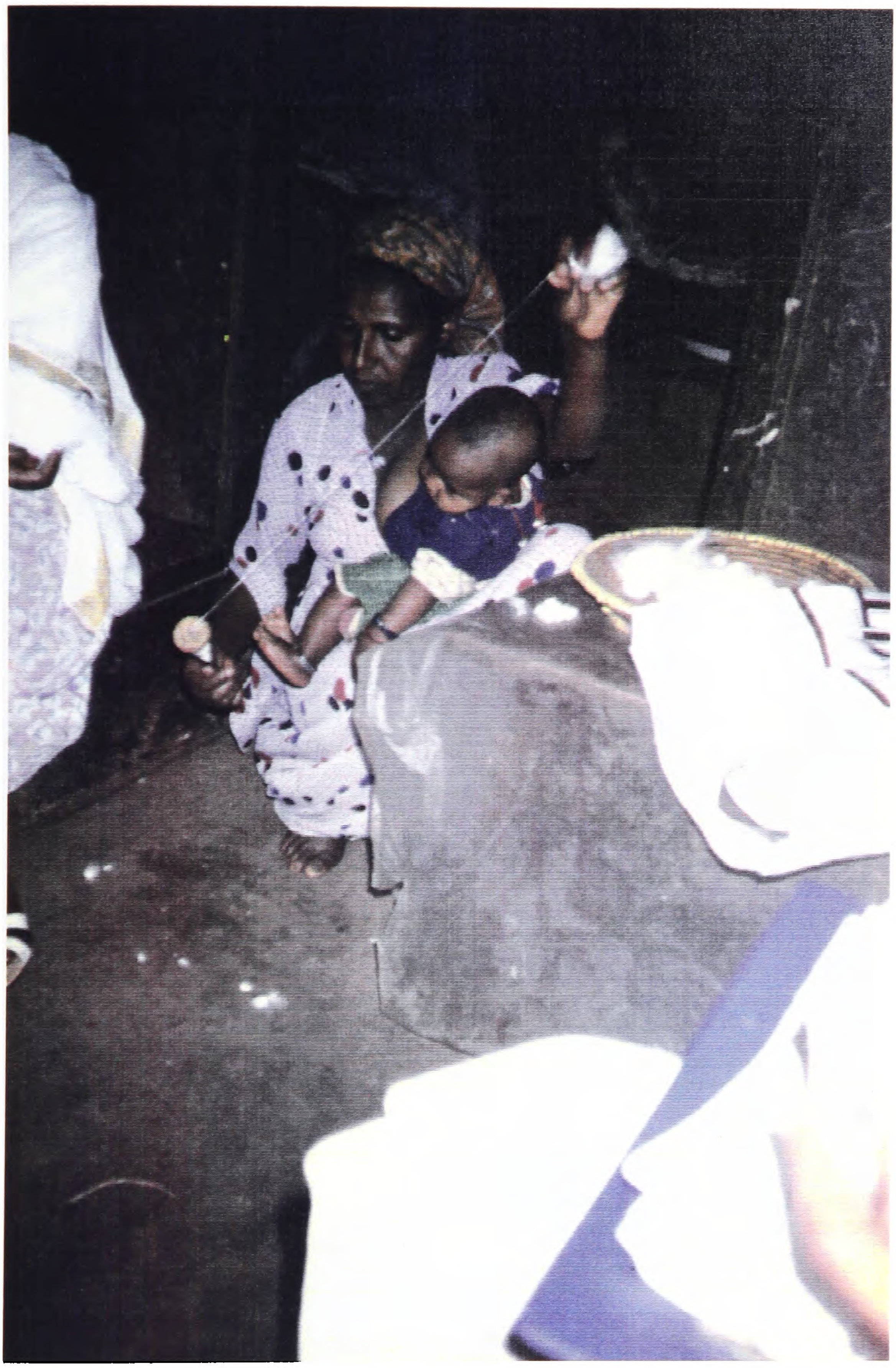
As expected, maternal age and parity (i.e. total number of live births) were positively correlated ($p < 0.001$). Maternal age was also positively correlated with the last birth interval ($p < 0.011$). That is, older mothers had longer last birth intervals (last birth interval is the interval that closed with the birth of the index infant) compared to younger mothers. However, no correlation was found between these variables and the duration, frequency, or nursing interval.

A significant negative correlation was found between the duration of suckling sessions and infant's age ($p < 0.048$). That is, as infant's age increased, duration of suckling sessions decreased. Interestingly, the

Table 4.1
Characteristics of Nursing Mother-infant Pairs, Duration of Nursing session (min), Frequency (occurrences per observation period), and Between-sessions Interval (min), by time of day (N = 15).

				Morning			Afternoon		
Case No.	Infant's age at the beginning of study (months)	Maternal age (years)	Parity	Mean session duration	Mean frequency	Mean interval duration	Mean session duration	Mean frequency	Mean interval duration
2	3.0	47	8	16.75	1.12	70.00	9.32	0.85	130.00
3	6.0	27	3	8.09	0.81	75.00	8.14	0.90	120.00
5	9.5	28	6	19.48	1.47	64.00	13.56	1.64	76.00
6	10.0	26	2	6.79	0.75	69.00	8.78	0.97	96.00
12	13.0	31	4	18.52	0.75	75.00	16.15	2.31	125.00
31	16.0	28	5	8.23	0.75	58.33	4.52	0.85	129.00
36	6.0	25	3	22.22	0.74	65.00	6.25	0.42	114.33**
53	5.0	23	3	24.13	1.72	48.57	12.84	0.92	58.56
62	9.5	26	4	7.92	0.83	35.00	12.90	0.81	67.50
63	5.5	21	3	16.84	1.05	57.00	15.00	1.11	75.25
70	6.0	39	8	11.94	1.19	14.00	14.66	1.33	87.50
72	8.0	43	8	8.33	0.83	74.00	13.54	1.04	47.50
76	18.0	29	3	16.45	0.68	74.00	18.00	0.43	78.25
82	15.0	20	1	10.00	0.83	19.00	4.81	0.53	92.00
101	1.0	21	2	9.10	1.18	36.00	11.20	0.80	82.50

** = ($p < 0.05$).



Spinning cotton as an income-generating activity.

A Gurage woman hosting a coffee ceremony in Kebele 11.

Young girl in charge of the house in her mother's absence.

Women in the study sample engaged in 'heavy work' (husking barley).

distribution of suckling duration against infant's age suggested a curvilinear (namely, quadratic) relationship. This was further investigated by using regression analysis (see **Table 4.2**).

Table 4.2
Regression Equations for Duration of Nursing Sessions (dependent variable) and Infant's Age (N=14).

Independent Variable	Estimate	t	p <	r^2	overall p <
intercept	18.50	5.04	0.002	0.26	**0.048**
age	-0.55	-2.18	**0.048**		
intercept	3.72	0.39	0.703	0.40	**0.045**
age^2	-0.08	-1.66	0.123		

The duration of nursing sessions increased with infant's age in the first instance, up to about 9 months, and gradually decreased thereafter. This pattern is in keeping with findings from elsewhere that suckling sessions were shorter but more frequent when the infant was very young (Konner and Worthman, 1980). They became longer and less frequent as the infant got older. By about 9 months, which was the mean age of introduction to weaning foods in the Kebele 11 sample (see Chapter 3), this pattern reversed so that the infant suckled less and less, at longer intervals as breastmilk was replaced by other foods until breastfeeding finally terminated.

The length of nursing intervals was positively correlated with maternal weight ($p < 0.018$), and maternal body-mass index ($p < 0.041$), but not with maternal height. These findings were confirmed when analysis of co-variance was applied (see **Table 4.3**). Heavier women, and women with higher body-mass index tended to have longer nursing intervals. The reasons for this are not clear.

Interestingly, no associations were found between maternal anthropometry and duration of suckling sessions.

Table 4.3
Regression Equations for Nursing Interval (dependent variable) and Maternal Anthropometry (N=14).

Independent Variable	Estimate	t	p <	r^2	overall p <
intercept	-116.22	-0.56	0.584	0.36	**0.018**
Mean Weight	11.38	2.71	**0.018**		
intercept	-130.59	-0.52	0.613	0.28	**0.041**
Body-mass Index	30.58	2.27	**0.041**		
intercept	31.95	0.74	0.475	0.02	n.s.
Height	-12.98	-0.48	0.637		

n.s. = not significant.

No associations were found between nursing interval and infant's age, or maternal age. This contrasts with the findings from the Gambia (Whitehead et al., 1978), the Kalahari (Konner and Worthman, 1980), and Papua New Guinea (Wood et al., 1985b), where frequency of feeding decreased as infant's age increased, implying that nursing intervals were longer for older infants.

4.3.1 Maternal Activities by Time of Day

Results of paired t-test analyses of duration and frequency of activities carried out by time of day showed no significant differences in the duration and frequency of suckling sessions 'between' mothers (see **Table 4.4**). There was only one case in which 'within' mother differences attained statistical significance (see Case No. 36 in **Table 4.1**). Nursing intervals were significantly longer in the afternoons compared to the mornings.

Table 4.4
Duration, Frequency, and Interval of Nursing Sessions by time of day (N=30).

Nursing	Morning Mean	Morning S.D.	Afternoon Mean	Afternoon S.D.	t	p <
Duration (min)	8.44	8.03	8.49	7.77	0.04	n.s.
Frequency	0.59	0.53	0.67	0.57	1.08	n.s.
Interval (min)	56.05	18.20	95.85	33.71	6.18	**0.001**

n.s. = not significant.

Some of the mothers reported nursing 2 to 3 times at night. However, the evaluation of night-time nursing in settings where the infant sleeps with the mother, and may suckle while the mother is asleep, is difficult (McNeilly et al., 1985).

Very few of the other maternal activities showed significant diurnal differences in duration (see **Table 4.5**).

Table 4.5
Paired t-tests for Duration of Maternal Activity (minutes) by time of day (N=30).

Activity	Mean Duration Morning	Mean Duration Afternoon	t	p <
Bottle feeding	1.46	1.51	-0.06	n.s.
Other feeding	7.46	5.53	1.56	n.s.
Resting	22.43	21.26	0.28	n.s.
Holding infant	16.19	14.74	0.61	n.s.
Light work	27.62	17.90	2.93	**0.007**
Heavy work	9.74	8.50	0.44	n.s.
Hand crafts	4.45	19.17	-3.94	**0.001**
Paid domestic labour	3.68	0.00	2.39	**0.024**
Washing self	5.01	3.08	1.10	n.s.
Washing infant	3.78	4.88	-0.63	n.s.

n.s. = not significant.

In the mornings, significantly more time was spent doing light work. Mothers spent more time on hand crafts, and none were engaged in paid domestic labour in the afternoons.

4.3.2 Associations between Activities

When examining correlations between activities, morning and afternoon observations were combined. Heavy work such as washing clothes and grinding grain was inversely correlated with providing weaning foods for the infant (see **Table 4.6**). That is, the longer the mother spent doing heavy work the less likely the infant was to be given weaning foods/snacks. However, this was not the case for breastfeeding, probably because predominantly breastfed infants were usually the younger ones who would be carried on the mother's back while she was engaged in heavy work, and these infants had not commenced weaning yet, precluding the provision of snacks (apart from breastmilk).

Table 4.6
Correlations between duration of Activities (N=15).

Activity	Pearson Correlation Coefficient	p <
Breastfeeding x other feeding	-0.106	n.s.
Breastfeeding x light work	-0.379	n.s.
Breastfeeding x heavy work	0.013	n.s.
Other feeding x light work	-0.232	n.s.
Other feeding x heavy work	-0.675	**0.006**
Other feeding x paid labour	0.461	n.s.
Light work x washing infant	-0.680	**0.005**
Heavy work x washing infant	-0.456	n.s.
Light work x heavy work	0.107	n.s.
Washing self x washing infant	0.711	**0.003**

n.s. = not significant.

Light work (such as sweeping the floor, washing up, and cooking) was inversely correlated with washing the infant. The reason for this is not clear. Washing the infant was an evening activity, and the above observations were carried out in the day time. However, this in itself does not explain the correlation.

4.3.3 Nursing Behaviour and Infant Weaning

There is considerable variation in both the commencement and the completion of weaning among these sub-sample mothers, as indeed there is in the main sample (see Chapter 3). Among the 15 nursing infants, age at commencement of weaning ranges from 2 to 17 months. Only three of these infants had completed weaning during the period of data collection - at 9, 12 and 16 months of age (see **Table 4.7**). Among the infants who had completed weaning before the study began, an age range of 9 to 13 months was found at the time of completion of weaning (see **Table 4.8**).

Table 4.7
Summary of Weaning Data of Suckling Mother-infant Pairs (N=15).

Case No.	Maternal age (yrs)	Infant's age at beginning of study (mo)	Infant's age at weaning commencement (mo)	Infant's age at weaning completion (mo)	Maternal reason for completion of weaning
2	47	3.0	.	.	.
3	27	6.0	9.0	9.0	pregnancy
5	28	9.5	10.0	.	.
6	26	10.0	11.0	16.0	breastmilk insufficiency
12	31	13.0	15.0	.	.
31	28	16.0	17.0	.	.
36	25	6.0	6.0	.	.
53	23	5.0	6.0	.	.
62	26	9.5	11.0	12.0	ill-health
63	21	5.5	6.5	.	.
70	39	6.0	7.0	.	.
72	43	8.0	9.0	.	.
76	29	18.0	11.0	.	.
82	20	15.0	12.0	.	.
101	21	1.0	2.0	.	.

'.' = weaning not completed.

Table 4.8
Summary of Reported Data of Mother-infant Pairs who had Completed Weaning before Observations began (N=5).

Case No.	Maternal age (yrs)	Infant's age at beginning of study (mo)	Infant's age at weaning commencement (mo)	Infant's age at weaning completion (mo)	Maternal reason for completion of weaning
19	37	15.5	8.0	9.0	breastmilk insufficiency
24	30	15.0	10.0	12.0	"
45	30	12.0	8.0	10.0	"
60	43	16.0	11.0	12.0	ill-health
88	26	14.0	10.0	13.0	breastmilk insufficiency

4.3.4 Maternal Activities and Infant Growth

Correlation analyses showed that most categories of daily maternal activity were not significantly associated with infant's six-monthly increments of weight and supine-length (**Table 4.9**). In many cases, however, the correlations were in the expected direction and approaching significance.

Table 4.9
Correlations between Maternal Activities and Infant Growth Performance over Six Months (N=14).

	Six-monthly increment			
	Weight		Supine-length	
Activity	Correlation Coefficient	p <	Correlation Coefficient	p <
Breastfeeding	0.272	n.s.	0.372	n.s.
Other feeding	-0.024	n.s.	-0.007	n.s.
Holding infant	0.561	**0.037**	0.232	n.s.
Washing infant	0.357	n.s.	0.211	n.s.
Light work	-0.107	n.s.	-0.025	n.s.
Heavy work	-0.279	n.s.	-0.232	n.s.
Income generating	-0.444	n.s.	-0.244	n.s.
Washing self	0.421	n.s.	0.124	n.s.

n.s. = not significant.

However, weight increment and time spent by the mother holding the infant (including playing with the infant, and carrying infant on the back while engaged in other activities) showed a positively significant association. This indicates that infants who had more contact with the mother gained more weight over six months.

The findings in **Table 4.9** were further investigated by using regression techniques. In the case of duration of nursing sessions, polynomial regressions (linear and quadratic) were used to correct for age. No significant associations were found.

Table 4.10
Regression Equations for Maternal Activities and Six-Monthly Weight Increment (N=13).

Independent Variable	Estimate	t	$p <$	r^2	overall $p <$
intercept	0.08	0.09	0.929	0.33	n.s.
holding infant	0.06	2.29	0.043		
age	0.02	0.57	0.578		
intercept	0.43	1.16	0.267	0.39	**0.017**
care	0.05	2.77	**0.017**		
intercept	0.06	0.08	0.935	0.41	**0.056**
care	0.05	2.69	**0.021**		
age	0.02	0.57	0.581		

n.s. = not significant.

Interestingly, while regression analysis of the effect of 'holding infant' on infant weight increments showed no significant results, 'holding infant' and 'washing infant', combined under the category of 'infant care', showed significantly negative association with infant's age. When age was corrected for, the results approached significance, indicating that about 41 per cent of the variance in six-monthly weight increment could be explained by differences in infant care (**Table 4.10**).

The interpretation suggested is twofold: firstly, older infants were carried around less and washed less often than younger infants; secondly, increased cleanliness, care, and possibly reduced exposure to infection by being carried around, instead of crawling/walking around the contaminated homestead, may have contributed to the increase in weight increment among these infants regardless of their age.

4.4 Discussion

Nursing activity was always initiated by the infant, either by crying until the mother offered her breast, by snuggling against her and reaching for the breast while being held by the mother, or by coming to the mother to suckle. Mothers did not let infants cry for long, and infants suckled from both breasts each time, often successively, but sometimes with a brief interval in between. In contrast to the data reported from rural regions where women's work-load has a significant bearing on their nursing behaviour, no 'opportunity feeds' (Panter-Brick, 1990) were observed in the Kebele 11 study.

Women's activities may vary according to the time of day. Thus in rural Senegal suckling was more frequent in the afternoons than in the mornings (Rosetta, 1989) as the women spent the mornings in agricultural work, and the hot afternoons relaxing at home. The opposite was the case in the Kebele 11 study where women suckled more frequently in the mornings while they worked in and around the home. They engaged themselves more in 'light work' in the afternoons while most infants slept.

Durations of suckling sessions and nursing intervals observed in the Kebele 11 study were much longer than those reported from !Kung (Konner and Worthman (1980) and from Quechua mother-infant pairs, (Vitzthum (1989), but similar to those reported from rural Bangladesh (Huffman *et al.*, 1980), and rural Nepal (Panter-Brick, 1987). Ecological, cultural, and social factors notwithstanding, this difference may be taken as a clear indication that nursing 'on demand' in the Kebele 11 setting may not have been totally 'biologic' (see Chapter 3 - Section 3.5.2.1.2). Mother's activity patterns, body weight, and body-mass index may be important mother-centred determinants of nursing pattern rather than the infant's demand only.

In contrast to Vitzthum's data, no significant differences were found in the duration of suckling sessions by time of day (with one exception). However, as in Vitzthum's Nuñoa study, it was found that nursing intervals were significantly longer in the afternoons among the Kebele 11 women. Vitzthum explained her results in terms of increased sibling-care in the afternoon when daughters returned home from school and helped their mothers by looking after their younger siblings. This Chapter enables us to identify further the mother-centred and infant-centred aspects of breastfeeding. The results of analysis have shown that the length of nursing intervals is mother-centred in that it is influenced by maternal age and body-mass index, while the length of suckling sessions is infant-centred in that it is influenced by the infant's age. However, observations also suggest that it was the infant and not the mother who initiated suckling, implying that the length of intervals between nursing sessions was governed by the infant's demand. This exemplifies the interrelationship of mother-centred and infant-centred factors in suckling activity. Other factors that influence the duration and frequency of nursing sessions, such as seasonal factors could not be investigated in the Kebele 11 study, due to the involuntary truncation of data collection.

Chapter 5

Maternal Well-being

5.1 Introduction

Indicators of maternal well-being in Ethiopia have included estimates of nutritional status from evaluations of dietary habits (Selinus *et al.*, 1971a, b, and c), measurements of energy intake (Gebre-Medhin and Gobezie, 1975; Miller *et al.*, 1976), and anthropometry (Harrison *et al.*, 1969; Miller *et al.*, 1976; Wenlock and Wenlock, 1981; Svenhuysen and Gebriel, 1988). Demographic indicators such as fertility and mortality have also been used (World Bank and Ministry of Health, 1986; Kwast *et al.*, 1986).

Selinus *et al.* (1971a, b, and c) collected detailed qualitative as well as quantitative data on the dietary habits of several rural Ethiopian populations in the northern and central/southern parts of the country, taking into account regional, ecological, ethnic, and cultural differences. Their meticulous investigations provided useful background data for other studies (Gebre-Medhin and Gobezie, 1975; Gebre-Medhin *et al.*, 1976a and b; Lönnerdal *et al.*, 1976; Gebre-Medhin, 1980), and also for planning suitable community intervention programmes, mainly by the Ethio-Swedish Pediatric Clinic, currently known as the Ethiopian Nutrition Institute.

Very few studies have documented dietary habits in urban areas. In Addis Ababa, Gebre-Medhin and Gobezie (1975) measured dietary intakes of 20 non-privileged and 10 privileged primigravidae in their last term of pregnancy, using a two day weighing inventory survey. They reported that the diet of the non-privileged group was deficient in all nutrients, except iron and thiamin, while only calcium and riboflavin failed to reach the recommended levels in the diet of the privileged group. As expected, birth weights were significantly lower in infants born to non-privileged women.

Miller et al. (1976) applied the methods of individual weighed dietary survey, anthropometric measurements, and clinical assessments, to evaluate dietary energy intakes among Ethiopian adults, school children and under-five year olds. Their findings revealed very low mean energy intakes of 1350 kcal per day among women. Daily intakes of as low as 1311 kcal were recorded among adult women in Debarek, a road-side town at an altitude of 3000 metres. These low energy intakes are comparable to those of rural Gambian mothers in the 'hungry season' (Paul et al., 1979). Miller et al. (1976) suggested that a metabolic adaptation to low energy intakes may have occurred in the Debarek women.

Analyses of anthropometric indices have corroborated these findings. A mean body weight of 48 kg. was reported among Debarek women (Harrison et al., 1969), and total body fat as estimated by skinfold thicknesses was also very low (Miller et al., 1976; Wenlock and Wenlock, 1981).

Poor maternal nutrition is associated with prolonged post-partum amenorrhoea (Billewicz, 1979; Wenlock and Wenlock, 1981), and higher plasma prolactin levels (Lunn et al., 1980). Most studies on this subject have indicated associations between the duration of lactational amenorrhoea and/or plasma prolactin concentrations and various estimates of maternal nutritional status (Prentice et al., 1983b; Lunn et al., 1984). Maternal weight, weight/height, weight/height^2, serum albumin, and dietary intake have all been used, and although some are better indices than others (for example, weight/height^2 is more meaningful than weight alone), the mechanism whereby dietary supplementation results in the reduction of prolactin with little effect in increasing body weight is as yet not well understood. The supplementation of the diet of lactating Gambian mothers resulted in a small increase in their body weight, combined with significant reductions in their plasma prolactin levels (Prentice et al., 1983; Lunn et al., 1984).

Prolactin is a hormone associated with the increase of breastmilk secretion. During lactation, the stimulus for prolactin secretion is triggered as the infant suckles the mother's nipple. Neural impulses generated by suckling are conveyed to the central nervous system, where they impinge upon specialized secretory neurons located in the hypothalamus. Significant increases in plasma prolactin levels begin within 2 to 5 minutes after suckling starts, and if suckling continues, levels 60 times higher than baseline accumulate in the circulation within 20 to 30 minutes (Neill, 1988).

The duration of lactational amenorrhoea may vary from a minimum of 2 to 3 months to a maximum of 3 to 4 years, depending mainly on the pattern of suckling: the more frequent or intense the suckling, the longer the delay in the return of menses. This period of post-partum amenorrhoea is associated with raised levels of plasma prolactin. Suckling frequency and the duration of inter-suckling intervals are key factors in determining levels of prolactin. However, it has been suggested that even when the intensity of suckling is minimal, basal levels of prolactin after parturition remain high (McNeilly, 1988).

In this chapter, the following questions are addressed:

1. What are the dietary habits of pregnant and lactating mothers in Ethiopian urban low-income households?
2. What are the relationships between the infant's weaning status, maternal anthropometry and duration of post-partum amenorrhoea?
3. What are the implications of these for maternal reproductive performance and well-being?

5.2 Subjects and Methods

Data on mothers' health, lactation, return of menses, and infants' weaning status were collected during monthly interviews with the sample women in their homes. The accuracy of reported maternal age was checked against major historical events and certain dates in the Ethiopian Calendar (see Appendix VI). The number, order, and age of children ever born, number of miscarriages, abortions, still-births, and the number, order, and age of children dead, were recorded (see Appendix III). A special effort was made to document individual reproductive histories by careful probing for information on the sensitive issues of pregnancies and their outcomes.

Measurements of maternal weight were taken at monthly intervals (from November to April), using a calibrated portable bathroom scale, and recorded to the nearest 0.5 kg. This scale was frequently checked by using an object of known weight. Maternal standing height was measured using a locally made portable stadiometer, and recorded to the nearest 0.1 cm.

'Adopted' mothers (N=5), non-lactating, and pregnant mothers (N=3 and 8, respectively) were excluded from analyses that included anthropometry.

Associations between maternal and infant weaning variables were examined. Infant age at the completion of weaning provided a measure of breastfeeding duration. As we have seen in Chapter 3, only 20 infants had completed weaning when data collection ended.

Correlations of maternal anthropometric indices and measures of reproductive performance were examined using the regression techniques applied previously in analyzing data from Papua New Guinea (Brush et al., 1983; Brush, 1986).

5.3 Results

5.3.1 Dietary Habits

Traditionally, dietary habits during pregnancy and lactation in Addis Ababa were governed by socio-economic and cultural factors. While well-to-do women consumed additional amounts of nutrient-rich foods during pregnancy, there were no dietary improvements for pregnant women in the low-income groups (Gebre-Medhin, 1980). Immediately after parturition, however, dramatic changes took place in the pattern of food intake of low-income mothers, provided that the pregnancy outcome was successful.

According to Gebre-Medhin (1980),

'The woman who, during gestation, was viewed with a feeling of tense expectation and even fear due to the possibility of an unsuccessful outcome, becomes the focal point of communal jubilation once a normal delivery has produced a viable newborn. The newly delivered mother is immediately prescribed bed rest for at least 40 days at the same time as she is accorded careful attention and lavish generosity. She is washed and her hair is anointed with ointment by women with special experience in traditional midwifery. She is visited by virtually everyone in the area and by a large circle of relatives and friends, most of whom arrive with gifts of raw food ingredients or a variety of prepared meals.' (Gebre-Medhin, 1980: 101)

Special foods consumed by the newly delivered mother include genfo, a gruel made from wheat, barley, teff or maize flour, and served with substantial amounts of spiced butter, yogurt, buttermilk, or Ayyib (soft cheese) depending on availability (see also Chapter 3 - Section 3.2).

The newly delivered mother is served genfo several times a day in the company of relatives and friends who take part in the jubilations (Gebre-Medhin, 1980). She is also obliged to taste some of the food brought to the family by a constant trickle of guests during the day, in addition to two main meals, one at mid-day and one in the evening. These meals ideally include meat, dairy products, fruits and vegetables.

Mean daily energy levels reached as much as 3000 Kcal during the first month post-partum, due to the combined effect of frequent meals, high contents of fat and protein of animal origin, and a significantly reduced level of activity (Gebre-Medhin, 1980). This was true particularly for low-income households where women did not have domestic helpers. In the better-off households where domestic help could be afforded, women maintained the weight gained during the last trimester of pregnancy and remained over-weight after delivery (Gebre-Medhin, 1980).

Gebre-Medhin's descriptions did not fully apply to the situation of the low-income households in Kebele 11. The six mothers who gave birth during the course of this study had very meagre supplies of extra food (with one exception), even though the same basic traditional practices were observed. The majority of the sample women reported that they did not increase their food intakes after delivery. The reasons for this included the restriction of grain transportation from the rural areas into the city by government control of the grain market (Alemayehu, 1987). Food supply was generally limited to the basic allowances specified on the household ration coupons. These coupons were usable at the kebele shop for buying food at controlled prices. Access to extra food supply required extra cash, in order to be able to purchase at higher prices from 'alternative' or uncontrolled markets. Most households simply could not afford to do this (with one or two exceptions).

Thus, while the newly-delivered mother drastically reduced her activities during the period of maternity confinement, she increased her food intake only slightly. Friends and relatives could relieve her from her daily household chores, but they could barely afford to provide her with extra food. There was one notable exception: a Gurage woman who was well provided for by her trader husband maintained her body weight above 80 kg, with a mean body-mass index of 30, at least for five months after delivery (as observed during the period of data collection).

In particular, meat and dairy products were in short supply. Clarified butter, usually served with genfo was costly and was used only during the first few days post-partum. Tella (home-made beer) and other lactogogues were not consumed much beyond the first week after delivery.

Once lactation had been established, maternal food intake depended on the day-to-day availability of foodstuffs. Nevertheless, mothers appeared to be able to nurse successfully, despite the inadequacy of their own diets. The women reported that at meal times, they served the men first, and then the other household members. The children, the mother, and any other female adults consumed the left-overs after the father had eaten.

Meal patterns in the sample households consisted of two relatively substantial meals a day, one at mid-day and one in the evening, with a small meal in the mornings. The morning meal, breakfast, consisted of left-overs from the previous evening's meal, tea or coffee with some _qitta_ (unleavened home-made bread), or _dabbo_ (leavened bread). The two other meals almost invariably consisted of _Injera_ or _enset_ with _wät_. _Injera_, usually made of _teff_ flour, is a thin spongy leavened bread which has been estimated to provide about 1.3 Kcal/g of energy as eaten (Miller _et al_., 1976).

Teff has a high iron content because of the way in which it is threshed: on the open ground, where the minute grain gets 'contaminated' by the iron-rich soil, and is milled without washing (Hofvander, 1968). The rarity of iron-deficiency anaemia observed among highland Ethiopians, even among vulnerable groups such as children, pregnant and lactating women, has been attributed to this practice (Hofvander, 1968; Gebre-Medhin _et al_., 1976a). Ethiopian spices used in everyday cooking have also been reported to be nutritionally beneficial. For example, bird's eye chili (_Capiscum minimum_), added to the butter served with _genfo_ for the newly delivered mother, provides significant amounts of ß-carotene. This explained the larger quantities of ß-carotene in the breastmilk of Ethiopian mothers compared to that of Swedish mothers (Gebre-Medhin _et al_. 1976b).

Similarly, the ubiquitous _berbere_, a hot spice mixture containing powdered red pepper (_Capiscum frutescens_), garlic, and other spices, used for making _wät_, the traditional sauce, has antibacterial qualities for destroying a variety of harmful organisms such as _salmonella_ (Rivers and Hill, 1971: these authors mistakenly refer to '_berbere_' as '_chow_', or salt). _Enset_, the root crop with a high carbohydrate content, which makes the staple diet in the central/southern regions of Ethiopia among the Gurage, Sidama, and some of the Oromo ethnic groups, was usually consumed in the form of unleavened bread. _Wät_ is a generic name for the various types of usually strongly spiced sauces based on onions, fat, and _berbere_ with pulses or beef, fish, mutton, or chicken and eggs. Meat was added only for special feasts and was rarely used for everyday consumption.

Instead, wät was monotonously made of roasted and ground pulses (shiro wät) including peas, chick peas, field beans, lentils, and less frequently potatoes and green vegetables. Although the avoidance of animal origin foods was meant to be a feature of 'fasting periods' in Orthodox Christian households, it was commonly practised outside fasting periods in the sample households.

Religious fasting is an important cultural factor to consider in relation to dietary habits in the Ethiopian highlands. Fasika-tsom (Easter Fast), or Abiyï-tsom ('The Big Fast'), the equivalent of Lent, occurred during the period of data collection. Religious fasts among Christian Orthodox Ethiopians take the form of abstention from certain foods. Among the Moslems however, during the month of Ramadan, a total prohibition of the consumption of food and water is enforced from sunrise to sunset every day, while substantial amounts of any kind of food can be consumed anytime after sunset and before daybreak. The fast of Ramadan has been given as one of the reasons for stopping breastfeeding among refugee mothers in the Sudan (Almedom and de Waal, 1990). However, Ramadan did not occur during the Kebele 11 study.

According to the rules of the Ethiopian Orthodox Church, vulnerable groups, that is, young children, pregnant and lactating women, the sick and infirm, are exempt from observing fasts. Exemption is granted upon request from the Church through the family's Nefs-abbat (spiritual Father, or Confessor). Nonetheless, many Christian women in the sample observed fasts, and their children ate only Ye-tsom megib, 'fasting food', on Wednesdays, Fridays, and throughout Lent. Moreover, mothers who observed fasting rules did not have their first meal of the day until past mid-day. The fasting rules have been summarized by Knutsson and Selinus (1970) as follows:

'The fasting rules are of two kinds. One governs the time for consumption of food. During a fasting day this must not take place until after the sun has passed its noon position. Sometimes the time is given as noon, sometimes as 3 pm.

'The second fasting rule concerns the diet allowed, which must not contain any food of animal origin with the exception of fish. Meat, eggs, milk and butter form the pillars in this list of restrictions. It also covers all dishes that contain even a tiny amount of these ingredients. Great care is taken to avoid the slightest contamination of cooking utensils. Even touching the forbidden food or inhaling its smell is considered as a break in the fasting rules and must be followed by request for absolution by the church.' (Knutsson and Selinus, 1970: 957).

Generally speaking, these rules are followed more strictly in rural than in urban areas. Every Wednesday and Friday is a fasting day outside of Lent, with the exception of a 50-day period between Ethiopian Easter and the day of Pentecost. Wednesdays and Fridays are traditionally set aside for charitable acts and fasting. This is associated with the belief that Jesus was disowned by the Jews on a Wednesday, and to commemorate the Crucifixion on a Friday.

Ninety eight per cent of the Christian mothers in the Kebele 11 sample fasted every Wednesday, Friday, and during Lent. This is similar to Knutsson and Selinus' finding (1970) in which 94 per cent of the sample women in Addis Ababa continued to observe fasts after delivery. The reasons given by the Kebele 11 women for not seeking exemption from the Church during fasting periods, were twofold: firstly, the availability of non-fasting foods (meat and dairy products) was very low, and two, since other household members observed fasting days, the woman saved fuel in preparing fasting meals only. Thus all household members fasted on Wednesdays, Fridays, and throughout Lent. The result was that both the mother and her weanling infant had restricted diets. Knutsson and Selinus (1970) reported that the fasting diets of 6 to 36 month-olds were significantly less adequate in calories and nutrients except for thiamin, niacin, and iron, than was the case during non-fasting periods.

Orthodox Christian mothers resumed their normal activities within and outside the home soon after the baby's christening, between one and three months post-partum as described in Chapter 3 (see Section 3.2). For Moslem women, maternity seclusion lasted between one and two months.

The case of low-income women whose pregnancy ends in still-birth, or neonatal death, is worth noting. Their situation is one of 'double deprivation':

> 'It is unthinkable for the mother who has not fostered a viable fetus to maturity to taste any "genfo". Such a mother immediately leaves her bed and starts to engage in her daily duties, thereby forfeiting her right to preferential treatment and the unique opportunity for nutritional recuperation in the immediate postnatal period. This is an eloquent commentary on the powerful influence of culture on dietary habits. At the same time it shows the double deprivation of the non-privileged woman in traditional Ethiopia.' (Gebre-Medhin, 1980: 103)

There was only one case of neonatal death in the Kebele 11 study. A month-old baby boy died from tetanus after a traditional practitioner had removed his uvula. The father of the baby was later reported to have sent his wife away, for having 'failed to nurture her baby' and so this mother was lost from the study sample.

5.3.2 Maternal Morbidity and Mortality

Data on maternal morbidity showed high incidences of 'aches and pains'. These were classified into four categories: abdominal pains, gynaecological complaints, back ache, and general malaise, using a simple guideline for coding lay- reported information on health (WHO, 1978). Symptoms of illness such as diarrhoea, fever, coughing, and vomiting were rare, hence the lack of association between maternal and infant symptoms, except for fever (see Chapter 6 - Section 6.5.4).

The most common complaint was Ye-menfäs chinquet (Amharic), 'oppression of the soul'. Eighty-three per cent of the sample mothers suffered from Ye-menfäs chinquet. The main reason for this complaint was linked to the absence of husbands (the bread-winners of the household) and sons who had been conscripted into the army. The mothers had no news from these absentee members of family, and as a result they had lost their _joie de vivre_. Significant associations were found between mother's 'oppression of the soul', level of household hygiene, and diarrhoea in the infant (See Chapter 6 - Section 6.6).

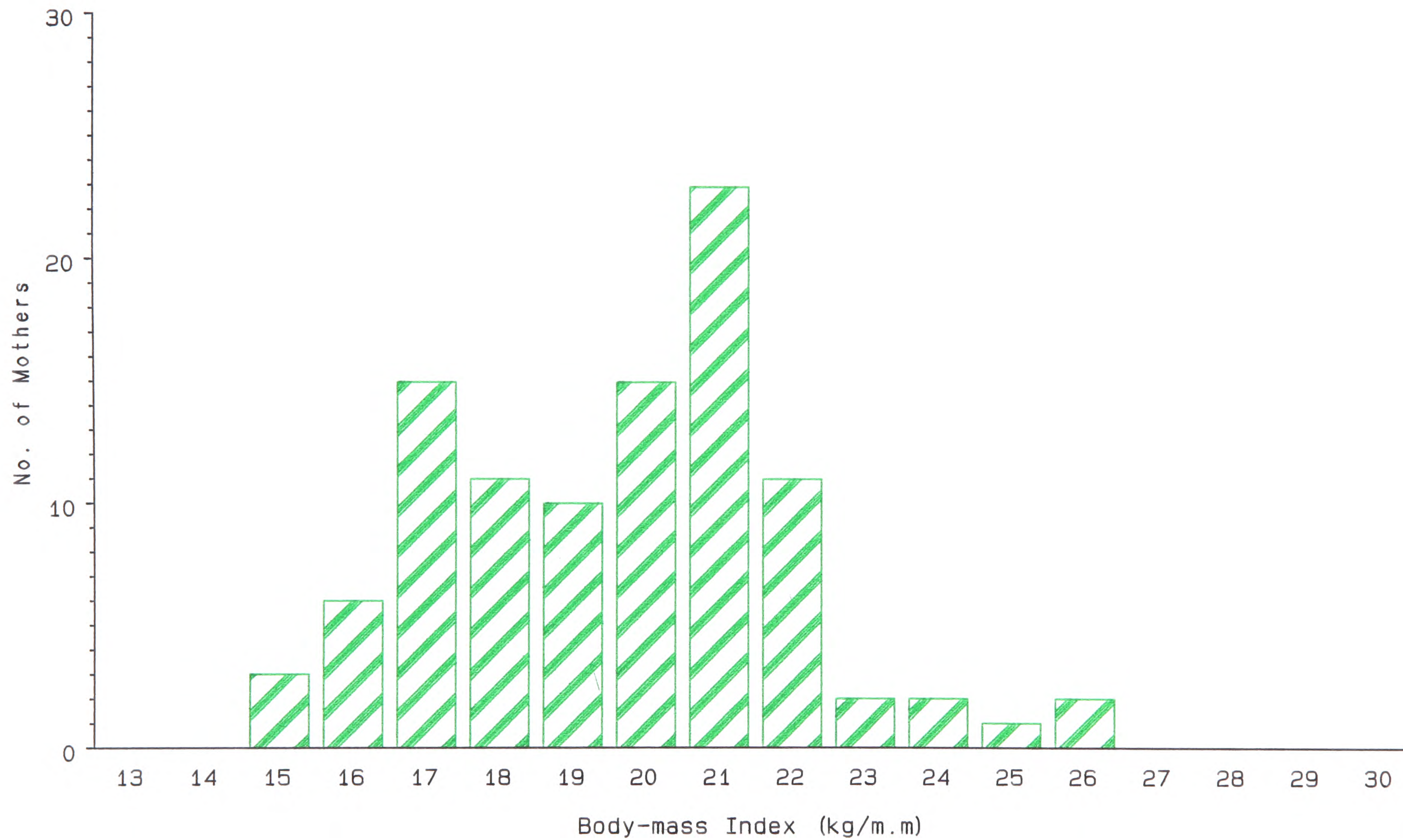
Kwast _et al_. (1986) estimated maternal mortality in Addis Ababa at 566 per 100,000 live births for 1982-83. The main cause of death was 'septic abortion', accounting for 54 per cent of direct obstetric cases. The majority of the victims were nullipara, mostly college students and teen-age girls who died after an abortion before 20 weeks gestation. Abortion is not legal in Ethiopia, and so it is performed illicitly, using hazardous methods. Among the _Kebele_ 11 sample mothers, two unmarried mothers, both living with their parents, reported having had an abortion, one of them during the study period. These abortions were again performed illicitly, but by medically trained practitioners.

5.3.3 Maternal Anthropometry

Relationships between maternal anthropometry and other variables were examined. An outlier, the previously mentioned Gurage mother whose body weight after delivery averaged 83 kg (see Section 5.3) was excluded from the analyses. **Table 5.1** shows the mean body-weight, standing height, and body-mass index (Weight/height^2) of non-pregnant mothers.

The distribution of maternal body-mass index in the sample mothers is shown on **Figure 5.1**. Interestingly, this distribution is similar to that reported from mothers in Batti, a famine relief camp on the lowlands of Wello, northern Ethiopia, during 1984-85 (Svenhuysen and Wolde-Gebriel, 1988). The mean body-mass index of the _Kebele_ 11 mothers is not significantly different from that of rural Sidama women in Sidamo, a region of relative prosperity (Ferro-Luzzi _et al_., 1990). In terms of maternal anthropometry, the Batti findings do not differ from those reported from non-famine regions of Ethiopia such as Sidamo and Addis Ababa. This reinforces the view that nutritional indicators may not be as

Figure 5.1 Mean Maternal Body-mass Index (N=90)



Coefficient of Variation = 12.1

strong as health indicators in assessing likely mortality in famine situations (de Waal, 1989).

Table 5.1 Anthropometry of Non-pregnant Mothers.

Variable	N	Mean	S.D.	C.V.	Range
Body weight (kg)	90	48.62	7.11	14.63	31.00 - 72.00
Stature (m)	94	1.58	0.05	3.32	1.48 - 1.74
Body-mass Index (kg/m^2)	90	19.28	2.31	11.97	13.78 - 25.82

These anthropometric indicators vary according to maternal age. **Table 5.2** shows their distributions by age-group. Mothers in the 30-40 years age-group showed significantly higher mean body-weight and body-mass index ($p < 0.048$).

Table 5.2
Anthropometry of Non-pregnant Mothers by Age Group (N=90).

Age (yrs)	N	Mean Weight (kg)	s.d.	range	Mean Height (m)	s.d.	range	Mean Body-mass Index (kg/m^2)	s.d.	range
<20	10	47.20	5.92	37.00 - 58.00	1.58	0.04	1.48 - 1.62	18.90	1.86	16.02 - 22.43
20-30	45	47.53	7.16	31.00 - 65.00	1.58	0.05	1.48 - 1.69	18.93	2.42	13.77 - 24.76
30-40	27	52.10	7.44	36.00 - 72.00	1.59	0.06	1.49 - 1.74	20.31	2.22	14.69 - 25.82
>40	8	49.31	5.79	41.00 - 60.00	1.60	0.06	1.49 - 1.68	19.23	1.59	16.16 - 21.77

Scatter diagrams of maternal weight on age suggested curvilinear associations in which weight seemed to decrease with increasing age. Correction for age using polynomial regressions yielded results indicating that 11 per cent of the variance in weight, and 7 per cent of the variance in body-mass index could be explained by maternal age differences ($p < 0.005$, and $p < 0.046$, respectively), while maternal height on its own showed no significant results (see **Table 5.3**).

Table 5.3
Polynomial Regressions of Maternal Anthropometric Indices (dependent variables) on Age.

Variable	N	Estimate	F	p <	Power of age	r^2	p <
Weight (kg)	90	0.001	9.30	**0.003**	3	0.11	**0.005**
		0.000	8.29	**0.005**	4		
Height (m)	94	0.000	2.48	n.s.	3	0.05	n.s.
		0.000	2.90	0.092	4		
		0.000	3.24	0.075	5		
Body-mass Index (kg/m^2)	90	0.000	5.64	**0.019**	4	0.07	**0.046**
		0.000	6.19	**0.025**	5		

n.s. = not significant.

5.3.4 Maternal Anthropometry and Infant Weaning

The timing of the completion of weaning showed significant association with maternal anthropometry, while that of the commencement of weaning did not (see **Table 5.4**).

Differences in maternal body-mass index explained between 29 and 46 per cent of the variance in the observed breastfeeding duration, while 23 per cent of the variance was explained by mean maternal weight alone (**Table 5.4**). The higher the body-mass index, the longer the mother was likely to breastfeed. This association persisted when the analysis was repeated for each month, and the results were further confirmed when maternal height was corrected for by using regression techniques.

Table 5.4
Regression Equations for Breastfeeding Duration (dependent variable) and Maternal Body-mass Index.

Rgr	Variable	N	Estimate	t	p <	r^2	p <
1	BMINov	13	1.066	3.17	**0.008**	0.46	**0.008**
	intercept		-8.345	-1.23	0.244		
2	BMIDec	13	0.865	2.21	**0.048**	0.29	**0.047**
	intercept		-3.927	-0.51	0.622		
3	BMIJan	12	0.729	2.18	**0.052**	0.30	**0.052**
	intercept		-1.451	-0.22	0.831		
4	BMIFeb	11	1.132	2.45	**0.034**	0.37	**0.034**
	intercept		-9.194	-1.01	0.335		
5	BMIMar	12	1.039	2.54	**0.027**	0.37	**0.027**
	intercept		-7.481	-0.925	0.375		
6	BMIApr	12	0.946	2.90	**0.014**	0.43	**0.014**
	intercept		-5.565	-0.85	0.411		
7	mwt	15	0.236	2.06	**0.059**	0.23	**0.059**
	intercept		0.127	0.02	0.984		
8	mwtbf	5	0.676	1.27	0.293	0.48	n.s
	mht		-79.600	-1.64	0.198		
	intercept		104.984	1.75	0.178		
9	mht	15	0.282	0.02	0.987	0.06	n.s.
	intercept		11.95	0.45	0.658		

Key: BMI = Body-mass Index (November-April).
mwtbf = Maternal weight at the termination of breastfeeding.
mht = maternal height.
mwt = maternal weight (mean).
n.s.= not significant.

In order to test the hypotheses that women with higher body-mass index and body weight may be able to maintain breastfeeding for longer than women with lower anthropometric indices, the above analyses were repeated for mothers who gave pregnancy and breastmilk insufficiency as their reasons for terminating breastfeeding. No significant effects were detected.

5.3.5 Duration of Breastfeeding and Post-partum Amenorrhoea

It is known that high frequency and intensity, with long duration of suckling raises prolactin levels and prolongs amenorrhoea (Huffman et al., 1978; Konner and Worthman, 1980). Lower maternal energy intakes are also associated with higher prolactin levels. This was evident in the Gambia where plasma prolactin levels were higher during the 'hungry season' of the rains when maternal energy intakes were at their lowest (Lunn et al., 1980).

Billewicz (1979) used the WHO data on breastfeeding to derive his mathematical formula for estimating the duration of post-partum amenorrhoea. When an allowance was made for maternal nutritional status, this was found to apply to both urban and rural mothers in nine countries included in the study. However, although urban well-to-do mothers in Ethiopia followed the mathematical prediction of the onset of menstruation, in rural and urban poor mothers in Ethiopia, menstruation was significantly delayed beyond that expected from prolonged breastfeeding.

In the Kebele 11 study, 27 mothers out of the 101 with complete records had had the return of menses during the period of data collection, while 74 had not. **Table 5.5** shows estimates of post-partum amenorrhoea computed by using the life-table method of survival analysis. Maternal body-mass index was investigated by dividing the women into two groups: those above and those below the mean value of 19.3. The influence of parity was examined by comparing primiparous and women with one child with multiparous women.

Table 5.5
Life Table Estimates of Duration of Post-partum Amenorrhoea in Sample Mothers (N=101).

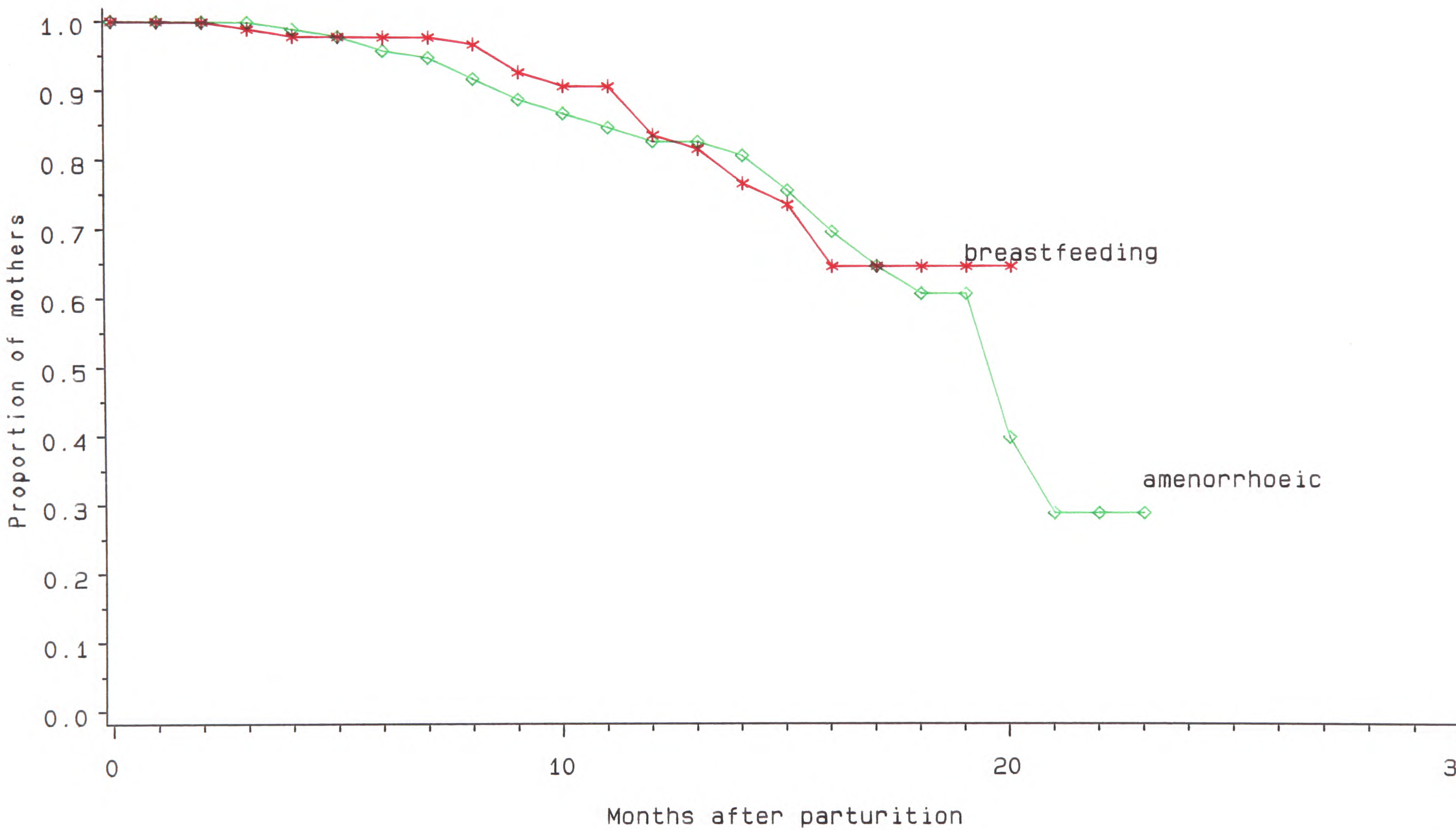
Group	N	No. Failures	No. Censored	Median (months)	Asymptotic s.e.
Age at Birth of Infant					
<20 years	17	6	11	19.56	2.90
20-30 "	50	10	40	21.59	4.81
30-40 "	28	16	12	19.89	1.14
>40 "	6	4	2	17.00	0.84
Mean Body Weight					
-40 Kg	8	3	5	21.00	4.77
40-44 "	20	3	17	18.73	1.46
45-49 "	5	0	5	15.00	0.00
50-54 "	47	18	29	20.00	1.32
55- "	21	7	14	20.00	3.75
Body-mass Index					
< 20 kg/m^2	45	11	34	20.76	0.86
> 19 "	56	19	37	17.50	1.30
Number of Live Births					
1	22	8	14	18.83	1.81
2-8	79	22	57	20.00	0.94
Number of Living Offspring					
1	22	8	14	18.83	1.78
2-8	79	22	57	19.88	1.09
Total	101	27	74	20.00	0.95

BMDP - 11 (Dixon, 1988).

Although mothers in the 20-30 years age-group, mothers whose body weight averaged less than 40 kg, and mothers with a body-mass index less than 20, showed longer durations of post-partum amenorrhoea, these differences did not achieve statistical significance. Similarly, duration of post-partum amenorrhoea was longer for higher parity women than primiparae, and women with one offspring, but test statistics (Generalized Savage/Mantel-Cox and Wilcoxon/Breslow) showed no significance, probably due to the large proportion of 'censored' cases (i.e. non-menstruating mothers) in the sample.

Figure 5.2 shows the survival curves for the duration of breastfeeding and post-partum amenorrhoea. As expected, the two curves are positively

Figure 5.2 Proportions of mothers breastfeeding and amenorrhoeic



BMDP – 1L (Dixon, 1988)

correlated with a coefficient of 0.98 ($p < 0.001$).

5.3.6 Reproductive Performance

Measures of reproductive performance examined include the total number of live births, number of children dead, and proportion of children surviving for each mother. These variables were positively correlated with maternal age, but, as with the anthropometric indices of weight and body-mass index, the associations were curvilinear.

The distribution of live births and living offspring by age is shown in **Table 5.6**.

Table 5.6
Measures of Reproductive Performance of Sample Mothers by Age-Group.

		Live births		Living Offspring	
Age (years)	N	Mean	S.D.	Mean	S.D.
<20	11	1.27	0.45	1.27	0.45
20-30	53	2.91	1.60	2.68	1.50
30-40	30	5.27	2.07	4.70	1.97
>40	9	8.11	2.45	6.67	0.95
Total	103	3.82	2.57	3.42	2.12

Results of stepwise regressions (using polynomials) indicated that age differentials accounted for as much as 63 per cent of the variance in parity (live births), and 59 per cent of the variance in living offspring. Only 5 per cent of the variance in proportion of surviving offspring was accounted for by maternal age (see **Table 5.7**). These results are similar to values reported from mothers in the highlands of Papua New Guinea (Brush, 1986).

Table 5.7
Polynomial Regressions of Live Births and Living Offspring on Maternal Age (N = 102).

Variable	b	F	p <	Power of age	r^2	p <
Live births	0.000	46.79	**0.001**	3	0.63	**0.001**
	0.000	17.61	**0.001**	5		
Living Offspring	0.006	46.15	**0.001**	2	0.59	**0.001**
	0.000	8.54	**0.004**	5		
Proportion Surviving	0.000	5.2	**0.025**	2	0.05	**0.025**

However, in contrast to the findings of Brush et al. (1983), regressions of age-corrected live births on age-corrected anthropometric indices (body weight and body-mass index) showed no significant associations.

5.4 Discussion

The results of the Kebele 11 study suggest that maternal dietary intakes during pregnancy and lactation are limited. The mean body weight of 48.6 kg, almost identical to those reported from the Simien region (Harrison et al., 1969; Miller et al., 1976; Wenlock and Wenlock, 1981), and mean body-mass index of 19.3 provide supporting evidence. However, lactation performance and reproductive capacity do not appear to be hampered as a result.

In a recent work, human nutritionists have proposed three cut-off points for body-mass index at 16.0, 17.0, and 18.5, to define grades I, II, and III, respectively of chronic energy deficiency (James et al., 1988). According to this classification, the Kebele 11 sample mothers are on average in the 'normal' range of over 18.5 (see **Figure 5.1**). A large proportion, 40 per cent are below the normal range with 3, 11, and 26 per cent in grades I, II, and III of chronic energy deficiency, respectively. Such classifications do not, however help to explain the apparent reproductive success of mothers as observed in the viability of newborns (survival of neonates) and successful lactational performance. Observations such as 'reproduction against the odds' (Prentice and Prentice, 1988) have been repeatedly made of populations in the less-developed countries, where maternal nutritional deficiency does not appear to affect the infant's well-being, at least not in the short term. The other side of the coin, maternal depletion, affecting women's well-being by shortening their life-expectancy, has not been studied and documented as much (Maher, 1990).

Differentials in maternal anthropometric indices showed no significant effect on the duration of lactational amenorrhoea. This may be due to the small proportion of women for whom the return of menstruation had occurred by the time data collection ceased.

Evidence from Guatemala suggested that the duration of post-partum amenorrhoea may be proportional to energy intakes during pregnancy (Delgado et al., 1978) and other studies have shown that women of lower socioeconomic status also have longer post-partum amenorrhoea (Lechtig et al., 1975; Huffman et al., 1978). In India, mothers below 40 Kg body weight had longer post-partum amenorrhoea (Prema et al., 1979; 1981) with a mean duration of 21.2 months. The median duration of 21 months found among the Kebele 11 mothers who weighed below 40 kg resembles the Indian situation.

Finally, it is worth noting that the strong positive association between maternal body-mass index and the observed duration of breastfeeding in the sample (**Table 5.4**) confirms the view that 'mother centred' factors are important determinants of the termination of breastfeeding (Chapter 3).

Chapter 6

Infant Health

6.1 Introduction

The health status of the infant is as critical as the feeding regime in determining optimal growth. Further, there are complex interrelationships between these determinants. Associations between inadequate or unsatisfactory nutritional state and infection-initiated morbidity and mortality are widely recognized and well documented (e.g., Tomkins, 1981; Black et al., 1984). Conversely, the prevalence of infection may affect the availability and use of dietary resources (e.g., Tomkins, 1986; Tomkins and Watson, 1988; Aaby, 1988; Uliasjek, 1988).

The rationale of this study is based on the view that in order to unravel the complex determinants of growth and health, there is a need to examine rigorously the effects of infection among infants in low-income households within the micro-environment of the home, and the macro-environment of the wider community. It will be shown that factors in both the micro and macro environment critically affect infant health, sometimes in unexpected ways.

Most studies have assessed infant health by using information from clinics and hospitals. Data based on clinic records have three main limitations. Firstly, the sample is biased because only 'sick' children are represented with the exclusion of 'healthy' children who remain at home. Secondly, only those in the community who make use of clinics and hospitals will be represented with the exclusion of those who may adhere to alternative means of health-care. Thirdly, the investigator examining mothers and infants as they present themselves at a clinic or a hospital does not have access to direct information concerning the living conditions of his/her subjects. It is probable that questionnaire data gathered during prospective studies in clinics will provide different results from similar data gathered during home visits where the accuracy of answers given could be checked against direct observation (Freij and Wall, 1977).

In Ethiopia, the most important study of the ecology of child health was conducted in 1972-74 by an Ethio-Swedish team. A socio-economically mixed sample of 600 households in Addis Ababa was studied longitudinally for a period of two years (Freij et al., 1976; Freij and Wall, 1977; 1979). Data were collected during fortnightly home visits by enumerators who conducted questionnaire based interviews with the adult household members. In addition, diagnoses of illness were carried out in a primary health-care clinic which was set up in Kirkos, the study site.

The most important contribution of the Kirkos study was that it pioneered the use of a statistical technique for examining interactions in a multifactorial frame-work of analysis. The technique called 'Theta Automatic Interaction Detector' (THAID), was applied in order to screen interaction effects between variables. Interesting results were obtained from this analysis. The main findings included the isolation of variables relating to socio-economic differentials such as the quality of housing; level of crowding; source of water-supply and, 'hygiene and sanitation' (assessed by the availability of a latrine), as powerful predictors of childhood diarrhoeal disease (Freij and Wall, 1979).

In this chapter, data on infant's and mother's morbidity are examined using log-linear analysis which supersedes the THAID technique. The application of log-linear analysis is demonstrated, particularly in exploring relationships between variables relating to illness, age, gender, and a number of environmental and socio-economic factors.

6.2 Subjects and Methods

Kebele 11 had limited primary health-care facilities. There was no regular clinic in Keftegna 24. However, a small clinic set up by the Mekane Yesus (Evangelical) church was held once a week, mornings only, in the northern part of the Kebele. This clinic offered basic medicines for the babies such as soluble aspirin, cough mixtures, eye ointments (mainly for the treatment of conjunctivitis, which was common in the dry season) and rehydration therapy (for infants with severe diarrhoea). The Mekane Yesus clinic was frequented by some of the Christian mothers and occasionally by the Moslem ones as well. The nearest regular clinic run by the Ministry of Health was Kolfe clinic in neighbouring Keftegna 25. This was about 40 minutes walk up-hill from Kebele 11. All mothers in the sample had visited this clinic at least once, for immunization.

On the days designated for immunization, the mothers set off very early in the morning and formed a queue before the clinic opened at 8:00 a.m. The queues were very long and the staff were few, so vaccinating the children was a slow process. A mother did not expect to return home before 11:00 a.m. on a typical day. At other times, the clinic provided basic services primarily for the inhabitants of Keftegna 25. On days other than vaccination days, the clinic was crowded and very few of the sample mothers reported visits other than for vaccination.

Morbidity data were collected during monthly visits to the home, using a structured interview schedule (see Appendices II and VIII). Each mother was asked whether her infant had been ill with diarrhoea, coughing, fever and vomiting for two consecutive days or more over the previous four weeks, and whether there had been any other illness. Diarrhoea was defined as frequent loose stools (more than three times a day) for two or more consecutive days. At the same time, the mother was interviewed about her own health over the same period of time. An attempt was made to specify mothers' complaints that fell in the categories 'aches and pains' and 'other'. For instance, a great many mothers reported that they suffered from constant '<u>Ye-menfäs chinquet</u>' (Amharic), which literally translates as 'oppression of the soul', a syndrome that proved to have considerable significance (see Sub-section 6.4.5.2).

Cross-sectional surveys of ethnicity, religion, mother's education, household water-supply, amount of daily water use, cost of water, waste disposal system, availability of latrines, occupation of household head, income of household head, and mother's own income-generating activity, were carried out at different stages of the study (see Appendix III). These complemented the longitudinal structured interview design, with one exception. The income survey was unsatisfactory, because the heads of household who were engaged in trade (26 per cent of the sample), were reluctant to report their average earnings, and the estimates given were probably inaccurate.

In addition, an assessment of the level of hygiene was done in each household by asking the mother how frequently she washed/bathed her infant (once a day was regarded as often), indirectly checking her answer while undressing the infant prior to weighing, and inspecting the cleanliness of the homestead at each visit. Constant litter including faecal contamination observed around the home, and signs of negligence of the infant as manifested by strong body and clothing odours were regarded as indicators of poor hygiene.

6.3 Statistical Analyses

The most useful statistical tools available for the analysis of qualitative or categorical data include the maximum likelihood estimation of log-linear models (Ku and Kullback, 1974; Brown, 1976; Benedetti and Brown, 1978; Fienberg, 1980; Edwards and Kreiner, 1983; Edwards, 1988).

The advantages of log-linear analysis over other statistical techniques such as a two by two chi-square contingency table or a multiway analysis of variance model are two-fold. Firstly, multivariate analysis can be carried out with the mixture of categorical and metric data used, whereas conventional multivariate methods would be inapplicable because of their built-in assumptions of metric qualities; linearity and additivity. Secondly, it enables one to look at all possible associations (statistically termed 'effects').

The relative importance of effects in log-linear models is assessed by computing two ad hoc test statistics for each effect (Brown, 1976). These are the chi-square statistic, X^2,

$$X^2 = \quad (\text{Observed} - \text{Expected})^2 / \text{Expected}$$

and the log-likelihood ratio chi-square, G^2.

$$G^2 = \quad \text{Observed} \ln(\text{Observed}/\text{Expected}).$$

Both are asymptotically distributed as chi-square, with n-p degrees of freedom (d.f.), where n is the number of cells, and p is the number of independent parameters estimated. The first statistic measures the 'marginal' association, namely, the association between two factors, without controlling for the possible effect of other factors. The second statistic measures the 'partial' or 'conditional' association, that is, the association between two terms when other factors are controlled for. These tests indicate the order of magnitude of the change in the goodness-of-fit produced by entering a given effect into the model. The marginal association tests for one parameter and the conditional association tests for the absence of that parameter; both have the same degrees of freedom and are often indicative of the magnitude of other conditional tests for the same parameter.

The primary use of log-linear models is exploratory and descriptive. The analyst decides which variables to include in the 'saturated' model. For a given effect, where both statistics are small, other conditional test statistics for that effect are unlikely to be large, and the effect would then not be needed in the model. Similarly, if both statistics are large, other conditional test statistics are unlikely to be small, and so the interaction term would be included in the model. When the two statistics are discrepant, it may be necessary to consider further models with and without the effect in question before deciding whether or not it should be included in the model.

The two test statistics thus differ in that the chi-square measure of association does not control for the interaction effect of other variables, while the log-likelihood ratio measure of association does. In this way, a clear association is distinguished from a tenuous one. This is useful for exploratory purposes. Analysis of data using log-linear models enables one to examine all possible effects, and to omit variables that have no explanatory value, in a 'stepwise' manner (viz. 'downward stepping') in order to select the best-fitting model.

All analyses were carried out on the Oxford University mainframe computers using the BMDP (Dixon, 1988) statistical package. Recently developed graphical models were also used for the presentation of the results of log-linear analysis (Edwards and Kreiner, 1983). The software used was 'MIM' (Edwards, 1988).

The analyses address the following questions:

1. What are the associations between the different morbidity measures recorded?
   (a) Is the presence of one symptom associated with the presence of another symptom?
   (b) How do these symptoms relate to particular diseases?
   (c) Does the presence of a symptom in one month predispose to the presence of the same symptom in the following month?
2. Is infant morbidity associated with maternal morbidity?
3. Is there seasonality in the prevalence of symptoms?
4. Is infant morbidity associated with other variables?

The last question is of particular interest, and allows us to develop a model for the most important constraints on infant health.

Data from 113 households are analyzed. However, not all mother-infant pairs have complete records of illness due to the mother's absence at the time of visit, and questions were never directed to an alternate child-minder. The sample sizes vary according to the completeness of data for the variables in question. Those with incomplete records have been excluded from some parts of the analysis - e.g., the part relating to seasonality.

6.4 Results and Discussion

The infant/child immunization programme was the most important medical intervention on Kebele 11, if not on Keftegna 24 as a whole. Vaccines against six major childhood killer diseases - viz. tetanus, diphtheria, polio, whooping cough, tuberculosis, and measles were administered to every child from the age of three months onwards. No cases of these diseases were found in the sample except for one instance during the first month of data collection, in which a month- old baby was lost from the sample due to neonatal tetanus probably caused by the removal of his uvula by a traditional practitioner.

The main severe health hazard that occurred during the study period was an epidemic of cerebro-spinal meningitis (CSM) in February and March. The symptoms of developed CSM are fever, convulsions, headache and a stiff neck. Two children in the Kebele 11 sample households were reported to have had these symptoms for a day or two, and consequently died. In both cases, the cause of death was medically confirmed as CSM. One of these fatalities was a 13 year-old boy whose younger brother was in the study sample and survived, and the other was a 20 month-old boy who was in the sample.

It is thus chiefly the day-to-day illnesses that are looked at here. The mother's own assessment and recall are relied upon. The suggestion, already made by other researchers, (e.g., Winikoff, 1981) that mothers who breastfeed are generally more aware than bottlefeeders, of slight changes in the health of their infants, and therefore more likely to report illness, is borne out by observations made during this study.

6.4.1 Associations between Symptoms

No clinical analysis of illnesses was carried out. The question of feasibility comes into this. A clinical investigation would have involved more human and material resources than were available in the Kebele 11 study. Further, any attempt to introduce a team of clinicians or a clinic in the kebele would have caused disruption of an otherwise smooth conduct of data collection. However, with the exception of cerebro-spinal meningitis, no major severe infectious disease was present. Instead, the infants suffered from clusters of less virulent infective agents. This sub-section investigates the different syndromes or clusters of symptoms present, by analyzing the associations between different symptoms.

Table 6.1 shows the associations between symptoms as explored by log-linear analysis. The 'first order association' shows that all symptoms, with the exception of diarrhoea and coughing, are closely associated with each other. It is important to note the difference between the 'marginal' and the 'conditional' associations of diarrhoea and coughing. The association between these two variables is highly significant when the other symptoms are present, but not after controlling for other symptoms in the model. By teasing out the interaction effect, the conditional measure of association suggests that the link between diarrhoea and coughing is merely a tenuous one.

Table 6.1
Associations between Symptoms (N=87).

Effect	d.f.	Conditional: Log-likelihood ratio (G^2)	p <	Marginal: Pearson X^2	p <
First order association					
Coughing x vomiting	1	22.30	**0.001**	59.72	**0.001**
Diarrhoea x vomiting	1	31.01	**0.001**	60.49	**0.001**
Fever x vomiting	1	6.82	**0.009**	55.27	**0.001**
Coughing x fever	1	69.41	**0.001**	108.42	**0.001**
Diarrhoea x fever	1	21.73	**0.001**	51.79	**0.001**
Coughing x diarrhoea	1	0.14	n.s.	19.18	**0.001**
Second order association					
Fev. x Diar. x Cough.	1	0.54	n.s.	0.96	n.s.
Fev. x Diar. x Vom.	1	1.75	n.s.	0.19	n.s.
Fev. x Cough. x Vom.	1	1.19	n.s.	6.47	**0.011**
Diar. x Cough. x Vom.	1	5.55	**0.018**	6.57	**0.010**
Third order association					
Fev.x Diar.x Cough.x Vom.	1	0.02	n.s.	.	.

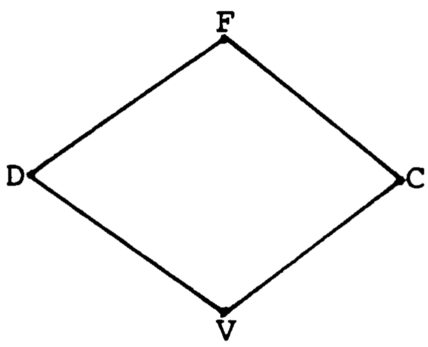
BMDP - 4F (Dixon, 1988)

n.s. = not significant
'.' = Chi-square not computed

In the 'second order association', the marginal and conditional measures of association both show significant links between diarrhoea, coughing, and vomiting. This is probably due to the presence of vomiting which, in the first order associations is strongly associated both with diarrhoea and with coughing, thus explaining the link between diarrhoea and coughing in the second order association.

The results in **Table 6.1** can be graphically represented by **Figure 6.1**. The lines joining up the symptoms represent significant 'effects' or associations. They are not causal links.

Figure 6.1
Associations between Symptoms.



where F = fever

D = diarrhoea

V = vomiting

and C = coughing

Deviance=2.65; d.f.=2.

How do these syndromes relate to particular diseases? While there is abundant evidence in the literature on the association between diarrhoea and vomiting as symptoms of the common disease of gastro-enteritis, the link between fever and diarrhoea is less clear unless one is discussing certain diseases such as cholera. While there was no cholera in the study area during the period of observation, it is possible that some forms of dysentery such as amoebic dysentery were present, manifested by the combined symptoms of diarrhoea and fever.

The symptoms of fever and vomiting may have been linked with the epidemic of cerebro-spinal meningitis (CSM). As mentioned above, two children in the sample households died in the epidemic. CSM is caused by meningococcal bacteria. On infection, these bacteria spread via the respiratory route. Of those who encounter this symptomless infection in the nasal passage, some will succumb to the disease, and the rest will become carriers. The case-fatality ratio of CSM was reported to be 21 per cent during the 1977 epidemics in various parts of Ethiopia, the highest rate being 30 per cent in Gojjam region (Eyassu and Estifanos, 1979). The meningococcus bacterium has virtually no survival time outside the human body in moist air, and it is also killed by ultraviolet light. It is often said that CSM is a disease that spreads in the dry season because epidemics tend to occur in the dry season. Infection rate decreases dramatically with the onset of rains (see Waddy, 1981). There is however evidence from a study carried out in Nigeria (Greenwood et al., 1984) that CSM in fact spreads in the rainy season as well. This Nigerian study found that the people who contracted the infection and carried it in their nasal passages (and thus were carriers during the rainy season), succumbed to the disease at the height of the dry season. This was often initiated by other respiratory infections that weakened the immune system causing, for example, less resistance in the respiratory tract and subsequent lesions of the lungs. This may explain some of the occurrences of fever, coughing, and vomiting. It is likely that some of the infants with these symptoms had mild forms of CSM.

The strong link between coughing and vomiting may be seen as evidence of minor respiratory infections, the risk of major diseases such as whooping cough and tuberculosis having been reduced through immunization. Upper respiratory tract infections such as the common cold were present in the study area, particularly in December and January.

The most important lower respiratory diseases in Addis Ababa responsible for most infant fatalities are streptococcus pneumonia and bronchial asthma (Teklu, 1986). Mild forms of these infections may also have prevailed among some of the infants in the study sample. The poor housing conditions, with little insulation from the severe cold at nights in the cold months of November-January, would no doubt contribute to this.

The following hypothesis emerges from the above discussion. It may safely be inferred that two main causal agents have been isolated, one is gastro-intestinal and the other respiratory. One is causing diarrhoea and the other coughing, and the two are not related. The symptoms of fever and vomiting are associated with both, but they do not, in themselves, constitute separate agents.

This hypothesis was tested using log-linear models in which one of the four symptoms was excluded each time (see **Table 6.2**). The results are consistent with the initial findings. Clearly, the association between coughing and vomiting, regardless of the presence of diarrhoea seems to suggest that these two symptoms are manifestations of respiratory infection. Similarly, the association between diarrhoea and vomiting, regardless of the presence of coughing would suggest the prevalence of gastro-intestinal infection. However, it is difficult to isolate instances when vomiting is associated with gastro-enteritis and not with respiratory infection.

It is worth mentioning that there was difficulty in interpreting the mothers' report of 'vomiting'. It is possible that in some cases, it referred to spittle accompanying coughs. This may account for the problem in distinguishing vomiting related to gastro-intestinal infections from vomiting related to respiratory infections.

The most significant result in **Table 6.2** is that in the absence of vomiting, there is no association between diarrhoea and coughing. Therefore the hypothesis that diarrhoea and coughing can be isolated as two unrelated agents may be accepted.

Associations of symptoms with age will be discussed later in Section 6.4.4.

Table 6.2
Further Tests of Associations between Symptoms (N=87).

		Association			
		Conditional		Marginal	
Effect	d.f.	Log-likelihood ratio (G^2)	p <	Pearson X^2	p <
Diarrhoea excluded					
First order association					
age x fever	2	2.41	n.s	1.98	n.s
age x coughing	2	2.23	n.s	3.14	n.s
age x vomiting	2	1.17	n.s	2.05	n.s.
fever x coughing *	1	72.44	**0.001**	108.97	**0.001**
fever x vomiting *	1	18.69	**0.001**	55.22	**0.001**
coughing x vomiting *	1	23.31	**0.001**	59.84	**0.001**
Second order association					
age x fev. x cough.	2	2.95	n.s	2.01	n.s
age x fev. x vom.	2	0.72	n.s	0.31	n.s.
age x cough. x vom.	2	1.65	n.s.	0.98	n.s.
fev. x cough. x vom.*	1	6.23	**0.013**	.	.
Third order association					
age x fev.x cough.x vom.	2	3.61	n.s.	.	.
Fever excluded					
First order association					
age x diarrhoea	2	10.22	**0.006**	12.81	**0.002**
age x coughing	2	1.29	n.s.	3.14	n.s.
age x vomiting	2	0.07	n.s.	2.05	n.s.
diarrhoea x cough. *	1	2.70	n.s.	19.01	**0.001**
diarrhoea x vomiting*	1	44.07	**0.001**	60.37	**0.001**
coughing x vomiting *	1	43.53	**0.001**	59.84	**0.001**
Second order association					
age x diar. x cough.	2	0.31	n.s.	0.56	n.s.
age x diar. x vom.	2	2.59	n.s.	2.60	n.s.
age x cough. x vom.	2	0.47	n.s.	0.98	n.s.
diar.x cough.x vom. *	1	6.61	**0.010**	.	.
Third order association					
age x diar.x cough.x vom	2	0.25	n.s.	.	.
Coughing excluded					
First order association					
age x fever	2	2.67	n.s.	1.98	n.s
age x diarrhoea	2	11.42	**0.003**	12.81	**0.002**
age x vomiting	2	0.36	n.s.	62.05	n.s.
fever x diarrhoea *	1	24.32	**0.001**	51.77	**0.001**
fever x vomiting *	1	27.77	**0.001**	55.22	**0.001**
diarrhoea x vomiting*	1	32.92	**0.001**	60.37	**0.001**

Table 6.2 (Cont.)

		Association			
		Conditional		Marginal	
Effect	d.f.	Log-likelihood ratio (G^2)	p <	Pearson X^2	p <
Second order association					
age x fever x diar.	2	1.47	n.s.	0.71	n.s.
age x fever x vom.	2	0.30	n.s.	20.31	n.s
age x diar. x vom.	2	2.62	n.s.	2.60	n.s.
fever x diar. x vom.*	1	0.25	n.s.	.	.
Third order association					
age x fev.x diar.x vom.	2	0.76	n.s.	.	.
Vomiting excluded					
First order association					
age x fever	2	3.72	n.s.	1.98	n.s.
age x diarrhoea	2	12.62	**0.002**	12.81	**0.002**
age x coughing	2	2.62	n.s.	3.14	n.s.
fever x diarrhoea *	1	33.91	**0.001**	51.77	**0.001**
fever x coughing *	1	91.11	**0.001**	108.97	**0.001**
diarrhoea x cough. *	1	1.14	n.s.	19.01	**0.001**
Second order association					
age x fev. x diar.	2	1.03	n.s.	0.71	n.s.
age x fever x cough.	2	2.81	n.s.	2.01	n.s.
age x diar. x cough.	2	1.33	n.s.	0.56	n.s.
fev. x diar.x cough.*	1	0.86	n.s.	.	.
Third order association					
age,fev.diar.,cough.	2	4.43	n.s.	.	.

BMDP - 4F (Dixon, 1988).

'.' = not calculated.
n.s. = not significant.
* = age effect removed - i.e. the analysis was carried out with the exclusion of the symptom stated as well as the age variable. The age variable refers to the three age-groups discussed in Section 6.4.4. The results were similar in magnitude and direction when the age effect was included.

Does illness in one month predispose to illness in the following month? In order to answer this question, the prevalence of symptoms from one month to the next was examined using log-linear models. Only the log-likelihood ratio tests of significance were computed. The results are shown in **Table 6.3.**

The prevalence of each symptom for adjacent months shows that coughing was significantly persistent almost throughout the study period. However, there is no association between prevalence of coughing for alternate months, suggesting that, in fact, it was not the same infants who had this symptom throughout. Therefore, it would appear that the symptom probably persisted in an infant for less than a month (the time of data collection may be between two episodes in the same month) or a maximum period of two months at a time. There is thus no evidence to suggest that the same infants were persistently ill.

For the rest of the symptoms, it appears that the highest prevalence was from February to April. This is certainly the case with diarrhoea. The persistence in prevalence of diarrhoea during February-March and March-April was significant ($p < 0.001$, and $p < 0.035$, respectively). It is possible that the same infants had diarrhoea during this period, since the association between prevalence in February and prevalence in April (alternate months) is significant ($p < 0.016$). Fever and vomiting showed significant persistence during the last two months of the study ($p < 0.001$ and $p < 0.018$, respectively).

Table 6.3
Probabilities of the Recurrence of Symptoms (N=54)

Effect	Log-likelihood ratio (G^2)	d.f.	p <
Coughing			
Adjacent months			
November x December	3.23	1	n.s.
December x January	12.52	1	**0.001**
January x February	3.98	1	**0.046**
February x March	7.31	1	**0.007**
March x April	5.37	1	**0.021**
Alternate months			
November x January	0.05	1	n.s.
December x February	0.31	1	n.s.
January x March	1.44	1	n.s.
February x April	2.49	1	n.s.
Diarrhoea			
Adjacent months			
November x December	1.53	1	n.s.
December x January	1.09	1	n.s.
January x February	1.83	1	n.s.
February x March	15.84	1	**0.001**
March x April	4.47	1	**0.035**
Alternate months			
November x January	2.36	1	n.s.
December x February	1.43	1	n.s.
January x March	1.71	1	n.s.
February x April	5.76	1	**0.016**
Fever			
Adjacent months			
November x December	1.60	1	n.s.
December x January	1.33	1	n.s.
January x February	0.31	1	n.s.
February x March	2.65	1	n.s.
March x April	14.49	1	**0.001**
Alternate months			
November x January	0.00	1	n.s.
December x February	0.46	1	n.s.
January x March	0.00	1	n.s.
February x April	1.04	1	n.s.
Vomiting			
Adjacent months			
November x December	0.00	1	n.s.
December x January	2.55	1	n.s.
January x February	2.17	1	n.s.
February x March	1.78	1	n.s.
March x April	5.65	1	**0.018**
Alternate months			
November x January	0.62	1	n.s.
December x February	0.22	1	n.s.
January x March	0.58	1	n.s.
February x April	0.41	1	n.s.

BMDP - 4F (Dixon, 1988).

n.s. = not significant

In sum, it appears that few of the infants in the sample displayed these symptoms persistently. There is little evidence to suggest that some infants were ill throughout the period of observation. A more likely explanation would seem to be a pattern of infection followed by recovery and possible reinfection for most infants in the sample.

6.4.2 Associations between Infant's and Mother's Morbidity

No striking associations were found between mother's symptoms and infant's symptoms, with the exception of fever. Diarrhoea in the infants did not correlate with diarrhoea in the mothers (see **Table 6.4**). This is no doubt partly due to the fact that diarrhoea was less common in the mothers than in the infants (see Chapter 5). Moreover, the contaminating agents for diarrhoea in infants, especially in the younger ones, are often not the same as those for diarrhoea in the mothers.

Table 6.4
Association between Mother's and Infant's Symptoms (N=84).

	Association				
	Conditional			Marginal	
Effect	Log-likelihood ratio (G^2)	d.f.	p <	Pearson X^2	p <
First order association					
mfev x bfev	10.24	1	**0.001**	10.35	**0.001**
mdiar x bdiar	0.05	1	n.s.	1.20	n.s.
mfev x bcough	0.24	1	n.s.	1.64	n.s.
mfev x bvom	1.57	1	n.s.	2.81	n.s.
Second order association					
mfev x bcough x bvom	5.08	1	**0.024**	5.61	**0.018**
Third order association					
mfev,bfev,bcof,bvom	0.12	1	n.s.	0.49	n.s.

BMDP - 4F (Dixon, 1988)

Key: mfev = mother's fever; bfev = infant's fever; bcof = infant's cough; n.s. = not significant; mdiar = mother's diarrhoea; bdiar = infant's diarrhoea; bvom = infant's vomiting

The association between fever in the infants and fever in the mothers was highly significant ($p < 0.001$). The second order association also shows that mother's fever is significantly associated with infant's coughing and vomiting ($p < 0.024$). These probably relate to incidence of influenza and the common cold which were passed on from mother to infant, and vice-versa.

Among the sources of contamination observed are, (i) the homestead, where this was characterized by the accumulation of litter including faecal contamination and (ii) the river/stream water. The river/stream water was highly polluted with a coliform count of more than 161/100 ml during the dry season. The pollutant organisms identified included E. Coli, bacteria associated with diarrhoeal illness, common in less-developed countries. Although none of the mothers who used river water reported using it for drinking, it is possible that children played with it and drank it unsupervised. Some of the mothers indicated that they used river water for washing-up purposes. Feeding and food storage utensils washed-up in contaminated water are likely to have been contaminated. As we have seen in Chapter 1, the cause of ill-health may not be the inadequacy of the food consumed by infants (in other words, undernutrition suppressing the immune response and thus contributing to increased susceptibility to diseases), but the way in which the food is prepared and stored, in environments where poor sanitary conditions prevail (Rowland et al., 1978; Black, 1984).

6.4.3 Season and Morbidity

The prevalence of symptoms showed seasonal patterns with peaks at certain months (see **Figure 6.2**). The results of log-linear analysis of associations between symptoms and month are shown in **Table 6.5**.

Figure 6.2 Prevalence of Symptoms (November–April)

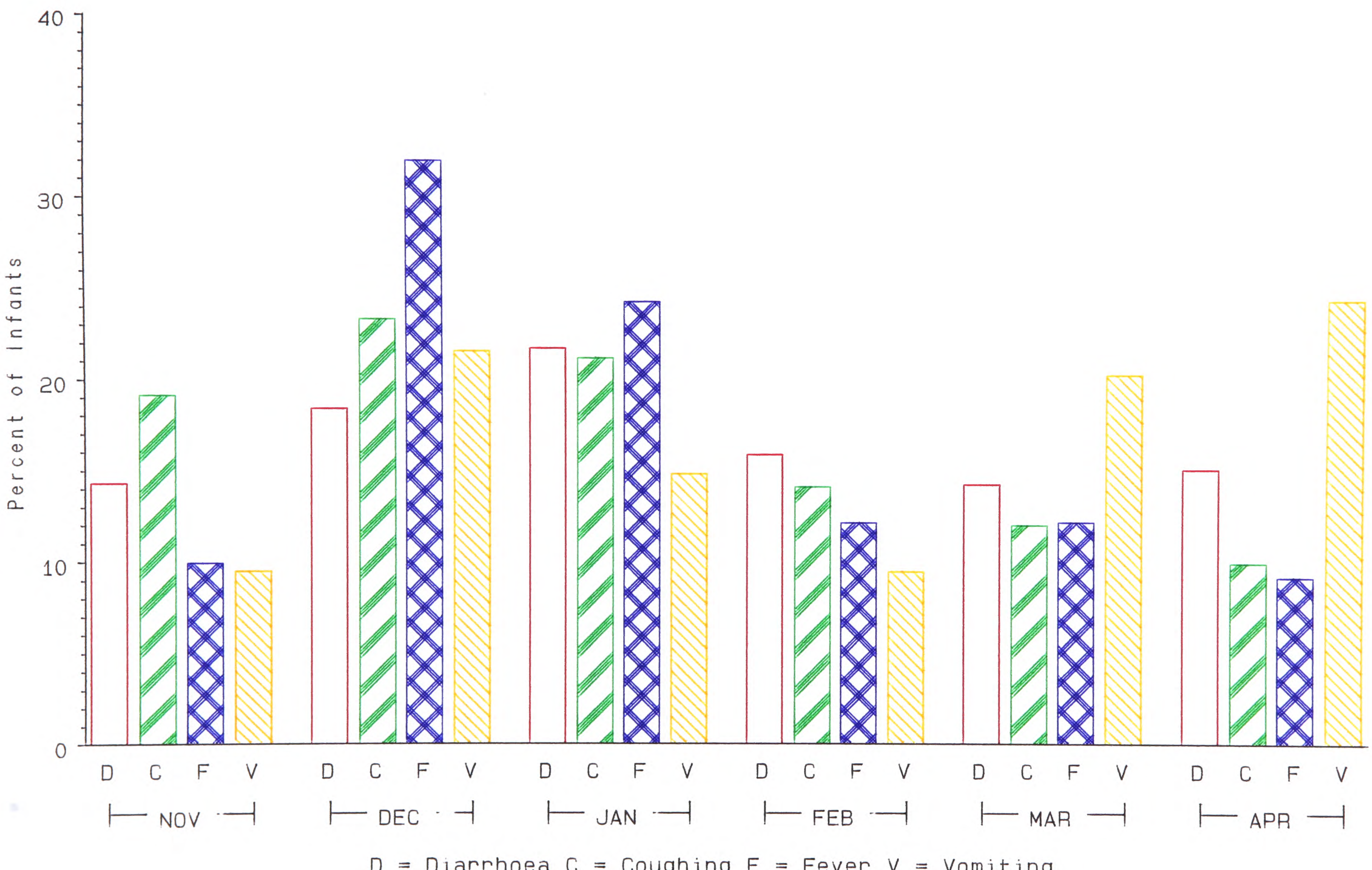


Table 6.5
Seasonality in the Prevalence of Symptoms (N=54).

		Association			
		Conditional			Marginal
Effect	d.f.	Log-likelihood ratio (G^2)	p <	Pearson X^2	p <
First order association					
Diarrhoea x month	5	2.90	n.s.	6.00	n.s.
Coughing x month	5	12.58	**0.028**	16.80	**0.005**
Fever x month	5	28.53	**0.001**	38.33	**0.001**
Vomiting x month	5	16.86	**0.005**	9.92	n.s.

BMDP - 4F (Dixon, 1988).

n.s. = not significant

There were no significant monthly differences in the prevalence of diarrhoea. In Ethiopia, diarrhoeal infection in children is rife in the rainy season. However, this does not rule out infection during the dry season all together. Diarrhoea was prevalent among the sample infants throughout the study period at more or less constant levels. Recent reports have shown that diarrhoeal diseases among infants and young children in Addis Ababa are very common and widespread throughout the seasons (Claeson, 1988). This is not surprising, considering the environmental hazards of a poor sewage system and unsatisfactory sanitary facilities in the city.

The prevalence of coughing showed significant monthly variation, with a peak in December. Most respiratory diseases are caused by viruses. A good example of these is respiratory syncytial virus, which affects infants. The peak in December of the prevalence of coughing probably corresponds with the seasonal change in the temperature and humidity of the air around that time (see Chapter 2, **Figures 2.1, 2.2**, and **2.3**).

Fever showed a highly significant seasonal pattern, also with a peak in December. Again this may be related to incidences of influenza and the common cold. We have already seen that the association between coughing and fever in the infants was highly significant ($p < 0.001$).

The prevalence of vomiting also showed a significant seasonal pattern with two peaks, one in December and the other in April. The first peak probably also relates to the respiratory infections, in which case the association with coughing might be explained. This would support the suggestion made earlier that the mothers' reports of coughing and vomiting may have represented coughing and spittle. The second peak, in March-April is difficult to interpret.

6.4.4 Age and Morbidity

Age effect on the prevalence of symptoms was examined by dividing the infants into three age-groups: (i) 0 to 6 months, (ii) 6-12 months, and (iii) over 12 months (see **Figure 6.3** and **Table 6.6**).

Table 6.2 has already shown that the association between diarrhoea and age is highly significant (see Sub-section 6.4.1). The results in **Table 6.6** show that the prevalence of diarrhoea is significantly higher in the 6-12 month age-group than the other two. This raises the question of whether a significantly higher prevalence of diarrhoea among infants in this age-group could be related to their weaning status and thus could be evidence of 'weanling's diarrhoea' (cf. Rowland et al., 1978) in the study sample.

Figure 6.3 Age-specific prevalence of Symptoms

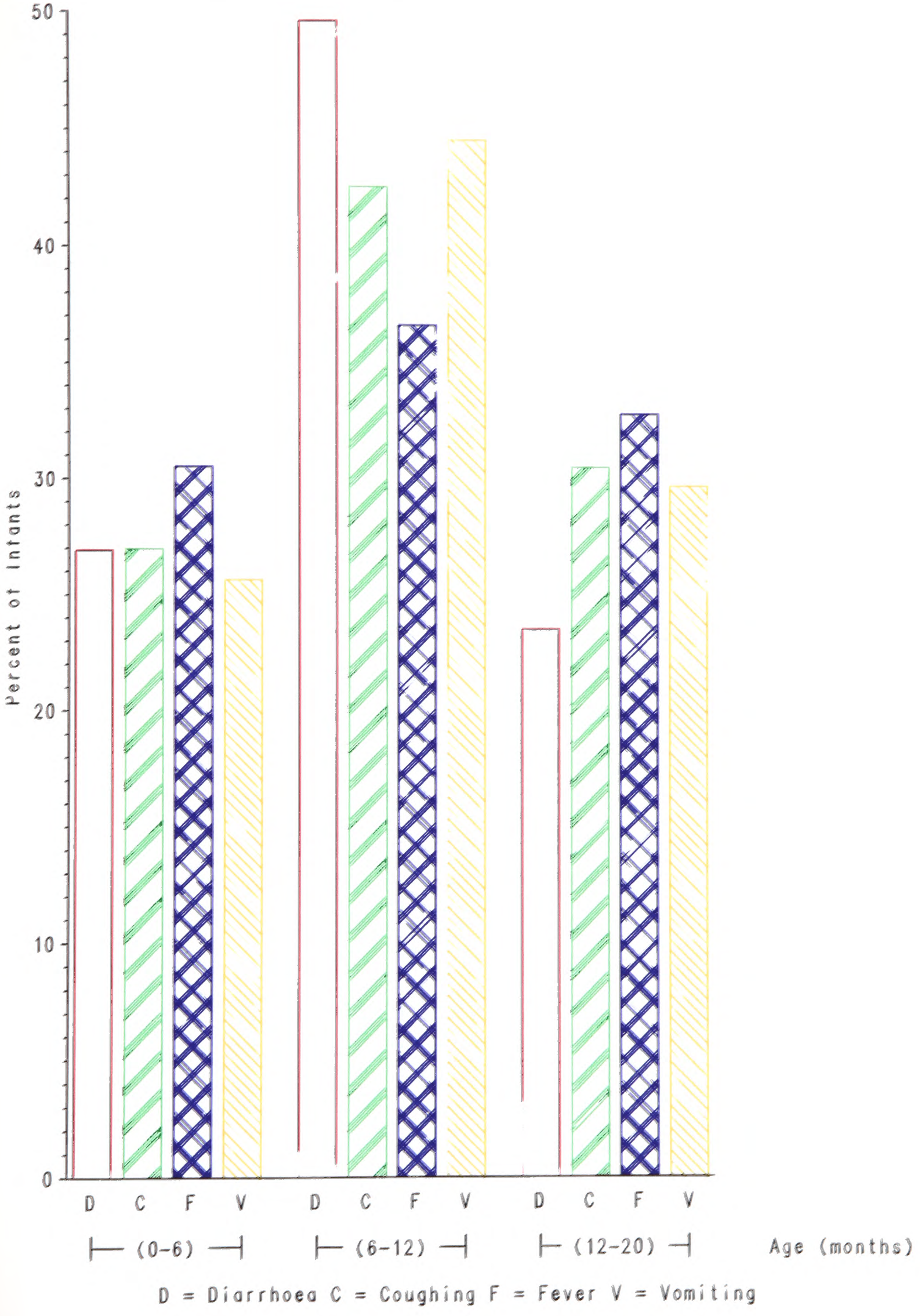


Table 6.6
Age-specific Prevalence of Symptoms.

	% prevalence					
	Age (months)			Log-likelihood ratio		
Symptom	(0-6) N=23	(6-12) N=33	(>12) N=32	(G^2)	d.f.	p <
Diarrhoea	26.90	49.60	23.50	11.11	2	**0.004**
Coughing	26.95	42.55	30.50	2.26	2	n.s.
Fever	30.53	36.64	32.82	3.58	2	n.s.
Vomiting	25.67	44.59	29.73	0.11	2	n.s.

BMDP - 4F (Dixon, 1988).

n.s. = not significant

However, in view of the discussion in Chapter 3, in which age was shown to be of secondary importance in the commencement and completion of weaning, the above analysis was repeated by replacing age-group by weaning-status group. The infants were re-classified into three groups, by weaning status: (i) Pre-weaning group: consisting of exclusively breastfed infants; (ii) Weaning group: comprising those who were partially breastfed or mixed-fed; and (iii) Weaned group: those who had completed weaning.

Group (iii) was very small, comprising of only four infants. The prevalence of diarrhoea was greater in group (ii) than in group (i), but the results were not statistically significant. Thus, while there is no evidence for weanling's diarrhoea, there is evidence for increased diarrhoea in the 6-12 months age-group. The reason for this may be other factors that relate to the behaviour and care of infants in the 6-12 months age-group. In this age-group, infants are (1) sitting-up on their own, (2) beginning to crawl, (3) being looked after by older siblings in addition to the mother, and (4) grasping objects and putting them into their mouths. Any one of these four factors may account for a decrease in bodily hygiene or an increase in the contact with infective agents.

In the absence of further detailed investigation, the suggestion that the behaviour and care of the 6-12 month old infant may account for the increase in diarrhoea must remain a residual hypothesis. If true, however, it would suggest that, for this sample at least, the existence of so-called 'weanling's diarrhoea' is an artifact of the erroneous assumption that infants are weaned at a definite age. The phenomenon might better be called 'developmental diarrhoea', as it is more closely related to the development of the infant's motor skills.

The prevalence of fever, coughing and vomiting, while highest among the 6-12 month age-group, showed no significant associations with either infant's age or weaning group.

6.4.5 Morbidity and Other Variables

All socio-economic variables available, and all measures of maternal behaviour and infant's behaviour were examined by inclusion in the log-linear models with the four symptoms of illness. The results are shown in **Tables 6.7, 6.8,** and **6.9.**

6.4.5.1 Socio-economic Variables

In **Table 6.7,** we can see that variables such as water supply, waste-disposal system and toilet facility are not associated with the prevalence of any of the symptoms. This is probably because the sample was more or less homogeneous with respect to these variables. For example, almost all households had access to piped water supply. The differences were in the ease of access to it - i.e. some had private water taps, some shared with other households in the compound, and some travelled some distance to fetch water from the public water distribution points. Those who used piped water as well as river water (which was highly polluted) were too few to make a significant difference in the prevalence of symptoms (see Chapter 2, **Table 2.8**).

Similarly, about 35 per cent of the households in the sample had no toilets (see Chapter 2, **Table 2.9**). The type of toilet facility in the households who had one, was a pit-latrine (again, fairly homogeneous). The differences were in whether it was private or shared. The number of households sharing the use of a pit-latrine ranged from two to eight. This however made no apparent difference to the prevalence of symptoms such as diarrhoea in the infants or in the mothers.

The waste disposal system was generally poor (see Chapter 2, **Table 2.10**). That is, the constant littering of passages and alleyways was common to most households in the sample. This meant that the positive effects of access to piped water supply in minimizing infection were negated by the widespread lack of proper waste disposal system and sanitation.

Table 6.7
Association of Symptoms with Socio-economic Variables (N=83).

	Association				
	Conditional			Marginal	
Effect	d.f.	Log-likelihood ratio (G^2)	p <	Pearson X^2	p <
First order association					
wdisp. x diarrhoea	4	1.88	n.s.	7.82	n.s.
wdisp. x fever	4	4.14	n.s.	12.64	**0.013**
wdisp. x coughing	4	5.63	n.s.	15.17	**0.004**
wdisp. x vomiting	4	4.15	n.s.	14.16	**0.007**
wsup. x diarrhoea	4	4.56	n.s.	16.63	**0.002**
wsup. x fever	4	2.35	n.s.	13.84	**0.008**
wsup. x coughing	4	7.42	n.s.	20.97	**0.001**
wsup. x vomiting	4	3.09	n.s.	5.09	n.s.
toil. x diarrhoea	2	0.71	n.s.	2.25	n.s.
toil. x fever	2	1.78	n.s.	3.34	n.s.
toil. x coughing	2	0.33	n.s.	0.87	n.s.
toil. x vomiting	2	0.20	n.s.	1.76	n.s.
hhd. x diarrhoea	1	0.19	n.s.	3.13	n.s.
hhd. x fever	1	0.00	n.s.	5.07	**0.024**
hhd. x coughing	1	7.62	**0.006**	17.18	**0.001**
hhd. x vomiting	1	2.19	n.s.	9.05	**0.003**
wdisp. x wsup.	16	43.40	**0.012**	50.94	**0.001**
wdisp. x toil.	8	18.31	**0.019**	17.91	**0.022**
wsup. x toil.	8	24.69	**0.002**	25.63	**0.001**

BMDP - 4F (Dixon, 1988)

Key: wdisp. = waste disposal system; wsup. = water supply; n.s. = not significant; hhd. = household head; toil. = toilet facility

The association between the gender of household head and infant's coughing is difficult to interpret. Infants in male-headed households suffered from coughing more than infants in female-headed households. It might be that there was more smoke in male-headed households, which caused the infants to cough. This speculation is based on the observation that women did not smoke, while many male heads of household smoked cigarettes. Most of the houses were poorly ventilated so that smoke from the previous night lingered on in the room the next morning until noon when most interviews were conducted.

In **Table 6.7**, the significant marginal associations between water supply and diarrhoea, waste-disposal and diarrhoea fail to be significant on the conditional association. This illustrates the discriminatory quality of log-linear analysis in enabling us to screen all possible effects, in order to obtain the most likely explanations. Although they appear to be significantly associated on the marginal level, water supply and diarrhoea are not associated when controlling for waste disposal, water supply, and toilet facilities, on the conditional level. These three variables, water-supply, waste-disposal system, and toilet facility are significantly associated with each other. The households whose water supply came from a public distribution point tended to dispose of their waste by throwing it into the river. Similarly, the association between water supply and toilet facility showed that the households who did not have a toilet facility also lacked a private or shared tap in close proximity to the home. These households used public water distribution points. Those households without any toilet facility disposed of their waste in the river or made no effort at all. The reason why water supply and diarrhoea in infants had no underlying association was therefore because most households were more-or-less the same with respect to these three closely related variables.

6.4.5.2 Maternal Variables

A great majority of the mothers, 83 per cent, reported that they suffered from constant Ye-menfäs chinquet ('oppression of the soul'). There was little variation in the reasons given for this complaint: 90.1 per cent of the mothers reported that the cause was related to the current laws of mass conscription: prolonged absence of a son who had been forcibly conscripted, or a husband who has been in the army for some time, resulting in the mothers' resigned attitude towards hygiene and child care. 6.4 per cent attributed Ye-menfäs chinquet to family/marital disharmony, and 3.5 per cent said that they did not know.

Mothers who suffered from 'oppression of the soul' tended to score significantly less on hygiene (see **Table 6.8**). This is perhaps not surprising. Mothers who had lost their joie de vivre due to the distress caused by the absence of their sons or husbands of whom they had no news, did not bother to keep their infants and their houses clean.

The magnitude of the mass conscription in Ethiopia is corroborated by a recent report from a human rights organization which asserts that about 100,000 men and boys have been recruited to the armed forces each year since the late 1970's (Africa Watch, 1990). Most methods of conscription were both arbitrary and brutal, including the notorious afessa or 'sweeping up' press gang. Most conscripts never return to their families again. Many die at the front line or are captured by the 'Liberation Fronts'.

This is a striking example of the impact on child care and health of an oppressive political/military policy, mediated through the psychological state of individual mothers.

The prevalence of coughing was greater among infants whose mothers spent part of the day outside the home. Whether the mother spent all day or only part of the day with her infant depended on whether or not she worked for a wage, and whether or not her work took her out of the house. The variables 'time spent with infant' and 'location of mother's work' are therefore related, and the association of each with the prevalence of coughing in the infant may be interpreted in the same way. The type of mother's employment was mostly paid house-work such as washing clothes and baking Injera (bread that constitutes the staple diet in the Ethiopian highlands), usually in the better-off households in the neighbourhood of Kebele 11. It may be that the infant was prone to coughing due to the lack of care subsequent to the mother's absence. It could also be due to the mother herself having greater exposure to respiratory infections, and then passing them on to the infant.

Table 6.8
Association of Infant Morbidity with Mother's Variables (N=71)

		Association			
		Conditional		Marginal	
Effect	d.f	Likelihood ratio (G^2)	p <	Pearson X^2	p <
First order association					
locw. x diarrhoea	1	6.36	**0.012**	8.38	**0.004**
locw. x fever	1	3.54	n.s.	0.24	n.s.
locw. x coughing	1	9.17	**0.003**	10.12	**0.002**
locw. x vomiting	1	0.14	n.s.	3.78	**0.052**
twb. x diarrhoea	1	2.73	n.s.	4.40	0.036
twb. x fever	1	2.67	n.s.	0.24	n.s.
twb. x coughing	1	8.30	**0.004**	9.29	**0.002**
twb. x vomiting	1	0.35	n.s.	3.47	n.s.
educ. x diarrhoea	3	8.94	**0.030**	10.17	**0.017**
educ. x fever	3	0.59	n.s.	5.39	n.s.
educ. x coughing	3	0.12	n.s.	3.82	n.s.
educ. x vomiting	3	4.62	n.s.	11.08	**0.013**
hyg. x diarrhoea	1	4.34	**0.037**	2.99	n.s.
hyg. x fever	1	0.00	n.s.	0.03	n.s.
hyg. x coughing	1	0.00	n.s.	0.08	n.s.
hyg. x vomiting	1	1.43	n.s.	1.21	n.s.
opp. x diarrhoea	1	3.43	n.s.	1.15	n.s.
opp. x coughing	1	0.00	n.s.	0.87	n.s.
opp. x fever	1	4.13	**0.042**	3.70	**0.054**
opp. x vomiting	1	0.19	n.s.	0.32	n.s.
locw. x twb.	1	260.03	**0.001**	276.31	**0.001**
hyg. x opp.	1	68.12	**0.001**	68.57	**0.001**
hyg. x educ.	3	12.80	**0.005**	12.68	**0.005**
educ. x opp.	3	29.27	**0.001**	33.87	**0.001**

BMDP - 4F (Dixon, 1988).

Key: twb.= mother's time spent with infant.
locw.= location of mother's work.
hyg.= hygiene.
educ.= mother's education.
opp.= 'oppression of the soul' (in the mother).
n.s.= not significant.

There was a higher prevalence of diarrhoea among infants whose mothers worked for an income within the home (**Table 6.8**). Such work included petty trade in which the mother was engaged in selling vegetables and/or charcoal by the roadside, close to her house. In these cases, the infant was usually minded by an older sibling or a relative.

Also interesting was the association of mother's education with diarrhoea. A significantly higher prevalence of diarrhoea was found among the infants of non-literate mothers, compared to those whose mothers had achieved basic literacy, primary schooling or primary schooling plus some vocational training ($p < 0.040$). This finding is in keeping with those of other studies that have shown mother's education to be an important determinant of child survival (e.g., Caldwell, 1979; Bertrand and Walmus, 1983; Tekçe and Shorter, 1984). The association of hygiene with diarrhoea is consistent with the association between mother's education and hygiene. Basic literacy may indeed help mothers to achieve better standards of hygiene. Alternatively, mothers who already maintained reasonable standards of hygiene may be the ones who were more likely to attend literacy classes.

6.4.5.3 <u>Infant's Variables</u>

Many mothers reported that the emergence of primary teeth was accompanied by diarrhoea in the infants, referred to as 'teething diarrhoea'. No significant association was found, however, between emergence of teeth and any of the symptoms of illness.

The mothers' assessment of the infants' readiness to eat (for those who had commenced weaning), and the quantities of food consumed was the measure of the infants' appetite. Not surprisingly, infants with fever had poor appetites (**Table 6.9**). Loss of appetite or anorexia in infants, as a consequence of febrile infections, has been reported in other studies (e.g., Dettwyler, 1989).

Whether the infant was given traditional medicine or modern medicine, or both, when ill, did not appear to predict incidence of symptoms, probably because the number of mothers who reported having given their infant modern medicine was very small. Mothers reported that they could not afford to buy medicine from the pharmacies. They would use modern medicine only when it was obtained free of charge from the Mekane Yesus clinic, but very few mothers visited this clinic. The majority of the mothers in Kebele 11 reported regular use of traditional medicine consisting of herbs such as rue (*Ruta graveolens*), damakisse (*genus Origanum*), and fresh eucalyptus twigs for infant ailments. A similar finding where decisions by parents to use modern medicine for their children depended on the household's purchasing power, has been reported from Afghanistan (Nabarro, 1984).

Table 6.9
Association of Symptoms with Infant's Variables (N=69).

		Association			
		Conditional		Marginal	
Effect	d.f.	Log-likelihood ratio (G^2)	p <	Pearson X^2	p <
First order association					
bapp. x diarrhoea	1	1.04	n.s.	4.94	**0.026**
bapp. x coughing	1	10.17	n.s.	5.08	**0.024**
bapp. x fever	1	10.90	**0.001**	18.34	**0.001**
bapp. x vomiting	1	0.38	n.s.	1.77	n.s.
bmed. x diarrhoea	2	0.42	n.s.	0.12	n.s.
bmed. x coughing	2	2.47	n.s.	3.26	n.s.
bmed. x fever	2	4.49	n.s.	4.83	n.s.
bmed. x vomiting	2	0.76	n.s.	0.13	n.s.

BMDP - 4F (Dixon, 1988).

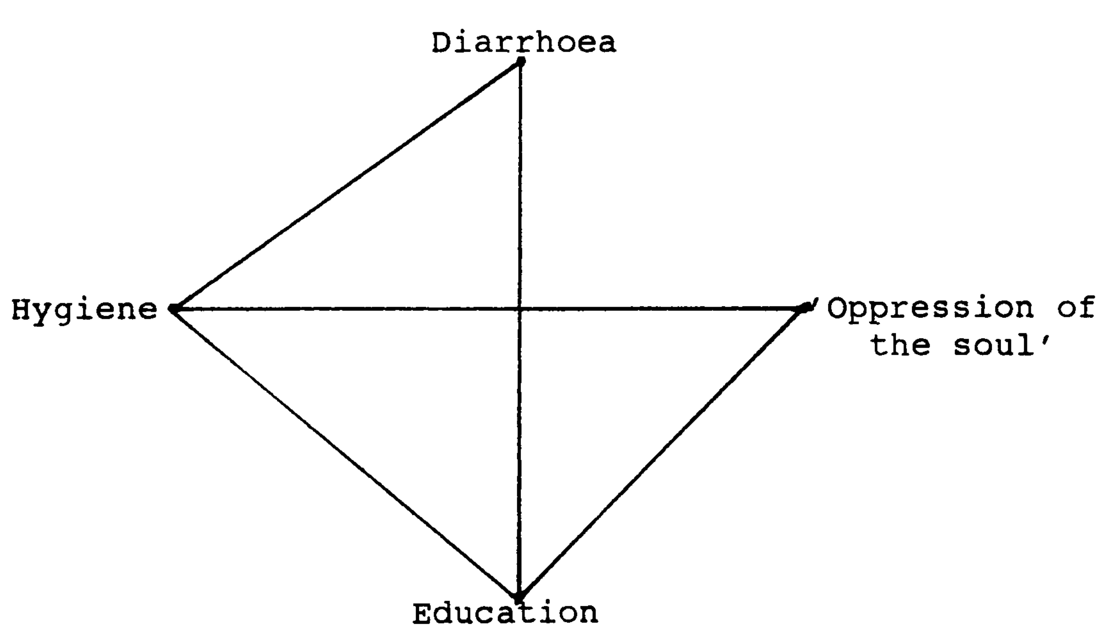
key: bapp. = infant's appetite
bmed. = type of medicine given to infant
n.s. = not significant

6.5 An Explanatory Health Model

The best fitting explanatory health model includes the maternal variables of education, hygiene, and 'oppression of the soul' with the incidence of diarrhoea in the infants. We have seen in **Table 6.8** that maternal education and hygiene were significant predictors of diarrhoea in the infant. This model is graphically represented in **Figure 6.4**, with the lines representing significant associations. The other variables discussed are of lesser overall importance, and do not appear in the model.

This model explains the interactions of significant variables that determine the health-status of the sample infants. It was selected by removing non-significant effects from the saturated log-linear model, i.e. by downward stepping within a hierarchical model, using the micro-computer programme, MIM (Edwards, 1988). The technique of stepwise regressions by removing effects is more reliable than by adding effects in log-linear analysis (Feinberg, 1980).

Figure 6.4
An Explanatory Health Model.



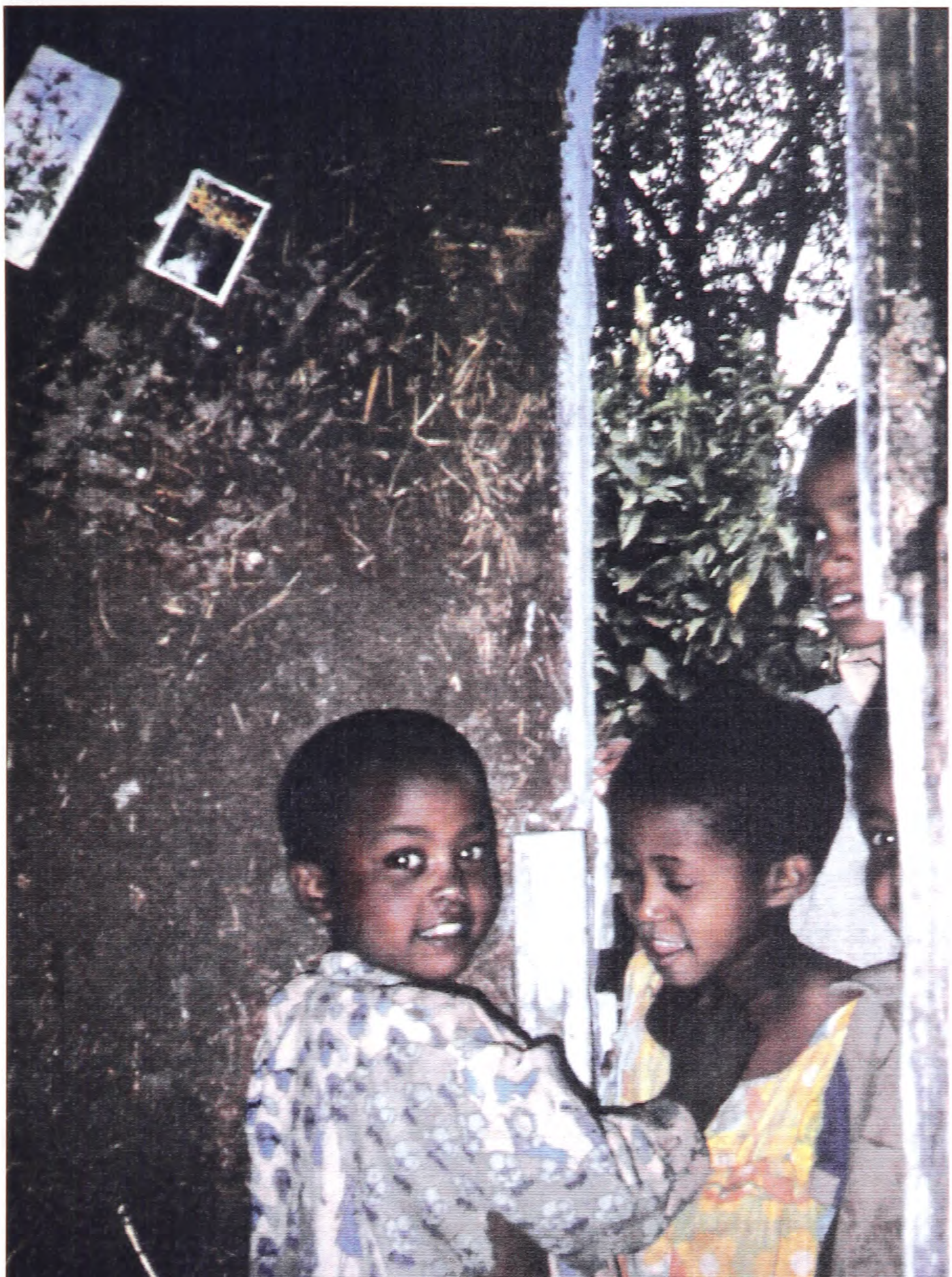
Deviance=13.36, d.f.=12

The main predictors of infant health in the study population have been clearly identified. These are maternal education, level of hygiene, and mother's 'oppression of the soul'. Literacy of the mother, even at the basic level seems to help secure adequate levels of hygiene in the home, resulting in minimizing the incidence of diarrhoea in the infant. This finding is in agreement with that of the Kirkos study in which parental education was found to be a significant predictor of child health (Freij and Wall, 1979).

While no direct association was found between 'oppression of the soul' in the mother and incidence of diarrhoea in the infant, there was an indirect link. If the mother did not suffer from 'oppression of the soul', the level of hygiene in the home was adequate, and this meant that the infant was relatively free from diarrhoea. This is a slightly unexpected finding to arise from this kind of micro-level study and illustrates the kind of subtle linkages that may be missed by more conventional and limited approaches to the subject.

It must be emphasized here that the use of log-linear models is mainly exploratory and descriptive. Causal links between variables in the model cannot be reliably inferred.

This chapter has documented, for the first time in Ethiopia, the consequences of unfavourable macro-environment (repressive political conditions), and micro-environment (insanitary conditions of the home) on mothers' and infants' health in urban low-income households. It is hoped that policy makers and those involved in planning intervention programmes in Ethiopia may benefit from the data presented.



Young boys in Kebele 11.

Chapter 7

Infant Growth

7.1 Introduction

This chapter examines the physical growth performance of Ethiopian infants in urban low-income households. In line with the approach of the preceding chapters, this chapter analyzes anthropometric variables in relation to maternal, infant, and environmental variables.

The contents of this chapter are divided into four main sections. The first section reviews anthropometric studies of Ethiopian children from the late 1960's to the present day, and outlines the rationale for this study. The second section describes the sample and methods. The assessment of measurement error and statistical analyses are also discussed in this section. Section three presents the data (1) in comparison to Tafari's data (1972) collected from a relatively large sample of 'underprivileged' children in Addis Ababa;
(2) in comparison to the NCHS international reference data (Hamill et al., 1979), including individual case-histories of infants at the top and bottom end of the NCHS weight-for-length percentiles of the median; and
(3) in relation to feeding patterns, illness experience, maternal characteristics, and environmental factors within the Kebele 11 sample. Section four outlines the conclusions.

7.1.1 Review of Anthropometric Studies of Ethiopian Children

Prior to the late 1960's, very few investigations had included anthropometric data from Ethiopian children. One of the earlier studies concerned with the nutrition of Ethiopian children reported anthropometric data from Asmara, and Addis Ababa (Woodruff and Hoerman, 1960). The study sample consisted of 77 children in three different hospitals in Addis Ababa, 13 children at the police training camp in Asmara, and 10 other children from unspecified localities in Addis Ababa - a total of 100 selected pre-school children. Woodruff and Hoerman reported that by about the age of 5-6 months, the mean weight of these children fell below the 16th percentile of the Iowa standards. This 'finding' was generally accepted as a confirmation that the growth of Ethiopian children was unsatisfactory by western standards. However, Woodruff and Hoerman presented no information concerning methods of sample selection or measurement, so their findings must be treated with caution.

It was Eksmyr (1970) who conducted the first systematic study of child-growth in Addis Ababa by means of a cross-sectional survey of 100 preschool children from privileged families, aged 4 to 60 months. He found that physical growth among this group compared well with the Harvard standard suggesting that the genetic potentiality of growth of Ethiopian children was not different from that of western European children, at least during the first five years of life. An exception to this was triceps skinfold thickness, in which the mean values for the children studied were below the British standard. Eksmyr explained this 'anthropometric discrepancy' as a possible indication of a difference in body fat distribution between Ethiopian and British children. The findings of satisfactory growth among Ethiopian children in favourable environments have been replicated by subsequent researchers.

Tafari (1972) collected cross-sectional anthropometric data from 1,114 'underprivileged' infants and children aged 3 to 36 months, attending ten Mobile Child Health Centres in Addis Ababa. All of the children were patients, and thus could be defined as 'ill'. However, the sample was selected to exclude those who had had acute illness, most notably gastro-enteritis, and those who had had weight loss in the previous month. Tafari described the children in his sample as being similar in feeding practice, socio-economic background, and disease pattern, to the majority of severely ill patients seen at the Ethio-Swedish Paediatric Clinic. No details of feeding and disease patterns were, however, provided.

Tafari's findings showed that underprivileged Ethiopian children had weight gains well below the mean for optimal values for Swedish children of the same age. However, because the exact age of the children in Tafari's sample was unknown, weight-for-length comparisons were made with the standard proposed by Jelliffe (1966), regardless of age. The results showed that, 53.9 per cent of the children scored in the normal range of weight-for-length, while as many as 33.4 per cent were within the range 81-90 per cent of the standard, i.e. above average. However, these findings were rendered less powerful by the fact that exact age was unknown, and that no account was taken of the effect of illness on the children's growth.

Belew et al. (1972) carried out anthropometric, clinical and biochemical surveys among under-11-year-olds in five different regions of the Ethiopia (including a low-income group in Addis Ababa). These researchers found inter-regional differences in anthropometry, and marked failure of growth in children above the age of 2 years, compared to Swedish children of the same age. Very few anthropometric differences were found below the age of 24 months. Belew et al. attributed the satisfactory growth of younger children to the practice of prolonged breastfeeding. However, detailed descriptions of feeding patterns for each region were not included in this study.

McKeag (1975) conducted a cross-sectional survey among predominantly low-income mothers and their children in a clinic in the small roadside town of Debarek in Gondar region. Only weight was analyzed in relation to maternal and socio-economic variables using correlation and chi-square tests of significance. Her findings showed that the better nourished infants were in the age-group 1 to 6 months. Those over 6 months showed increasing signs of protein-calorie-malnutrition with increasing age. This implies a falling-off earlier than the 24 months found in previous studies. This may be due to peculiarities of the study site - a traditional area with considerable rural influence - or weaknesses in the methods used. In addition, Mckeag reported that heavier mothers tended to have heavier children. The reason, however, was unclear. Mckeag did not examine this finding further to see whether heavier mothers gave birth to heavier children, or whether heavier mothers were able to produce more breastmilk enabling their children to grow faster, or both. McKeag's study lacked in both the strength of design and rigour of analysis required to satisfactorily address the questions it formulated at the outset.

Non-governmental agencies such as the Save the Children Fund (UK) have been collecting anthropometric data from children in the famine-prone areas of Wollo, Hararghe, Sidamo, Arsi, and northern Shoa since the mid 1970s. The aim of this exercise was to test the predictive value of 'nutritional anthropometry' as an early indicator of famine. Their methods have been modified several times over the years. In recent years, cluster surveys of randomly chosen villages in which cross-sectional data are collected from children under 5 are undertaken every 4 months. In addition, there is continuous monitoring of random samples of children in selected Farmers' Associations (FAs), in which a series of cross-sectional data are collected every month from a random sample of about 50 children per FA. Weight-for-length (WFL) as a percentile of a 'smoothed' version of the NCHS data is calculated for each child every month and compared to that child's WFL for the previous month. These data have been analyzed in conjunction with data on climate, livestock and grain prices in order to see if nutritional status was correlated with socio-economic measures of distress, and whether it is useful to invest in anthropometry for famine early warning systems (D'Souza, 1989). Although no useful associations were found between anthropometry and socio-economic indicators, D'Souza recommended that the use of anthropometry be continued, despite the fact that it is 'expensive and prone to observer error' (p. 54). D'Souza emphasized the need to rigorously process socio-economic data collected from local informants in order to get a more accurate picture of the degree of crisis. It is interesting to note that the mean WFL for these children in very poor famine-prone regions was above the 90th percentile.

Groenowold and Tilahun (1990) conducted a retrospective study of hospitalized children in Addis Ababa between birth and five years. Using the Harvard and Iowa tables as standards, they found no significant differences in weight-for-age between those who came from rural areas and those who came from Addis Ababa. Socio-economic factors such as level of household income and father's occupation showed significant negative associations with the child's weight-for-age and weight-for-height. Similarly, the last closed birth interval and maternal age showed significant negative associations with the anthropometric indices of nutritional state. These researchers reported that children with normal nutritional status and those with mild levels of malnutrition on admission to hospital had better chances of survival than those who were already malnourished. A positive relationship between the degree of malnutrition and the risk of mortality in respiratory disease patients was reported.

In summary, previous studies have shown that under optimal conditions, the growth performance of Ethiopian children compares well with western standards. Genetic factors are therefore ruled out as possible reasons for growth retardation. In poor quality environments, as studies of urban underprivileged and rural children have shown, Ethiopian children grow at an initial rate comparable to that of western children up to the age of about 24 months, whereafter they grow more slowly. However, precise relationships between environmental and growth variables remain obscure. This is not dissimilar to what is found in predominantly breastfed infants in other less developed, and even in developed countries (see Chapter 1).

7.1.2 Study Rationale

Physical growth is one of the most useful indicators of infant health. Anthropometric indices such as body weight are used in determining the viability of the infant at birth and throughout infancy and childhood. Infants that are small-for-gestational-age (SGA) remain smaller, on average, than infants with normal birth weights, throughout infancy and early childhood (Cruise, 1973; Fitzhardinghe and Steven, 1972; Garn et al., 1979). SGA infants also seem to be more at risk of death in the period of infancy (Morley et al., 1968; Antrobus, 1971). However, in many field studies in less-developed countries, reliable birth weight data are difficult to obtain. This is because many births take place in the home, where the weighing of the neonate is not a common practice. National figures of the average birth weight are usually calculated from hospital records, even though those born in hospital may not be representative of the population at large. In Addis Ababa, birth weights of full-term infants born in hospitals have averaged about 3.1 kg in recent years (Naeye and Tafari, 1985). This compares well with figures from developed countries.

Previous studies have not looked at growth increment in relation to a full range of feeding, maternal, and environmental variables. Individual cases have not been examined, and no estimates of measurement error have been made. This study proposes to explore the growth of Ethiopian infants in urban low-income households by taking into account all of these factors.

7.2 Subjects and Methods

Data on birth-weight were available for only 10 infants in the *Kebele* 11 sample. Nine of these were born in hospital and the mothers had kept the cards containing details of the newborn baby. One baby boy, born during the study, was weighed by the investigator soon after birth (before feeding began). Mean birth weight for these ten infants amounted to 3.23 ($\pm$ 0.41) kg. The range was 2.5 to 3.8 kg, with two infants weighing below 3 kg at birth. It is not known how many of the *Kebele* 11 sample were SGA infants since no data on gestational age are available, and birth weights are unknown for the majority of infants.

Anthropometric measurements were taken from a total of 113 infants during monthly visits to the home. Measurements were taken at intervals of 29 $\pm$ 2 days, at more or less the same time of the day. Infants were weighed in the nude, using a portable spring balance with harnesses accurate to 0.01 kg. Weight was recorded to the nearest 0.1 kg. In some instances where it was not possible to undress the infant, clothing items similar to the ones worn at the time were weighed separately and their weight deducted from the total weight. The scale was regularly checked against an object of known weight, according to standard field methods (UNICEF, 1986). No attempt was made to ascertain whether the infants were weighed before or after feeding, because there was no fixed feeding schedule (see Chapter 3).

Exact birth dates were obtained from each infant's vaccination card (see Appendix V) and re-checked with the mother's report. While all infants were weighed irrespective of age, other anthropometric measurements were taken only when the infant reached the age of 3 months. This was because younger infants tended to curl up, so that accurate measurements of length were difficult if not impossible. From the age of 3 months onwards, one could stretch the infant's legs in order to measure and record the recumbent length. There is one exception: it was found upon re-checking that one baby girl was 2 months old when she was first measured for length.

A wooden measuring board with parallel tape measures fixed on each side, a fixed headboard, and a sliding foot-piece, was used for measuring supine-length. This equipment was locally made from lightweight wood to make it easier to carry. Supine-length was recorded to the nearest 0.1 cm.

Mid-upper-arm circumference was measured using an insertion tape measure and recorded to the nearest 0.5 cm. Triceps and sub-scapular skinfold thicknesses were measured using a Holtain Tanner Whitehouse calliper, and recorded to the nearest 0.2 cm. All measurements were taken by the investigator and one assistant, following the techniques outlined in the IBP handbook (Weiner and Lourie, 1981).

7.2.1 Assessment of Measurement Error

Anthropometric studies that report data on measurement error are rare. In this study, measurement error for supine-length was estimated by 8 repeat measurements of 10 infants taken on the same day. These were carried out in the field conditions of Kebele 13 (see Appendix I), prior to the start of data collection in Kebele 11, while practising the technique of measuring supine-length with the assistant who accompanied the researcher during the entire period of data collection. The measurement error variance was 0.021 cm^2.

7.2.2 Analytical Methods

Repeated measures of body weight and supine-length were analyzed. Other anthropometric measurements, namely, mid-upper-arm circumference and the skinfold thicknesses were not included in the analysis because the latter were considered to be more prone to measurement error (which was not estimated), and the former does not tell us anything that weight and supine-length do not.

The analysis is divided into three major parts. The first part compares the Kebele 11 data with Tafari's data (1972) from underprivileged children in Addis Ababa. The second major part compares the Kebele 11 data with the NCHS reference data. This was carried out despite the recognition that these reference data are, strictly speaking, inappropriate to serve as reference for predominantly breastfed infants (see Chapter 1). The point of the exercise was to make the Kebele 11 data comparable to other anthropometric studies of predominantly breastfed infants in which the NCHS reference data have been used.

As stated in Chapter 1, the NCHS data were put together from various data sets, and claim to reflect the growth of healthy American children of all ethnicities. The data for infants and young children (from 0 to 36 months) were supplied by the Fels Research Institute in Ohio from a longitudinal study of relatively small numbers of infants who were predominantly bottle-fed. Hamill et al. (1979) do not provide detailed descriptions of how the data were collected, and whether or not they are normally distributed. In the adoption of the NCHS data by the WHO for international use, the assumption has been made that the data are normally distributed, so that the 50th percentile is the same as the median. The mean corresponds to the median, and plus and minus one standard deviation correspond to the 90th and 10th percentiles, respectively. Plus and minus two standard deviations correspond to the 97th and the 3rd percentiles, respectively.

Many have criticized the quality and appropriateness of the NCHS data. In current relief work where anthropometry is used to monitor nutritional status and to identify individuals at risk, smoothed growth curves based on the NCHS data are used. For example, for East Africa, the Save the Children Fund (UK) uses smoothed curves that are closer to the Harvard reference data than they are to the raw NCHS data reference (Seaman, personal communication). If we are to have reference data which can be put to reliable use, we must await the results of the 'DARLING' longitudinal study which is currently compiling anthropometric data of breastfed infants living in an optimal environment (Dewey et al., 1989).

Weight-for-length percentiles were computed by entering data on weight, length, sex, and age into the CDC subroutine, a microcomputer programme that calculates the percentiles compared to the NCHS data. These were then grouped into different classes comparable to Neumann's (1979) classification, without translating them into the varying degrees of malnutrition or otherwise. One is reluctant to interpret these arbitrary categories in terms of levels of malnutrition because a lot more needs to be known besides the anthropometry of a child in order to determine whether or not that child is malnourished. For instance, a healthy child with an adequate intake of nutrients may score low on the weight-for-length or weight-for-age chart because that child is genetically thin. The child's feeding patterns and illness experience combined with anthropometric measurements and other details, such as mid-parental height, provide better grounds for evaluating the child's nutritional state. These classes or categories are thus presented without any labels of nutritional status. Infants in both higher and lower extreme categories are examined closely by looking at individual case histories of illness experience, feeding/weaning status, maternal characteristics, and the environment of the home.

The third major part analyzes the data in relation to feeding/weaning status and illness experience using within and between infants comparisons. Longitudinal anthropometric data are examined in conjunction with repeated measures of morbidity and weaning status.

Out of the total number of 113 infants studied, 78 infants (41 girls and 37 boys) had complete records of weight for the six measurement sessions. Twelve out of the 78 were under three months of age at the beginning of the study, and so they lack six complete records for all anthropometric measurements, leaving us with 66 whose records of weight and length are complete for six months. The mean age of the 66 sub-sample infants (38 girls and 28 boys) at first measurement was 10 months with a range of 2 to 19 months. This sub-sample was examined in detail in the analysis of short-term variation in stature growth (see Harrison et al., 1990).

Infants were divided into two weaning categories: those who were breastfed (both exclusively and partially) and those who had completed weaning. Analysis of variance using regression techniques was applied to examine both attained weight, length and increments of both parameters for all intervals according to the infant's weaning status. The results did not attain statistical significance -i.e., there was no difference between breastfed and weaned infants. This was probably largely due to the small sample size in the 'weaned' category (those who had terminated breastfeeding). No attempt was made to compare exclusively breastfed infants with mixed-fed infants for two reasons: (1) because the number of exclusively breastfed infants with complete anthropometric data was very small, and (2) because there was such a big age difference between the two groups, that it would not have made sense to compare attained growth or increments of growth.

Similarly, the effect of the prevalence of symptoms such as diarrhoea, coughing, fever, and vomiting was investigated using regression techniques. The analysis here was undertaken according to the following steps:

1. The sum of occurrences of symptoms over the six months of observation were calculated. That is, the scores of yes or no (1 or 0, respectively) of each symptom recorded every month were added up so that an infant with a record of 1,0,1,0,1,0, for diarrhoea has a total of 3 for diarrhoea over six months, an infant with a record of 0,0,0,0,1,1, has a total of 2, and so on.
2. Increments of weight and supine-length over the duration of the observation period (i.e. grams per six month, and centimetres per six month, respectively) were calculated.
3. Multiple linear regressions were carried out to examine the effect of illness (total score for each symptom) on the increments of weight and supine-length, taking the age factor into account (i.e. a correction for age was done in order to eliminate effects due to the associations of age and weight increment). Increment in supine-length showed no association with age. Only 52 infants could be included in these analyses.
4. An attempt was made to differentiate between infants whose score of symptoms was the same in step 3, although they may not have had the given symptom or symptoms at the same time. For example, an infant with a record of 1,0,1,0,0,0 for diarrhoea scores 2 in step 3, the same as an infant with a record of 0,0,0,0,1,1, even though their

illness experience is not the same with regards to time. In an attempt to allow for this, each infant's sum of scores of symptoms was calculated separately for the first and second half of the study. Thus the first infant in the above example scores 2 for the first part, and 0 for the second part. The second infant scores 0 for the first part and 2 for the second part of the study. In this way each infant was compared with her/himself according to 'early' experience of illness and 'late' experience of illness, and the effect that that has on the overall increment in weight and supine-length.

5. Further multiple regression analyses were carried out to examine the effect of combinations of illness experiences such as early diarrhoea and late fever, late coughing and late diarrhoea, and so on. Interaction terms were manually calculated. These were then entered in a regression model, and the most significant effects selected in a stepwise manner by backward elimination (deletion).
6. Increments of weight and supine-length over the interval of six month were examined by regressions, taking into account maternal age, birth rank, last birth-space, level of household hygiene, sanitary facilities of the home, maternal education, ethnicity and religion. Infant's weight was also examined against mother's weight each month. These analyses did not yield any significant results (see below).

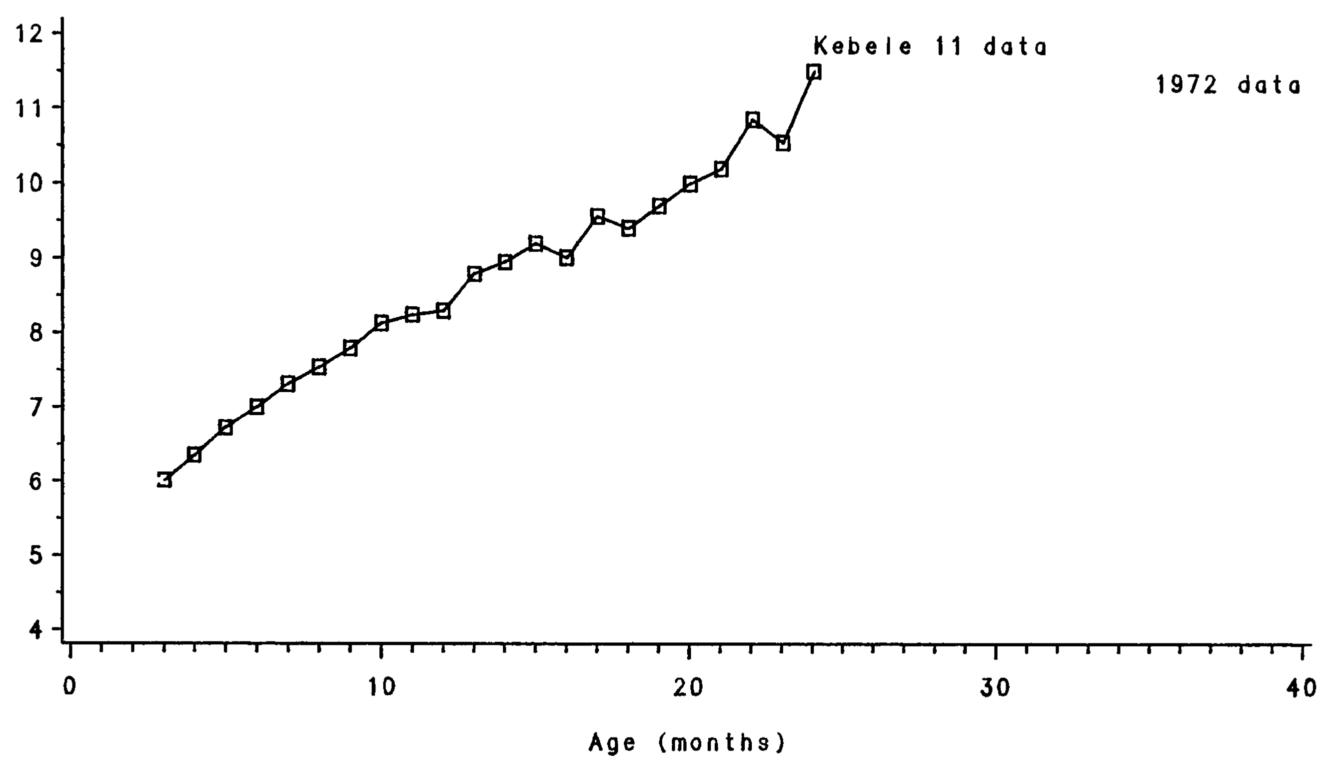
7.3 Results and Discussion

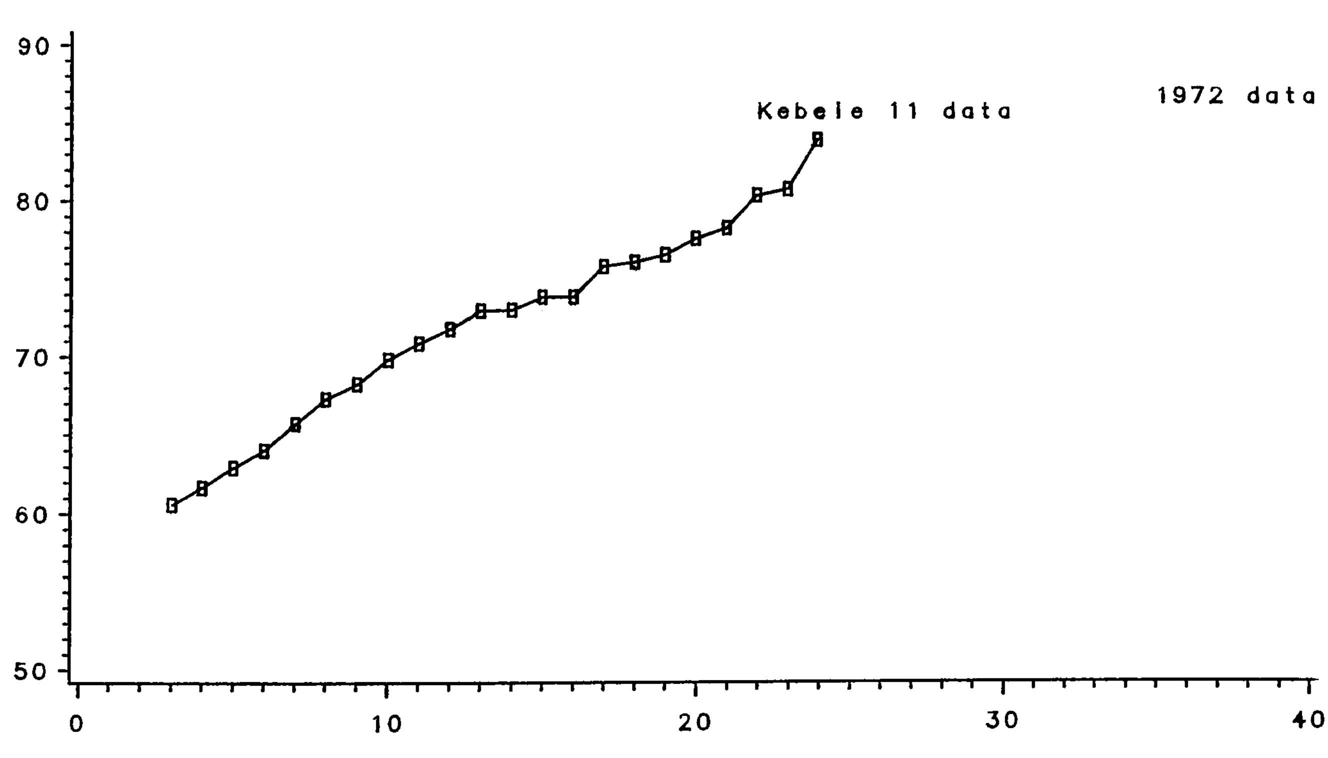
7.3.1 Comparison of Kebele 11 Data with Tafari's Data

The Kebele 11 data are compared with Tafari's data on weight and recumbent length of 1114 children who attended ten mobile child clinics in Addis Ababa, in **Figure 7.1** (see Appendix XI for the raw data). This is not a strict comparison since repeated measurements were used, and infants may be included in more than one age group. The total number of measurements from which means were calculated thus exceeds the sample size of 113

Figure 7.1 Mean Weight and Length of Kebele 11 Infants

Compared to Data from Tafari (1972)





of 113 infants. Nevertheless interesting contrasts can be made.

Kebele 11 infants are strikingly bigger than those in Tafari's sample. This may be indicative of differences in health status given that the latter were 'ill' children who attended clinics, unlike the Kebele 11 sample children who were mostly 'healthy' and were measured in their homes. The lack of accurate information on age in Tafari's sample may have contributed to these differences. It is also possible that the anthropometric status of underprivileged Ethiopian children has improved since the early 1970's on account of improved health services, particularly the success of the under-fives immunization programme in urban centres.

7.3.2 Description of Data with Reference to the NCHS Data

Table 7.1 shows weight for length percentile distribution of the sub-sample of 66 infants with complete records, by month. When serial measurements of each infant are examined, we find that infants cross and re-cross these arbitrary boundaries during the course of six months of observation. This may be due to catch-up/slow-down processes in growth performance whereby infants arrive at a given attained weight via a variety of routes.

It is apparent from **Table 7.1** that the majority of the infants were progressively getting thinner. This pattern is clear among those in the 75-90 percentile category with numbers decreasing from 15 in month one, to 6 in month six. In months three to six, the number in the less than 5 percentile category rises to 7. This finding supports the observations stated in previous chapters that the environment was progressively deteriorating during the study period. In terms of household food consumption, the trend was a gradual decline from months one and two to six, with two brief rises in January (month 3) and April (month 6). This may be related to the religious feasts of Ethiopian Christmas and Easter when relatively more food of high quality is consumed in Christian

Table 7.1

Weight for Length Percentile Distribution of Sample Infants (N=66).

	Month											
	Nov.		Dec.		Jan.		Feb.		Mar.		Apr.	
Wt/Ln Percentile	N	%	N	%	N	%	N	%	N	%	N	%
< 5	3	4.5	4	6.0	1	1.5	7	10.6	7	10.6	7	10.6
5 - 10	2	3.3	1	1.5	6	9.1	2	3.0	4	6.0	3	4.5
10 - 25	9	13.6	11	16.7	13	19.7	11	16.7	14	21.2	13	19.7
25 - 75	28	42.4	35	53.0	33	50.0	37	56.1	33	50.0	34	51.5
75 - 90	15	22.7	8	12.1	8	12.1	6	9.1	7	10.6	6	9.1
90 - 95	4	6.0	4	6.0	3	4.5	2	3.0	0	0.0	1	1.5
> 95	5	7.5	3	4.5	2	3.0	1	1.5	1	1.5	2	3.5

households (majority of the sample). The implication of this for the predominantly breastfed infants is that either (1) the supply of breastmilk will increase due to the mothers' improved diet, or (2) a greater variety of weaning foods will be provided. The effect of the first festive eating is however very short-lived because the 'Big Fast' of Lent follows within a matter of weeks, wherein the diet remains poor and limited (see Chapter 5).

It is interesting to look at the mean weight-for-length percentile of the sample infants by month (**Table 7.2**). While the mean drops sharply during the six months for boys, it seems to fluctuate for girls. When the sexes are combined, the pattern is one of a gradual decline with a slight modulation in April, possibly on account of the feast after Lent (longest fasting period).

Table 7.2 Mean weight-for-length percentile of sample infants by month.

		Mean weight-for-length percentile					
Sex	N	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
boys	28	68.92	59.15	47.05	40.28	29.27	31.93
girls	38	47.58	43.40	50.31	35.22	37.03	42.64
both	66	57.08	51.28	49.37	38.96	34.72	37.95

7.3.2.1 Case Histories of Infants who scored below the 5th Percentile

Eight infants out of the 66 scored less than the 5th percentile of the NCHS data at least once during the study period. Plots of weight-for-length percentile on age over the six-month study period for each of these infants are presented in **Figure 7.2**. The infants' identity has been concealed under pseudonyms in order to preserve the confidentiality of data in the following description of individual details.

Figure 7.2 Infants who scored < 5 Weight-for-length percentile of the NCHS reference median

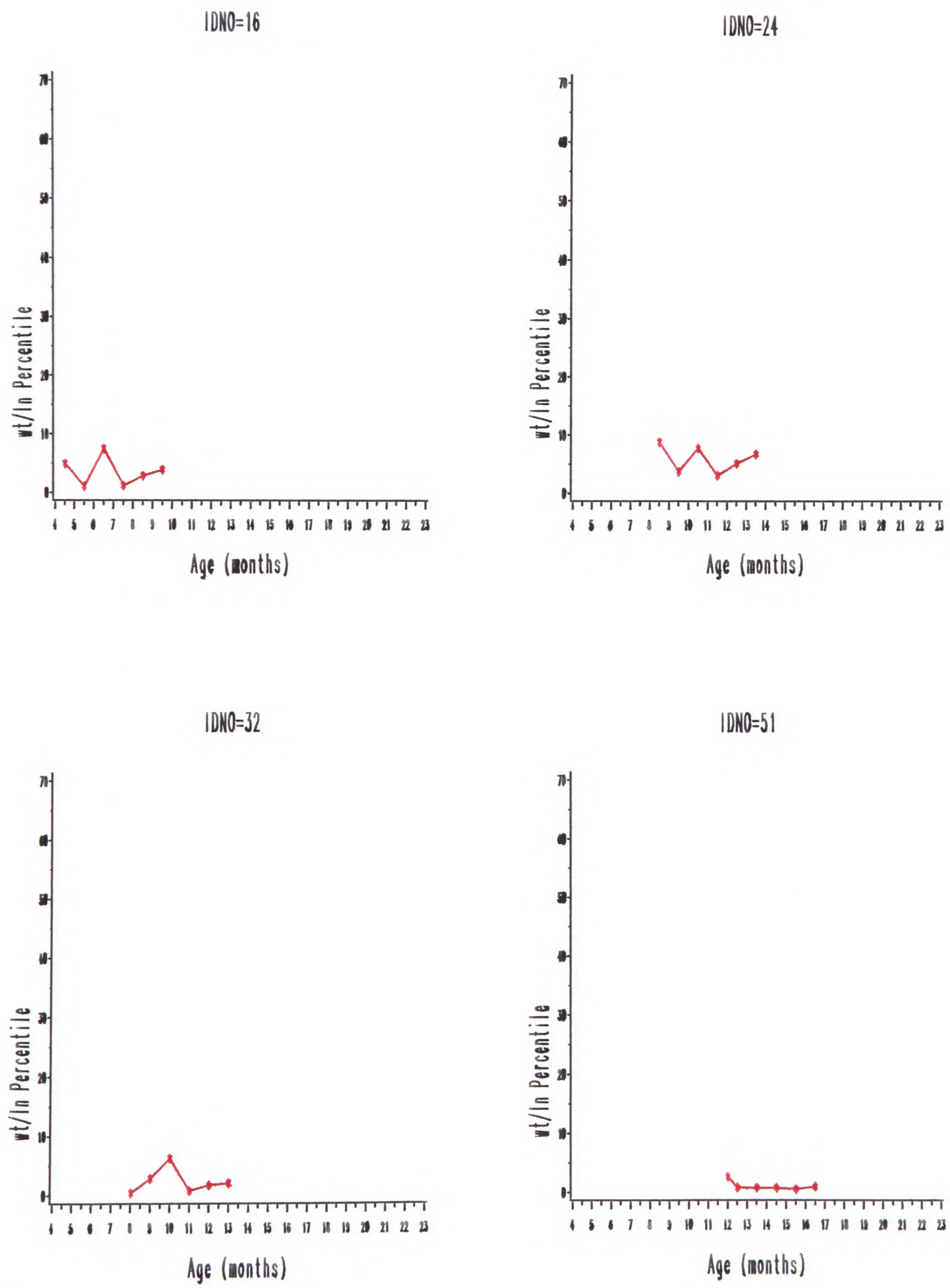
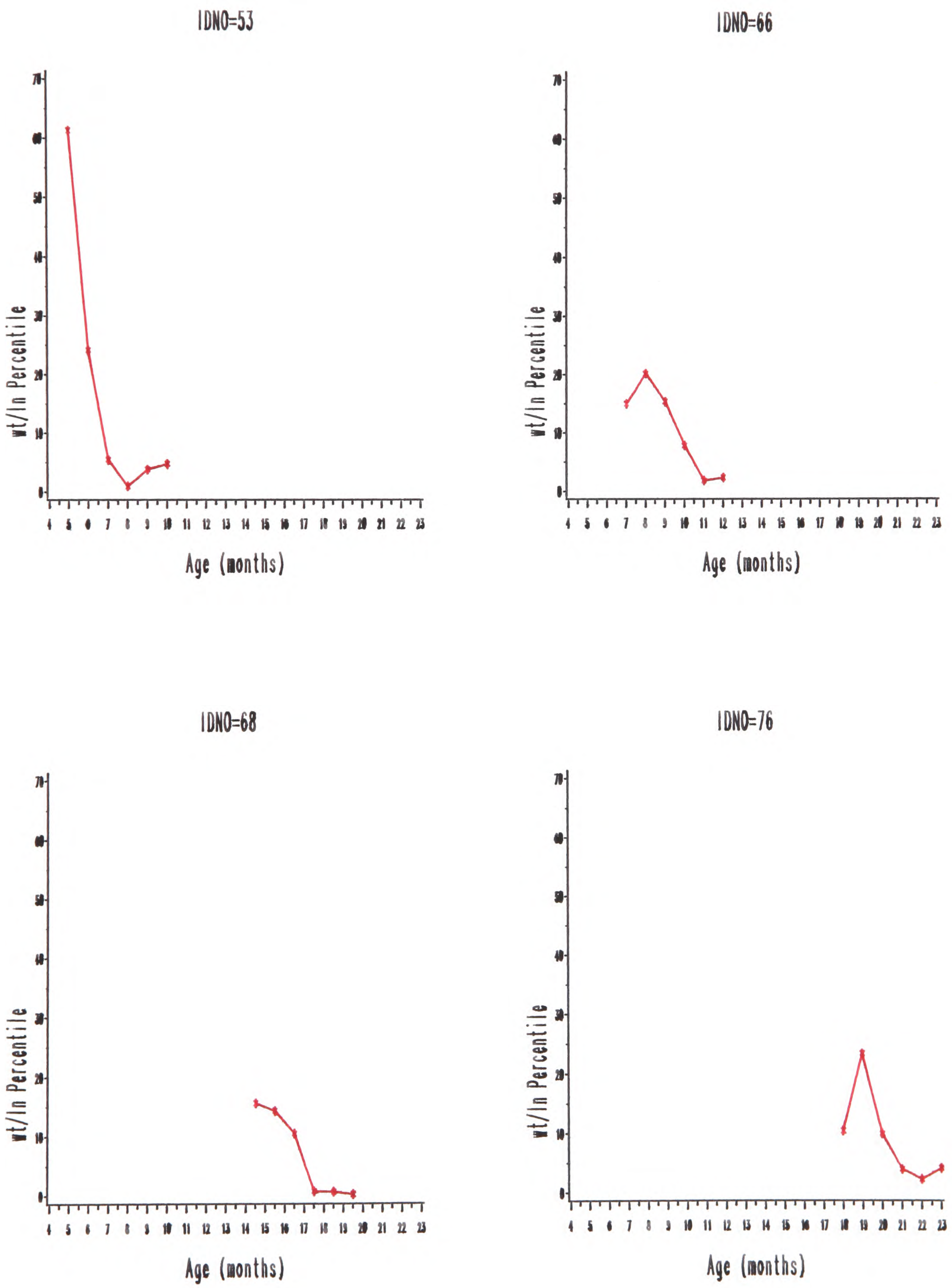


Figure 7.2 (Continued)



Case 1 (IDNO 16)

Alemnesh, a girl aged 4.5 months at the beginning of the study, was fragile-looking and very quiet when observed. She was born in a nearby village in Shoa, to a 16 year old mother. Soon after birth, one of her mother's sisters adopted her. Alemnesh was never breastfed. Her daily diet consisted of diluted cow's milk and atmit, a barley pap. Alemnesh had a poor appetite, and her adopted mother did not try to entice her to consume more by adding variety to the food. This infant was hardly ever ill, according to her adopted mother's reports. It may be that the adopted mother failed to notice it when Alemnesh was ill. Alemnesh's weight-for-length percentile fluctuated between 4.9 and 7.5 in November and January, respectively, with values as low as 1.1 and 1.2 in December and February, respectively.

Case 2 (IDNO 24)

Abebe was a boy of 8.5 months at the beginning of the study. He was introduced to weaning foods at 10 months of age, and was still being breastfed until data collection ended. Abebe was a second child to a 30 year-old mother. There was a birth-interval of 22 months between Abebe and his older brother. Abebe was irritable and cried ceaselessly during weighing and measuring sessions. During the last month of observation he was suffering from a skin rash that made him even more temperamental. His daily weaning diet consisted of food from the 'family pot', with occasional additions of eggs and oranges. His appetite was reported to be good. Nevertheless, Abebe's weight-for-length percentile remained low throughout the study period, falling below the 5th centile in December and February when he was reported to have had mild diarrhoea and vomiting. His mother, an Oromo Christian, was a recent migrant to the city, married to a man from her village who had lived in Addis Ababa for a longer period than she had. This household shared a pit-latrine with 5 other households in the compound. Household waste was regularly collected and burned. The mother was healthy, and scored well on hygiene.

Case 3 (IDNO 32)

Aynalem, a girl aged 8 months at the beginning of the study, was the fifth child to a 28 year-old mother. The last birth interval was 13 months. Aynalem was abruptly weaned just when observations began. The mother stopped breastfeeding due to a new pregnancy, whereupon Aynalem was fed on cow's milk and atmit for the first time. She rejected her new diet at first, and was thus force fed. No illnesses were reported during the study period. However, Aynalem's performance on the weight-for-length percentile chart remained low, dropping to 0.5 and 0.9 in November and February, respectively. Aynalem's father and mother are both Amhara Christian, who had lived in Addis Ababa for more than 10 years.

Case 4 (IDNO 51)

Amsalech, a 12 month-old girl, had wrinkles on her face and body at the beginning of the study. She was the second child to a 35 year-old mother. The last birth interval was 60 months. Amsalech was introduced to atmit and injera when breastfeeding stopped at the age of 14 months. Her mother reported that her breastmilk supply had been very little from the start, but she breastfed exclusively for 14 months. At this delayed introduction, Amsalech did not accept her weaning foods readily, and was therefore force fed every time. She was often ill with fever and persistent coughing, but not with diarrhoea. She remained significantly below the 5th weight-for-length percentile throughout the period of observation. She had no primary teeth until the age of 16.5 months, when data collection ended. Her parents were both recent migrants to Addis Ababa. The household had no toilet facility: the bank of the river nearby was used both as a toilet and a rubbish dump.

Case 5 (IDNO 53)

Belayneh was a 5 month-old boy at the beginning of the study. He is the eighth child to a 43 year-old mother. The last birth interval was 19 months. Belayneh was breastfed throughout the study period, weaning foods including cow's milk, atmit, potatoes, and eggs having been introduced when he was 9 months old. He usually had a good appetite, and if he refused to eat, his mother would try altering the type of weaning food. He was reported to be ill with severe diarrhoea, accompanied by intermittent fever, and vomiting in December and January when his weight-for-length percentile plummeted sharply from 61.2 in November to 5.5 in January. A further drop to 0.9 occurred in February, although his mother reported that his health had improved by then. Belayneh's parents, both Amhara Christians, had lived in Addis Ababa for more than ten years.

Case 6 (IDNO 66)

Murida was a girl of 7 months at the beginning of the study. Murida is the sixth child of a 32 year-old mother. She was exclusively breastfed until 9 months of age, although her mother's breastmilk supply was consistently low. At 9 months, Murida's diet was supplemented by solids such as gotcho (ensete bread crumbled with cottage cheese), injera and wät from the 'family pot'. Murida refused to eat these foods, and her mother did not try and change these weaning foods, or their presentation. From January onwards (when supplementation began), Murida was intermittently ill with diarrhoea, fever, coughing, and vomiting. This coincided with a consistent decline in her weight-for-length percentile, falling to 1.9 in March. Murida's mother, a Gurage Moslem, was a widow who had recently migrated to Addis Ababa.

Case 7 (IDNO 68)

Atnafu was a boy aged 14.5 months at the beginning of the study. His mother, a 17 year-old schoolgirl died during a hospital delivery. Atnafu was looked after by his maternal grandmother. He had never been breastfed. He was fed on atmit, ajja, injera, shiro wät, and potatoes. On several occasions, his grandmother reported that Atnafu's appetite was poor. She did not however, try to alter his food or to force feed him. Atnafu's performance on the weight-for-length chart deteriorated to the extremely low levels of 0.8, 0.7, and 0.3 during the last three months of observation, but no illnesses were reported. This may be because his grandmother was not observant enough. There was no toilet facility in the house, and rubbish was dumped over the nearby cliffs.

Case 8 (IDNO 76)

Bizunesh, was a girl of 18 months at the beginning of the study. She was the second child of a 25 year old mother. The last birth interval was 30 months. Bizunesh was still being breastfed although she had been introduced to solids at 12 months of age. Her weaning foods consisted of small portions of food from the 'family pot', which she usually refused to take. Her mother, did not try to entice her to eat more, or different types of weaning food. She was intermittently ill with fever, coughing, diarrhoea, and vomiting. Bizunesh's mother, a Gurage Christian who had lived in Addis Ababa for over ten years, was engaged in seasonal work, consisting of coffee picking in the southern provinces for stretches of 4 to 12 weeks at a time. At this time, Bizunesh and her older brother were looked after by neighbours.

An infant who falls below the 5th percentile of weight-for-length is a cause for concern in medical and nutritional terms. This category is usually labelled 'severe protein-energy-malnutrition (PEM)', although strictly speaking, such a diagnosis requires a clinical examination as well. The age of infants in this category ranges from 4.5 to 18 months. They were all exclusively breastfed up to 8 months or more with the exception of the two adopted infants (Cases 2 and 7). Five out of the eight cases had poor appetites for the basic weaning foods that were introduced late. The immediate causes of growth failure include abrupt weaning, inadequacy of weaning foods, prevalence of infections (that may have not been always reported as with the case of adopted infants), absence of the mother (implying lack of care), and poor household hygiene. These factors may operate in concert to hamper the infant's growth, or they may act in isolation in different individuals.

7.3.2.2 Case Histories of Infants above the 95th Percentile

Seven infants out of the 66 scored above the 95th centile at least once during the study period. Plots of weight-for-length percentile curves for each case are presented in **Figure 7.3**.

Case 1 (IDNO 23)

Kebede was a 6 month old boy at the beginning of the study. The third child to a 26 year-old mother, he looked healthy and bouncy, and displayed a happy disposition throughout. The last birth-interval was 16 months. Kebede was exclusively breastfed for the first 8.5 months, after which weaning foods, including atmit and ajja were introduced to his diet. He accepted these foods willingly, and he was never ill throughout the study period. His mother scored well on hygiene.

Case 2 (IDNO 43)

Jemal was a boy of 6.5 months at the beginning of the study. He was the fifth child to a 22 year-old mother. Jemal's mother had lost two children, a new-born baby girl, and a boy of two months, before Jemal. The last birth-interval was 18 months. Jemal was exclusively breastfed until the age of 7.5 months when cow's milk was introduced to supplement his

Figure 7.3 Infants who scored > 95 Weight-for-length percentile of the NCHS reference median

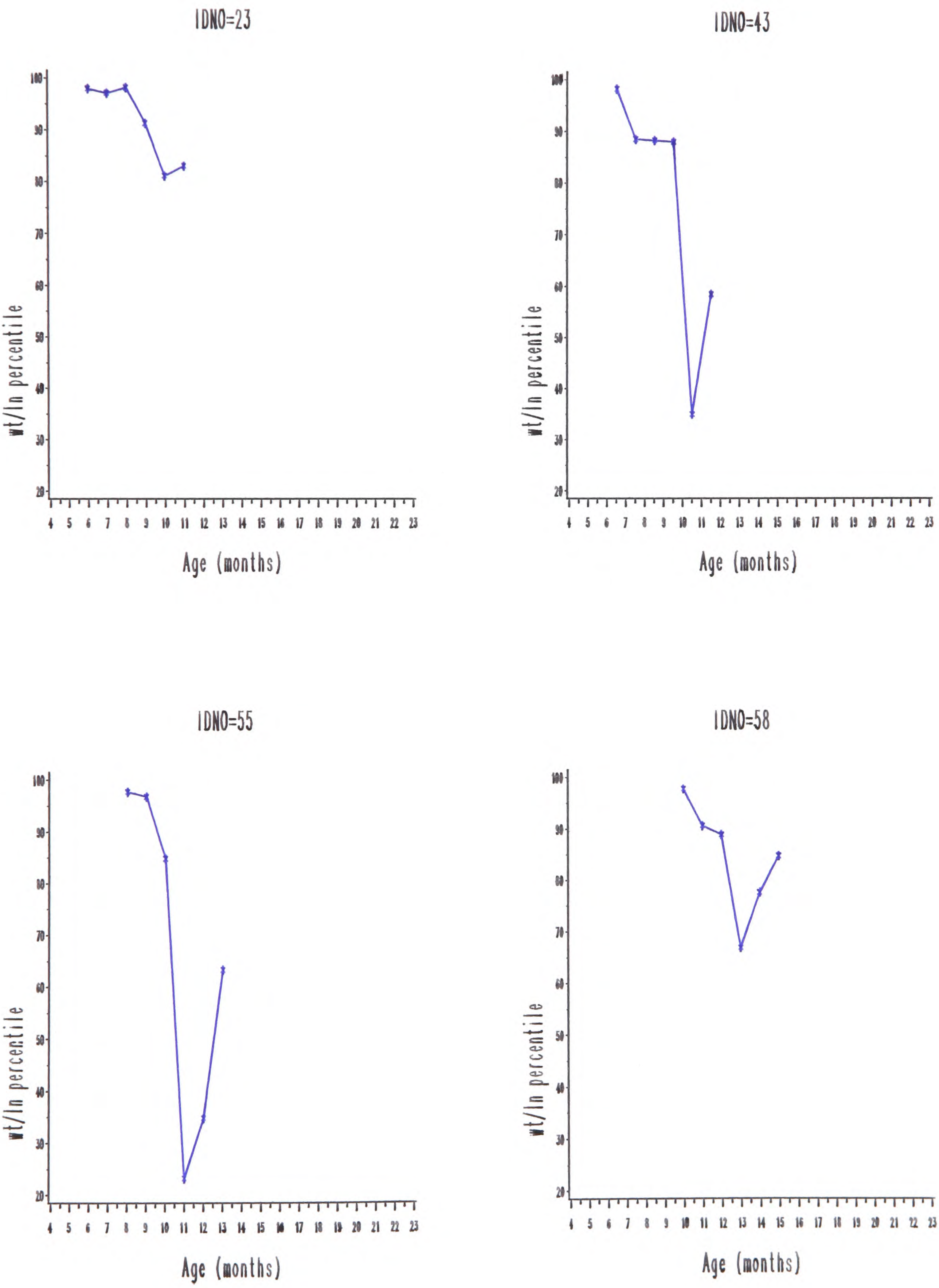
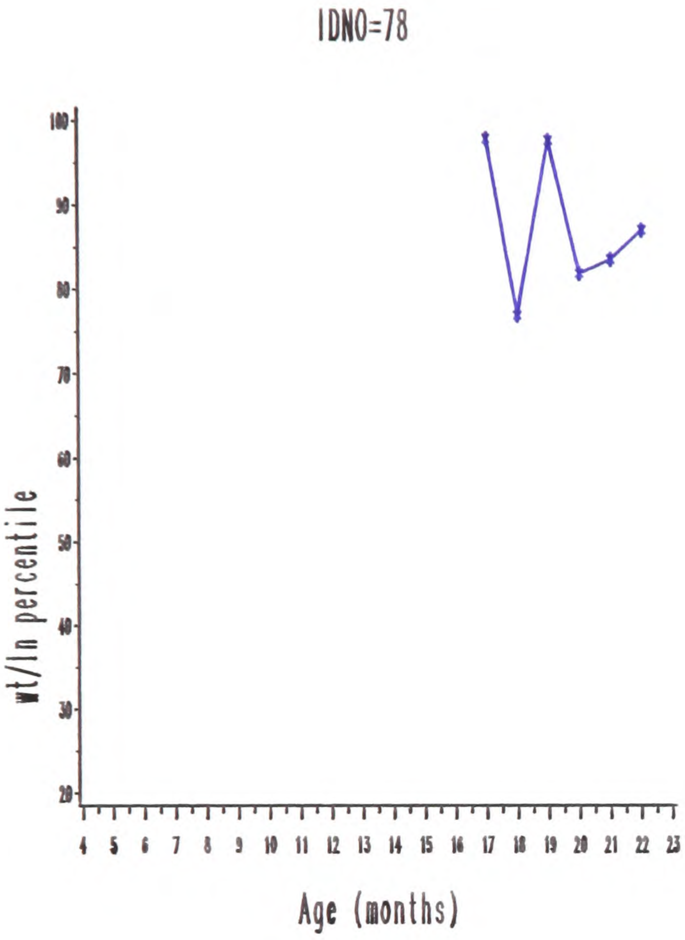
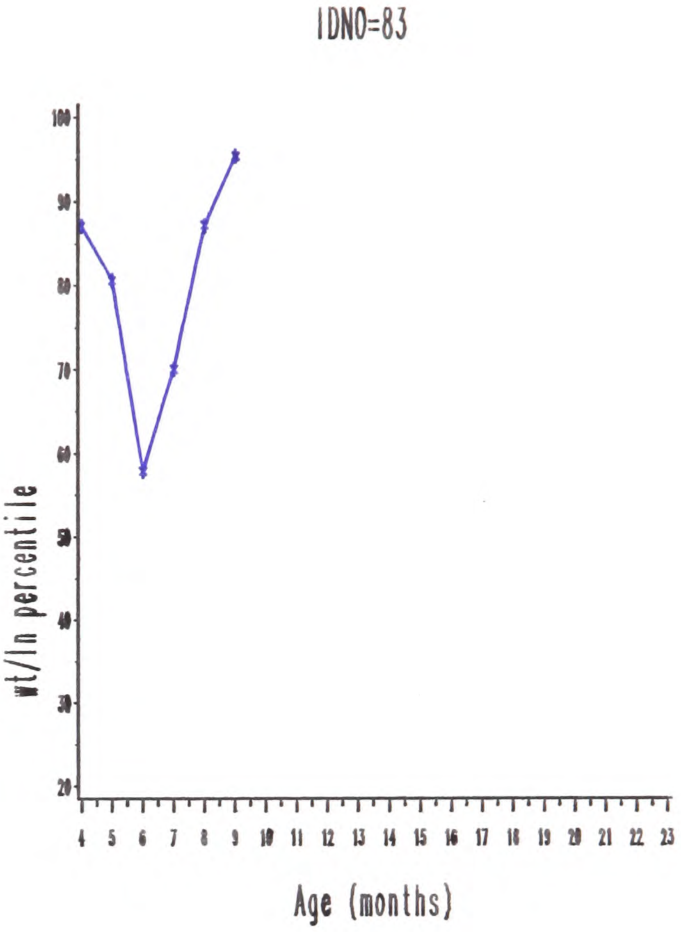
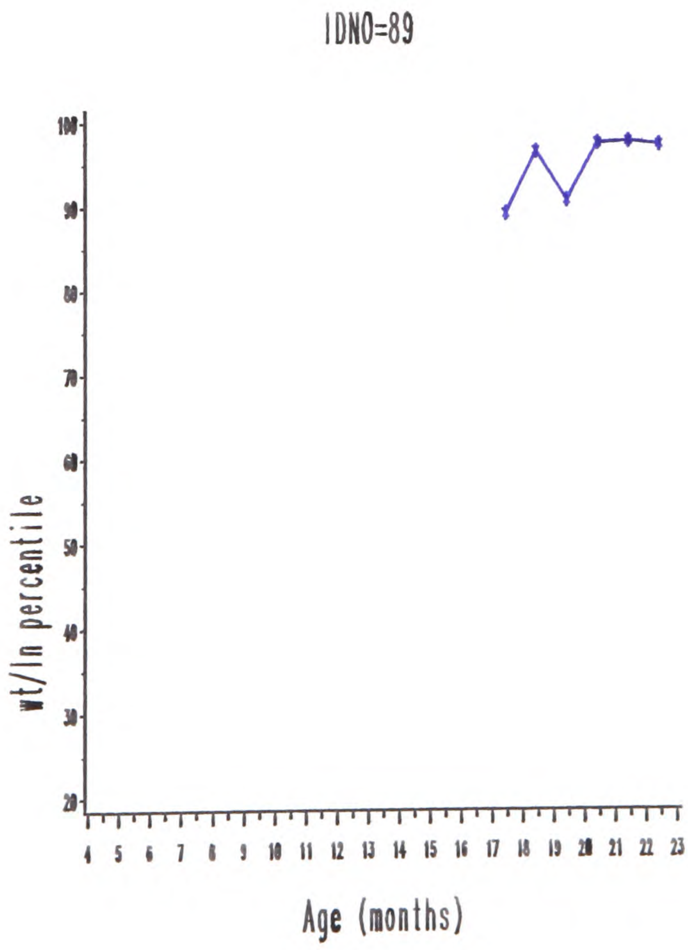


Figure 7.3 (Continued)







diet of breastmilk. His parents, Gurage Moslems, had lived in Addis Ababa over 15 years. Jemal was seldom ill. The household had a private pit latrine. Waste was disposed of in the river, otherwise, Jemal's mother's hygiene was rated very high.

Case 3 (IDNO 55)

Yenienesh was a girl aged 8 months at the beginning of the study. She was the fourth child to a 31 year-old mother. The last closed birth-interval was 15 months. Yenienesh was never breastfed because her mother could not initiate suckling. Yenienesh was fed on cow's milk and atmit from the beginning. When she was 4 months old, ajja was added to her diet on a regular basis. Yenienesh was intermittently ill with diarrhoea, fever, coughing, and vomiting during the study period, with a severe bout of diarrhoea in February when her weight-for-length percentile plummeted from 84.5 to 23.1. Complete loss of appetite was reported at this period. Yenienesh's mother suffered from Ye-menfäs chinquet ('oppression of the soul').

Case 4 (IDNO 58)

Emebet, a 10 month old girl was happy and healthy-looking with a lively disposition at the start of observation. She was the third child to a 37 year-old mother. The last closed birth-interval was 72 months. Emebet was exclusively breastfed until the age of 11 months when her mother became ill with stomach ulcers, reducing her milk supply. Her mother then decided to introduce cow's milk to her infant's diet. A month later, the mother gave-up breastfeeding completely. Emebet became ill with persistent fever and vomiting in February, when her weight-for-length percentile dropped from 88.9 to 66.8, However, she was soon on the road to recovery, rising to 77.6 and 84.8 percentiles in March and April, respectively. Emebet was born into a Gurage Christian household. The parents had lived in Addis Ababa for over 20 years. The mother's standard of hygiene was rated very good.

Case 5 (IDNO 78)

Almaz was an irritable 17 month-old girl at the beginning of the study. She was the thirteenth child to a 39 year-old mother. The last birth-interval was 12 months. Almaz had been introduced to weaning foods such as cow's milk, potatoes and eggs at the age of 5 months. By the end of data collection period, she had almost a full complement of primary teeth, but was still being breastfed. Her mother, a Gurage Christian, who had recently migrated to Addis Ababa, complained of Ye-menfäs chinquet ('oppression of the soul') and a 'weak heart'. Almaz was hardly ever ill. Her mother scored poorly on hygiene.

Case 6 (IDNO 83)

Mintewab, a girl aged 4 months at the beginning of the study, was exclusively breastfed throughout. Her mother, primiparous, aged 18, had lived in Addis Ababa for over 10 years. Mintewab was hardly ever ill.

Case 7 (IDNO 89)

Dawit, a boy aged 17.5 months at the beginning of the study, was exclusively breastfed until 4 months of age. He was then introduced to cow's milk, Faffa, eggs, vegetables, and injera. His mother, primiparous, aged 27, was a full-time employee in an office (a secretary), who continued breastfeeding until Dawit was 9 months old. Breastfeeding was terminated due to breastmilk insufficiency. Dawit ate his weaning foods willingly and had a good appetite. Dawit's parents, Gurage Christian, had lived in Addis Ababa for over 10 years. Dawit was looked after by a resident maid while his mother was at work. The standard of hygiene was rated high.

These infants also vary in age, ranging from 4 to 17.5 months. They were all exclusively breastfed for at least 4 months, with one exception (Case 3) who was not breastfed at all. Weaning foods were introduced late in some cases (e.g., Cases 1 and 2) without any ill effects. The quality of the home environment in terms of hygiene may have prevented infection in these cases. These infants were weaned gradually with the exception of one (Case 4) who was weaned abruptly. These cases again highlight variability in growth performance. As in the cases at the lower end of the scale discussed in the preceding section, these infants have attained high scores in the NCHS reference data for weight-for-length through a variety of routes. High birth rank, and short birth intervals may not in themselves be detrimental to the child if appropriate weaning foods are provided and the micro-environment is infection-free, but other factors hitherto unknown might also be at work (cf. Cases 3 and 5 in Section 7.3.2.1 with Cases 2 and 5 in this Section). These findings are consonant with those of Zeitlin and Ghassemi (1986) on 'positive deviance' - the phenomenon of children whose nutritional status remains above average, and are healthy despite pervasive malnutrition in their communities.

The study of individual cases demonstrates that it is important to study each case carefully before translating anthropometry into levels of malnourishment, although anthropometry may often prove to be an approximate guide.

7.3.3 The Kebele 11 Growth Data

Relationships between weight and age were investigated in the first sub-sample of 78 infants with six complete records of weight. There was a highly significant correlation between weight and age. Plots of weight on age for each month (November to April), differentiated by sex, showed no significant sex differences. Similarly, monthly increments of weight showed no significant sex differences.

Among the second sub-sample of 66 infants with complete anthropometric records, weight and supine-length increments for 1, 2, 3, 4 and 5 monthly intervals showed that the variance is most pronounced in the one monthly intervals, less so in the bi-monthly intervals, and goes on decreasing as the measurement interval increases. The decrease in variance in both weight and supine-length, as measurement interval increased, is indicative of a levelling-off effect of time as short-term variances are ironed out in the long-term. In other words, short-term variation due to environmental stresses, catch-up and slow-down processes, measurement error (found to be very small in this study), or a combination of these, disappears in the long-term.

The use of variance in growth as a measure of the quality of the environment is important. It has been shown elsewhere that short-term variances were higher in the Kebele 11 sample infants compared to those of a sample of Oxford infants. The assumption was made that the Oxford infants were living in optimal environmental conditions, while the Addis Ababa infants were responding to environmental 'insults' (Harrison *et al*., 1990). The following sections propose to examine some of these environmental insults.

7.3.3.1 Weaning and Growth

Increments of supine-length over one-month and two-month intervals immediately before and after the initiation and completion of weaning were examined. 44 infants were included in the first part of the analysis, looking at the introduction of weaning foods, and 6 in the second stage, looking at the termination of breastfeeding. The results showed no significant differences in the that mean increments of weight and supine-length in both cases. Analysis of the effect of the termination of breastfeeding was constrained by the small sample size: only six infants with complete anthropometric data had completed weaning.

7.3.3.2 Illness and Growth

Analysis of variance using increments of weight (grammes per six months) and supine-length (centimetres per six months) over the total period of six months yielded the results presented in **Tables 7.3** and **7.4**.

Table 7.3 shows that relative weight deficits, in grammes, of 254.84, 191.91, 159.14, and 74.82 over the period of six months were incurred when fever, diarrhoea, coughing, and all symptoms were present, respectively ($p < 0.001$). The presence of fever accounts for 38 per cent of the variation in six monthly weight increments. This finding is supported by the significant association found between infant's appetite and fever (see Chapter 6). The presence of fever inhibited the consumption of food, thereby causing the loss of weight. In extreme cases such as measles (which was not prevalent in the sample, due to the effect of immunization) fever is associated with anorexia (Aaby, 1988).

Table 7.3
Regression Equations for Six-monthly Increment in Weight (N=52).

Rgr	Variable	b	t	p <	r^2	p <
1	fever	-254.84	-2.76	**0.008**	0.38	**0.001**
	age	-118.52	-5.26	**0.001**		
	intercept	3280.51	8.75	**0.001**		
2	diarrhoea	-191.91	-2.18	**0.034**	0.35	**0.001**
	age	-109.32	-4.80	**0.001**		
	intercept	3020.52	8.57	**0.001**		
3	coughing	-159.14	-2.01	**0.050**	0.34	**0.001**
	age	-107.11	-4.68	**0.001**		
	intercept	3007.37	8.44	**0.001**		
4	vomiting	-29.27	-0.23	n.s.	0.29	**0.001**
	age	-107.70	-4.52	**0.001**		
	intercept	2770.62	7.55	**0.001**		
5	all symptoms	-74.82	-2.42	**0.019**	0.38	**0.001**
	age	-110.56	-5.06	**0.001**		
	intercept	2653.83	9.39	**0.001**		

Regression Equation $y = a + bx$ where a = intercept
and b = estimate

Presence of diarrhoea could explain 35 per cent of the variation in weight increment, and presence of coughing could explain 34 per cent of the variation. Vomiting on its own had no significant effect on the increment of body weight, however, when all four symptoms are considered together, 38 per cent of the variation could be explained.

None of the four symptoms (considered separately, or together) seemed to have a significant effect on the six-monthly increment of supine-length (see **Table 7.4**).

Table 7.4
Regression Equations for Six-monthly Increment in Supine-length (N=52).

Rgr	Variable	b	t	p <	r^2	p <
1	fever	0.15	0.57	n.s.	0.02	n.s.
	age	-0.03	-0.38	n.s.		
	intercept	5.92	4.48	**0.001**		
2	diarrhoea	-0.06	-0.24	n.s.	0.01	n.s.
	age	-0.05	-0.63	n.s.		
	intercept	6.48	5.42	**0.001**		
3	coughing	-0.12	-0.56	n.s.	0.02	n.s.
	age	-0.04	-0.63	n.s.		
	intercept	6.58	5.73	**0.001**		
4	vomiting	-0.02	-0.06	n.s.	0.01	n.s.
	age	-0.04	-0.60	n.s.		
	intercept	6.37	5.65	**0.001**		
5	all symptoms*	-0.01	-0.12	n.s.	0.01	n.s.
	age	-0.04	-0.62	n.s.		
	intercept	6.22	6.55	**0.001**		

* N=45
n.s. = not significant.

While it is not surprising that weight is a more sensitive index of the short-term effect of illness on growth, and increment in supine-length may be indicative of long-term effects, the above analysis remains insensitive to the differences in illness experience according to time. As discussed previously in the description of methods, an infant with a score of 1,1,1,0,0,0, a total of 3 for diarrhoea over the six month study period, could not be distinguished from an infant who scored 0,0,0,1,1,1, a total of 3, or 0,0,1,1,0,1, also a total of 3 in the above analysis.

Various techniques were explored to overcome this problem. The most precise techniques, including the imposition of a binary distribution proved impractical due to the large number of classes (up to 32 classes) with a small sample of 52 infants. An alternative technique involved the classification of illness experience into the first three months (early) and the second three months (late) of the study. Each infant was compared with her/himself according to the early and late illness experience, in order to determine whether the effect of one on the six-monthly increment of weight and supine-length was significantly different from the other.

The results are interesting. Significant differences were found between the effects of early and late illness experiences on weight increment over the total period of six months (see **Table 7.5**). Diarrhoea in the first three months did not have a significant effect on the overall weight increment for six months, while diarrhoea in the second three months did. The differences were as dramatic and in the same direction for fever. 40 per cent of the variation could be explained by these differences in both cases. The results concerning coughing are in the opposite direction (i.e. coughing in the first three months incurred more weight deficit), and the regression was not significant. Vomiting showed no significant effect. While the uncertainty about the accuracy of mothers' report of vomiting (i.e., that spittle may have been reported as vomiting) may account for the results concerning vomiting and the lack of effect on the six-monthly weight increment, the reason for the results regarding coughing is unclear.

Table 7.5
Regression Equations for Increment in Weight (N=52) - Symptoms recorded during (1) the first three months of the study, and (2) the second three months of the study.

Rgr	Variable	b	t	p <	r^2	p <
1	diarrhoea (1)	-31.84	-0.22	n.s.	0.40	**0.001**
	diarrhoea (2)	-344.83	-2.74	**0.009**		
	age	-117.12	-5.33	**0.001**		
	intercept	2542.28	10.07	**0.001**		
2	fever (1)	-95.58	-0.69	n.s.	0.40	**0.001**
	fever (2)	-358.25	-2.56	**0.013**		
	age	-121.74	-5.39	**0.001**		
	intercept	2639.97	9.67	**0.001**		
3	coughing (1)	-204.24	-1.67	n.s.	0.35	**0.001**
	coughing (2)	-50.30	-0.36	n.s.		
	age	-102.91	-4.51	**0.001**		
	intercept	2430.78	9.40	**0.001**		
4	vomiting (1)	44.86	0.19	n.s.	0.31	**0.001**
	vomiting (2)	-71.53	-0.40	n.s.		
	age	-110.18	-4.62	**0.001**		
	intercept	2261.39	8.50	**0.001**		

n.s. = not significant

Diarrhoea and fever caused slower growth later but not earlier in the dry season. We can assume that the rainy season (June-September) is a time of slower growth, although because of the shortened time span of this study, this could not be investigated fully. The faster growth in November-January may therefore represent 'catch-up' growth after slower growth during the rains, or the slower growth in February-April may represent catch-down or slow-down growth after the faster growth of the preceding months.

What is of interest here is the mechanism of these processes of 'catch-up' and 'slow-down' growth. The analyses on prevalence of symptoms show no significant monthly or seasonal differences for diarrhoea (see Chapter 6 - **Figure 6.2** and **Table 6.5**). The prevalence of fever had two peaks: in December and March, i.e., one in each three month period. These illnesses, however, had different consequences in these different time periods. While the data do not allow us to come to definite answers to this puzzle, it is likely that the greater availability of food in the first three months of the study was an important contributing factor, allowing for greater therapeutic feeding of ill infants. The relative scarcity of food in the second three months, by contrast, made therapeutic feeding more difficult.

This is in agreement with the findings reported by Tomkins' (1986) review of the literature on malnutrition and the risk of infection. Tomkins concluded that infections, especially fevers and diarrhoeas, had important effects on the duration and outcome of illness episodes; and only smaller effects on their incidence and severity. Weight deficit is thus a possible negative outcome that is made more likely by malnutrition.

Again, no significant effects were found in the analysis relating to supine-length increment (see **Table 7.6**). Nonetheless, the direction of the regression lines are the same as those for weight-increment.

Table 7.6
Regression Equations for Increment in Supine-length (N=45) - Symptoms recorded during (1) the first three months of the study, and (2) the second three months of the study.

Rgr	Variable	b	t	p <	r^2	p <
1	diarrhoea (1)	0.29	0.74	n.s.	0.04	n.s.
	diarrhoea (2)	-0.36	-1.03	n.s.		
	age	-0.06	-0.87	n.s.		
	intercept	6.38	7.14	**0.001**		
2	fever (1)	0.49	1.28	n.s.	0.05	
	fever (2)	-0.21	-0.52	n.s.		
	age	-0.05	-0.68	n.s.		
	intercept	5.82	6.17	**0.001**		
3	coughing (1)	0.27	0.83	n.s.	0.06	n.s.
	coughing (2)	-0.56	-1.53	n.s.		
	age	-0.05	-0.66	n.s.		
	intercept	6.12	7.64	**0.001**		
4	vomiting (1)	0.56	0.90	n.s.	0.04	n.s.
	vomiting (2)	-0.38	-0.81	n.s.		
	age	-0.06	-0.80	n.s.		
	intercept	6.22	7.65	**0.001**		

n.s. = not significant

One question remains unanswered: 'Did a combination or combinations of symptoms have more predictive value for overall weight-increment than each symptom considered separately?'. In order to answer this question, interaction terms between early and late diarrhoea with all other symptoms (early and late) were calculated manually, and then entered in the multiple linear regressions model, in which regressions were carried out by selecting the most significant terms in a stepwise manner (backward selection was used). The results showed that the interaction between late diarrhoea and early coughing did have a more significant effect on the infants' weight increment over six months (see **Table 7.7**). In other words, an infant with coughing in the first three months of the study, followed by diarrhoea in the next three months, suffered significantly more weight loss (as much as 269.2 g or more) than an infant who had diarrhoea only or coughing only on either the first or the second part of the study. 47 per cent of the variation in weight increment could be explained by this combination of symptoms, compared to diarrhoea only which accounted for 40 per cent of the variation. There is no obvious explanation for this.

Table 7.7
Regression Equation for Weight Increment over six months, and the interaction between coughing in the first three months of the study (1) and diarrhoea in the second three months of the study (2).

Variable	b	s.e.	p <	r2	p <
diarrhoea (2)*coughing (1)	-269.20	67.45	**0.001**	0.47	**0.001**
age	-129.82	20.82	**0.001**		
intercept	2592.74				

The effect of fever combined with other symptoms had less predictive value, and was treated with more caution in the light of the significant seasonal pattern found in the prevalence of fever (see Chapter 6 - **Figure 6.2**). There were two peaks for fever, the first one in December and the second one in March.

7.3.3.3 Environmental and Maternal Factors

Regression analyses of weight and supine-length increments over six months in relation to maternal age, birth rank, last birth-space, level of household hygiene, sanitary facilities of the home, maternal education, ethnicity and religion showed no significant results. No association was found between infant's weight and mother's weight each month.

7.4 Conclusion

Previous studies have shown that under favourable environmental conditions, the growth performance of Ethiopian children, for the first 24 months, compares well with European counterparts. Studies purporting to show otherwise (e.g., Tafari's and Mackeag's) have serious methodological limitations. The results of the Kebele 11 study confirm this, subject to the problems of using reference data such as the NCHS. The Kebele 11 infants compare well with international reference data, and display growth performance superior to Tafari's sample.

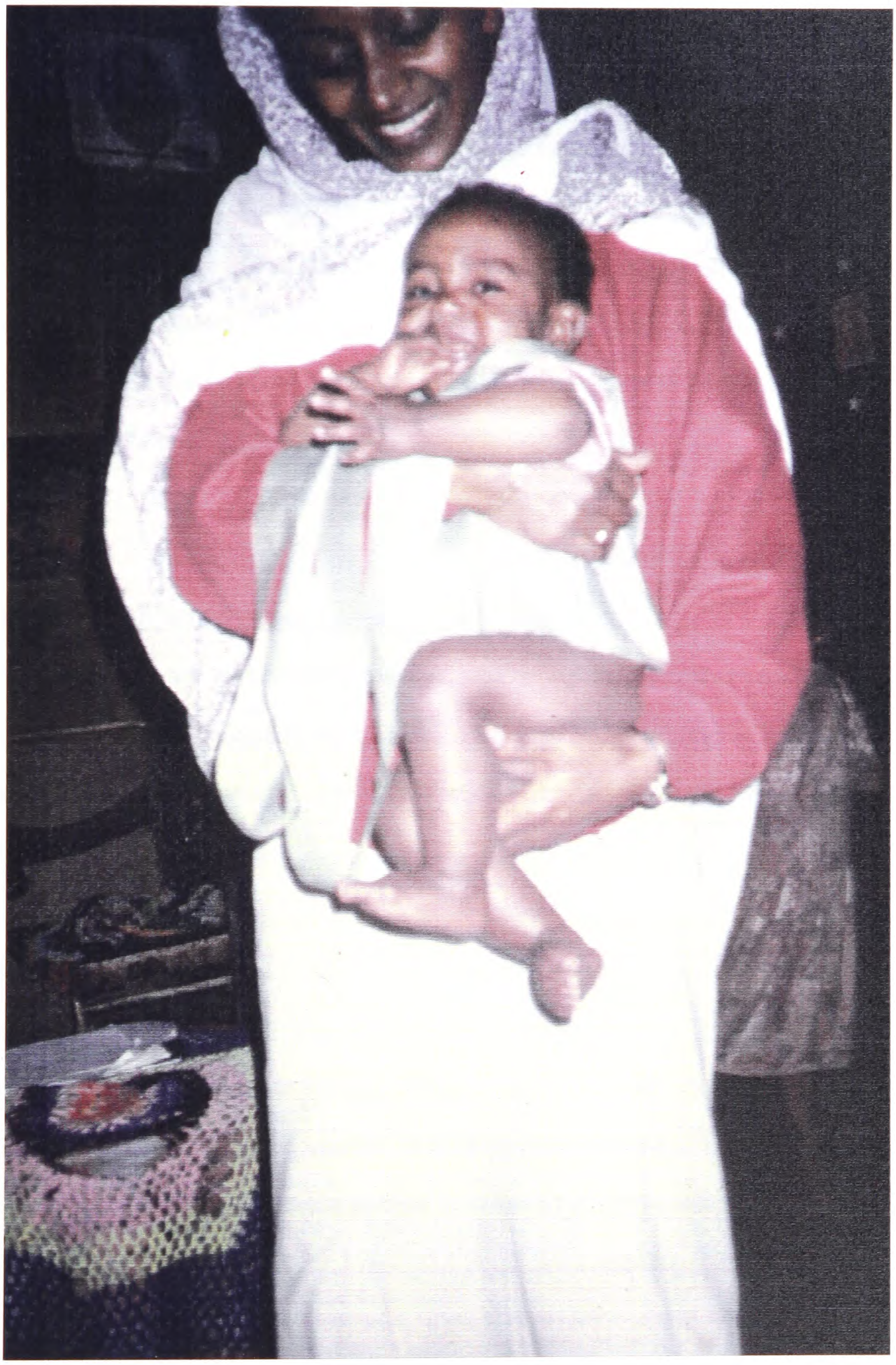
The Kebele 11 study has not been able to overcome all the methodological and analytical problems encountered in previous work. However, in the longitudinal design, assessment of measurement error, and analysis of a multitude of environmental factors, it has surpassed its predecessors.

Weight-for-length percentile of the NCHS reference median was chosen for comparison of the Kebele 11 anthropometric data with international data, because it is independent of age, and we can ask 'How thin are these infants compared to their western counterparts?' rather than 'How small or how big are they?' which may suggest that smallness is undesirable. However, this exercise has raised more questions than can be answered. NCHS weight-for-length percentile values tell us very little about the well-being of infants who are in the 'normal' range. It is interesting to note that mean weight-for-length figures reported from rural famine-prone regions are all above the 90th percentile, and do not have any apparent association with socio-economic indicators of distress (D'Souza, 1989).

This study has also included a case-study approach. Focusing on infants who manifest the anthropometric extremes on the NCHS scale, we are able to identify the complexity of factors which determine the growth performance of individual infants. These include the feeding regime, weaning status, illness experience, maternal behaviour, and the quality of the micro-environment of the home.

While the growth of the infants in general conforms to international reference data, analysis has shown that the Kebele 11 infants display greater variability than their counterparts in Oxford, U.K. Assuming that the Oxford children are exposed to an optimal environment, this implies processes of catch-up and slow-down growth among the Kebele 11 children. Investigations of weaning and external factors showed no effect on growth. This is in agreement with the findings of a study of low-income urban households in the Sudan (Zumrawi et al., 1987a).

The major identifiable constraint on growth was illness. The effect of illness experience on growth deficits has been examined before. In a study of Sudanese infants in urban low-income households, infection could account for only a small fraction of growth differentials (Zumrawi et al., 1987b). Weight deficit more than one standard deviation of the NCHS mean was defined as 'growth faltering', and diarrhoea was associated with weight deficit. A bigger sample was used in the Sudanese study compared to the Kebele 11 study. Nevertheless, the Kebele 11 study has gone beyond that of Zumrawi et al.'s in that it has demonstrated clearly the importance of the timing (seasonality) of illness experience. While symptoms of illness diarrhoea showed no seasonality in themselves, their consequences were markedly seasonal. It was found that diarrhoea and fever both led to significant deficits in weight, but only when they occurred during the months of February-April. During November-January, they had no significant effect. It is hypothesized that this may be related to the greater efficacy of therapeutic feeding during the earlier time period, which coincides with the harvest and 'catch-up' growth following the rains. It follows that during the first two years of life, Ethiopian children achieve satisfactory growth performance by growing faster during certain months of the year, and this faster growth is closely related to a period of adequate food supply when illnesses have a smaller impact on growth.



One of the infants in the study sample with the investigator.

Chapter 8

Conclusions

8.1 Introduction

This chapter aims to assess the merits and limitations of the *Kebele* 11 study. Firstly, the study design and methods are evaluated. Secondly, the main findings are discussed in the light of the strengths and limitations of study design and methods. Thirdly, the theoretical implications of these findings are discussed, together with issues for further research. Finally, some comments are made on the policy implications of the findings.

8.2 Appraisal of Study Design and Methods

The design and methods of the study upon which this thesis is based have shown both strengths and limitations. These have already been considered in some detail in the relevant chapters; the following is a summary.

8.2.1 Merits

Firstly, the *Kebele* 11 Study was designed to investigate infant health, and growth intensively within low-income households in an urban ecosystem by methods of direct observation. This is a wide domain of study, involving the simultaneous gathering of quantitative and qualitative data on feeding, morbidity, and anthropometry, and hence necessitated a relatively modest sample size, manageable by a single investigator (with one assistant). The main advantage of such a small-scale study is that the accuracy of data is enhanced. The reasons are two-fold: (i) problems of inter-observer bias and measurement error are diminished, and (ii) the extent of disruption of the subjects' daily lives is minimized when only one or two investigators are involved. People are more likely to give reliable information when they are harassed less.

The intent was to achieve a total ascertainment of the situation of mothers and their under two year-old infants, prospectively, in conditions of chronic deprivation. To this end, a predominantly settled population was chosen (the low-income sections of Kebele 11), rather than one consisting mostly of recent migrants (as was the case of the low-income sections of Kebele 13). Almost all low-income mothers with infants under the age of two were included in the study (with a cooperation rate of 96 per cent). Visiting the subjects in their own homes was necessary in order to obtain as accurate a picture as possible of the issues under study. Fortunately, this also proved to be an effective method of eliciting the required information without delay.

Secondly, the conduct of study benefited from the ease of communication between investigator and subjects who shared, in broad terms, the same culture. There was no need to spend time on a preliminary stage of language learning and acquisition of basic cultural facts and social skills.

Thirdly, the study was designed to cover seasonal variation with a full annual cycle. This has been achieved to some extent. Despite the unexpected truncation of the data, it was possible to detect some effects of season on weaning, morbidity, and growth performance. The design of the monthly structured interview schedule provided a useful tool for keeping the longitudinal element in the collection of data simple and reasonably accurate. The value of longitudinal data for the purposes of examining the issues the study aimed to address cannot be overemphasized. Long-term interrelationships between feeding patterns, prevalence of illness, and growth performance can only be studied satisfactorily by following the same individuals over a period of time.

A major problem that often arises in longitudinal studies is that of a shrinking sample when people drop out of the study through mobility or loss of interest. This was not a significant problem in the Kebele 11 study where a sample of 113 mother-infant pairs was maintained for six months. However, there were problems arising from missing data due to the absence of the mother at various times during the period of data collection.

Fourthly, the integration of qualitative and quantitative data collected by direct observation proved to be a useful approach. The qualitative data provided the context within which quantitative data could be interpreted. In addition, an attempt was made to assess the magnitude of error in the quantitative data in field conditions, namely in the measurement of infant's supine-length.

In sum, The Kebele 11 study has attempted a total ascertainment of the situation of mothers and infants in the deprived sections of the community. The subjects had almost all been resident in the city of Addis Ababa for over ten years, and thus represented a stable community which had adapted to the environment over a period of time. The data reported reflect long-term adaptation rather than temporary transitional features. For this reason, the findings may be applicable to comparable situations of chronic deprivation.

8.2.2 Limitations

The most important limitation of the Kebele 11 study was the premature ending of fieldwork after six months' data had been collected. This reduced the quantitative data available, aborted plans to study further aspects of conditions in Kebele 11 such as seasonal factors covering a full year cycle, and meant that the data were deficient in observations concerning long-term biological processes (in particular, the full duration of lactation and post-partum amenorrhoea). Leaving this aside, the principal limitations of study design and methods can be summarized as follows.

Firstly, the smallness of sample size proved to be a serious drawback when analyzing the data obtained during half the originally planned duration of fieldwork. This also constrained the application of statistical analyses. Data collected over a period of twelve months would have allowed a more thorough investigation of several crucial issues. For example, in Chapter 3, the normative model of weaning could have been ruled out more forcefully if the period of observation had been twice as long, with the possibility of reducing the proportion of censored cases in the completion of weaning. As it was, the interpretations of results regarding the completion of weaning had to remain tentative. In addition, the failure of the analysis to show ethnic differences in infant-feeding practice may have been in part because the ethnic categories described in Chapter 2, which were multifarious and subtle, were re-grouped into larger denominations since the numbers representing each category were not large enough. So a larger sample size would have been necessary to investigate the normative model more rigorously.

However, the influence of ethnicity on weaning practices was not one of the original prime concerns of this research, and therefore shortcomings in the study design with respect to this issue are inevitable. These shortcomings, now identified, can hopefully be addressed in future research.

Secondly, some methodological problems sprang from logistical difficulties of doing research in people's homes in an urban setting. The advantage of working among "one's own people" also carried with it the disadvantage of not having the protection or immunity from the hazards of socio-political harassment and abuse of human rights associated with a repressive totalitarian system of government. Kebele officials have the power to detain, abuse, and even forcibly conscript anyone they regarded as a threat, in my case, by being 'too inquisitive' in their territory (see Cutler, 1988 for a brief account of the origin and domain of kebele offices in Addis Ababa). One had to keep a low profile throughout the period of fieldwork, and leave the place at short notice when events took an unfavourable turn beginning in March 1988. The war against the 'northeners' (an umbrella term for Eritreans and Tigrayans who are, by definition, 'the enemy of the broad masses of Ethiopia') was, for the first time, publicly declared by the State President who launched a new offensive under the slogan 'Everything to the war front'.

Minute-by-minute observations, as described in Chapter 4, could not be carried out from dawn until the late evening due to the problems of transport and safety, not to mention the midnight-to-dawn curfew which was strictly enforced in Addis Ababa. This has curtailed precise accounts of frequency of nursing sessions per day.

A third limitation relates to the analysis of health data in which retrospective information was used. There were two problems of interpretation. The first one was that information on the duration of illness was not available. This has made it impossible to distinguish cases of prolonged illness from cases of briefer illnesses. Secondly, and inevitably, no clinical information was included. In theory, the method used, based on the mother's recall of her own and her infant's illness over a period of one month, while technically the most feasible way of investigating the relevant issues (see Ross and Vaughan, 1986), did not have the precision that could have been achieved by direct clinical diagnoses. Thus, in Chapter 5, the lack of clinical assessment of maternal morbidity has restricted the analysis to general issues. Similarly, in Chapter 6, the absence of clinical information has made it difficult to identify with certainty the diseases to which the syndromes were related, although good use has been made of the available information. Also, the syndrome described as 'oppression of the soul' lacked psychological or psychiatric precision: a clinical psychological analysis would have been required to investigate to what extent this condition amounted to clinical depression.

In reality, however, the inclusion of a clinical investigation would have been so disruptive of the natural state that the accuracy of data obtained would have been at stake. Mothers would have been required to visit a clinic because mobile facilities would have been impossible to organize. This would have defied the intention to gain an insight into the real situation in the homes of the study sample. In fact, this limitation, although worthy of mention, highlights the other strengths of study design and methods.

The start of an attempt was made to overcome some of the problems related to the absence of clinical data, with the micro-bacteriological analysis of water samples from the Tinishu Akaki river and Kataba stream. The records in Kolfe clinic in neighbouring Keftegna 25 were also consulted before data collection began, with the aim of assessing the coverage of the child immunization programme. With more time available, it might have been possible to utilise the clinic records to identify the principal diseases prevalent in the area, according to the approximate location of the clinic users' residence and the time of year.

The fourth limitation, and a serious one in terms of limiting the scope of analysis, relates to the anthropometric data presented in Chapter 7. The nature of the sample, particularly, (i) the mixed age of the infants at the start of data collection, (ii) the subsequent smallness in numbers per age/age-group, and (iii) missing data, on account of absences and the shortened period of data collection, has limited the scope of analysis and interpretation of results. Complete longitudinal data on infants of the same age would have been ideal. However, this is very difficult to achieve in non-laboratory conditions. In the low-income sections of Kebele 11, it was not possible to find more than 20 or 30 infants who were of exactly the same age at the beginning of data collection.

In summary, the study design has shown the potential for a thorough investigation of the problems defined at the outset. This potential has been realized to some extent, despite the abrupt truncation of data. The very open-endedness of the small sample and intensive approach enabled the identification of unexpected factors and the exploration of their importance. While a replication of this study would attempt to correct some of the deficiencies outlined with respect to the ethnicity of subjects and the absence of clinical data, such a replication should also seek to preserve the benefits following on from the intimate observation of mothers' activities and the understanding of their predicaments and their attitudes.

8.3 Main Findings

To a certain extent, each fieldwork site is sui generis, and it is pointless to attempt to generalize from a particular situation at a particular time to conclusions of wider significance. However, the findings of the Kebele 11 study do raise serious questions about a number of assumptions implicit in much writing on infant feeding, particularly concerning weaning, whether that writing be academic, popular, or policy-oriented.

The first main finding relates to the universality of breastfeeding. The fact that relatively prolonged breastfeeding is both desired and practised by the women in Kebele 11 of Addis Ababa may come as a surprise to those who subscribe to the belief that breastfeeding is in universal decline in urban centres of less-developed countries. This belief appears to be held by a large number of people with powerful influence over policy, including for instance, those responsible for drafting the WHO-funded Breastfeeding Information Group for Ethiopia (BIGE). This group campaigns to promote breastfeeding practice in Addis Ababa by allocating considerable energy and resources for the cause. Clearly, there is an information gap concerning the beliefs and practices of urban low-income women who outnumber the middle/high-income women in the city. The findings of the WHO collaborative study on breastfeeding (WHO, 1981) which reported that prolonged breastfeeding was practised among the 'urban-poor' and 'rural' women alike, and was in decline among the 'urban rich' do not appear to have been taken into consideration in the design of BIGE.

The rather unusual nature of the city of Addis Ababa may in part account for the high prevalence of breastfeeding, in particular the way in which the city remains akin to a collection of villages. In addition, the poverty of most of the women means that commercial infant formulae are not real options concerning infant feeding. However, we must ask: Are such conditions really exceptional in today's less-developed countries? Recent comparative analysis of urban ecological conditions throughout the less-developed world suggests that semi-traditional forms of community cohesion are more common and more effective than has often been supposed (Hardoy et al., 1990). Also, while cultural anthropologists (and casual observers) may identify supposedly 'typical' traits of dietary habits, these are often more akin to 'ideal' traits, unattainable by the majority who are too poor to have access to the prescribed variety of foods. Rigorous investigation using survey techniques and quantitative analysis is required to verify casually-identified 'trends' or practices.

The same lesson applies with equal force to studies of breastfeeding in 'traditional' rural areas. Common assumptions of universal prolonged breastfeeding may prove, on closer examination, to be no more than culturally-prescribed ideals or general statistical averages, concealing variability in actual practice.

This leads us directly to the second main finding of the study, that is the inadequacy of the 'normative model' of weaning. Stated succinctly, the problem is that individual mothers' practices of weaning vary so much within a culturally homogenous population that the notion of a culturally-prescribed norm is inapplicable. This was clearly the case in the Kebele 11 study sample, and on examination, probably also in other data sets (e.g., Knutsson and Mellbin, 1969). This compels us to look elsewhere for an adequate explanation of when and why mothers wean their infants. Normative considerations may play a role, but they do not play the dominant role.

In response to this challenge, a model has been formulated that includes the whole range of factors that, in the Kebele 11 study, influenced the two aspects, the commencement and the completion, of weaning. The model is integrated, in that it includes elements relating to the mother, the infant, and the external environment. It is interactive, in that the elements influence one another, and the two constituent features of weaning also influence each other. The model is finally probabilistic, in that the final outcome in terms of the timing of weaning, and the duration of the weaning process, is the outcome of all these factors, and exhibits a probabilistic spread over infant's age.

The study identified three locations for the principal factors that influence the weaning process. These are the infant, the mother, and the external environment. Infant-centred factors include size, emergence of primary teeth, and appetite. Mother-centred factors include the mother's health, work, supply of breastmilk, pregnancy, and socio-cultural characteristics. Environmental factors include season and the availability/affordability of weaning foods. A sub-set of infant-centred factors (most significantly, the emergence of primary teeth and appetite) and environmental factors (season and the availability of weaning foods) influenced the commencement of weaning, while a sub-set of mother-centred factors (pregnancy, breastmilk insufficiency, ill-health, and to a lesser extent, weight and body-mass index) influenced the termination of breastfeeding.

The fact that the two critical aspects of the weaning process are determined by different sets of factors is very important. It means that there is no predetermined length of time between the commencement and completion of weaning. The duration of the weaning process depends entirely on the timing of inter-related factors in the infant, the mother and the environment: it is a probabilistic function of these factors, not the result of cultural norms. Consequently, the process can range between being abrupt and gradual.

The probabilistic model of weaning is an important contribution to the literature. It implies a research agenda with an emphasis on within-population variability in weaning practice.

This is the main theoretical contribution of this thesis. The other chapters elaborate on aspects of the model, the weaning process, and identify other important elements in the health and growth of infants in Kebele 11.

Chapter 4 presented precise data on suckling behaviour and infant care based on direct observation. Implicit in this description and analysis was an identification of the socio-cultural reasons why certain factors did and did not influence the weaning process. For example, a 'mother-centred factor' that did not, in the event, have any direct relation to weaning was the mother's work. This was probably because of the nature of the paid work undertaken by women in the study sample (chiefly domestic employment and hand crafts such as spinning), which did not require them to be separated from their children for long periods during the day. In addition, cultural attitudes allowed women to take suckling infants with them when they went to work, and to nurse them in public. However, the extremes of 'biologic' breastfeeding, which have been described for instance among the !Kung, were not found in Kebele 11.

Chapter 5 turned to an analysis of the condition of the mothers. While not suffering from the acute food shortages and accompanying physical privations found in some parts of rural Ethiopia, the mothers of Kebele 11 lived in poverty, with relatively meagre diets. They appeared to represent yet another instance of that common paradox in less-developed countries, characterised as 'reproduction against the odds': even chronically malnourished women (40 per cent of the study sample) managed to give birth to a number of viable neonates and to practise prolonged breastfeeding. It was however found that mothers with higher body-mass indices were able to sustain lactation for longer.

The mothers of Kebele 11 suffered from a variety of complaints. One of the most common complaints was Ye-menfäs chinquet or 'oppression of the soul', a state of chronic low morale which was most often associated with the forcible conscription of their close male relatives to fight in the army.

Constraints on infant health were examined in detail. Chapter 2 described the physical environment of Addis Ababa and Kebele 11 and showed that most modern amenities were limited or lacking, and that the quality of the environment (in terms of hygiene and sanitation) was poor. Chapter 6 examined the associations between the environment, maternal health, and a set of symptoms which the sample infants suffered from. This analysis was limited to syndromes rather than diseases on account of the methodological limitations discussed above. However, an interesting cluster of findings emerged.

These findings were integrated in an explanatory health-model showing that diarrhoea in the infant was closely associated with household hygiene. This was in turn closely related to the level of the mother's education and the mother's morale - specifically, whether or not she suffered from 'oppression of the soul'. As has been mentioned, this state of low morale was brought about largely by the arbitrary and oppressive conscription policies of the present government. While the association between mother's education and child health has been commonly observed and should thus come as no surprise, the other relationship is more unexpected, demonstrating the causal link between political oppression and low morale, the latter of which was associated with household hygiene. This precise causal sequence is probably unique to Ethiopia, however, mothers in other societies where civil violence and political repression are the norm may be presumed to suffer in similar ways. This implies a research agenda which is of theoretical and practical interest, but which is also politically sensitive.

The infant's well-being is ultimately judged by physical growth performance. Chapter 7 examined the anthropometry of the infants in Kebele 11. Contrary to the findings of some previous studies, the growth of the infants compared well with international reference data throughout the first two years of life. This illustrates the nutritional benefits of prolonged breastfeeding to the infant, and also the methodological shortcomings of the clinic-based studies that had earlier claimed to find poor growth performance of Ethiopian infants. Nevertheless, growth performance was variable (compared to a sample of children measured in Oxford) and closely linked to a number of factors suggestive of environmental insults, in particular, illness and seasonal stress.

It was found that during the period of data collection, which was the first part of the dry season following the period the harvest was brought in, the anthropometric status of the infants was in relative decline. This can be attributed to catch-up growth during the harvest season (November-January) or slow-down during the following months. The occurrence of the symptoms described in Chapter 6 also had an impact on growth. In particular, children who suffered from diarrhoea showed a deficit of weight amounting to 191.91 grammes over six months. While the prevalence of diarrhoea in itself showed no seasonal variation, its impact did. Diarrhoea during November-January caused no appreciable deficit in weight, while it did during the following three months. This suggests that the mechanism of catch-up and slow-down growth may be located in the processes of recovery from illness bouts.

8.4 Issues for Further Research

The discussion of the main findings, above, has suggested a number of issues for future research. This thesis has formulated a model of weaning which makes strong claims about the relative importance of different types of factors influencing the weaning process. This model requires further testing and elaboration. A study of mothers, selected more carefully with regard to ethnicity, and followed over a longer period in order to have fewer 'censored' cases for the termination of breastfeeding, and to obtain a set of data relating to all seasons, would achieve these aims. However it is necessary to complement this methodological rigour with sensitive investigation of the cultural attitudes and practices which surround the factors influencing weaning, in particular the 'mother-centred' factors.

A second research project would be a follow-up on the determinants of infant's health, specifically the psychological factors in the mother that influence household hygiene and infant care. The working hypothesis should be that mothers who suffer from depression or other forms of low morale give less adequate attention to the cleaning of the home and the care of the infant, with negative effects on child health.

A third research project concerns the links between illness and growth, and specifically the seasonal element in this. This requires a careful epidemiological study of the incidence, severity and duration of certain illnesses over the seasons, and the impact of these illness episodes on child growth. The hypothesis arising from this thesis is that the seasonal pattern of child growth is influenced by the varying extent of recovery from illness bouts.

8.5 Policy Implications

A number of implications for policy clearly follow from the findings of the Kebele 11 study. These may be summarized as follows.

Firstly, the provision of sanitary services and facilities should be foremost among the priorities of intervention programmes.

Secondly, the WHO sponsored BIGE is irrelevant to urban low-income women who recognize the values of breastmilk and practice prolonged breastfeeding. Instead, available resources could be re-channelled to provide proper sanitation and primary health care.

Thirdly, infants exposed to abrupt weaning are most at risk of disease and malnutrition. Abrupt weaning mostly occurs when a mother becomes pregnant before she had introduced weaning foods to her infant. It follows that when a health worker discovers that a woman is pregnant, he or she should be concerned not just for the well-being of the mother, but for the youngest child as well, if necessary providing extra weaning foods.

A final recommendation is that the morale of the mothers needs to be improved. While one possible course of action might be the provision of psychological assistance, such as counselling and medication, the restoration of the mothers' joie de vivre is probably best achieved through political reforms which remove the underlying causes of 'oppression of the soul'.

Appendix I

Research Schedule

I. <u>Preliminary Work</u>

(i) October-December 1986: Preliminary reading, correspondence with various organizations and individuals associated with the field of interest in Oxford and elsewhere. Exploring sources of funding and planning a visit to Ethiopia in order to 'test the waters'.

(ii) January-February 1987: travel to Addis Ababa to discuss research plans with the Director of the Ethiopian Nutrition Institute (ENI), the Programme Director of the WHO/UNICEF Joint Nutrition Support Programme (JNSP), the Chief Statistician, and others. I spent a week in Sidamo (Awassa, Yirga-Alem, and the village of Shafina where I observed fieldwork in progress). This field-trip was valuable in the assessment of the possibilities, advantages, and disadvantages of collaborating with the JNSP.

(iii) March-September 1987: Further reading and planning in Oxford. Preparation for fieldwork, and departure.

II. <u>Pilot Study: September-October 1987</u>

(i) Evaluation of information obtained from the Addis Ababa City Council - International Coordinating Committee for Welfare and Development' (ICC), the Central Statistical Office (CSO), the Ministry of Health (MOH), and the University - Institute of Development Research (IDR).

(ii) Selection of Study Site. <u>Keftegna</u> 24 was identified as a suitable study-site. Permission to conduct fieldwork was obtained from the ICC and <u>Keftegna</u> 24 Offices.

(iii) At first, <u>Kebele</u> 13 was selected because it was the most populated <u>kebele</u> not only in the <u>keftegna</u> but also in the whole of Addis Ababa. Moreover, <u>Kebele</u> 13 had a large section of low-income households which were located peripherally to the better-off sections of the <u>kebele</u> comprised of transient populations. The The <u>kebele</u> records were patchy as a result. A house-to-house enquiry was conducted in order to register mothers with infants under two years of age in households that were identified by the kebele Health Representative (who accompanied me and my assistant) as low-income, and to recruit them into the study. The result was unpromising. Many women were unavailable, having gone to nearby villages, the market, or to work as day labourers. Some of the women visited were not interested, and others showed interest but they were unable to provide reliable information on their infants' birth dates in the absence of records such as birth, christening, and immunization cards. The mothers' estimate of the children's age appeared unreliable. It became apparent too that these households consisted of largely new migrants from the rural regions of the south-west and were very mobile. This was an undesirable feature in view of the longitudinal study design.

(iv) By contrast, the low-income population of Kebele 11 constituted a settled community and hence more accessible. House-to-house enquiries continued in Kebele 11. Because this Kebele was an active participant of the MOH's child immunization programme, every mother kept a copy of her infant's immunization record-card with the infant's name, birth date, and record of vaccinations on it. This was important because it meant that many of the problems of interpreting findings from the anthropometric and other data could be avoided because the infant's exact age was known.

III. The Kebele 11 Study (November 1987 - April 1988)

(i) Monthly structured interviews and anthropometry (November-April). The number of houses visited everyday ranged from 8 to 12. Each anthropometry and monthly interview schedule took 2 to 3 weeks. The remaining time was allocated to visits to the sub -sample of twenty women from whom minute-by-minute observational data were collected.

(ii) Additional cross-sectional surveys during monthly visits (December and March).

(iii) Minute-by-minute observation of sub-sample (December-April). Each mother was visited every other month, at least three times in total.

(iv) Storage of raw data in micro-computer files. This was done during week-ends and public holidays.

Appendix II

Monthly Structured Interview Schedule

House No. ____________
የቤት ቁጥር፡

Name ______________________ Mother No. ___________
ስም፡ የእናት ቁጥር፡

Weight ____|____|____|____|____|____|____|____|____|____|____|____|(kg.)
ክብደት፡

Height _____ (m)
ርዝመት፡

Age _______ (yrs)
ዕድሜ፡

1. Are you menstruating? 0 = no _______
   የወር፡ አበባዎ፡ እያተቃለን፧ የለም
   1 = yes ______
   አዎን

2. Are you breastfeeding? 0 = no _______
   ያጠባሉን፧ የለም
   1 = yes ______
   አዎን

3. When you breastfeed, does the milk come 0 = immediately?
   ሲያጠቡ፡ ይወርድሎታልን፧ ወዲያውኑ፡
   1 = after a little while?
   ጥቂት፡ ቆይቶ፡
   2 = after a long while?
   ረዥም፡ ጊዜ፡ ቆይቶ፡

4. How much milk do you produce? 0 = less than enough
   ስንት፡ ያህል፡ የሚወርድ፡ ይመስሎታል፧ የማይበቃ፡
   1 = just enough
   በቂ፡
   2 = more than enough
   በጣም፡ ብዙ፡

5. Over the last month, have you been ill with fever?
   ባለፈው፡ ወር፡ ውስጥ፡ እነዚህ፡ ገበረ፡ ወይ፡ ትኩሳት፡
   0 = no _______
   የለም
   1 = yes ______
   አዎን
   diarrhoea? 0 = no _______
   ተቅማጥ፡ የለም
   1 = yes ______
   አዎን
   coughing? 0 = no _______
   ሳል፡ የለም
   1 = yes ______
   አዎን
   vomiting? 0 = no _______
   ትውከት፡ የለም
   1 = yes ______
   አዎን

   other illness/pains/aches? ________________________________
   ሌላ፡ ሕመምስ፡

Comments:

6. Which medicines did you take? ምን፡ዓይነት፡ መድኃኒት፡ ወሰዱ፡

0 = 'traditional' የቤት፡ ________

1 = 'modern' የሕክምና፡ቤት ________

2 = both ሁለቱም፡ ________

7. Was it/were they effective? ጠቀመዎት፡ ወይ፡

0 = not at all በፍጹም፡ ________

1 = to some degree ትንሽ፡ ________

2 = very በጣም፡ ________

8. Over the last month, has your infant been ill for more than two days with fever?
ባለፈው፡ ወር፡ ውስጥ፡ ልጅዎ፡ አሞት (ከሞት)፡ ገበሬ ወይ፡ ከሁለት፡ ቀን፡ በላይ፡ ትኩሳት፡

0 = no የለም ________

1 = yes አዎን ________

diarrhoea? ተቅማጥ፡

0 = no የለም ________

1 = yes አዎን ________

coughing? ሳል፡

0 = no የለም ________

1 = yes አዎን ________

vomiting? ትውከት፡

0 = no የለም ________

1 = yes አዎን ________

9. Whose help did you seek first? በመጀመርያ፡ የማንን፡ እርዳታ፡ ጠየቁ፡

1 = doctor/nurse/health worker የሕክምና፡ ________

2 = traditional doctor/herbalist የመድኃኒት፡ ዐዋቂ፡ ሰው፡ ________

3 = relatives/friends/neighbours የዘመድ፡ ጓደኛ፡ ጎረቤት፡ ________

10. Which medicines did you give your infant? ለልጅዎ፡ ምን፡ ዓይነት፡ መድኃኒት፡ ሰጡ፡

0 = traditional የዐዋቂ፡ ሰው፡ የቤት፡ ________

1 = modern የሕክምና፡ቤት ________

2 = both ሁለቱም ________

11. Has your infant had any new teeth? ልጅዎ (ልጅሽ)፡ ጥርስ፡ አውጥታለችን (አውጥቷል)፡ ጨምሮ ሁለቱ (ሁል)፡

0 = no የለም ________

1 = yes አዎን ________

12. How many/which? ስንት፡ ናቸው፡ የትኞቹ፡ ____________________

Comments:

13. What other (other than breast milk) foods are you giving your infant?
ተጨማሪ፡ምግብ፡ከጡት፡ሌላ፡ምን፡ምን፡

____

____

How often? ______________________________
በቀን፡ስንት፡ጊዜ፡ይሆናል፡

14. Does she/he eat readily/willingly? 0 = no ______ 1 = yes ______
ደስ፡ ብላ (ብሎ)፡ ትበላለች፡ ወይ፡ (ይበላል)
0 = no ______ የለም
1 = yes ______ አዎን

15. If she/he refuses to eat, what do you do?
እምቢ፡ ካለች፡ (ካለ)፡ ምን፡ ያደርጋሉ፡

0 = nothing ______ ምንም፡

1 = try again and again ______ እንደገና፡ እሞክራለሁ፡

2 = force feed ______ በግድ፡ አበላታለሁ፡ (አበላዋለሁ)

16. Are you with your baby 1 = all day? ______
ቀኑ፡ በሙሉ፡ ከልጅዎ፡ ጋራ፡ ነዎት፡ ወይ፡

2 = when not at work? ______ ወይ፡ ስራ፡ ባልሄዱበት፡ ብቻ፡

17. What is your work?
ስራዎ፡ ምንድን፡ ነው፡

0 = none ______ ስራ፡ የለኝም፡

1 = going to school ______ ትምህርት፡ ቤት፡ እሄዳለሁ፡

2 = manual/unskilled labour ______ የቀን፡ ስራ፡

3 = domestic labour ______ የቤት፡ ስራ

4 = skilled/professional work ______ ፋብሪካ፡ ሰራተኛ / ጸሐፊ / ሌላ፡

18. Does your work take you away from home?
ስራዎ፡ ከቤት፡ ውጪ፡ ነው፡ ወይ፡

0 = no ______ አይደለም፡

1 = yes ______ አዎን፡

19. If you go out to work, do you take your baby with you?
ወይ፡ ስራ፡ ሲሄዱ፡ ልጅዎን (ትን)፡ ይዘው፡ ነው፡ የሚሄዱት፡

0 = no ______ አይደለም

1 = sometimes ______ አንዳንድ፡ ጊዜ፡

2 = always ______ ሁልጊዜ፡

20. If you leave your baby at home when you go to work, who looks after her/him?
ልጅዎ (ልጅዎ) እናት፡ ከተራች (ራ) ማን፡ ይንከባከባታል (ከዋል)፡

1 = a sibling ______ ታላቅ፡ እህት/ወንድም

2 = neighbour ______ ጎረቤት፡

3 = relative ______ ዘመድ፡

4 = child minder ______ ሞግዚት፡

Appendix III

Cross-sectional Survey Sheets

A. Ethnicity, Religion, and Sanitary Facilities

Mother No. ____________ House No. ____________
የእናት፡ ቁጥር የቤት፡ ቁጥር

1. How long have you lived in this house? ____________________
   እዚህ፡ቤት፡ ስንት፡ዓመት፡ ተቀምጠዋል፧
2. How much rent do you pay? ____________________
   የኪራይ፡ቤት፡ነው፧ ስንት፡ይከፍላሉ፧
3. Where did you live before? ____________________
   በፊት፡ የት፡ ነበረ፡ የሚኖሩት፧
4. Where were you born? ____________________
   የተወለዱበት፡ አገር፡ የት፡ ነው፧
5. What is your first language? ____________________
   የትውልድ ፡ቋንቋ፡ምንድር፡ነው፧
6. Which ethnic group do you belong to? ____________________
   ብሔርዎ፡ ምንድር፡ ነው፧
7. Which religion do you follow? ____________________
   ሃይማኖትዎ፡ምንድር፡ ነው፧
8. Where do you get water from? ____________________
   የሚጠጣ፡ ውሃ፡ ከየት፡ ነው፡ የሚያገኙት፧
9. How many jars/buckets do you buy/use everyday? ____________________
   በቀን፡ ስንት፡ እንስራ/ባልዲ፡ ውሃ፡ ይቀዳሉ፧
10. How much do you pay? ____________________
    ስንት፡ ይከፍላሉ፧
11. Where is your latrine? ____________________
    ሽንት፡ ቤትዎ፡ የት ጋ፡ ነው፧
12. What type is it? ____________________
    አሰራሩ፡ ምን፡ ዓይነት፡ ነው፧
13. How many households use it? ____________________
    ለስንት፡ ቤቶች፡ ያገለግላል፧
14. Where do you dispose of waste? ____________________
    ቆሻሻ፡ የት፡ ነው፡ የሚጥሉት፧
15. Who collects it? ____________________
    ማን፡ ያነሳል፧

Comments:

B. Income, Education, and other Maternal Characteristics

Mother No. ______________
የእናት፡ ቁጥር፡

House No. __________
የቤት፡ ቁጥር፡

1. Head of household ________________
   ባለቤትዎ፡ ማን፡ ነው፡
2. Occupation of household head ______________
   ስራቸው፡ ምንድር፡ ነው፡
3. Can you read? _________ write? ____________
   ማንበብ፡ መጻፍ፡ ይችላሉን፡
4. How many years of school did you attend? ______________
   ስንተኛ፡ ክፍል፡ ደረሱ፡
5. Are you currently going to school? __________________
   አሁን፡ ይማራሉን፡
6. How much is your school fee? _______________________
   ለትምህርት፡ ለት፡ ይከፈልበታል፡
7. Have you had other/vocational training? ______________
   ሌላ፡ ሚደገኙ፡ ትምህርት/ማስልጠኛ፡ ሰርሰዋልን፡
8. How old are you? ___________
   ዕድሜዎ፡ ስንት፡ ነው፡
9. How many children have you had? ______________
   ስንት፡ ልጆች፡ አለዎት፡

   girls __ name & age ___________ boys __ name & age ___________
   ሴቶች፡ ስም፡ ዕድሜያቸው፡ ወንዶች፡ ስም፡ ዕድሜያቸው፡

10. Any losses? miscarriage _______ still birth __________
    በእርግዝና፡ ጊዜ የጠፋ፡ ሽሎች፡ ሞቶ፡ የተወለዱ፡
    abortion _________ death _______ age _______
    ያስወረዱት፡ የሞተ፡ ሕፃን፡ ዕድሜ

11. How many of your children are at school at present? ______
ትምህርት፡ ቤት፡ ያሉ፡ ልጆችዎ፡ ስንት፡ ናቸው፡

12. What is the children's school fee? ____________________
ለልጆቹ፡ ትምህርት፡ ቤት፡ ስንት፡ ይከፍላሉ፡

13. Are rotating credit associations common in this area? ______
እዚህ፡ ሰፈር፡ ዕቁብ፡ የተለመደ፡ ነው፡

14. Do you belong to one? ________________ ማኅበር፡ እድር፡
እርስዎስ፡ ዕቁብ፡ አለዎት፡

15. How much do you pay? ___________ how often? ______________
ስንት፡ ይከፍላሉ፡ በስንት፡ ጊዜ፡

16. How many members are there in your group? __________________
የዕቁብ፡ አባላት፡ ስንት፡ ናቸው፡
(ማኅበር/እድር)

17. What is your main source of income? __________
ዋናው፡ ገቢ፡ የሚያገኙት፡ ከየት፡ ነው፡

18. What is your secondary source of income? ______________
ከዛ፡ ቀጥሎስ፡

19. Are there any other earners in your household? ____________
እዚህ፡ ቤት፡ ገቢ፡ ያላቸው፡ ሌሎች፡ ሰዎች፡ አሉ፡

20. Do you get help from your relatives? _______________
ከዘመዶችዎ፡ እርዳታ፡ ያገኛሉን፡

what kind? ________________
ምን፡ መሰል፡

21. How much do you pay for electricity? __________________
ለመብራት፡ ሃይል፡ በወር፡ ስንት፡ ይከፍላሉ፡

How often? ____________
በአንድ፡ ወር፡
በሶስት፡ ወር፡

Comments

Appendix IV

Anthropometry Sheet (with Immunization Record)

Infant No. ______ House No. ______ Mother No. ______
የሕፃን፡ ቁጥር የቤት፡ ቁጥር፡ የእናት፡ ቁጥር፡

Name ______________ Date of Birth ______________ Sex ________
ስም የተወለደበት፡ ቀን ጾታ፡

	1	2	3	4	5	6	7	8	9	10	11	12
date:												
time:												
Weight (kg.)												
Length (cm.)												
MUAC (cm.)												
SSST (mm.)												
TST (mm.)												

<u>Immunization Record</u>

DPT ______|______|______|
Polio ______________
BCG ______|______|______|
Measles ______________
Tetanus ______________
Others ______________

<u>Other events</u>

____
____
____
____
____

<u>Comments</u>:

Appendix V

Infant's Immunization Card

የግለሰብ የክትባት ካርድ
INDIVIDUAL VACCINATION CARD

የምዝገባ ቁጥር ....
Registratio No.

የጤና ድርጅት ስም ....
Health Instituti..

የምዝገባ ቀን ....
Registration Date

ሙሉ ስም ከነአያት ....
Full Name

የእናት ስም ....
Mother's Name

የተወለደበት ቀን ....
Date of Brith

ፆታ ....
Sex

አውራጃ ....
Awraja

ወረዳ ....
Woreda

ከተማ መንደር ....
Town Village

ከፍተኛ ....
Higher

ቀበሌ ....
Kebele

የቤት ቁጥር ....
House No.

ማሳሰቢያ፣ ካርዱን በጥንቃቄ ይያዙት ቀንቀጠሮም አያሳልፉ ።

Side 1

የክትባት ዓይነት Vaccine	የተሰጠበት ቀን Date Ghiven			መልዕል Booster		የቀጠሮ ቀን Appointment Date		
	I	II	III			1	2	3
ዲፒቲ/DPT								
ፖሊዮ/Plio								
ቢሲጂ/BCG								
ኩፍኝ/Measles								
ቴታነስ/TT								
ሌሎች/Others								

Side 2

የግለሰብ የክትባት ካርድ
INDIVIDUAL VACCINATION CARD

	የምዝገባ ቁጥር .... Registratio No.
ጤና ድርጅት ስም .... Health Instituti	የምዝገባ ቀን .... Registration Date
ሙሉ ስም ከነአያት .... Full Name	የእናት ስም .... Mother's Name
ተወለደበት ቀን .... Date of Brith	ፆታ .... Sex
	አውራጃ .... Awraja
ወረዳ .... Woreda	ከተማ መንደር .... Town Village
ከፍተኛ .... Higher	ቀበሌ .... Kebele
ቤት ቁጥር .... House No.	

ማሳሰቢያ፡ ካርዱን በጥንቃቄ ይያዙት ቀነቀጠሮም አያሳልፉ ።

Appendix VI

The Ethiopian Calendar

Ethiopian Year 1980 (1987-88 European Calendar)

Ethiopian Month	No. of days	European date	National holidays & Religious Festivals
1 Meskerem	30		
1 Meskerem		12 September	New Year's Day
2 "		13 "	Revolution's Day
17 "		28 "	Masqal (the finding of the true cross)
2 Teqemt	30		
23 Teqemt		3 November	'Id-al-Mawlid (Mohammed's birthday)
3 Hedar	30		
21 Hedar		1 December	Crowning of Mary (Hedar Maryam)
4 Tahsas	30		
28 Tahsas		7 January	Christmas Day
5 Ter	30		
6 Ter		15 January	Circumcision (naming of Jesus)
11 "		20 "	Temqat (Epiphany)
12 "		21 "	Qana Ze-Gelila (the first miracle)
23 "		1 February	St. George's Day and Tsome Neneweh (beginning of the fast for Ninneveh)
6 Yekatit	30		
7 Yekatit		15 February	Holy Trinity and beginning of Lent (main fasting period)
12 "		20 February	The kindling of the 1974 Revolution
23 "		2 March	Adwa Victory Day
7 Megabit	30		
4 Megabit		13 March	Mount of Olives (the Transfiguration)
25 "		3 April	Hosanna (Palm Sunday)
28 "		6 April	Patriots Victory Day
30 "		8 "	Good Friday
8 Miazya	30		
2 Miazya		10 April	Fasika (Easter Day)
3 "		11 "	Ma'dot (Easter Monday)
23 "		1 May	International Labour Day
24 "		2 May	'Id-al-Fatir (end of Ramadan)
9 Guenbot	30		
11 Guenbot		19 May	Ascension Day
21 "		29 "	Day of Pentecost
10 Sené	30		
11 Hamle	30		
12 Nehase	30		
13 Nehase		19 August	Feast of Debre-Tabor
13 Pagumen	5		
3 Pagumen		8 September	St. Rufael

In addition to the 'holy days' listed above, many devout Orthodox Christian women observed some of the following days in commemoration of individual patron Saints:

1. Day 3 of each month (except for Pagumen) - Be'ata Mariam
2. Day 7 " " " " " " - Holy Trinity
3. Day 12 " " " - St. Michael
4. Day 14 " " " - Abuna Aregawi
5. Day 16 " " " - Kidane Mehret
6. Day 19 " " " - St. Gabriel
7. Day 21 " " " - St. Mary
8. Day 23 " " " - St. George
9. Day 24 " " " - Abuna Tekle-Haimanot
10. Day 27 " " " - Medhane Alem
11. Day 29 " " " - Be'ale Egzeabiher

Generally, these 'holy days' are more strictly observed in rural than in urban areas. Many of the women in the study observed one or two Saint's day every month. Strict observance of a Saint's Day involved refraining from heavy domestic work such as grinding grain, baking, and washing clothes.

Appendix VII

Description of Covariates Examined by Cox Regression Models (Chapter 3).

Variable	Description
I Infant's appetite	based on the mother's rating, was coded as 1 = large and 0 = poor.
II Emergence of teeth	the number of teeth in the infant's oral cavity, as recorded on observation during the study were coded by group as, 1 = (2 to 4), 2 = (4 to 8), and 3 = (more than 8).
III Birth order	coded by group as, 1 = 1 (first -born), 2 = (2 to 8), and 3 = (higher than 8).
IV Birth-interval	coded by group as 1 = (12 to 24 months), 2 = (more than 24 months).
V Maternal age at infant's birth	coded by group as,1 = (16 to 25) years (this included primiparous mothers, because there was no significant difference when they were grouped separately), 2 = (26 to 30) years, 3 = (31 to 35) years, 4 = (36 -40), and 5 = (41 - 47) years (the oldest mother in the sample was 47).
VI Maternal income-generating activity	1 = engaged in any of the activities listed in **Table 3.9** (see p.104). 2 = No activity.
VII Location of mother's work	1 = at home, and 2 = away from home.
VIII Maternal time spent with infant	1 = all day and 2 = part of the day.
IX Ethnicity	1 = Gurage 2 = Oromo 3 = Amhara 4 = Other.
X Religion	1 = Christian and 2 = Moslem.
XI Mother's 'oppression of the soul'	Many mothers had reported suffering from Ye-menfäs Chinquet, (Amharic, literally translated as 'oppression of the soul'). This was coded 1 = Yes, and 0 = No.

Appendix VIII

Monthly Record of Symptoms

IdNo.	November	December	January	February	March	April
1	ns	F	C	F D	D	D V
2	F D C	ns	F D C V	F D C V	D	D C
3	ns	ns	C	F C	D	ns
4	V	ns	F	.	ns	F D
5	F D V	ns	ns	ns	V	ns
6	ns	F	C	C	ns	ns
7	F C	F C	F C D	ns	ns	ns
8	C	C D	D	C V	C V	ns
9	ns	ns	F D C V	D C V	F D C V	F D C V
10	F	F D C	F D C V	.	F C	F D C V
11	F	F	ns	ns	ns	ns
12	C	ns	F D	ns	ns	D
13	.	ns	ns	.	ns	ns
14	D	F D	D C	ns	ns	ns
15	ns	F C V	C	ns	ns	ns
16	D	ns	ns	ns	ns	ns
17	F C	F	ns	F C	ns	ns
18	D C	F C	.	ns	ns	ns
19	ns	.	.	.	ns	ns
20	ns	.	.	D C	D	C V
21	.	ns	ns	F C	ns	ns
22	ns	F D C	.	ns	D	D C V
23	ns	ns	ns	ns	ns	ns
24	ns	ns	ns	ns	ns	ns
25	C	F C V	C	ns	ns	ns
26	C	F C	F D	ns	ns	ns
27	ns	F C	.	ns	C V	C V
28	C	F C D	C	F D	F D	F D V
29	ns	ns	ns	F C	ns	ns
30	ns	F V	ns	D	ns	ns
31	ns	D	D C	ns	ns	ns
32	ns	ns	ns	ns	ns	ns
33	D	C	ns	ns	C V	ns
34	D	D	ns	D	D	ns
35	D	ns	ns	.	ns	ns
36	ns	ns	F D C V	ns	.	F D C V
37	C	.	.	ns	.	.
38	ns	ns	.	ns	ns	.
39	ns	F D C	C	F D C	ns	.
40	ns	.	ns	.	ns	.
41	ns	ns	F D C V	F D	ns	ns
42	ns	ns	ns	F C V	ns	ns
43	ns	F D C V	ns	.	F D V	F D V
44	.	.	.	.	.	.
45	ns	ns	D	D	V	D
46	ns	ns	ns	ns	F	ns
47	ns	ns	ns	ns	F	F D C V
48	.	ns	D	D	ns	.
49	ns	ns	ns	ns	ns	ns
50	C V	F C	F C	.	.	.
51	C	F C	F C	C	ns	ns
52	ns	ns	.	ns	D	ns
53	ns	F C	F D C V	F D C	F C	F
54	D V	F D C	F D C V	C	C	ns
55	C	F C	F C	F C	F C V	ns
56	.	ns	ns	ns	ns	ns
57	ns	F D C	F C	D	D	ns
58	D V	ns	F C	.	.	ns

Monthly Record of Symptoms (Cont.)

IdNo.	November	December	January	February	March	April
59	.	F	ns	.	.	C V
60	ns	F C	.	ns	F	ns
61	F C	F C	D V	C	C V	ns
62	ns	C	ns	ns	D V	D V
63	F	ns	ns	D	D	ns
64	ns	ns	ns	D	F C	ns
65	ns	D	ns	ns	F D C V	ns
66	C	F C	ns	.	F D C V	ns
67	F D C V	F D C V	.	.	F D C	ns
68	D V	ns	F C	ns	F C	F D C V
69	C	F C V	C	ns	ns	ns
70	ns	ns	.	C	ns	ns
71	.	.	ns	C	ns	ns
72	ns	D C V	F C	ns	ns	ns
73	.	ns	F D V	ns	ns	D
74	.	ns	D	ns	ns	ns
75	ns	ns	F	ns	ns	ns
76	D C	D	.	D C	ns	F D C V
77	.	.	.	.	.	.
78	C	F	F	ns	ns	ns
79	C	ns	ns	ns	C V	D C V
80	F	F D C	D	F D	ns	ns
81	ns	F D V	F D C	F C V	F C V	F D C V
82	ns	ns	ns	ns	ns	ns
83	ns	F C V	F C	ns	ns	ns
84	ns	ns	.	ns	ns	ns
85	F D C	F C V	F D C	.	.	.
86	ns	ns	F D V	V	C V	C
87	D	ns	F D	.	ns	ns
88	ns	ns	F D	F D V	ns	ns
89	D	.	.	.	.	.
90	D	.	ns	D	ns	.
91	C	F D V	ns	ns	ns	.
92	C	.	ns	D	D	.
93	ns	F D	ns	F	F	.
94	ns	F	F	ns	ns	.
95	C	ns	F	ns	ns	.
96	C	ns	ns	ns	ns	.
97	F	C	.	.	.	.
98	.	F D	F D	ns	ns	.
99	.	.	.	.	.	.
100	.	.	.	.	.	.
101	ns	F D C	.	ns	ns	.
102	ns	F D V	F	ns	ns	.
103	ns	F D C V	ns	ns	ns	.
104	ns	F C V	F C	ns	ns	.
105	F C	.	.	ns	ns	.
106	ns	F D	ns	ns	ns	.
107	ns	ns	F C	D	D	.
108	.	.	F D C V	ns	.	.
109	.	.	ns	F C	ns	.
110	.	.	ns	F D V	ns	D
111	.	.	.	.	.	.
112	ns	F C V	F C	C	C	ns
113	.	.	.	ns	ns	F

Key: D = diarrhoea　　V = vomiting
F = fever　　C = coughing
ns = no symptoms　　'.' = no information

Appendix IX

Anthropometric data of 'underprivileged' children in Addis Ababa (from Tafari, 1972) with those of Kebele 11 children in parentheses.

		Weight			Length		
Age (mo.)	N	Mean	S.D.	S.E.	Mean	S.D.	S.E.
3	30(9)	4.17(5.98)	1.34(0.62)	0.24(0.27)	54.4(60.40)	2.7(1.43)	0.6(0.60)
4	31(9)	5.20(6.32)	0.82(0.73)	0.15(0.24)	58.5(61.49)	0.7(0.97)	0.1(0.30)
5	32(15)	5.92(6.69)	1.13(0.77)	0.20(0.19)	61.5(62.77)	2.7(1.10)	0.5(0.28)
6	30(24)	6.22(6.97)	0.84(0.79)	0.15(0.16)	63.5(63.82)	3.3(1.93)	0.6(0.39)
7	32(29)	6.71(7.28)	1.19(0.89)	0.21(0.16)	65.3(65.52)	2.1(1.96)	0.4(0.36)
8	40(34)	6.84(7.51)	1.04(0.95)	0.16(0.16)	66.5(67.11)	4.1(3.16)	0.6(0.55)
9	44(33)	6.95(7.76)	0.93(0.93)	0.14(0.16)	66.6(68.06)	4.1(3.16)	0.6(0.55)
10	51(32)	7.35(8.10)	0.99(1.00)	0.14(0.18)	67.9(69.59)	3.9(3.12)	0.5(0.55)
11	55(28)	7.60(8.22)	1.01(0.95)	0.14(0.18)	68.8(70.63)	3.5(3.39)	0.5(0.64)
12	63(22)	7.81(8.27)	1.15(1.21)	0.14(0.26)	70.4(71.56)	3.8(3.46)	0.5(0.74)
13	52(18)	7.73(8.77)	1.12(1.19)	0.16(0.28)	70.2(72.72)	3.4(3.80)	0.5(0.89)
14	43(15)	8.30(8.93)	0.84(1.06)	0.13(0.27)	71.7(72.77)	0.6(2.81)	0.1(0.73)
15	46(14)	8.50(9.18)	1.09(1.24)	0.16(0.33)	73.3(73.59)	2.3(2.84)	0.4(0.76)
16	37(16)	8.34(8.99)	1.38(1.20)	0.23(0.30)	73.0(73.58)	3.2(3.60)	0.5(0.90)
17	51(17)	8.44(9.55)	1.02(1.25)	0.14(0.30)	73.7(75.56)	3.8(4.11)	0.5(0.99)
18	47(19)	8.96(9.39)	1.04(1.35)	0.15(0.31)	75.3(75.80)	3.3(4.11)	0.5(0.94)
19	37(19)	8.89(9.69)	1.13(1.40)	0.19(0.32)	75.3(76.29)	2.4(3.38)	0.4(0.77)
20	47(16)	9.05(9.99)	1.16(1.43)	0.17(0.36)	76.4(77.33)	6.4(3.70)	0.9(0.93)
21	46(14)	9.03(10.19)	1.19(1.59)	0.18(0.42)	77.1(78.01)	3.3(3.99)	0.5(1.06)
22	34(13)	9.64(10.85)	1.10(1.59)	0.19(0.53)	77.7(80.08)	5.4(3.43)	0.9(1.14)
23	30(13)	9.98(10.54)	1.35(1.10)	0.25(0.49)	78.7(80.50)	4.3(3.67)	0.8(1.64)
24	30(13)	9.49(11.50)	1.40(1.41)	0.26(1.00)	78.6(83.65)	5.0(6.15)	0.9(4.35)
25-27	64	10.31	1.41	0.18	80.9	1.5	0.2
28-30	40	10.51	1.52	0.24	82.6	4.8	0.8
31-33	48	11.06	1.30	0.19	84.7	4.2	0.6
34-36	59	11.33	1.28	0.17	86.7	3.0	0.4
Total	1114* (422)						

* Tafari's column actually adds up to 1119.

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