AFRICA NUTRITION

Nutrition and Health Status of Young Children and Their Mothers in Eritrea

Findings from the 1995/96 Eritrea Demographic and Health Survey

U.S. Agency for International Development

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EXECUTIVE SUMMARY

Malnutrition is one of the most important health and welfare problems among infants and young children in Eritrea, resulting in serious health and economic consequences for both the individual and nation. Thirty-eight percent of Eritrean children 0 to 35 months of age are stunted, 16 percent are wasted, and 44 per cent of children are underweight. Of the children who are stunted, almost half are severely stunted. However, 19 percent of the wasted children are severely wasted.

Stunting and wasting show a clear age-specific pattern. The proportion of children stunted rises gradually from 4 to 21 months of age, at which time it peaks at about 61 percent, then drops between 22 and 27 months of age before rising to 80 percent by the end of the third year. Wasting follows a different pattern: the proportion of children wasted rises gradually from 3 months until it peaks at about 31 per ent of children at 16 months, after which it declines slowly to 20 percent at 21 months. By the third year of life, a little over 15 percent of children are wasted. The proportion of children underweight increases rapidly from 6 to 10 months of age then peaks at 16 months. All three indicators suggest that infants and toddlers in the first two years of life are the most vulnerable to malnutrition.

While almost all (98 percent) Eritrean children are breastfed, 48 percent of newborns are put to the breast within the first hour after birth, and 65 percent of children are exclusively breastfed until 4 months of age. This is the third highest rate in Africa. The key infant feeding behaviors that pose the greatest threat to child nutritional status and health is the early introduction of complementary liquids and foods and the use of a non-variable weaning diet from six months of age. Almost 36 percent of Eritrean infants under 4 months are receiving complementary liquids and foods. The introduction of complementary feeding before age 4 months puts infants at risk of malnutrition because the liquids and solid foods offered are nutritionally inferior to breast milk. In addition, feeding young infants liquids and solid foods increases their exposure to pathogens and consequently puts them at a greater risk of diarrhea. Fortunately, bottle-feeding is not common in Eritrea. Only 5 percent of children under one year are bottle-fed.

On the other hand, only 45 percent of Eritrean infants age 6 to 9 months are fed solid foods in addition to breast milk. The introduction of complementary foods, which is critical to meeting protein, energy, and micronutrient needs at about 6 months of age, therefore, is seriously delayed for more than half of Eritrean infants.

In Eritrea, 76 of every 1,000 infants born die before their first birthday. Among all children under 5 years, 153 of every 1,000 will die before reaching their fifth birthday. Malnutrition is an important factor in the deaths of young children.. An estimated 61 percent of all deaths among children under the age of five years are related to malnutrition. Because of its high prevalence, mild to moderate rather than severe malnutrition contributes the majority of these deaths (46 percent). This suggests that nutrition programs to prevent and treat mild to moderate malnutrition, as well as severe malnutrition, will have an important impact on child mortality.

The overall level of vaccination coverage in Eritrea is low. Just over 40 percent of children age 12 to 23 months have received all the recommended vaccinations.

Malnutrition and illness have a synergistic relationship. Malnutrition is an important factor in the death from disease of many young children. Among the children studied, one-quarter had diarrhea in the two weeks preceding the survey. The prevalence of diarrhea climbs precipitously during infancy peaking at about 40 percent at 11 to 12 months of age. Among children with diarrhea, a little over one-third were given some form of oral rehydration therapy (ORT). About 36 percent of children were given increased fluids during a diarrheal episode, and 15 percent were given the same amount.

Women's nutritional status prior to conception and during pregnancy is important both as an indicator of women's overall health and as a predictor of pregnancy outcome for the mother and infant. In Eritrea, 41 percent of non-pregnant mothers meet the criteria for chronic energy deficiency—i.e., a body mass index (BMI) of less than 18.5. This level of underweight is indicative of poor maternal nutritional status, and puts women and their children at risk.

Analysis of the factors associated with both maternal and child malnutrition point to poverty as the overriding factor determining the nutritional status of women and children in Eritrea. However, because the immediate causes are inadequate food intake and illness, both short- and long-term strategies are needed. Short-term strategies include the following:

- Focus on the first two years of life. Specifically, focus on encouraging mothers to exclusively breastfeed their infants for about six months and to introduce nutritious and hygienically prepared variable weaning foods no sooner than four months of age.

- Train health workers in optimal infant feeding to enable them to promote exclusive breastfeeding for the first six months and timely introduction of complementary feeding from six to nine months, particularly in rural areas.

- Improve child-feeding behaviors related to illness. Specifically, for those children who are still breastfed, focus on increasing the frequency of breastfeeding during and after a diarrheal episode to reduce dehydration and allow for catch-up growth. For children who are weaned, focus on increasing the use of oral rehydration therapy during diarrhea. For all children, promote active feeding during and after illness.

- Improve the energy balance of all women and, in particular, pregnant and lactating women, by improving dietary quality and quantity and by reducing energy expenditure.

- Improve access to and use of reproductive health services to allow women to space their births to at least two years apart. This will improve the probability of child survival and also permit women time to recuperate nutritionally between pregnancies.

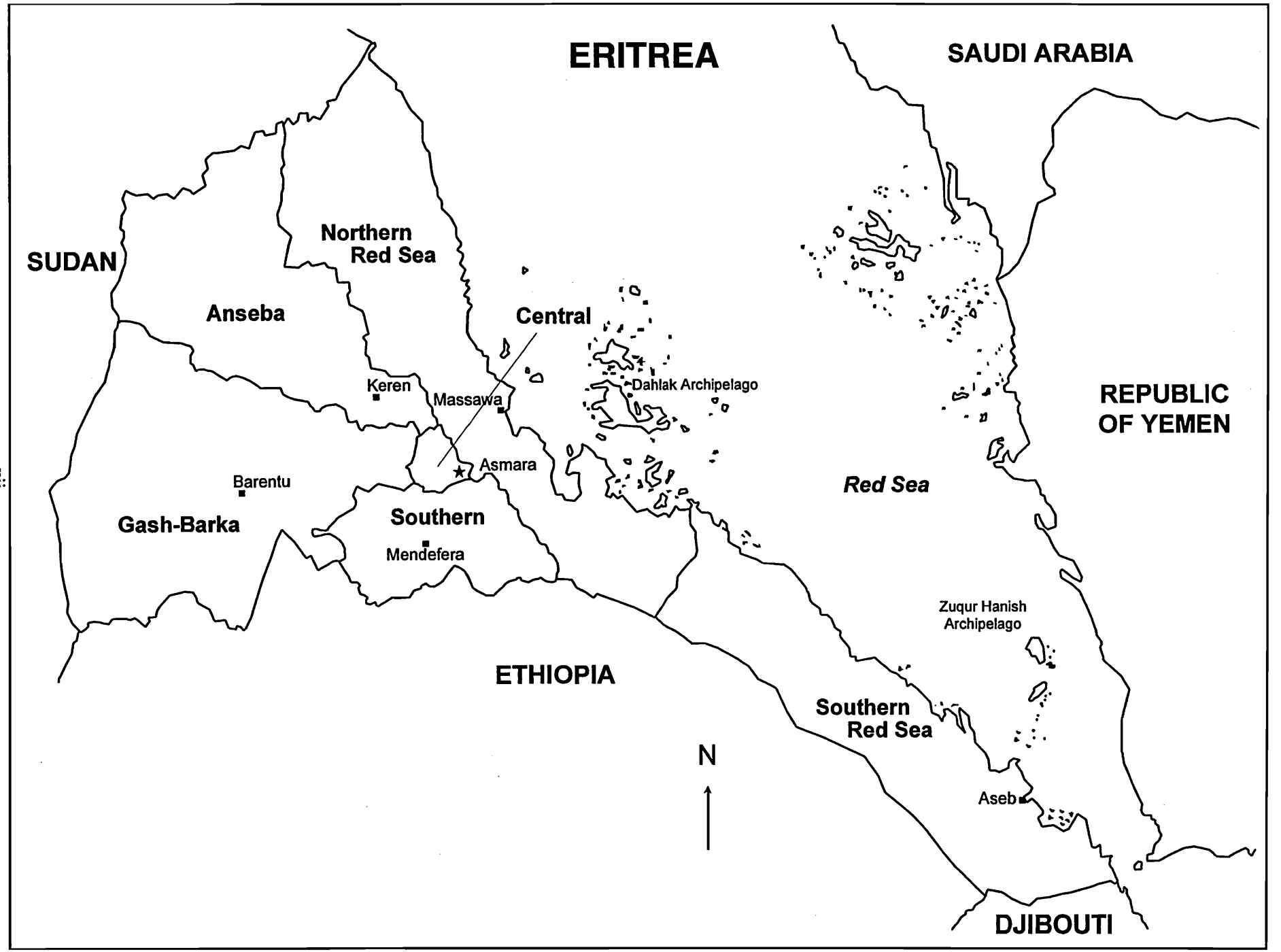
- Reinforce the integrated management of childhood illness, currently promoted by UNICEF and WHO.

Long-term strategies include the following:

- Improve access to educational opportunities for female children. Maternal education is strongly associated with the nutritional status of both mothers and children. Although the effect of maternal education, independent of its association with wealth, could not be disentangled in this study, a large body of literature shows that independent of household wealth, maternal education has a strong positive effect on the nutritional status of children.

- Promote income-earning opportunities for women to improve the economic status of households, thereby improving the nutritional status of women and children.

- Improve access to water and sanitation, and overall environmental and household hygiene. This will reduce exposure to diarrhea, a direct cause of malnutrition in children.


ERITREA
SAUDI ARABIA
SUDAN
Northern
Red Sea
Anseba
Central
Keren
Massawa
Dahlak Archipelago
REPUBLIC
OF YEMEN
Asmara
Barentu
Red Sea
Gash-Barka
Southern
Mendefera
Zuqur Hanish
Archipelago
ETHIOPIA
Southern
Red Sea
N
Aseb
DJIBOUTI

CHAPTER 1

INTRODUCTION

1.1 Geography, History and Economy

Geography

Eritrea, shaped like a hatchet, lies north of the equator and just north of the Horn of Africa. It is bounded in the northwest by the Sudan, in the south by Ethiopia, and in the southeast by Djibouti. Its longest border, the "handle" of the hatchet, is in the east on the Red Sea.

The country has a coastline of more than 1,000 kilometers (625 miles) and its territory includes more than 350 islands. Eritrea's proximity to the Red Sea together with its physical features account for its varied climate and rainfall. The highlands have a cool temperate climate while the lowlands are characterized by a hot and humid climate, especially along the coast. Eritrea is in the Saharan rainfall zone and receives its heaviest rains from the southwest monsoons. In normal years, rainfall varies from an annual average of 400 mm to 650 mm in the highlands and from 200 mm to 300 mm in the lowlands.

History

On 1 January 1890, Italy set the boundaries of Eritrea and ruled it as a colony until 1941 when the British defeated the Italians in the African theater and took over the administration of Eritrea. During World War II, the British made Eritrea into an important center for British and American operations in the region.

With Italy's defeat in the Second World War, the question of the disposal of its colonies was raised in the United Nations (UN). The UN sent several multinational investigative teams to Eritrea to conduct local surveys on the wishes of the people. Different teams came up with different solutions, including dividing Eritrea into various portions and awarding them to Britain, France and Ethiopia; maintaining the protectorate for 10 years and then conducting a referendum; and granting full independence. After some years of deliberation, the UN adopted a resolution federating Eritrea with Ethiopia, but guaranteeing Eritreans some democratic rights and autonomy.

However, during the federation with Ethiopia, Emperor Haile Selassie's government systematically violated the rights granted by the UN. In 1961, an armed struggle for independence began after years of peaceful protest against Ethiopian infringements on Eritrean democratic rights and autonomy produced no improvement in a parliament and annexation of Eritrea as Ethiopia's fourteenth province in 1962.

In May 1991, 30 years after the struggle for independence began, the Eritrean People's Liberation Front (EPLF) liberated the entire country and established the Provisional Government of Eritrea (PGE). At the same time, the Ethiopian People's Revolutionary Democratic Front overthrew the Dergue, the Ethiopian Military junta, and instituted a Transitional Government in Ethiopia (TGE). In July 1991, at a national conference in Addis Ababa held to deliberate on the future of the country, the TGE endorsed the EPLF's decision to settle the Eritrean question in a referendum to be held two years hence, in which only Eritreans would participate.

In April 1993, the PGE conducted an internationally supervised referendum in which 98.5 percent of the population participated; 99.8 percent voted for independence. The head of the UN observer mission said the referendum was "free and fair at every stage." Other observer groups confirmed this.

After Eritreans celebrated their official independence on 24 May 1993, the Government was enlarged and reorganized, and a timetable of four years was set to accomplish the drafting of a constitution, development of political pluralism, and the establishment of an elected government (Ministry of Foreign Affairs, 1995).

Administratively, the country is divided into 6 zones, 55 sub-zones, 654 village administrations, and 2,581 villages. Eritrea has proclaimed decentralization of power and services to the zones and is working towards its full implementation.

Economy

Economically, the thirty-year war of liberation caused decades of lost development as well as the destruction of economic and social infrastructures. In 1995, Eritrea was a low-income developing country with a per capita income of less than US $200 per year.

Over 70 percent of Eritrea's people depend for their livelihood on traditional subsistence agriculture including crop farming, livestock raising and fishing, although commercial agriculture and fishing have recently been revived. Eritrea's industrial base is extremely backward and narrow as it is made up of small- and medium-scale, consumer-goods-producing industries (food, beverages, leather goods, textiles, etc.) whose technology is largely out of date as a result of neglect of investment during the long war.

Eritrea has, however, ample natural resources including over 2 million hectares of potentially arable land and the vast Red Sea continental shelf. The Red Sea fishing grounds are estimated to be capable of sustaining a production level of around 70,000 tons of fish per annum, while the current production level is less than 5,000 tons per year. As far as mineral resources are concerned, studies indicate the existence of base metals (gold, copper, zinc, lead, silver, etc.) in several parts of the country but the commercial viability of the deposits has yet to be established. In fact, several companies have recently applied and received licenses to undertake exploration and prospecting work for base metals in the promising areas of the country. The potential for extracting petroleum from the Red Sea is also considered to be good and one company has already been granted an exploration license. Government development efforts since independence have concentrated on rehabilitating and rebuilding the war-damaged and destroyed economic and social infrastructures, creating and strengthening the institutions of a new state, and laying down the policy and legislative groundwork for development. In November 1994, the government issued a Macro-Policy statement that spells out the broad goals and strategies of development for the next twenty years. According to the Macro-Policy, "The creation of a modern technologically advanced and internationally competitive economy within the next two decades is an overriding national development objective." The key strategies envisaged in realizing this objective are "...human capital formation with education and health as key inputs, export oriented development both in industry and agriculture, infrastructure development to remove critical bottlenecks, environmental restoration and protection, and the promotion of the private sector."

1.2 Population

Since there has not been any survey of census conducted in the country before or after independence, the population size is not known with any degree of precision. Some rough professional estimates put the country's population in the range of 2.5 to 3.5 million. Estimates of the number of Eritreans living abroad range between 700,000 and 1,000,000. The population is culturally and linguistically diverse, consisting of nine ethnic groups, namely, Afar, Bilen, Hedarib, Kunama, Nara, Rashaida, Saho, Tigre, and Tigrigna.

1.3 Nutrition and Food Security Policy

Investments in food security and nutrition can directly and indirectly address the most fundamental causes and consequences of poverty, ignorance, and ill-health. Nutrition improvements are clearly important for human well-being, but they are also investments in economic development through impacts on productivity and educability of future generations. Worldwide evidence also suggests a close association between food and security and political instability brought about by unrest in the population. Recent studies indicate that more than half of all child mortality results from the interaction of malnutrition and infection. Food security and nutrition are therefore among the top development priorities for Eritrea, especially because the prevalence of malnutrition is among the highest in the world. Causes include inadequate dietary intake, inappropriate maternal and child care, and high disease prevalence and severity. These immediate causes are in turn due to poor access by households to sufficient food, limited health services, and a lack of awareness and support for the needs of women and mothers of young children. Addressing the multiple casualties of malnutrition requires concerted action in many sectors at many levels—households, community, zonal, and national. Regional and international support are also vital. The food and nutrition strategy of Eritrea is to implement coordinated health and agriculture sector interventions aimed at producing sustained nutritional improvements in the long term.

Objectives:

- To ensure food security in all households and improve the nutritional status of the population, especially women and children.
- To eliminate iodine deficiency disorders by the year 2000.
- To virtually eliminate vitamin A deficiency by the year 2000.
- To reduce iron deficiency anemia by one-third by the year 2000.
- To achieve food security at the national level in the coming 5 years.
- To incorporate food and nutritional objectives within health, agriculture, poverty alleviation, education, industry, and other sectorial priorities.
- To develop and maintain the necessary technical, managerial, and institutional capabilities to accomplish the above objectives.

1.4 Micronutrient Deficiencies

In 1993, the Ministry of Health with assistance from UNICEF undertook a national micronutrient deficiency survey. This survey shows that vitamin A deficiency, iodine deficiency disorder, and nutritional anemia are all public health problems in Eritrea.

According to this survey, 7 percent of Eritrean infants suffer from vitamin A deficiency (VAD) and 28 percent more are at risk of developing it. These relatively low rates may result from high rates of breastfeeding, since breast milk provides enough vitamin A for a baby. Vitamin A deficiency is probably much higher in older children, contributing to blindness and increased susceptibility to diarrhea, measles, and pneumonia—three leading killers of children. This deficiency can be easily prevented by adding small amounts of fruits and green vegetables to the child's diet or by giving the child a vitamin A capsule three

times a year at a cost of about one Birr (US 15 cents). The Ministry of Health has already programmed the distribution of vitamin A capsules to under-five children during one of the National Immunization Days (NIDs), effective December 1997.

Iodine deficiency disorders (IDDs) are widespread in Eritrea, with 22 percent of 10-year-old school children showing the most visible symptom of iodine deficiency—a goiter in the neck. Estimates based on a recent national survey (Micronutrient Deficiency Survey, 1993) suggest that 510 cretins and 50,960 infants suffering from some IQ loss are born in Eritrea every year due to iodine deficiency. It is also believed that as many as 637,000 children age 0-17 years have some form of IQ loss. A pregnant woman with a high level of iodine deficiency may give birth to a child who is stillborn or brain-damaged. Iodine deficiency disorders can be prevented by adding iodine to salt, a universally consumed product. To this end, iodation equipment has been put into operation in the salt plants at Assab and Massawa, which supply most of Eritrea's and Ethiopia's salt. This will enable both these countries to counter the serious effects of IDD and to enhance the productivity of their populations at home, in the workplace, and in schools.

Another large problem in Eritrea is anemia (iron deficiency). About 55 percent of infants have anemia, which is a leading cause of mortality (12 percent) in children admitted to hospitals. Anemia among women is also believed to be high. Women need more iron than men. While men lose about 1 mg of iron per day, women usually lose 2 mg, and pregnant and lactating women lose 3 mg as the child draws down some of the mother's iron. Pregnancy also brings greater risk to anemic women. Malaria or hemorrhage in healthy women might result in mild illness but in anemic women they are life-threatening. Unfortunately, there is no easy way to prevent anemia. Iron tablets, at 5 or 6 cents (US one cent), are inexpensive but they require adequate contact between women and health services. The most promising solution, the double fortification of salt with iron and iodine, is not yet fully tested. In Eritrea, the traditional practice of letting the "sick" blood of an anemic patient is extremely damaging—an anemic person needs to have her blood increased, not to have it taken away.

CHAPTER 2

NUTRITIONAL STATUS OF INFANTS AND CHILDREN

Malnutrition is an important health and welfare problem among infants and young children in Eritrea. This chapter will examine the prevalence and severity of malnutrition among Eritrean infants and children (from birth to 3 years of age), regional differences in malnutrition, and the age-specific nature of the patterns of malnutrition. Context will be provided by comparing Eritrean data and trends with information from DHS surveys in other sub-Saharan countries.

2.1 Effects of Malnutrition

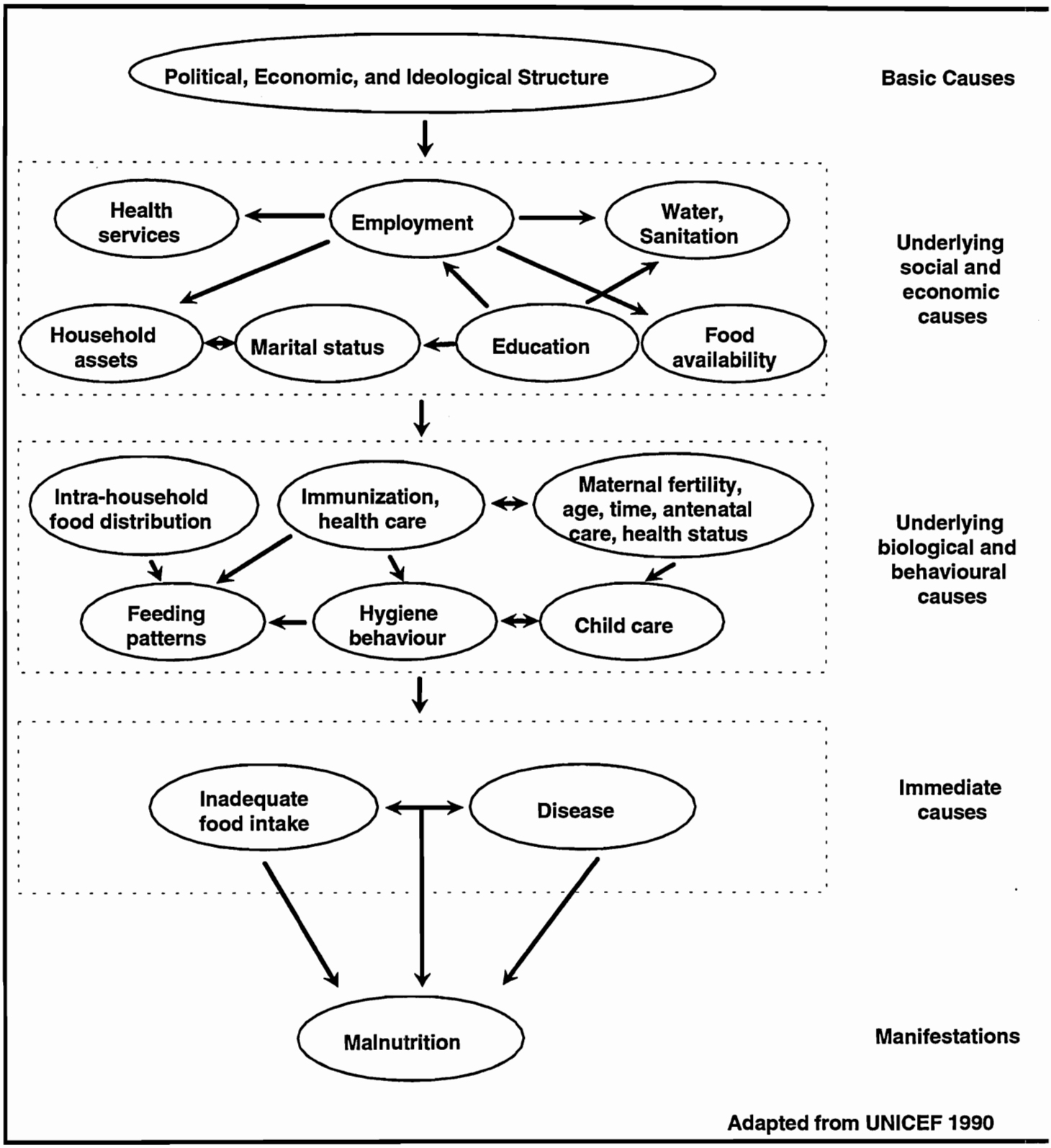
Malnutrition results in increased risk of illness and death. In addition, malnutrition can result in a lower level of cognitive development and educational attainment (Brozek and Schurch, 1984). In adulthood, the accumulated effects of malnutrition can reduce worker productivity and increase absenteeism in the workplace, both of which may reduce individual and national lifetime earning potential (World Bank, 1993). Malnutrition can also have intergenerational effects; infants born to women who were malnourished during early childhood are smaller than infants born to women who were not malnourished during early childhood (Villar and Rivera, 1988). Low birth weight infants (defined as birth weight less than or equal to 2.5 kg) are at greater risk of illness and death compared with normal birth weight infants (IOM, 1985).

Malnutrition is a direct result of inadequate food intake and infectious disease. Inadequate food intake is a consequence of some combination of insufficient food at the household level and improper feeding practices. Increased incidence and duration of infectious diseases—particularly diarrhea, acute respiratory illness, malaria, and measles—result from inadequate health care, insufficient water supply, and poor environmental sanitation (Haggerty et al., 1994a; Clemens and Stanton, 1987). Diarrheal disease compromises nutritional status through reduced dietary intake, poor absorption, and increased nutrient loss (Brown et al., 1990; Rosenberg et al., 1977; Rahaman and Wahed, 1983). Children in environments where infectious diseases are common often suffer recurrent infections and are unable to recover fully from each bout of illness. These recurrent infections weaken immunity and increase susceptibility to malnutrition.

Understanding the interaction between inadequate food intake and infectious disease is important in understanding the direct causes of child malnutrition (Lutter et al., 1989). Diarrhea plays a particularly important role in this interaction. Several studies have pointed to the fact that children's nutritional status depends on both the prevalence of diarrhea and food intake. Thus, when both malnutrition and infection are present, the result is an interaction that is biologically more detrimental than the combined effect of the two working independently (Scrimshaw et al., 1968). These interactive effects are important in Eritrea, where the delayed introduction of complementary foods (resulting in inadequate nutrient intake) and the high prevalence of diarrheal disease between 3 and 12 months of age correspond to a dramatic increase in the prevalence of malnutrition.

Inadequate intake of food and disease reflect underlying social and economic conditions at the household, community, and national levels. Figure 2.1, adapted from the UNICEF conceptual framework (UNICEF, 1990; Jonsson, 1995), reflects the relationships among variables and mechanisms that lead to childhood malnutrition. Political, socioeconomic, environmental, and cultural factors operating at the national and community levels, and poverty at the household level, ultimately affect the nutritional status of children. For example, in communities that have little access to health care, children are more vulnerable to malnutrition

Figure 2.1
Causes of Malnutrition



as a consequence of low immunization rates, poor antenatal care, and inadequate treatment of common childhood diseases. Poor sanitation also puts children at increased risk of infection from the ingestion of contaminated food and water (Esrey et al., 1985; Haggerty et al., 1994a). At the household level, employment, by providing a source of income, is an important determinant of household food security. In particular, female employment, which offers women opportunities for resource control, has been shown to result in increased food availability, improved child care practices, and improved nutritional status. Similarly, maternal education, through its association with the biological and behavioral causes of malnutrition, such as intra-household food distribution, child care practices, feeding behaviors and patterns, and food handling procedures, is a powerful predictor of children's nutritional status (Moore and Favin, 1990).

2.2 Basic Indicators of Nutritional Status

The assessment of nutritional status is based on the concept that in a well-nourished population the distribution of children's height and weight, for a given age, will approximate a normal distribution. This means that about 68 percent of children will have a height or weight within 1 standard deviation of the median for that age. About 14 percent of children will have a height or weight within 1 or 2 standard deviations of the median for that age. Of the remainder, 2 percent will have a height or weight less than 2 standard deviations from the median for that age. Because all populations have similar genetic potential for growth (Habicht et al., 1974), the U.S. National Center for Health Statistics (NCHS) Reference Data are recommended by WHO (1979) to be used in the evaluation of nutritional status.

There are three commonly used indicators of the nutritional status of infants and children.

Stunting, defined as height-for-age more than 2 standard deviations below (-2 SD) the median of the NCHS reference population, is the failure to grow adequately in height in relation to age. It reflects past or chronic malnutrition and results from inadequate food intake over a long period of time and/or repeated episodes of illness, particularly diarrhea.

Wasting, defined as weight-for-height more than 2 standard deviations below (-2 SD) the median of the NCHS reference population, is the failure to gain weight adequately in relation to height and reflects recent or acute malnutrition. Wasting results from a recent shortage of adequate nutrition and/or recent or current illness, especially diarrhea.

Underweight, defined as weight-for-age more than 2 standard deviations below (-2 SD) the median of the NCHS reference population, is a composite indicator that reflects either chronic or acute malnutritional status, or both. It does not add additional information beyond that provided by the indicators of stunting and wasting; however, it is often used as a general indicator of a population's health status.

Children who are 2 standard deviations below the reference median but not 3 standard deviations below the reference median are considered moderately malnourished. Children who are 3 or more standard deviations below the reference median are considered severely malnourished.

2.3 Data and Methodology

The 1995 Eritrea DHS includes 2,580 children under three years of age. Of these children, 2,424 were living at the time of the survey and were eligible for anthropometric data collection. Complete anthropometric data are available for 2,269 children, 94 percent of all living children under three years of age sampled in the EDHS. The reason most commonly reported for not measuring a child was that the child was not at home. Appendix C presents data on the quality of nutrition data from the 1995 EDHS.

The tables, figures, and analyses in this report that do not directly measure anthropometry are based on all 2,580 children under the age of 3 years included in the EDHS; anthropometric analyses are based on the 2,269 children for whom complete anthropometric data are available. All the analyses in this report were done using SPSS for Windows, Version 6.1.3, and STATA for Windows, Version 5.0. The figures in this report were made using Harvard Graphics, Version 3.0. For bivariate tables, p-values were determined using Pearson's chi-square test. Multivariate analyses used logistic regression and ordered logistic regression. (Appendix F describes the regression methodologies used in more detail.)

2.4 Gestational Age and Birth Weight

Birth weights and size at birth for all living children under the age of 3 years are presented in Table 2.1. Mothers were able to report birth weights for only 14 percent of children, making interpretation of the data difficult. The mean birth weight for these children is 3.2 kg (with a standard deviation of ±0.04 kg), which is slightly lower to the NCHS median of 3.3 kg (WHO, 1979). Among those children weighed at birth, the prevalence of low-birth-weight births is 14 percent. Roughly 10 percent of infants were perceived by their mothers to be small at birth, and 17 percent were perceived to be very small.

Table 2.1 Birth weight and size at birth for children under three years

Among children under three years of age, the percentage weighed at birth, mean birth weight, the percentage of low birth weight births (< 2.5 kg) and the percent distribution of births that were small at birth or of average size or larger, by zone, residence, socioeconomic status, and whether the child was weighed at birth, Eritrea 1995

		Birth weight			Size at birth					
Variable	Weighed at birth	Mean (kg)	SD	Low birth weight	Average or larger	Small	Very small	DK/ Missing	Total	Number of births
Zone										
Southern Red Sea	16.0	*	*	*	49.6	12.1	29.9	8.4	100.0	68
Northern Red Sea	5.6	(3.3)	(0.17)	(10.9)	62.6	10.5	25.6	1.2	100.0	341
Anseba	6.4	3.5)	(0.23)	(6.3)	61.7	12.2	25.6	0.4	100.0	330
Gash-Barka	5.3	(3.2)	(0.16)	(20.8)	57.1	9.5	26.0	7.4	100.0	499
Southern	6.7	3.1	0.10	14.3	82.4	10.1	7.1	0.5	100.0	882
Central	48.2	3.1	0.05	13.2	78.1	9.9	10.8	1.2	100.0	459
	p=0.00			p=0.78[a]		p=0.00				
Residence										
Urban	52.7	3.2	0.04	11.4	82.2	7.5	8.5	1.7	100.0	542
Rural	3.5	3.2	0.12	21.9	67.5	11.1	19.0	2.4	100.0	2,037
	p=0.00			p=0.03		p=0.00				
Socioeconomic status										
Low	2.2	(3.2)	(.19)	(18.3)	64.5	11.1	21.4	3.0	100.0	1,459
Medium	9.5	3.2	0.10	15.9	76.8	9.2	12.8	1.2	100.0	665
High	57.8	3.2	0.05	12.4	81.2	9.4	8.0	1.4	100.0	455
	p=0.00			p=0.55		p=0.00				
Weighed at birth										
Not weighed	na	na	na	na	68.3	10.8	18.3	2.6	100.0	2,222
Weighed	100.0	3.2	0.04	13.5	85.0	7.6	7.4	0.0	100.0	358
						p=0.00				
Total	13.9	3.2	0.04	13.5	70.6	10.3	16.8	2.2	100.0	
Number	2,580	358		358						2,580

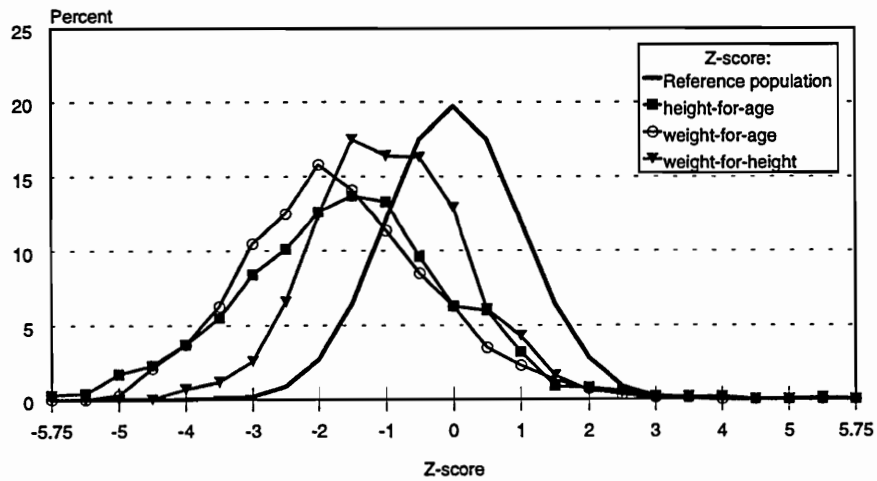
Note: Level of significance determined using Chi-square test. Figures in parentheses are based on 25 to 49 unweighted children; an asterisk indicates that a figure is based on fewer than 25 children and has been suppressed.
na = Not applicable
[a] Chi-square statistic is unreliable due to small number of cases in one or more cells.

There were large regional differences in the proportion of newborns weighed at birth. The highest proportion was in the Central Zone, where less than half of all infants (48 percent) were weighed at birth. This zone includes the capital city, Asmara. In the Southern Red Sea Zone 16 percent of infants were weighed, and less than 7 percent were weighed in all the other zones. A little over half (53 percent) of children in urban areas were weighed compared with only 4 percent of rural children; over half (58 percent) of all children from families with a high socioeconomic status index were weighed compared with less than 10 percent for poorer families. Eighty-five percent of children who were weighed at birth were perceived to be of average or larger size by their mothers. These results suggest that babies from better-off families and zones were more likely to be weighed than were babies from poorer families. This suggests that the mean birth weight of 3.2 kg is an overestimate of the true mean birth weight.

2.5 Nutritional Status and Prevalence of Malnutrition

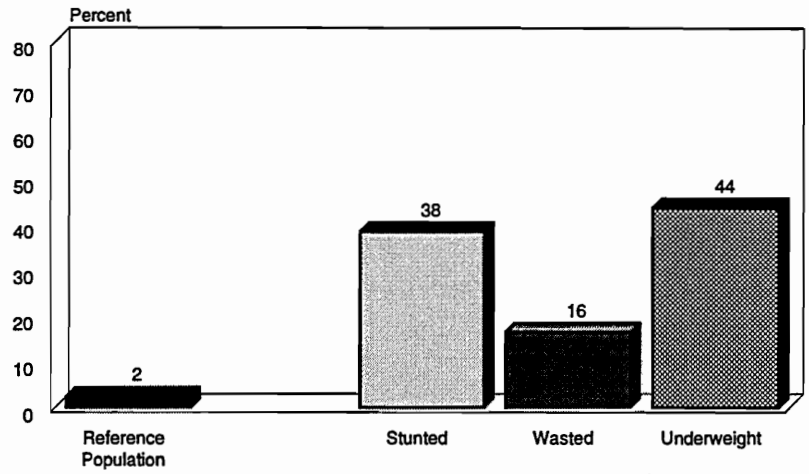
In Figure 2.2, the nutritional status of Eritrean children under 36 months of age is compared with the international reference standard. In this figure, the distribution of z-scores for height-for-age, weight-for-age and weight-for-height are compared to the normal distribution of the reference standard. It is clear that all three curves for Eritrea are substantially shifted to the lower end of the scale, indicating quite low levels of nutrition. Weight-for-age shows the greatest shifting to the left, followed by height-for-age and then weight-for-height. The dispersions of the distributions are somewhat greater than that of the reference standard, indicating a somewhat greater heterogeneity in Eritrean children than in the population on which the reference standard is built. The parts of the distributions to the left of -2 z-score indicate the proportions of Eritrean children with moderate or severe malnutrition. These results are summarized in the next figure and table.

Figure 2.2 Distribution of Height-for-Age, Weight-for-Age and Weight-for-Height, Eritrea



The prevalence of malnutrition in Eritrea is high, with 38 percent of children 0 to 35 months of age being stunted, and 16 percent being wasted (Figure 2.3). These are 19 and 8 times, respectively, the levels that would be expected in a healthy, well-nourished population. Forty-four percent of children are underweight for their age, 22 times the level expected in a healthy, well-nourished population.

Figure 2.3 Malnutrition among Children under Three Years, Eritrea



Note: *Stunted* reflects chronic malnutrition; *wasted* reflects acute malnutrition; *underweight* reflects chronic or acute malnutrition, or a combination of both.

Source: EDHS 1995

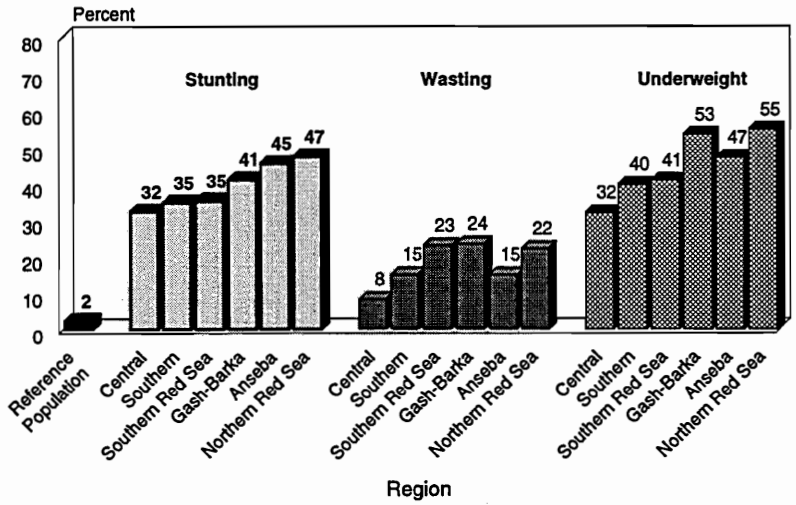
Severe stunting and underweight (i.e., 3 standard deviations below the reference median) affect 18 and 17 percent of all Eritrean children, respectively. Of the children who are stunted, almost half are severely stunted (Table 2.2). Roughly 19 percent of wasted children (3 percent of all children) are severely wasted (Table 2.2). In a healthy, well-nourished population only 0.13 percent of children are expected to be severely malnourished. The level of severe stunting in Eritrea is 138 times that expected in a healthy, well-nourished population, and the level of severe wasting is 24 times the healthy level.

2.6 Geographic Variations in Malnutrition

There is significant regional variation in the proportion of children suffering from malnutrition (Figure 2.4 and Table 2.2). The highest prevalence of stunted and underweight children (Figure 2.4) is in the Northern Red Sea Zone (47 and 55 percent, for stunting and underweight, respectively), and the lowest is in the Central Zone (32 percent stunted and wasted). The Central Zone also has the lowest levels of wasting (8 percent). Wasting is highest in the Gash-Barka Zone (24 percent).

Severe wasting ranges from 1 percent in the Central Zone to 4 percent in the Southern Red Sea and Gash-Barka. The Central Zone also has the lowest proportion of children severely stunted, and the Northern Red Sea Zone has the highest proportion (26 percent; Table 2.2).

Figure 2.4 Stunting, Wasting, and Underweight among Children under Three Years by Region, Eritrea



Note: *Stunted* reflects chronic malnutrition; *wasted* reflects acute malnutrition; *underweight* reflects chronic or acute malnutrition, or a combination of both.

Source: EDHS 1995

Table 2.2 Stunting, wasting, and underweight

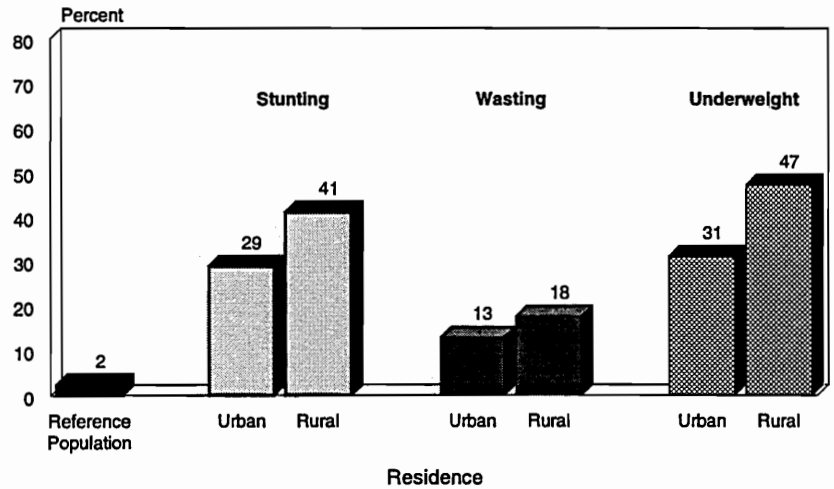
Among children under three years of age, the percentage who are moderately malnourished and the percentage who are severely malnourished, by selected background characteristics, Eritrea 1995

Background characteristics	Stunting			Wasting			Underweight			Number of children
	Normal	Moderate	Severe	Normal	Moderate	Severe	Normal	Moderate	Severe	
Zone										
Southern Red Sea	64.8	17.6	17.6	77.0	18.7	4.3	59.2	27.6	13.2	36
Northern Red Sea	52.8	20.9	26.3	77.8	18.6	3.7	45.3	31.3	23.5	281
Anseba	54.6	24.3	21.1	85.0	11.0	4.0	53.0	30.1	16.9	300
Gash-Barka	59.0	19.6	21.4	76.5	19.4	4.1	46.6	26.2	27.3	425
Southern	65.3	19.0	15.7	84.9	12.0	3.0	60.3	25.5	14.1	820
Central	67.8	19.7	12.5	91.7	7.0	1.3	68.0	24.1	7.9	408
		p=0.00			p=0.00			p=0.00		
Residence										
Urban	71.3	17.4	11.3	87.2	10.7	2.0	69.0	21.6	9.4	473
Rural	59.1	20.9	20.1	82.6	13.9	3.4	52.9	28.1	19.0	1,796
		p=0.00			p=0.05			p=0.00		
Socioeconomic status										
Low	56.6	21.6	21.8	80.6	15.3	4.1	50.2	27.6	22.2	1,270
Medium	65.4	19.4	15.2	85.4	12.2	2.4	59.5	28.2	12.3	599
High	71.9	16.7	11.4	90.1	8.5	1.3	70.8	21.7	7.4	400
		p=0.00			p=0.00			p=0.00		
Sex of child										
Male	63.6	19.7	16.6	83.8	12.7	3.5	57.7	26.3	16.0	1,162
Female	59.5	20.6	20.0	83.3	13.9	2.8	54.8	27.2	18.0	1,107
		p=0.07			p=0.48			p=0.31		
Total	61.6	20.1	18.3	83.6	13.3	3.1	56.3	26.8	17.0	2,269

Note: Level of significance determined using Chi-square test.

Urban-rural differences are more pronounced for stunting and underweight than for wasting. The level of stunting is 12 percentage points higher in rural areas (41 versus 29 percent), while the level of underweight is 16 percentage points higher in rural areas (47 versus 31 percent). In contrast, the level of wasting is only 5 percentage points higher in rural areas (18 versus 13 percent; Figure 2.5). A larger proportion of rural children than urban children are severely stunted (20 versus 11 percent), and a slightly larger proportion are severely wasted (3 versus 2 percent; Table 2.2).

Figure 2.5 Stunting, Wasting, and Underweight among Children under Three Years by Residence, Eritrea



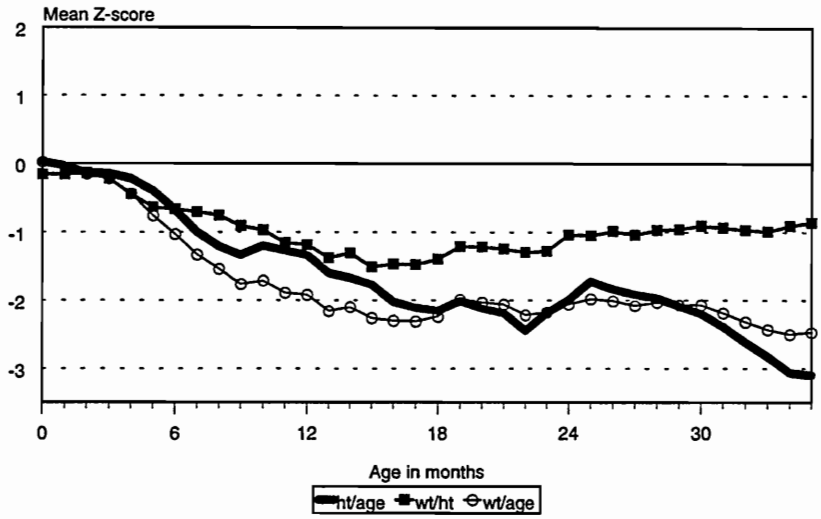
Note: *Stunted* reflects chronic malnutrition; *wasted* reflects acute malnutrition; *underweight* reflects chronic or acute malnutrition, or a combination of both.

Source: EDHS 1995

2.7 Age-specific Patterns of Nutrition and Malnutrition

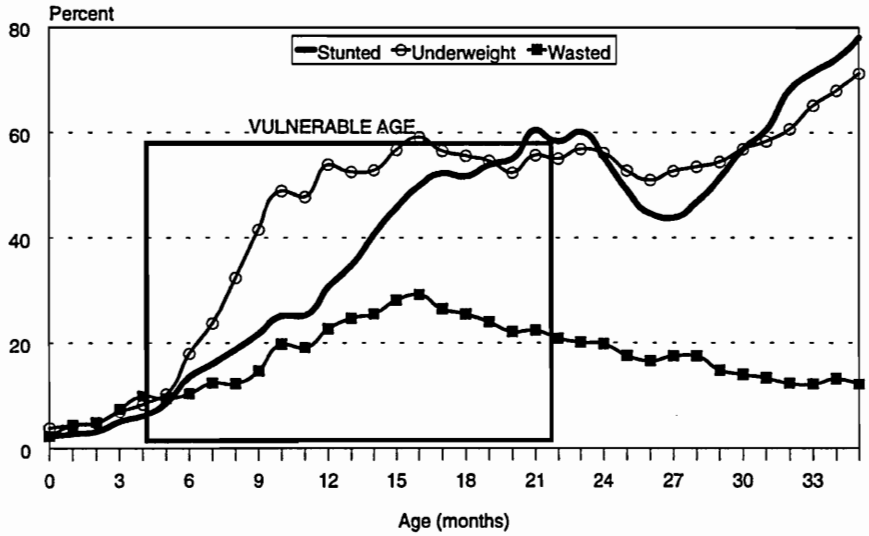
The deterioration of nutritional status according to age can be seen from Figure 2.6, where mean z-score for height-for-age, weight-for-age, and weight-for-height is plotted according to age. The line at zero z-score represents the mean of the reference standard, which by definition does not vary by age. Positive and negative deviations from this zero line indicate conditions of over- and undernutrition, respectively. It can be seen from Figure 2.6 that mean z-scores of Eritrean children for height-for-age and for weight-for-age progressively deteriorate from approximately being equal to those of the reference population at ages 0-4 months to over 2 standard deviations below the reference for children over 30 months of age. Weight-for-height also deteriorates until about 15 months of age and then recovers slightly, but is still about 1 standard deviation below the reference mean for children 24 months of age and over.

Figure 2.6 Mean Z-score for Height-for-Age, Weight-for-Age, and Weight-for-Height, Eritrea



In terms of malnutrition, there is a clear age-specific pattern of stunting, wasting, and underweight (Figure 2.7). The proportion of children stunted rises rapidly from 4 to 21 months of age, at which time it reaches 61 percent. The proportion then drops somewhat between 22 and 27 months of age before rising to a level of 80 percent by the end of the third year. Underweight follows a pattern similar to stunting. A major difference is that underweight rises much more steeply than stunting from 6 months to 10 months of age.

Figure 2.7 Stunting, Underweight, and Wasting by Age, Eritrea



Note: *Stunted* reflects chronic malnutrition; *wasted* reflects acute malnutrition; *underweight* reflects chronic or acute malnutrition, or a combination of both.

Source: EDHS 1995

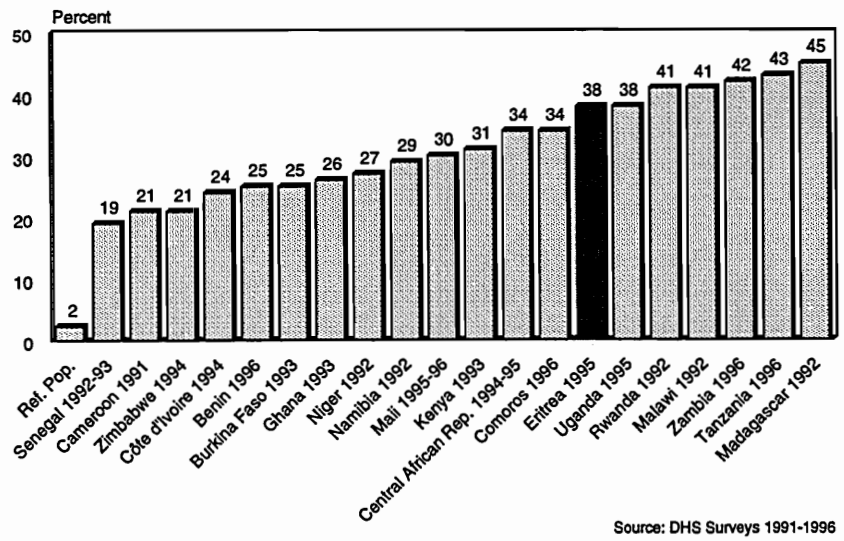
Wasting, on the other hand, follows a different pattern, illustrating the difference in etiology between stunting and wasting. The proportion of children wasted rises from 3 months to 16 months of age, where it peaks at about 31 percent of children. Thereafter the proportion of children wasted starts to gradually decline, with about 20 percent of children wasted by the time they are 21 months old, and a little over 15 percent wasted in the third year of life.

These patterns show that, in the first three months of life, relatively few children are malnourished. Between the ages of 3 and 21 months malnutrition rates consistently rise. During this period children are very vulnerable both to wasting and to stunting. Inadequate dietary intake and illness experienced during infancy and the second year of life result in long-term growth failure, manifested by the sustained high level of stunting in the third year of life. These data indicate that stunting rates in Eritrea rise to extremely high levels (80 percent) by the end of the third year of life. However, the extraordinarily high stunting rates at age 3 years found in the EDHS may reflect unusual historical conditions. Children who were 3 years old or older at the time of the survey were born soon after the end of the Eritrean War of Liberation, and spent their first few years of life in a post-war environment of very poor economic, social, and health conditions during which food production suffered from a continuous drought as well. These conditions probably contributed to the high stunting rates seen among children in their third year of life in the EDHS data.

2.8 Malnutrition among Children Age 0 to 35 Months in Eritrea Compared with Other Sub-Saharan Countries

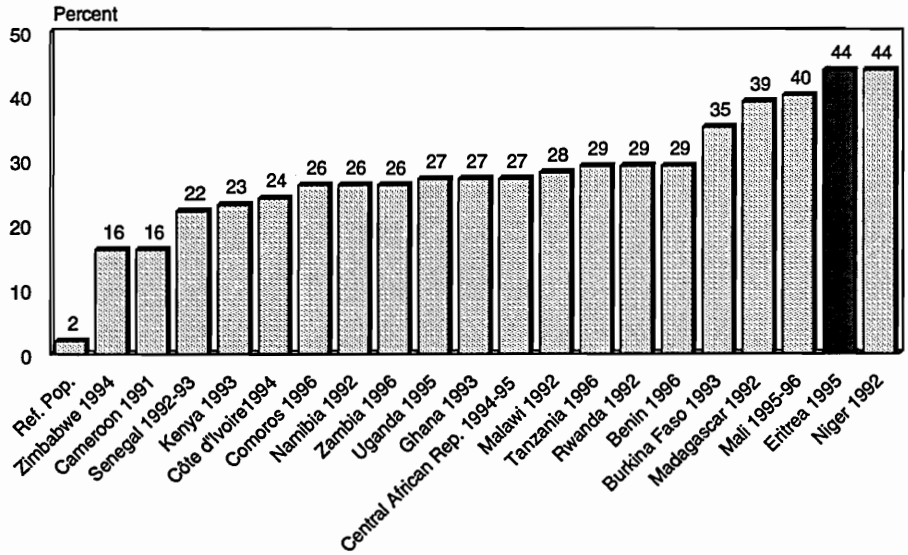
Comparison of nutritional status among sub-Saharan countries must be done with caution as the season in which anthropometric data are collected can greatly affect the proportion of children categorized as malnourished. Underweight and wasting are especially vulnerable to this limitation; stunting is likely to be less affected. Among children under 3 years in the sub-Saharan countries surveyed (Figure 2.7), the proportion stunted ranged from 19 percent in Senegal (1992-93) to 45 percent in Madagascar (1992). Eritrea falls towards the high end of this range, with about 38 percent of children stunted. Eritrea has the highest rate of underweight for children 0-35 months in sub-Saharan Africa. The proportion underweight in sub-Saharan African countries (Figure 2.8) ranged from 16 percent in Zimbabwe (1994) and Cameroon (1991) to 44 percent in Eritrea (1995) and Niger (1992).

Figure 2.8 Stunting among Children Age 0 to 35 Months in Eritrea Compared with Other Sub-Saharan Countries



Source: DHS Surveys 1991-1996

Figure 2.9 Underweight Children Age 0 to 35 Months in Eritrea Compared with Other Sub-Saharan Countries



Source: DHS Surveys 1991-1996

CHAPTER 3

INFANT AND CHILD FEEDING PRACTICES

3.1 Optimal Infant and Child Feeding Practices

Infant and child feeding practices are important predictors of child nutritional status and the prevalence of malnutrition. In this chapter, optimal infant feeding practices are described and compared with infant feeding practices in Eritrea.

Optimal infant feeding is defined by WHO and UNICEF as follows (WHO/UNICEF, 1990; WHO, 1994):[1]

- Initiation of breastfeeding within about one hour of birth;
- On-demand and frequent feeding (including night feeds);
- Exclusive breastfeeding (defined as breast milk only and no other foods or liquids) until the infant is about 6 months of age;
- Breastfeeding complemented with hygienically prepared appropriate local solid weaning foods at about 6 months of age;
- Increased breastfeeding during illness and recovery; and
- Continued breastfeeding well into the second year of life and beyond.

Early initiation of breastfeeding has two important benefits. First, it fosters mother-infant bonding. Second, taking advantage of the newborn's intense sucking reflex and alertness immediately postpartum, it permits the newborn to benefit within the first hour of life from the nutritional, anti-bacterial, and anti-viral properties of colostrum (Righard and Alade, 1990). Early initiation of breastfeeding also stimulates breast milk production and causes the uterus to retract, which can reduce postpartum blood loss. When the initiation of breastfeeding is delayed, the newborn is often provided with another source of nourishment, often liquids and foods that can introduce infection and delay lactogenesis (milk arrival) (Perez-Escamilla et al., 1996).

Frequent, on-demand breastfeeding, including night feeds, is important to ensure that an infant receives sufficient breast milk and that the supply of breast milk is maintained. Frequent feedings can help to prevent the problem of engorgement. On-demand feeding is important to ensure that newborns regain their birth weight (de Carvalho et al., 1983). Infants should be breastfed 8 to 10 times every 24 hours. This frequency of feeding should be higher during the first month of life.

Exclusive breastfeeding, defined as breast milk as the only source of infant food or liquid, meets nutritional requirements (Cohen et al., 1994), satisfies fluid needs even in hot and humid climates (Sachdev

---

[1] Note that these recommendations are not universally agreed upon and should be interpreted as rough guidelines.

et al., 1991), and protects against illness (Huffman and Combest, 1990) for the first six months of life. Exclusively breastfed infants are 14 times less likely to die from diarrhea compared with formula-fed infants and 4 times less likely to die compared with partially breastfed infants (Victora et al., 1987). Exclusive breastfeeding is the infant feeding behavior most predictive of infant survival.

At about 6 months of age breast milk alone will no longer satisfy the energy and protein requirements of most infants. Complementary foods that are rich in energy, protein, and micronutrients, hygienically prepared, and soft to eat need to be given to the infant. During this transitional period when complementary foods are being introduced, on-demand and frequent breastfeeding should continue to ensure that infants receive all the benefits of breastfeeding. Increased diarrheal morbidity (which is often associated with the introduction of other foods and liquids) can be prevented with hygienic preparation and storage of the foods and liquids given to a child.

Increased breastfeeding during illness and recovery is important to reduce the risk of inadequate nutrient intake during illness, to prevent dehydration, and to promote catch-up growth. Dietary intake of all foods, except breast milk, is reduced during illness (Hoyle et al., 1980; Brown et al., 1990; Dickin et al., 1990). Breastfeeding, by providing a continual source of high quality and hygienic food, plays a critical role in the maintenance of infant and child nutritional status in and around periods of illness.

Both WHO and UNICEF recommend that because of its many nutritional and immunological benefits breastfeeding should continue into the second year of life and beyond. Breastfeeding beyond about 6 months of age should be complemented with energy and other nutrient-dense weaning foods.

3.2 Initiation of Breastfeeding

In Eritrea, virtually all children (98 percent) are breastfed (Table 3.1). There are some differences in the proportion ever breastfed by various background characteristics.[2] Regionally, the Southern Red Sea Zone has the lowest proportion of children breastfed (94 percent). Slightly more rural than urban children are breastfed. Children whose mothers are uneducated, children who are from families with a low or medium socioeconomic score, and children whose mothers were assisted at delivery by a traditional birth attendant or a friend or relative are slightly more likely to be breastfed. Still, almost all children (at least 96 percent) whose mothers have a secondary school education or more, children who come from families with a high socioeconomic score, and children whose mothers were assisted at delivery by a doctor or nurse are breastfed. Indeed, the background characteristic category with the smallest proportion ever breastfed, those living in the Southern Red Sea Zone, has at least 93 percent of children ever breastfed.

Although virtually all children are breastfed, the recommended practice of initiating breastfeeding within the first hour after giving birth occurs in slightly less than half of all births (48 percent; Table 3.1). Two thirds of all births (69 percent) are breastfed within one day of birth. Regionally, the zone of Anseba has the highest proportion of infants breastfed in the first hour (84 percent) and the first day (93 percent) after birth. In contrast, in the Southern Zone less than one third (29 percent) of children are breastfed in the first hour, and just over half (53 percent) are breastfed in the first day after birth. While urban children were slightly less likely to be breastfed than rural children, of those children who were breastfed, urban children were more likely to receive breast milk within the first hour and the first 24 hours following their birth. Similarly, early breastfeeding is more common for children whose mothers have a secondary education, children who come from families with a high socioeconomic score, and children whose mothers received

[2] It should be noted that Table 3.1 is based on all children, including those who died soon after birth. Some of the minor differentials in ever breastfeeding could be due to variations in early neonatal mortality rather than to intentions to breastfeed.

Table 3.1 Initial breastfeeding

Percentage of children born in the three years preceding the survey who were ever breastfed, and the percentage who started breastfeeding within one hour of birth and within one day of birth, by selected background characteristics, Eritrea 1995

Background characteristic	Ever breastfed	Percentage who started breastfeeding: Within one hour of birth	Within one day of birth	Number of children
Zone				
Southern Red Sea	93.6	41.9	54.0	68
Northern Red Sea	98.6	50.3	72.5	341
Anseba	99.5	84.0	92.6	330
Gash-Barka	98.4	52.9	77.4	499
Southern	99.2	28.9	52.9	882
Central	96.4	54.2	74.4	459
	p=0.00	p=0.00	p=0.00	
Residence				
Urban	97.2	57.2	80.3	542
Rural	98.7	45.9	66.2	2,037
	p=0.03	p=0.00	p=0.00	
Mother's age				
15-19	99.4	39.4	60.6	222
20-24	99.2	50.2	72.1	537
25-29	97.1	44.5	67.8	633
30-34	98.1	55.3	74.7	478
35-49	98.7	48.1	67.2	711
	p=0.03	p=0.00	p=0.00	
Mother's education				
None	98.6	47.4	67.5	1,987
Primary	97.9	49.1	74.3	398
Secondary+	96.6	55.1	75.9	195
	p=0.09	p=0.12	p=0.00	
Socioeconomic status				
Low	98.7	48.1	68.4	1,459
Medium	99.2	45.0	65.0	665
High	96.2	53.6	78.0	455
	p=0.00	p=0.02	p=0.00	
Assistance at delivery				
Doctor	97.7	51.4	70.7	204
Nurse/Midw/Aux. Midw	96.7	55.4	82.2	328
TBA	98.1	44.5	68.1	1,387
Relative/Friend/Other	99.9	49.6	63.1	610
No one	(100.0)	(82.4)	(89.5)	45
	p=0.00[a]	p=0.00	p=0.00	
Total	98.4	48.3	69.3	2574

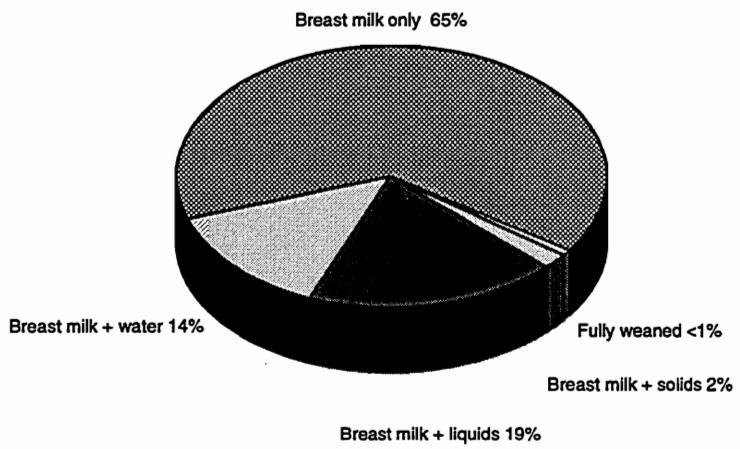
Note: Level of significance determined using Chi-square test. Figures in parentheses are based on 25 to 49 children.
[a] Chi-square statistic is unreliable due to small number of cases in one or more cells.

assistance at delivery from a doctor or a nurse than for children in other categories. This would suggest that while children from poorer households (rural, low socioeconomic score, low maternal education, no medical assistance at delivery) are slightly more likely to be breastfed compared to children from wealthier families, wealthier children who are breastfed are more likely to receive breast milk soon after birth.

3.3 Exclusive Breastfeeding

Exclusive breastfeeding, a behavior important to infant health and survival, is practiced for a little less than two-thirds (65 percent) of all infants under 4 months of age (Figure 3.1). In addition to breast milk, 14 percent of infants receive water, 19 percent receive other liquids, and 2 percent receive solids. By 4 months of age, 2 percent of infants are fully weaned. All children under 4 months are not exclusively breastfed (as is recommended by WHO), but the level of exclusive breastfeeding in Eritrea is the third highest among sub-Saharan countries that had DHS surveys between 1991 and 1996 (Figure 3.2).

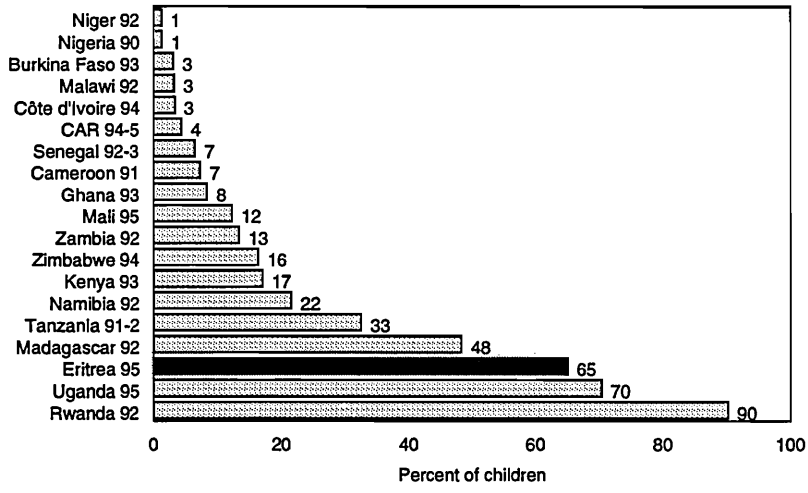
Figure 3.1 Feeding Practices for Infants under 4 Months, Eritrea



Note: Information on feeding practices is based on the 24 hours preceding the survey. WHO recommends that all infants should be breastfed exclusively until 4-6 months of age.

Source: EDHS 1995

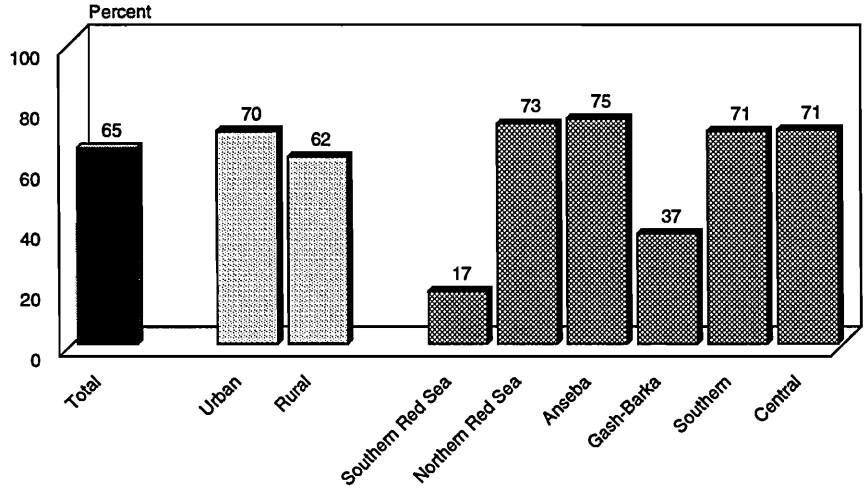
Figure 3.2 Infants Under 4 Months Who Are Exclusively Breastfed in Eritrea Compared with Other Sub-Saharan Countries



Source: DHS Surveys 1991-1996

The percentage of infants under four months of age who are exclusively breastfed varies by region and residence (Figure 3.3). Urban children are more likely to be exclusively breastfed than rural children (70 versus 62 percent). Regional differences are even larger. Seventy percent or more of infants under 4 months of age are exclusively breastfed in the Northern Red Sea, Anseba, Southern, and Central zones; only half as many (36.5 percent) are exclusively breastfed in Gash-Barka, and only 17 percent are exclusively breastfed in the Southern Red Sea Zone.

Figure 3.3 Exclusive Breastfeeding among Infants under 4 Months by Residence and Zone, Eritrea



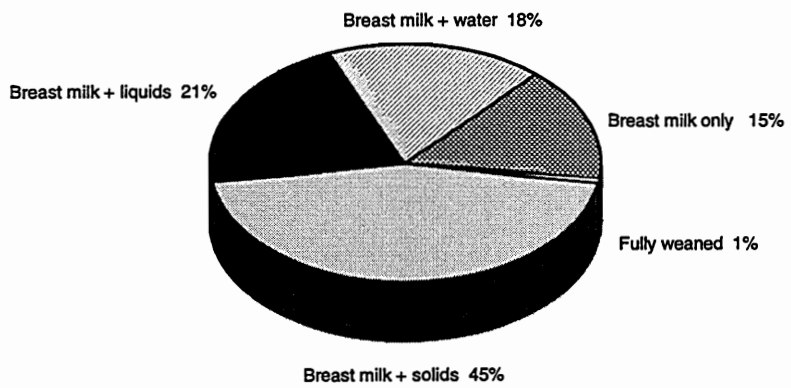
Note: Information on feeding practices is based on the 24 hours preceding the survey. WHO recommends that all infants should be breastfed exclusively until 4-6 months of age.

Source: EDHS 1995

3.4 Introduction of Complementary Foods

Optimal infant feeding practices include the introduction of complementary solid (or semisolid) foods at about 6 months of age. All infants between 6 and 9 months of age should receive complementary foods in addition to breast milk. In Eritrea, data on feeding practices in the 24 hours prior to the survey indicate that only 45 percent of infants in this age group receive both breast milk and complementary foods (Figure 3.4). Virtually all other children (except the 1 percent of children who are weaned) receive either only breast milk, or breast milk and water or other liquids, with no other source of nutrients. The introduction of complementary foods is delayed for more than half of all Eritrean infants.[3] Compared to other sub-Saharan countries, the proportion of infants receiving complementary foods at this age is low; only in Burkina Faso, Ghana, and Mali is the proportion of children receiving complementary foods lower than the proportion is in Eritrea (Figure 3.5).

Figure 3.4 Feeding Practices for Infants Age 6 to 9 Months, Eritrea



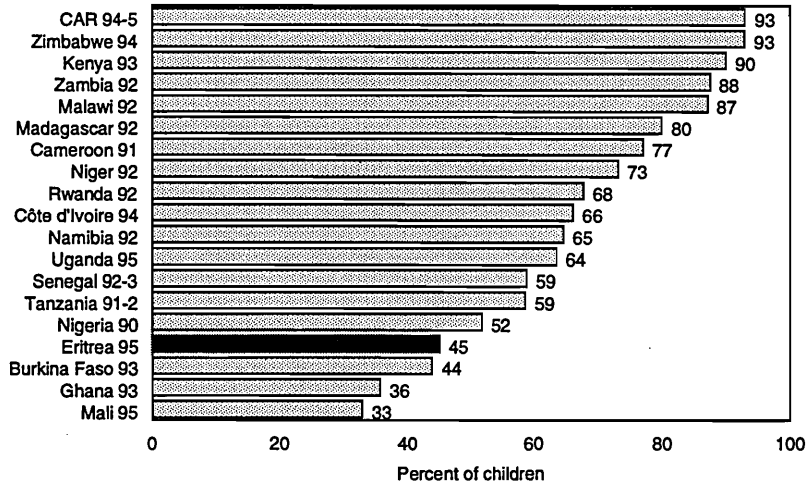
Note: Information on feeding practices is based on the 24 hours preceding the survey. WHO recommends that by the age of 6 months all infants should receive solid foods in addition to breast milk.

Source: EDHS 1995

There are large regional differences in the introduction of complementary solid foods among infants age 6 to 9 months (Figure 3.6). Sixty-five percent of urban children receive complementary foods compared with 38 percent of rural children. Slightly more than half of the infants between 6 to 9 months of age in Gash-Barka and Central zones receive complementary foods (54 and 58 percent, respectively), compared to roughly one-third of infants in Anseba and Southern Red Sea zones (31 and 33 percent, respectively), with the Northern Red Sea and Gash-Barka zones being slightly higher at 39 percent.

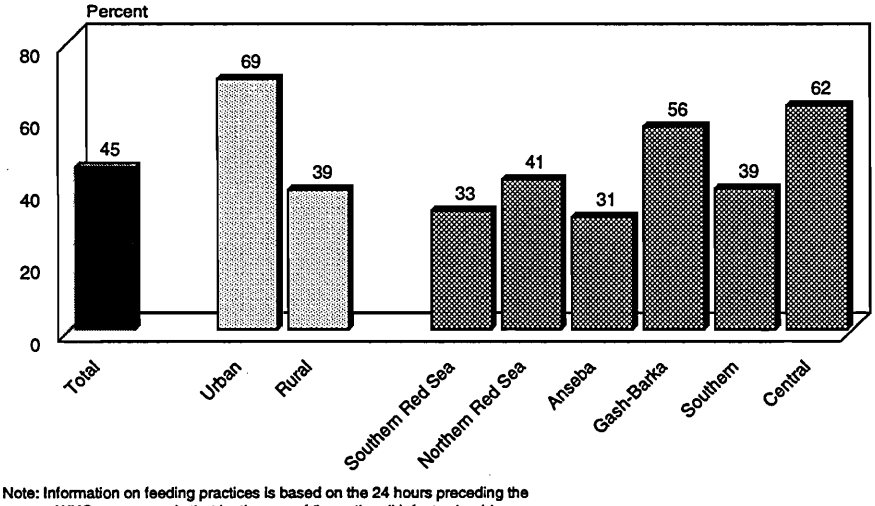
[3] The introduction of complementary foods at about 6 months is critical because breast milk can no longer satisfy an infant's energy, protein, and micronutrient needs.

Figure 3.5 Infants Age 6-9 Months Receiving Solids and Breast Milk in Eritrea Compared with Other Sub-Saharan Countries



Source: DHS Surveys 1991-1996

Figure 3.6 Breastfeeding with Complementary Solid Foods among Infants Age 6 to 9 Months, by Residence and Zone, Eritrea



Note: Information on feeding practices is based on the 24 hours preceding the survey. WHO recommends that by the age of 6 months all infants should receive solid foods in addition to breast milk.

Source: EDHS 1995

The kind of complementary food children received in the 24 hours prior to the survey varied by age and breastfeeding status (Table 3.2). Among all breastfeeding children, the most common food or liquid received was liquids other than milk or water (55 percent), which were introduced relatively early in life.

Table 3.2 Types of food received by children in the preceding 24 hours

Percentage of children under three years of age who received specific types of food in the 24 hours before the interview, and the percentage using a bottle with a nipple, by breastfeeding status and child's age in months, Eritrea 1995

Age (in months)	Breast milk only	Infant formula	Other milk	Other liquids	Meat/ poultry/ fish/ eggs	Injira/ gat/ sebko/ ajja[1]	Other	Use of bottle with a nipple	Number of children
BREASTFEEDING CHILDREN									
<2	75.5	0.0	3.7	11.5	0.5	0.4	0.9	0.5	140
2-3	56.9	0.0	8.0	21.4	0.0	2.0	0.0	4.9	173
4-5	45.2	2.3	10.7	22.5	1.1	3.5	5.5	3.4	134
6-7	21.3	11.3	25.0	47.2	10.3	16.5	26.1	5.9	147
8-9	9.8	18.4	30.1	53.2	13.7	43.1	40.4	2.7	143
10-11	6.5	13.6	35.3	68.4	22.0	50.2	53.5	3.9	133
12-13	3.4	11.2	47.2	76.0	29.0	73.3	57.3	5.5	124
14-15	0.0	10.7	44.3	76.0	20.1	75.1	64.1	4.8	123
16-17	1.0	12.5	43.8	75.7	29.9	80.2	63.3	5.9	107
18-23	0.2	8.7	47.4	72.7	22.6	89.5	72.2	1.8	224
24-29	0.0	10.0	42.1	80.5	27.2	88.2	78.5	6.7	111
30-35	0.0	9.6	67.4	74.0	31.5	85.1	70.6	0.0	68
0-3 months	65.2	0.0	6.1	16.9	0.2	1.3	0.4	2.9	313
4-6 months	40.6	6.1	13.5	27.9	3.2	5.9	10.5	4.7	211
7-9 months	9.5	15.5	30.8	54.8	13.8	36.7	38.2	3.4	213
Total	19.9	8.7	31.9	54.8	16.1	48.4	42.4	3.8	1,628
NON-BREASTFEEDING CHILDREN									
18-23 months	NA	24.2	58.6	80.9	38.4	88.9	80.5	11.5	105
24-29 months	NA	15.5	61.7	79.6	43.4	93.4	77.3	4.6	306
30-35 months	NA	13.0	53.0	88.0	38.8	93.5	78.2	8.2	337
Total	NA	16.1	59.0	83.4	40.3	91.4	77.0	8.8	796

Note: Total for non-breastfeeding children includes children age 0-17 months.
NA = Not applicable
[1] Grain/flour/cereal

Almost half of all children (48 percent) also received local grains or cereal.[4] Few breastfeeding children of any age were bottle fed or given infant formula (4 and 9 percent, respectively). Among non-breastfeeding children, almost all received local grains or cereals (91 percent) and 83 percent were given liquids other than milk or water. Not surprisingly, many more non-breastfeeding children than breastfeeding children received infant formula, other milk, or were bottle-fed, though the proportion bottle-fed was low (9 percent of non-breastfeeding children). Very few breastfeeding children in the last 24 hours received animal protein. Among children under 36 months of age, only 1 in 6 children received this type of food in the day before the survey.

Information gathered about the last seven days for children 6 to 35 months of age shows results similar to those of the last 24 hours (Table 3.3). Although most children (86 percent) got some form of solid food in the last seven days, the proportions who received eggs, fish, and poultry and other meats are quite low (33 and 32 percent, respectively). Among those who did receive them, the average was less than three days a week (means of 2.8 and 2.4 days, respectively), compared with other solids that were received, on average, more than four days a week.

[4] Local grains or cereals include injira/gat/sebko/ajja.

Table 3.3 Foods received in last seven days

Percent of living children over six months of age by type of food received during last seven days and mean number of days received type of food, Eritrea 1995

Food group	Percent receiving in past week	Mean no. of days received by those receiving in past week
Water-based liquids	58.0	3.7
Milk-based liquids	34.8	3.7
Eggs, fish, poultry	33.3	2.8
Red meats	31.8	2.4
Grains and grain products	34.6	4.3
Tubers, plantains	not asked	not asked
Other solids	39.6	4.1
Any solid food	85.5	4.0
Number of children	1,546	1,546

Table 3.4 shows breastfeeding status by age in months for children 0-36 months of age, including the age patterns of exclusive breastfeeding and the introduction of water and complementary foods. These patterns show that, even though two-thirds of the youngest infants (less than 2 months of age) are exclusively breastfed, the introduction of plain water and other foods starts early. By 2-3 months of age, a little over a quarter of infants (27 percent) receive other foods, and 16 percent receive water in addition to breast milk. By age 6 months, when all infants should receive complementary foods, about 58 percent of infants get these foods, while 20 percent get only water in addition to breast milk. It is not until age 14 months that almost all children (90 percent) receive complementary foods in addition to breast milk and that no children are exclusively breastfed.

Table 3.4 Breastfeeding status

Percent distribution of living children under three years of age by current breastfeeding status, according to child's current age in months, Eritrea 1995

	Breastfeeding status					
			Breastfeeding and:			
Age in months	Not breast-feeding	Exclusively breastfed	Plain water only	Comple-mentary foods	Total	Number of living children
<2	0.0	75.5	10.8	13.8	100.0	140
2-3	0.4	56.6	15.7	27.3	100.0	173
4-5	0.5	45.0	25.2	29.3	100.0	135
6-7	1.2	21.0	20.4	57.4	100.0	149
8-9	0.0	9.8	15.0	75.2	100.0	143
10-11	4.0	6.3	6.7	83.1	100.0	138
12-13	7.4	3.2	3.3	86.2	100.0	134
14-15	8.2	0.0	1.5	90.4	100.0	134
16-17	14.9	0.9	2.2	82.0	100.0	126
18-19	21.3	0.0	1.4	77.2	100.0	133
20-21	32.7	0.5	1.3	65.5	100.0	103
22-23	46.5	0.0	1.0	52.5	100.0	93
24-25	67.6	0.0	1.4	31.0	100.0	144
26-27	73.9	0.0	0.5	25.6	100.0	132
28-29	78.9	0.0	0.0	21.1	100.0	141
30-31	82.5	0.0	0.0	17.5	100.0	170
32-33	83.7	0.0	0.0	16.3	100.0	132
34-35	83.8	0.0	0.0	16.2	100.0	103
0-3 months	0.2	65.0	13.5	21.2	100.0	313
4-6 months	1.2	40.2	23.2	35.5	100.0	214
7-9 months	0.0	9.5	17.0	73.6	100.0	213

Note: Breastfeeding status refers to 24 hours preceding the survey. Children classified as *breastfeeding and plain water only* receive no complementary foods.

3.5 Bottle Use

Bottle-feeding is not common in Eritrea. Only 5 percent of infants under age one year are bottle-fed (Table 3.5). Significant bivariate differences in bottle-feeding exist for many background characteristics. Bottle-feeding is nine times higher among children in urban areas compared with rural areas, and almost nine times higher among children whose mothers have secondary education compared with children whose mothers have no education. Bottle-feeding is higher in a number of categories including children who live in the Central Zone, children from families with high socioeconomic scores, and children whose mothers are working.

Because many of the factors associated with bottle-feeding are highly correlated, a logistic regression model was developed to identify the influence on the risk of bottle-feeding of each factor independently of all other factors, and to develop a model that best explains bottle-feeding risks. The estimates of the odds (by exponentiating the log odds, which is the coefficient) are presented in the fifth column of Table 3.6. For each factor, one category of the factor serves as the reference category, as indicated by the value of 1. Odds greater than 1 indicate greater risk, while odds less than 1 indicate reduced risk, compared with the reference category.

After controlling for a variety of socioeconomic and other factors in the logistic regression, three factors were statistically significant ($p<.05$): urban/rural residence, whether the child's mother was working, and whether the child's mother listened to the radio weekly. Urban children were roughly eight times more likely to be bottle-fed than were rural children. Children whose mothers were not working were about three times less likely to be bottle-fed than children of working mothers. Similarly, children whose mothers did not listen to a radio weekly were roughly four times less likely to be bottle-fed than children whose mothers did listen to a radio weekly. The effect on bottle-feeding of a medium socioeconomic status score compared with a high score is statistically significant at the 10 percent level, and indicates that children from medium socioeconomic status families are about five times less likely to be bottle-fed than children from high socioeconomic status families. These results all suggest that bottle-feeding is positively associated with wealth. That wealthier women

Table 3.5 Prevalence of bottle use

Percentage of children under one year using a bottle, by selected background characteristics, Eritrea 1995

Background characteristic	Bottle use	Number of children
Zone		
Southern Red Sea	(7.1)	22
Northern Red Sea	5.7	116
Anseba	2.2	116
Gash-Barka	1.3	155
Southern	1.3	324
Central	14.3	146
	p=0.00[a]	
Residence		
Urban	15.1	174
Rural	1.7	705
	p=0.00	
Mother's education		
None	2.5	666
Primary	5.3	152
Secondary+	21.4	60
	p=0.00	
Mother's occupation		
Not working	3.6	663
Working	6.6	214
	p=0.08	
Partner's education		
None	1.8	570
Primary	6.0	158
Secondary+	14.5	117
	p=0.00	
Partner's occupation		
Professional	13.4	97
Manual labor	10.2	114
Agricultural	1.3	546
Other	3.6	88
	p=0.00[a]	
Socioeconomic status		
Low	2.1	510
Medium	1.2	229
High	17.4	140
	p=0.00	
Antenatal care provider		
Doctor	5.2	255
Nurse/Midwife	6.7	216
No one	2.5	407
	p=0.04	
Assistance at delivery		
Doctor	17.4	59
Nurse/Midwife/Aux. midwife	9.6	118
TBA	2.8	465
Relative/Friend/Other	1.4	237
	p=0.00	
Reads newspaper weekly		
No	3.1	774
Yes	13.1	104
	p=0.00	
Watches television weekly		
No	3.0	808
Yes	19.3	70
	p=0.00	
Listens to radio weekly		
No	2.0	487
Yes	7.2	392
	p=0.00	
Total	4.7	716

Note: Level of significance determined using Chi-square test; figures in parentheses are based on 25 to 49 unweighted children.
[a] Chi-square statistic is unreliable due to small number of cases in one or more cells.

Table 3.6 Logistic regression results: Risk of bottle-feeding

Results from a logistic regression model that examines the causes of bottle-feeding among children under one year of age, Eritrea 1995

Variable	Coefficient (B)	Standard error	Significance	Exp(B)
Zone			0.01	
Southern Red Sea	0.40	1.01		1.50
Northern Red Sea	1.14	0.72		3.12
Anseba	-2.06	1.20	0.09	0.13
Gash-Barka	-0.74	0.92		0.48
Southern	-1.50	0.65	0.02	0.22
Central				*1.00*
Residence				
Urban	1.95	0.74	0.01	7.01
Rural				*1.00*
Mother's education				
None	-0.59	0.69		0.56
Primary	-0.62	0.54		0.54
Secondary				*1.00*
Mother's occupation				
Not Working	-1.06	0.46	0.02	0.35
Working				*1.00*
Partner's education				
None	-0.23	0.73		0.79
Primary	-0.38	0.54		0.69
Secondary				*1.00*
Partner's occupation				
Professional	1.05	0.74		2.86
Manual Labor	0.66	0.75		1.93
Other	-0.04	0.92		0.96
Agricultural				*1.00*
Socioeconomic status				
Low	-0.21	1.00		0.81
Medium	-1.54	0.81	0.06	0.21
High				*1.00*
Media exposure: newspaper				
Doesn't read	0.21	0.53		1.23
Reads weekly				*1.00*
Media exposure: TV				
Doesn't watch	0.96	0.51	0.06	2.61
Watches weekly				*1.00*
Media exposure: radio				
Doesn't listen	-1.42	0.66	0.03	0.24
Listens weekly				*1.00*
Source of antenatal care				
Doctor	-0.39	0.45		0.68
TBA etc.	0.69	0.62		2.00
Nurse/Midwife				*1.00*
Assistance at delivery				
Doctor	0.00	0.63		1.00
Nurse etc	-0.53	0.58		0.59
Other	-0.25	0.65		0.78
TBA				*1.00*

Note: Only p<=0.10 are shown.

are more likely to bottle-feed than are poorer women is also consistent with previous results in this chapter, which show that wealthier women are less likely to breastfeed their infants compared to poorer mothers, and that a larger proportion of non-breastfed infants are bottle-fed compared with breastfed infants. The health risk that bottle-feeding presents for infants of wealthy women cannot be determined here because this model does not control for the fact that wealthy women may make use of their greater access to resources to use bottles hygienically. There is, however, the danger that poor women, who do not have access to these resources, may regard bottle-feeding as a status symbol and copy this behavior.

3.6 Duration of Breastfeeding

The median duration of breastfeeding[5] (or the time for which 50 percent of children receive only breast milk) among all children under 3 years old is presented in Table 3.7. The median duration of any breastfeeding was 22 months, illustrating that children are breastfed well into the second year of life. This practice is consistent with optimal breastfeeding practices. Children in rural areas, children in the Southern Zone, children whose mothers were illiterate, and children whose mothers had had no medical assistance at delivery had slightly higher median durations of any breastfeeding than did children with other background characteristics. The median duration of exclusive breastfeeding was 3 months. As noted in Table 3.2, less than half of the children age 4-5 months are exclusively breastfeeding, contrary to WHO recommendations. The median duration of full breastfeeding (breast milk only or breast milk and water) was just under 7 months. Differences in median duration of full breastfeeding across background characteristics were similar to those for any breastfeeding. There were no noticeable gender differences in median durations for any breastfeeding category.

3.7 Reasons for Weaning

Information on the reasons for weaning was obtained from mothers for all children less than 3 years old. Table 3.8 groups these reasons into five categories: maternal factors (maternal illness, nipple/breast problems, insufficient milk); child ill or dead; weaning age (including child refused breast milk and mother forced solid food), mother became pregnant; and other reasons (including mother working or started using contraception). Among those children who were weaned, the mother becoming pregnant was the most common reason cited for weaning (41 percent of children weaned). Mothers from rural areas, mothers who had no education, and mothers from families with a low socioeconomic status were more likely to cite pregnancy as a reason for weaning than were women in other categories. Close to 20 percent of children were weaned because of weaning age and a similar proportion were weaned due to maternal factors. In 16 percent of the cases, the child either died or was weaned because he or she was ill.

[5] The median duration of breastfeeding is calculated based on all 2,580 children under 3 years of age covered by the 1995/96 EDHS.

Table 3.7 Median duration and frequency of breastfeeding

Median duration of any breastfeeding, exclusive breastfeeding, and full breastfeeding among children under three years of age, and the percentage of children under six months of age who were breastfed six or more times in the 24 hours preceding the interview, according to background characteristics, Eritrea 1995

Background characteristics	Median duration of breastfeeding[1]			Number of children under 3 years of age	Children under six months	
	Any breast-feeding	Exclusive breast-feeding	Full breast-feeding[2]		Breastfed 6 or more times in preceding 24 hours	Number of children
Child's sex						
Male	21.6	3.4	5.6	1,333	96.2	246
Female	22.7	3.3	5.8	1,246	93.8	203
Residence						
Urban	19.7	3.6	4.7	542	92.5	84
Asmara	19.1	(3.1)	(3.8)	287	86.8	39
Other towns	20.4	(4.0)	(5.2)	255	97.3	46
Rural	22.5	3.3	6.2	2,037	95.7	364
Zone						
Southern Red Sea	14.8	*	*	68	*	12
Northern Red Sea	22.0	4.2	5.8	341	94.5	55
Anseba	21.3	4.9	6.6	330	100.0	69
Gash-Barka	22.2	(0.7)	4.9	499	88.7	82
Southern	23.2	3.7	6.7	882	98.1	160
Central	20.4	4.0	4.9	459	91.1	70
Mother's education						
No education	22.6	3.3	6.3	1,987	95.7	347
Primary incomplete	21.0	3.8	5.0	359	95.2	60
Primary complete	19.2	*	*	119	(91.8)	26
Secondary+	17.0	*	*	115	*	16
Assistance at delivery						
Health professional	19.6	2.7	4.6	532	92.2	87
Traditional midwife	22.3	3.3	6.0	1,387	94.8	248
Other or none	23.2	3.7	6.4	655	98.1	114
Total	22.0	3.3	5.7	2,580	95.1	448
Mean	22.8	4.7	6.7	-	-	-
Prevalence/Incidence mean	22.4	4.5	6.6	-	-	-

Note: Total includes 7 children for whom data on assistance at delivery are missing. Figures in parentheses are based on 25 to 49 unweighted children; an asterisk indicates that a figure is based on fewer than 25 children and has been suppressed.

[1] Medians and means are based on current status and durations are in months.

[2] Either exclusive breastfeeding or breastfeeding and plain water only

Table 3.8 Reasons for weaning

Percent distribution of the reasons for weaning for children born in the three years preceding the survey, by selected background characteristics, Eritrea 1995

Background characteristic	Reasons for weaning					Total	Number of children
	Mother factors[1]	Child ill/died	Weaning age[2]	Became pregnant	Other[3]		
Duration of breastfeeding							
0-5	10.7	73.6	4.7	8.9	2.1	100.0	106
6-11	20.8	19.7	10.2	43.3	6.1	100.0	136
12-17	19.5	10.1	17.1	51.3	2.0	100.0	290
18-23	21.7	3.8	18.5	47.7	8.4	100.0	210
24-36	20.1	2.6	41.6	30.4	5.2	100.0	160
			p=0.00				
Zone							
Southern Red Sea	24.6	21.1	38.0	14.8	1.5	100.0	32
Northern Red Sea	25.4	19.4	20.0	33.1	2.1	100.0	123
Anseba	21.6	17.3	17.2	41.2	2.7	100.0	121
Gash-Barka	12.6	21.2	22.1	40.7	3.5	100.0	175
Southern	17.8	13.8	8.8	53.6	6.0	100.0	276
Central	20.3	11.5	28.8	32.2	7.1	100.0	184
			p=0.00				
Residence							
Urban	24.0	15.7	25.5	27.9	6.8	100.0	229
Rural	17.4	16.4	16.9	45.4	3.9	100.0	682
			p=0.00				
Education							
None	18.7	16.6	16.7	44.4	3.7	100.0	681
Primary	17.1	16.9	24.1	36.9	4.9	100.0	145
Secondary+	25.4	11.8	29.5	21.7	11.6	100.0	86
			p=0.00				
Socioeconomic status							
Low	16.5	17.8	16.6	46.0	3.1	100.0	501
Medium	20.1	14.9	18.7	41.1	5.3	100.0	217
High	24.6	13.7	25.9	28.1	7.8	100.0	193
			p=0.00				
Total	19.1	16.2	19.1	41.0	4.6	100.0	911

Note: Level of significance determined using Chi-square test.
[1] Mother ill/weak, nipple/breast problem, insufficient milk
[2] Child refused, weaning age, force solid food
[3] Working, started using contraceptive method, other

3.8 Summary and Recommendations

In Eritrea, one-third of newborn infants are not put to the breast until the second day of life or later, about one-third of children are not exclusively breastfed through 4 months of age, and a little more than half of all infants 6 to 9 months of age do not receive complementary foods. These feeding behaviors are contrary to recommended practices and pose a threat to child nutritional status and health. Late initiation of breastfeeding prevents the infant from receiving the benefits of colostrum and raises the likelihood that other liquids will be given and thus expose the newborn to pathogens.

The use of plain water, other liquids, and/or complementary foods at ages under 4 months also unnecessarily exposes children to pathogens. Delaying the introduction of complementary foods puts infants at risk of malnutrition because, beyond about 6 months, breast milk alone is inadequate to meet energy, protein, and micronutrient needs. Thus, the key recommendations to improve infant and child feeding practices are as follows:

- Roughly one-third of Eritrean children under four months of age are not exclusively breastfed. The median duration of exclusive breastfeeding shows no large variation across categories, but it does seem that children whose mothers' received assistance at delivery from a health professional are more likely to stop exclusive breastfeeding early. This suggests that information should be distributed to and at health facilities.

- The introduction of complementary foods at age 6-9 months is twice as common in urban areas as in rural areas. This suggests that information campaigns should be targeted in rural areas. Investigation of the causes of the higher rate in urban areas may reveal effective strategies that can be used to help design an effective rural campaign.

- Bottle-feeding prevalence is currently very low in Eritrea as a whole, but bottle-feeding prevalence is significantly higher among urban mothers and mothers who are exposed to radio and television. As the Eritrean population becomes more urbanized and the reach of the mass media increases, bottle-feeding may become a problem. Even without such changes, bottle-feeding may become a status symbol and could conceivably spread to groups of the population who do not currently bottle-feed. A public information campaign on the radio (to reach the widest audience) would help prevent the development of a bottle-feeding problem.

CHAPTER 4

MORBIDITY AND MORTALITY

Illness and inadequate food intake are direct causes of malnutrition (Jamison, 1993), which in turn results in increased risk of death (Pelletier et al., 1993). In many developing countries, malaria, measles, acute respiratory infection (ARI), and diarrheal diseases are the most common childhood illnesses and account for the greatest proportion of infant and under-five mortality. In this chapter, mortality rates and the prevalence and age-specific patterns of common childhood illnesses and care-seeking behaviors from the 1995 EDHS are described.

4.1 Infant and Under-five Mortality

Infant and under-five mortality rates were calculated for 0-4, 5-9, and 10-14 years preceding the 1995 EDHS. The infant mortality rate (IMR) is the probability of death in the first year of life and is calculated per 1,000 live births. Similarly, the under-five mortality rate (U5MR) is the probability of dying before the child's fifth birthday and is calculated per 1,000 live births. Although these mortality rates are calculated for a five-year period preceding the DHS, ten-year rates are used in the calculations of specific background factors.

The IMR for the period 0-4 years preceding the 1995 EDHS is 66 infant deaths per 1,000 births. For the ten-year period preceding the EDHS, the IMR is 76 infant deaths per 1,000 births. Table 4.1 shows variations in the IMR by urban-rural residence, zone, maternal education, maternal age at birth, previous birth interval, and infant sex.[1] Infants living in the Central Zone—the zone with the capital city—have the lowest regional IMR (57 per 1,000). Urban infants have a higher IMR than do rural infants (80 per 1,000 and 74 per 1,000, respectively). The breakdown of the IMR by maternal education is also unexpected. Infants whose mothers have at least a secondary education have the lowest IMR (56 per 1,000), but infants whose mothers have a complete primary education have higher infant mortality (87 per 1,000) than do infants whose mothers have no education or have an

Table 4.1 Infant and under-five mortality rates

Infant and under-five mortality rates for the ten-year period preceding the survey, by selected background characteristics, Eritrea 1995

Background characteristic	Mortality rates (per 1,000) Infant	Under-five
Residence		
Urban	79.8	128.9
Rural	74.4	159.9
Zone		
Southern Red Sea	106.8	238.8
Northern Red Sea	93.4	186.7
Anseba	70.3	146.1
Gash-Barka	87.4	190.1
Southern	71.0	146.2
Central	57.3	92.2
Mother's education		
No education	76.0	157.8
Primary incomplete	75.3	130.0
Primary complete	86.6	131.9
Secondary+	56.2	99.2
Age of mother at birth		
< 20	89.7	162.9
20-29	74.3	156.2
30-39	77.4	147.2
40-49	42.7	135.8
Birth order		
1	86.9	156.8
2-3	68.8	155.4
4-6	73.2	144.9
7+	78.9	155.6
Previous birth interval		
< 2 years	113.4	215.6
2-3 years	58.1	130.4
4 or more years	37.2	75.6
Sex of child		
Male	81.9	163.4
Female	69.0	141.3
Size at birth[1]		
Small or very small	43.1	na
Average or larger	55.7	na
Total	75.6	152.5

Note: *Infant mortality rate*: the probability of dying before the first birthday; *under-five mortality rate*: the probability of dying before the fifth birthday.
na = Not applicable
[1] Births in the 3 years before the survey

[1] In Table 4.1 infant and under-five mortality rates for the ten-year period preceding the 1995/96 EDHS are analyzed according to background characteristics. Five-year rates are shown, but these are not used in the analysis of differentials. Ten-year rates have been found to give stronger statistical validity to these analyses.

incomplete primary education (76 and 75 per 1,000, respectively). This unusual increase with education occurred in only one other Demographic and Health Survey, Namibia (Bicego and Ahmad, 1996), and it may be due to omission of deaths among less educated women or could reflect the higher mortality risks of poor urban areas where many of these women reside. Female infants have much lower infant mortality than do male infants. Infants of birth order 2-6 have lower mortality than do first births or infants of birth order 7 or higher. Previous birth interval appears to have a strong relationship with infant mortality, with IMR being three times higher for infants born after a short interval (2 years or less) compared with infants born after an interval of 4 or more years (113 and 37 per 1,000, respectively).

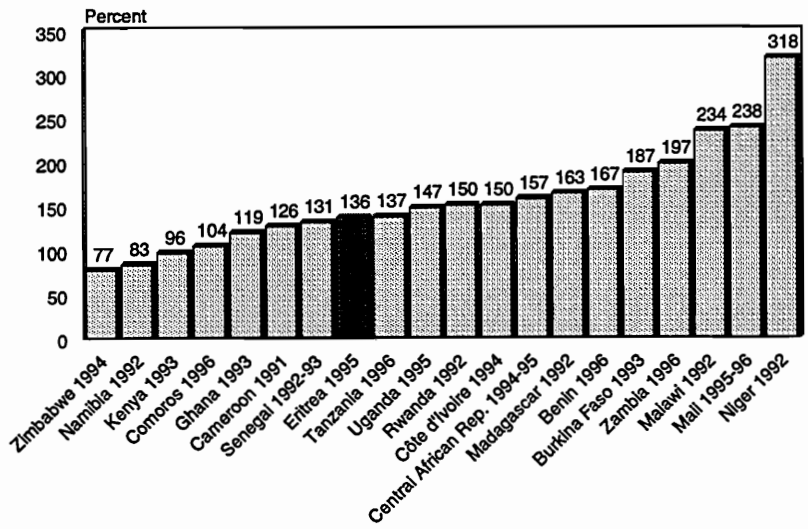
The U5MR for the five years preceding the survey is 136 deaths per 1,000 births, indicating that a little over half of all deaths before age 5 years occur during the first year of life and the rest occur during the subsequent 4 years. For the ten-year period preceding the survey, the under-five mortality rate is 153 per 1,000. Unlike the IMR, the U5MR is higher in rural areas than in urban areas. The relationship of under-five mortality and maternal education is also closer to what one might generally expect: the U5MR declines as the level of maternal education increases, dropping from 158 per 1,000 for children whose mothers are uneducated to 99 per 1,000 for children whose mothers have at least a secondary education, which is still extremely high. Patterns of U5MR for other characteristics are similar to those for infant mortality.

Since the relationships reported in this section between mortality and the various characteristics associated with it are bivariate associations and may themselves be correlated, they do not imply causality. Differences based on zone and urban-rural residence are likely to be related to other socioeconomic characteristics of the population in these regions and/or access to medical care.

4.2 Comparison with Other Sub-Saharan Countries

Compared with under-five mortality in the period 1991-1996 in other sub-Saharan countries, the U5MR of 136 in Eritrea for 0-4 years preceding the survey is in the lower middle range (Figure 4.1). The U5MR ranges from 77 per 1,000 in Zimbabwe (1994) to 318 per 1,000 in Niger (1992).

Figure 4.1 Under-five Mortality in Eritrea Compared with Other Sub-Saharan Countries

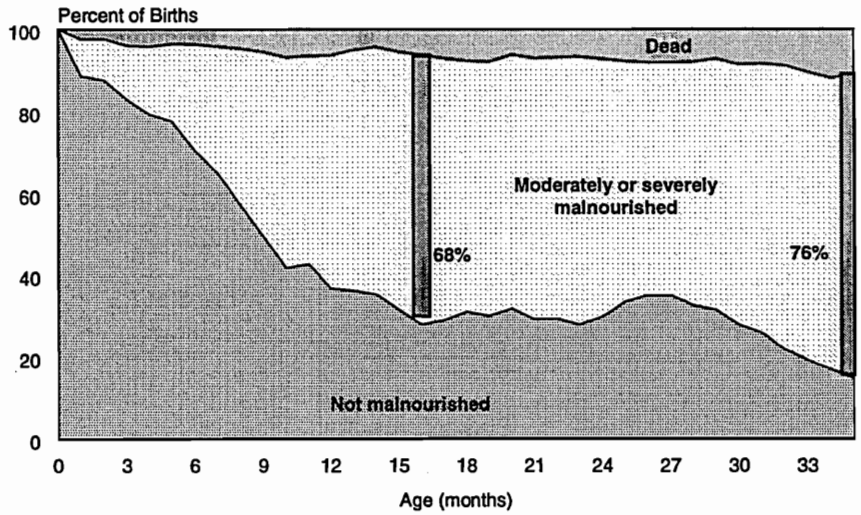


Source: DHS Surveys 1991-1996

4.3 Association of Malnutrition with Mortality

Figure 4.2 shows the survival and nutritional status of Eritrean children by age. From the figure it can be seen that malnutrition and mortality take a tremendous toll on young children, such that by age 2 years, only 30 percent of children are alive and not malnourished. Malnourished children are at much greater risk of morbidity and subsequent death. Based on a model by Pelletier et al. (1993), an estimate of the contribution of malnutrition to under-five mortality can be done. Using this model with the EDHS data, 15 percent of under-five mortality (20 deaths per 1,000 births) are estimated to be due to severe malnutrition and 46 percent (63 deaths per 1,000 births) to be due to moderate and mild malnutrition (Figure 4.3). If this model were to hold and malnutrition were to be eliminated in Eritrea, the under-five mortality rate would drop to 53 per 1,000.

Figure 4.2 Survival and Nutritional Status of Children, Eritrea

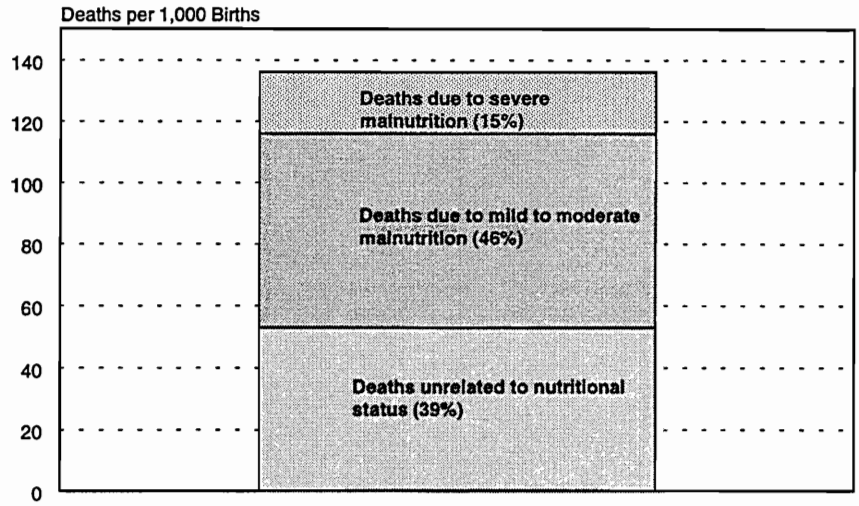


Note: A child with a Z-score below -3 SD on the reference standard is considered severely malnourished while one with a Z-score between -3 and -2 SD is considered moderately malnourished.

Source: EDHS 1995

In Eritrea, the prevalence of malnutrition is lower in urban areas, which also have lower U5MRs compared with rural areas. However, urban areas have higher IMRs, despite lower levels of stunting and wasting, than do rural areas, suggesting that urban infant deaths may be due more to childhood diseases or other causes not directly related to malnutrition. Regionally, the prevalence of severe stunting is highest in the Northern Red Sea Zone, which has high IMRs and U5MRs. Severe wasting is most prevalent in the Southern Red Sea Zone, which has the highest infant and under-five mortality rates of all the zones. However, these associations do not prove causality and further research is needed to examine the causal links between malnutrition and child mortality in Eritrea.

Figure 4.3 Contribution of Malnutrition to Under-five Mortality, Eritrea



Note: Calculation based on Pelletier et al., 1994.

Source: EDHS 1995

4.4 Vaccinations

The overall level of vaccinations in Eritrea is quite low. Just over 40 percent of children age 12 to 23 months have received all the recommended vaccinations while 38 percent have received no vaccinations at all (Table 4.2). Vaccination cards were seen for 50 percent of children age 12 to 23.

A vast differential in vaccination rates exists between urban areas and rural areas. Seventy-nine percent of urban children received all their vaccinations compared with 31 percent of rural children. Conversely, almost 50 percent of rural children received no vaccinations compared with 4 percent of urban children.

Table 4.3 suggests that the Eritrean vaccination program is improving. The number of children with vaccination cards is 10 percent higher for children age 12-23 months compared with children age 24-35 months. The percentage of children vaccinated by 12 months of age is higher for every vaccination for children age now 12-23 months than for children now age 24-35 months. The percentage of children who have all their vaccinations has increased, and the percentage who have no vaccinations has decreased. Note that for both groups of children dropout rates for multiple dose vaccinations (DPT and polio) are quite low.

Table 4.2 Vaccinations by background characteristics

Percentage of children 12-23 months who had received specific vaccines by the time of the survey (according to the vaccination card or the mother's report), and the percentage with a vaccination card, according to selected background characteristics, Eritrea 1995

Background characteristic	Percentage of children who received:											Percentage with a card	Number of children
	BCG	DPT1	DPT2	DPT3	Polio0[1]	Polio1	Polio2	Polio3	Measles	All[2]	None		
Child's sex													
Male	61.5	61.7	55.2	48.9	21.2	61.3	55.6	46.7	52.4	41.6	37.0	50.3	371
Female	59.8	60.0	55.5	48.7	16.9	59.8	56.2	48.7	49.5	41.2	38.5	50.4	354
Birth order													
1	67.9	67.0	60.5	58.3	30.3	67.0	61.5	55.1	54.4	48.7	31.4	53.4	163
2-3	62.1	62.4	57.2	49.1	19.9	62.2	56.8	48.4	55.2	43.9	35.8	54.9	213
4-5	54.8	55.6	48.6	38.8	11.4	55.0	50.0	39.4	43.5	30.9	42.8	44.8	168
6+	57.9	58.3	54.7	49.2	15.3	58.1	55.1	47.7	50.0	41.6	41.1	47.4	180
Residence													
Urban	94.7	94.4	91.3	87.1	55.3	94.7	92.3	84.5	87.0	79.0	3.9	80.1	161
Asmara	97.5	98.3	95.8	91.6	78.2	98.3	97.5	91.6	93.3	87.4	0.8	89.1	87
Other towns	91.5	89.7	86.1	81.8	28.4	90.5	86.1	76.1	79.5	69.1	7.5	69.4	74
Rural	51.0	51.3	45.1	37.9	8.8	50.8	45.5	37.1	40.7	30.6	47.4	41.8	564
Zone													
Southern Red Sea	(21.7)	(21.7)	(21.7)	(21.7)	(17.9)	(21.7)	(21.7)	(21.7)	(21.7)	(21.7)	(78.3)	(17.9)	14
Northern Red Sea	32.0	31.8	27.6	23.7	7.1	30.3	28.8	24.2	27.8	20.2	65.7	15.8	103
Anseba	59.5	56.4	44.0	36.4	20.5	58.7	46.3	25.3	53.5	24.5	40.5	51.5	82
Gash-Barka	30.1	30.4	21.4	15.3	3.9	31.7	23.0	16.3	19.7	10.3	67.9	22.5	137
Southern	71.0	72.2	68.6	59.7	12.9	71.0	67.4	59.3	55.9	49.0	27.0	58.8	248
Central	97.7	98.2	95.1	90.2	52.9	97.4	96.2	90.2	91.3	85.3	1.3	90.2	141
Mother's education													
No education	50.8	51.1	45.2	38.5	10.6	51.0	46.0	37.7	41.9	32.3	47.4	42.4	550
Primary incomplete	91.7	90.7	84.6	75.9	35.6	89.2	83.0	73.3	74.9	62.2	8.3	73.4	103
Primary complete	(88.6)	(90.9)	(90.9)	(86.4)	(53.5)	(90.9)	(90.9)	(80.8)	(77.0)	(72.6)	(9.1)	(75.3)	33
Secondary+	(94.6)	(94.6)	(90.8)	(90.8)	(66.4)	(94.6)	(94.6)	(92.7)	(94.6)	(88.9)	(3.5)	(79.7)	39
Total	60.7	60.9	55.3	48.8	19.1	60.6	55.9	47.7	51.0	41.4	37.7	50.3	725

Note: Figures in parentheses are based on 25 to 49 children.
[1] Polio 0 is given at birth.
[2] Children who are fully vaccinated (i.e., those who have received BCG, measles, and three doses of DPT and polio (excluding polio 0).

Table 4.3 Vaccinations in first year of life by current age

Among children one year and two years old, the percentage with a vaccination card and the percentage who had received each vaccine before their first birthday, according to current age of the child, Eritrea 1995

Vaccine	Current age of child in months		All children 12-35 months
	12-23	24-35	
Vaccination card seen by interviewer	50.3	40.5	45.1
Percentage vaccinated at 0-11 months[1]			
BCG	54.3	41.6	47.6
DPT 1	54.8	42.0	48.0
DPT 2	49.1	36.0	42.2
DPT 3	42.0	29.8	35.5
Polio 0[2]	19.1	13.1	15.9
Polio 1	53.9	41.5	47.3
Polio 2	49.3	34.8	41.6
Polio 3	41.2	27.9	34.1
Measles	35.5	23.0	28.9
All vaccinations[3]	29.8	18.7	23.9
No vaccinations	44.3	56.8	50.9
Number of children	725	821	1,546

[1] Information was obtained either from a vaccination card or from the mother if there was no written record. For children whose information was based on the mother's report, the proportion of vaccinations given during the first year of life was assumed to be the same as that for children with a written vaccination record.
[2] Polio 0 is given at birth.
[3] Children who have received BCG, measles, and three doses each of DPT and polio vaccines (excluding polio 0)

4.5 Regional and Age-specific Patterns of Morbidity

The prevalence of common childhood illnesses (i.e., diarrhea, ARI, and fever) was examined based on maternal recall for the two-week period preceding the interview. Close to one-quarter (24 percent) of the children had had diarrhea (Table 4.4). Almost the same proportion of children had had a cough with rapid breathing (indicative of respiratory infection, 23 percent), 41 percent had had a cough, and 42 percent had had a fever in the two weeks preceding the survey. These data should be interpreted with caution because of the methodological problems often associated with maternal recall (Haggerty et al., 1994b; Martorell et al., 1976).

Significant differences (based on Pearson's chi-square test) for these illnesses were found by zone, urban-rural residence, and socioeconomic status (Table 4.4). All the illnesses were less prevalent in urban areas than in rural areas, although the differences were statistically significant at the 5 percent level only for diarrhea and fever. The Southern Red Sea Zone had the highest prevalence of all four childhood health problems, and Anseba and Central zones had among the lowest prevalence. Not surprisingly, children from families with a low socioeconomic status had the highest prevalence of diarrhea, fever, cough, and cough with rapid breathing, compared with children from medium or high socioeconomic status households.

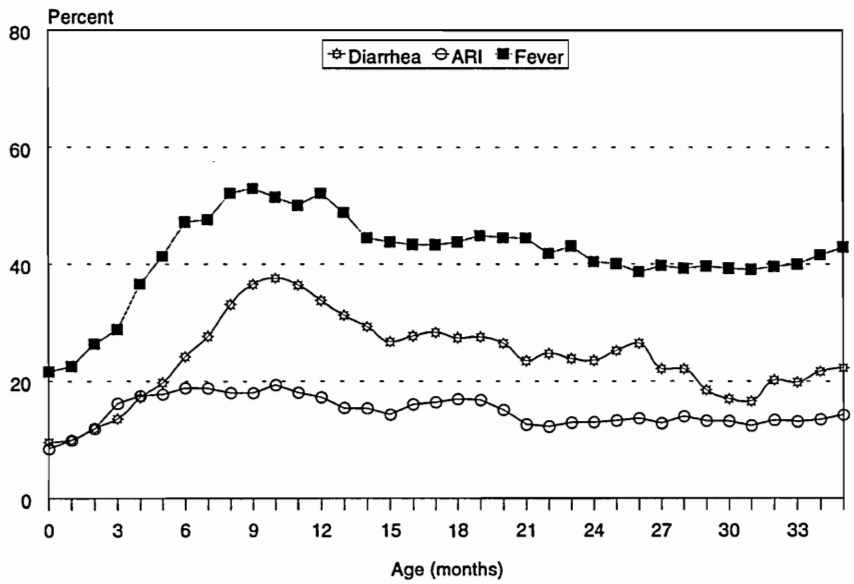
Table 4.4 Prevalence and treatment of diarrhea, fever, and cough

Percentage of children under three years of age with diarrhea, fever, cough and cough with rapid breathing in the two weeks preceding the survey and the percentage for whom treatment was sought, by selected background characteristics, Eritrea 1995

	Percentage of children with:					Advice/treatment sought for:			
Background characteristics	Diarrhea	Fever	Cough	Cough with rapid breathing	Number of children	Diar-rhea	Number of children	Cough	Number of children
Zone									
Southern Red Sea	39.1	56.7	55.7	33.8	59	(36.3)	23	32.8	33
Northern Red Sea	23.4	44.0	46.1	21.4	317	45.0	72	34.4	146
Anseba	15.0	39.6	35.3	20.7	314	(24.8)	47	28.9	110
Gash-Barka	29.7	49.9	47.9	29.3	461	28.5	137	32.3	221
Southern	26.1	41.0	38.5	20.9	841	26.1	220	27.9	324
Central	16.3	30.9	35.0	21.5	432	47.5	70	54.2	151
	p=0.00	p=0.00	p=0.00	p=0.00		p=0.00		p=0.00	
Residence									
Urban	17.8	33.8	36.9	19.8	500	58.4	89	58.1	184
Rural	25.1	43.5	41.6	23.8	1925	27.1	480	28.6	800
	p=0.00	p=0.00	p=0.06	p=0.06		p=0.00		p=0.00	
Socioeconomic status									
Low	26.3	45.5	43.9	25.7	1,369	24.9	358	23.1	601
Medium	22.4	37.9	35.9	20.3	633	40.4	141	45.5	226
High	16.5	34.1	37.3	18.2	422	51.5	70	60.1	158
	p=0.00	p=0.00	p=0.00	p=0.00		p=0.00		p=0.00	
Sex of child									
Male	22.7	40.8	39.1	22.4	1,242	32.7	280	36.3	485
Female	24.5	42.2	42.3	23.6	1,182	31.3	289	32.1	499
	p=0.28	p=0.48	p=0.10	p=0.46		p=0.72		p=0.17	
Total	23.6	41.5	40.7	23.0	2424	32.0	569	34.1	984

Note: Level of significance determined using Chi-square test. Figures in parentheses are based on 25 to 49 unweighted children.

Figure 4.4 Diarrhea, ARI, and Fever by Age of Child, Eritrea

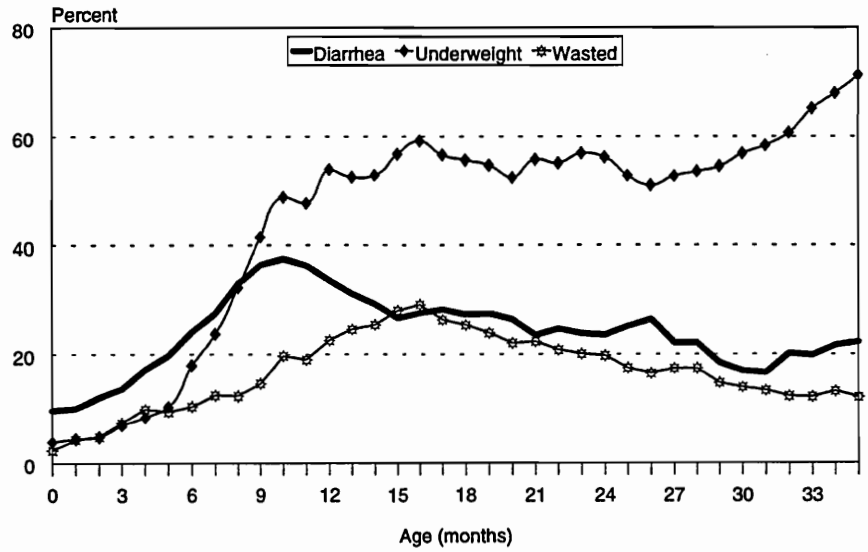


Source: EDHS 1995

As with malnutrition, significant age-related patterns were found in the prevalence of diarrhea, fever, and cough. The prevalence of diarrhea (Figure 4.4) climbs precipitously during infancy peaking at about 11 to 12 months of age, where close to 40 percent of infants age 12 months have had diarrhea in the two-week period prior to the survey. Thereafter the prevalence of diarrhea is lower, but even in the third year of life, over one-fifth of children were recorded as suffering from diarrhea in the two-week period preceding the survey. The higher prevalence of diarrhea during infancy reflects the increased risk of pathogens due to the introduction of liquids and solids that may be contaminated due to unhygienic handling or preparation. In addition, once infants begin to crawl and move around, they tend to put objects into their mouth, again increasing the risk of pathogen contamination.

Diarrhea frequently causes fluid loss and dehydration, decreased food intake because of anorexia, malabsorption, and increased nutrient loss (Molla et al., 1983). Both dehydration and decreased food intake can lead directly to weight loss. Figure 4.5 shows the age-specific patterns for diarrhea, wasting, and underweight to illustrate the relationship between diarrhea and acute malnutrition (Figure 4.5). The patterns for diarrhea and wasting differ markedly: diarrhea peaks at 10 months and declines gradually thereafter, while wasting peaks at 16 months. However, the connection between diarrhea and nutritional status for children under one year of age is shown by the rapid rise in the percentage underweight, which slows its rise at the same age as diarrhea prevalence begins to decline. It should be noted that the diarrhea data used here only reflect diarrheal disease in the two weeks preceding the survey and may not be representative of recurrent episodes.

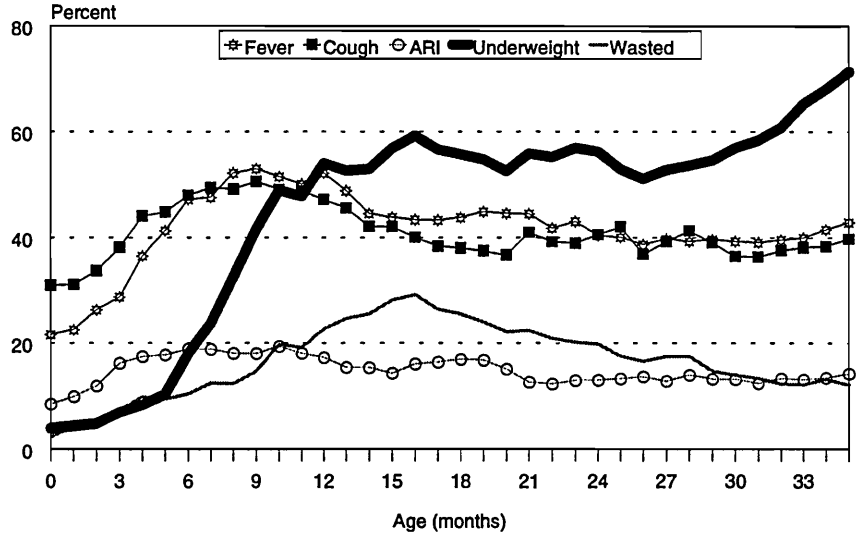
Figure 4.5 Diarrhea, Underweight, and Wasting by Age of Child, Eritrea



Source: EDHS 1995

The age-specific patterns of fever and cough, shown in Figure 4.6, also rise abruptly starting at birth but peak slightly earlier, with cough peaking at about 7 months and fever peaking at about 9 to 10 months of age. Both fever and cough drop slightly after reaching their peak prevalence. The prevalence of these two childhood illnesses then decreases by roughly 10 percentage points through the third year of life, with about 40 percent of children of that age having had a cough or fever in the two weeks prior to the survey.

Figure 4.6 Fever, Cough, ARI, Underweight and Wasting by Age of Child, Eritrea



Source: EDHS 1995

4.6 Morbidity, Breastfeeding, and Treatment

Overall, advice or treatment was sought for only about one-third of reported illnesses (Table 4.4). Women in rural areas were only half as likely as women in urban areas to have sought treatment for their children's episodes of diarrhea or cough in the two weeks preceding the survey. Regionally, mothers in the Central Zone were most likely to have sought treatment (48 percent for diarrhea and 54 percent for cough) compared with other zones. Compared with poor women, women from high socioeconomic status families were twice as likely to have sought treatment for diarrhea, and almost three times more likely to have sought treatment when their child had a cough. The sex of the child was not significantly associated with either prevalence of morbidity or seeking advice or treatment.

Among women who sought advice or treatment for their children's recent episodes of diarrhea or cough, more than three-quarters (79 percent for both diarrhea and cough) went to a public facility and only about 21 percent went to a private facility (Table 4.5). Urban women were more likely than rural women to go a private facility, although the difference was statistically significant only for coughs. Similarly, the higher the socioeconomic status of a woman's family, the more likely she was to have gone to a private facility rather than to a public facility to seek treatment for her child's episode of cough. Gender differences in source of treatment are not significant for cough but are statistically significant at the 7 percent level for diarrhea and suggest that female children were slightly less likely to be taken to a private facility and more likely to be taken to a public facility than were male children. While for the most part the numbers are too small to allow meaningful regional comparisons, it appears that women in the Central Zone were more likely to go to a private facility for cough treatment, compared with other zones, which is probably related to the greater prevalence of private services and wealth in the capital.

Table 4.5 Sources of treatment for diarrhea and cough

Percent distribution of children under three years of age with diarrhea or a cough whose mothers sought treatment/advice from various sources, by selected background characteristics, Eritrea 1995

Background characteristics	Source of treatment for diarrhea: Public facility	Source of treatment for diarrhea: Private/ other	Total	Number of children	Source of treatment for cough: Public facility	Source of treatment for cough: Private/ other	Total	Number of children
Zone								
Southern Red Sea	*	*	100.0	8	*	*	100.0	11
Northern Red Sea	86.8	13.2	100.0	32	86.8	13.2	100.0	50
Anseba	*	*	100.0	12	(75.9)	(24.1)	100.0	32
Gash-Barka	(90.5)	(9.5)	100.0	39	74.4	25.6	100.0	71
Southern	(79.3)	(20.7)	100.0	57	88.4	11.6	100.0	90
Central	(65.3)	(34.7)	100.0	33	69.8	30.2	100.0	82
	p=0.10				p=0.03			
Residence								
Urban	77.1	22.9	100.0	52	70.2	29.8	100.0	107
Rural	80.3	19.7	100.0	130	83.7	16.3	100.0	229
	p=0.69				p=0.01			
Socioeconomic status								
Low	79.8	20.2	100.0	89	86.9	13.1	100.0	138
Medium	77.2	22.8	100.0	57	79.3	20.7	100.0	103
High	81.6	18.4	100.0	36	68.6	31.4	100.0	95
	p=0.87				p=0.00			
Sex of child								
Male	73.5	26.5	100.0	92	78.7	21.3	100.0	176
Female	85.3	14.7	100.0	90	80.2	19.8	100.0	160
	p=0.07				p=0.89			
Total	79.4	20.6	100.0	182	79.4	20.6	100.0	336

Note: Level of significance determined using Chi-square test. Figures in parentheses are based on 25 to 49 unweighted children; an asterisk indicates that a figure is based on fewer than 25 children and has been suppressed.
[1] Government hospital, government health center, government health post
[2] Private hospital/clinic, private doctor, traditional practitioner, other, private pharmacy

Among children with diarrhea in the two weeks preceding the survey, a little over one-third of children (38 percent) were given some form of oral rehydration therapy, almost all of whom (33 percent) were given pre-packaged oral rehydration salts (ORS) (Table 4.6). More than twice as many urban children as rural children suffering from diarrhea were given either ORS or RHF (recommended home fluids), with a much larger urban-rural difference for the pre-packaged ORS compared with the homemade RHF. Regionally, about two-thirds of children (64 percent) with recent diarrhea living in the Central Zone received some oral rehydration, mostly ORS. The lowest use of oral rehydration was in the Southern and Anseba Zones (29 and 27 percent, respectively). The use of some form of oral rehydration increased with the socioeconomic status of the family. Children from families with high socioeconomic status were almost three times as likely to get ORS as were children from low socioeconomic status households. These associations suggest that better socioeconomic status, including the socioeconomic status of the area of residence, are positively related to use of some oral rehydration therapy during diarrhea, particularly pre-packaged, oral rehydration salts. Gender differences in rehydration practice were not significant.

Table 4.6 Use of oral rehydration therapy for treatment of diarrhea

Percentage of children under three years of age who had diarrhea in the preceding two weeks whose mothers treated them with oral rehydration salts (ORS), recommended home fluids (RHF), and either ORS or RHF, by selected background characteristics, Eritrea 1995

	Oral rehydration therapy			
Background characteristic	Given ORS	Given RHF	Given ORS or RHF	Number of children
Zone				
Southern Red Sea	(40.7)	(18.3)	(45.3)	23
Northern Red Sea	40.6	7.8	42.8	74
Anseba	(26.8)	(6.9)	(26.8)	47
Gash-Barka	26.7	20.7	38.0	137
Southern	25.3	4.8	28.5	220
Central	61.5	15.5	64.1	70
	p=0.00	p=0.00	p=0.00	
Residence				
Urban	68.2	13.2	70.9	89
Rural	26.3	10.6	31.4	483
	p=0.00	p=0.46	p=0.00	
Socioeconomic status				
Low	23.6	8.9	28.2	360
Medium	39.9	15.3	46.5	142
High	66.0	13.4	68.1	70
	p=0.00	p=0.10	p=0.00	
Sex of child				
Male	33.0	13.7	37.9	281
Female	32.6	8.5	37.2	290
	p=1.00	p=0.08	p=0.86	
Total	32.8	11.0	37.6	571

Note: Level of significance determined using Chi-square test. Figures in parentheses are based on 25 to 49 unweighted children.

Current recommendations by WHO and UNICEF call for the continuation of feeding, with an increase in fluids, during a diarrheal episode. Women who are breastfeeding are encouraged not only to continue breastfeeding but also to increase the frequency of these feeds. Table 4.7 presents mothers' knowledge and opinions about feeding practices during diarrheal episodes. Almost two-thirds (64 percent) of mothers said they knew about using ORS to treat diarrhea. Mothers in the Southern Zone, mothers in urban areas, and mothers with higher education were most likely to have heard about ORS.

Only about half (49 percent) of the mothers said children with diarrhea should get more liquids, and less than one-quarter of the mothers (24 percent) said that intake of solid foods should be increased during diarrhea. A little over one-third of mothers favored decreasing fluids during diarrhea, and 57 percent said solid foods should be decreased when a child has diarrhea. These opinions did not vary noticeably by mother's age. Regionally, mothers in the more developed Central Zone were most likely to favor increasing foods and liquids during diarrhea and among the least likely to favor decreasing foods and liquids compared with mothers in the other zones. Urban mothers and educated mothers were more likely to favor increasing liquids and foods and less likely to favor decreasing liquids and foods during diarrhea (as opposed to

Table 4.7 Knowledge of diarrhea care

Percentage of women with births in the three years preceding the survey who know about oral rehydration packets (maichow) for treatment of diarrhea and the percent distribution of women by their opinions about appropriate feeding practices during diarrhea, by selected background characteristics, Eritrea 1995

Background characteristic	Know about oral rehydration packets for treatment of diarrhea	Women's opinions about appropriate changes in feeding practices during diarrhea: Liquids				Solid foods				Total	Number of women
		Less	Same	More	DK	Less	Same	More	DK		
Mother's age											
15-19	60.6	36.4	14.5	46.0	3.2	56.4	18.6	21.5	3.4	100.0	201
20-24	62.5	31.1	16.9	51.6	.4	52.1	20.7	26.4	.8	100.0	459
25-29	64.8	34.0	13.2	52.1	.7	60.1	16.7	22.6	.7	100.0	516
30-34	64.5	37.1	15.9	45.4	1.6	57.5	18.1	23.1	1.4	100.0	400
35-49	64.4	38.9	11.0	48.2	1.8	57.5	18.1	23.1	1.3	100.0	627
	p=0.55		p=0.09				p=0.20				
Zone											
Southern Red Sea	73.5	76.3	3.8	19.9	.0	84.2	7.6	8.2	.0	100.0	54
Northern Red Sea	58.5	40.0	10.3	45.4	4.4	72.6	8.4	15.7	3.2	100.0	289
Anseba	18.3	27.9	10.3	60.6	1.3	75.7	6.8	16.2	1.3	100.0	280
Gash-Barka	60.1	51.2	18.0	28.6	2.3	58.8	22.5	17.1	1.6	100.0	429
Southern	81.6	32.4	17.5	50.2	.0	45.1	26.0	28.4	.4	100.0	755
Central	68.4	21.3	9.6	68.1	1.0	48.6	16.1	34.1	1.2	100.0	395
	p=0.00		p=0.00[a]				p=0.00				
Residence											
Urban	76.5	27.9	9.1	62.0	.9	49.4	14.2	35.4	1.0	100.0	462
Rural	60.4	37.6	15.2	45.7	1.5	58.9	19.4	20.4	1.3	100.0	1,740
	p=0.00		p=0.00				p=0.00				
Mother's education											
None	60.4	39.1	14.6	44.7	1.5	60.4	18.7	19.6	1.4	100.0	1,698
Primary	74.9	24.7	13.0	61.5	.7	49.4	14.8	35.2	.5	100.0	334
Secondary+	75.9	21.3	8.8	69.0	.9	36.6	22.0	39.7	1.7	100.0	170
	p=0.00		p=0.00				p=0.00				
Total	63.8	35.6	14.0	49.1	1.4	56.9	18.3	23.5	1.3	100.0	2,202

Note: Level of significance determined using Chi-square test.
[a] Chi-square statistic is unreliable due to small number of cases in one or more cells.

maintaining the amount given). Thus, knowledge of appropriate feeding practices appears to be positively correlated with wealth, education, and urban residence. Presumably, wealthier, more educated mothers living in urban areas are more likely to be exposed to messages and information about correct feeding practices during diarrhea than are women living in poorer, more remote areas. One source of information could be dispensaries of ORS, a treatment that urban, wealthier women are more likely to use.

Knowledge and practice, however, are not always the same. Table 4.8 compares beliefs and practice concerning appropriate liquid intake during diarrhea among women whose child had had diarrhea in the two weeks preceding the survey. While 45 percent of women believed that liquid intake should be increased during diarrhea, somewhat fewer women (36 percent) actually did increase liquids given to their child during a recent episode of diarrhea. There is a smaller difference in the knowledge and practices of women who believed that liquid intake should remain the same or decrease. In both rural areas and urban areas, women are more likely to say liquids should be increased than they are to actually increase liquids. Conversely, more women decrease or maintain liquid intake during diarrhea than say that they believe that these practices should be followed. This suggests that while some women are aware that fluids should be increased during diarrhea, they do not always follow this practice. It is possible, however, that these women do not have full control over the treatment of their ill children.

Table 4.8 Attitudes and practices concerning diarrhea care

Among children under three years of age who had diarrhea in the past two weeks, the percent distribution of their mothers' reported knowledge of appropriate liquid intake during diarrhea and the percent distribution of the actual change in their liquid intake, by selected background characteristics, Eritrea 1995

	Belief concerning change in liquids				Actual change in liquids					
Background characteristic	Less	Same	More	Don't know	Less	Same	More	Don't know/ missing	Total	Number of children
Mother's age										
15-19	(43.5)	(10.3)	(46.3)	(.0)	(37.5)	(24.7)	(33.9)	(3.9)	100.0	58
20-24	36.7	15.1	48.2	0.0	54.0	11.0	31.7	3.3	100.0	110
25-29	41.7	14.3	43.9	0.0	40.4	14.4	44.6	.6	100.0	126
30-34	43.4	10.9	44.0	1.8	50.6	11.3	37.6	.5	100.0	111
35-49	44.4	9.4	44.2	1.9	50.5	15.9	33.4	.2	100.0	167
		p=0.66[a]				p=0.03[a]				
Zone										
Southern Red Sea	(70.3)	(2.3)	(27.4)	(.0)	(54.4)	(25.0)	(18.3)	(2.3)	100.0	23
Northern Red Sea	44.7	11.8	40.8	2.7	55.1	8.5	34.6	1.8	100.0	74
Anseba	(31.8)	(9.5)	(58.7)	(.0)	(58.0)	(20.5)	(20.0)	(1.4)	100.0	47
Gash-Barka	51.7	19.8	26.7	1.8	38.7	19.7	40.5	1.0	100.0	137
Southern	37.8	10.0	52.2	0.0	52.5	9.3	36.8	1.4	100.0	220
Central	31.4	7.8	59.8	1.0	32.9	20.1	45.9	1.0	100.0	70
		p=0.00[a]				p=0.01[a]				
Residence										
Urban	32.4	10.4	56.4	0.8	33.2	18.8	46.4	1.6	100.0	89
Rural	43.8	12.3	43.0	0.9	50.3	13.8	34.6	1.3	100.0	483
		p=0.14[a]				p=0.03				
Mother's education										
None	44.1	12.5	42.5	0.9	49.1	14.4	35.0	1.5	100.0	475
Primary	33.4	8.0	57.4	1.1	45.6	11.8	41.6	1.0	100.0	64
Secondary+	(28.5)	(12.4)	(59.1)	(.0)	(30.3)	(23.2)	(46.5)	(.0)	100.0	32
		p=0.20[a]				p=0.38[a]				
Total	42.0	12.0	45.1	0.9	47.7	14.6	36.4	1.3	100.0	571

Note: Level of significance determined using Chi-square test. Figures in parentheses are based on 25 to 49 unweighted children.
[a] Chi-square statistic is unreliable due to small number of cases in one or more cells.

An examination of beliefs and practices by mother's education yields interesting results. On the question of decreasing liquid intake during diarrheal episodes, there is a larger difference between beliefs and practices among primary educated women than there is among uneducated women. While 33 percent of primary educated women said that liquids should be decreased, about 12 percent more (almost 46 percent) did in fact give their children less liquids during recent diarrheal episodes. The difference between beliefs and practices regarding decreasing fluid intake was much smaller (5 percent) among uneducated mothers. This would suggest that, while primary educated mothers may be more exposed than uneducated mothers to information about correct feeding practices, they do not necessarily translate this information into practice.

4.7 Factors Associated with Diarrhea

Diarrhea in the previous two weeks was significantly related to a number of biological and non-biological factors (Table 4.9). Bivariate analysis showed that diarrhea was less prevalent among children living in Anseba Zone or Central Zone (15 and 16 percent, respectively), and in urban areas (18 percent), compared with other zones (23 to 39 percent) and rural areas (25 percent). Maternal and paternal education at the primary level was associated with a reduced relevance of diarrhea (17 and 18 percent, respectively) compared with children of uneducated mothers and fathers (25 and 26 percent, respectively). However,

Table 4.9 Prevalence of diarrhea

Percentage of children under three years of age who had diarrhea in the two weeks preceding the survey, by selected background characteristics, Eritrea 1995

Background characteristic	Diarrhea in last two weeks	Number of children
Zone		
Southern Red Sea	39.1	59
Northern Red Sea	23.4	317
Anseba	15.0	314
Gash-Barka	29.7	461
Southern	26.1	841
Central	16.3	432
	p=0.00	
Residence		
Urban	17.8	500
Rural	25.1	1,925
	p=0.00	
Mother's education		
None	25.4	1,868
Primary	17.1	375
Secondary+	17.8	181
	p=0.00	
Partner's education		
None	26.1	1,619
Primary	18.4	418
Secondary+	17.7	322
	p=0.00	
Child's age		
0-5	12.5	448
6-11	34.2	430
12-17	28.0	395
18-23	25.9	330
24-29	23.0	417
30-35	18.9	405
	p=0.00	
Drinks from a bottle		
No	23.5	2,292
Yes	24.3	133
	p=0.83	

Table 4.9—*Continued*

Background characteristic	Diarrhea in last two weeks	Number of children
Source of drinking water		
Purchased	13.0	182
Tap	21.5	466
Well	24.4	785
Surface/rainwater	25.9	987
	p=0.00	
Type of toilet facility		
Flush toilet	18.6	200
Latrine	16.4	111
None/other	24.4	2,108
	p=0.04	
Socioeconomic status		
Low	26.3	1,369
Medium	22.4	633
High	16.5	422
	p=0.00	
Main floor material		
Natural	25.0	2,067
Finished/other	15.0	343
	p=0.00	
Diet (last 24 hours)		
Exclusively breastfed	11.2	324
Breastfed + water	24.3	153
Breastfed + liquids	20.7	239
Breastfed + solids	31.5	911
Weaned	20.3	796
	p=0.00	
Exposure to media sources		
No source	25.9	1,309
One or more sources	20.8	1,115
	p=0.00	
Total	23.6	2,424

Note: Level of significance based on Chi-square test.

secondary education was not associated with greatly reduced diarrheal prevalence with respect to primary education. Prevalence of diarrhea among children from households with a latrine or flush toilet (19 and 16 percent, respectively), households that purchased their drinking water (13 percent), households with a high socioeconomic status (17 percent), and households with a finished floor (15 percent) had a lower prevalence of diarrhea than did children from poorer households (26 percent), households with no toilet (24 percent), households that used surface or rainwater as drinking water (26 percent), and households with a natural (dirt) floor (25 percent). Children whose mothers were exposed to media were a little less likely to have had diarrhea in the past two weeks compared with those children whose mothers were not regularly exposed to media (26 versus 21 percent, respectively). Among biological factors, child's age was important (as previously seen in Figure 4.4), with children between 6 to 11 months of age facing the greatest risk of diarrhea (34 percent) and infants less than 6 months of age facing the lowest risk of diarrhea (13 percent).

Children who were exclusively breastfed were at the least risk of diarrhea (11 percent), probably because they were the least exposed to contaminants from unhygienically prepared foods and fluids. Children who received solids in addition to breast milk had a higher prevalence of diarrhea than children with any other diet (32 percent).

The factors identified as important in the bivariate analyses were used in a logistic regression model to explain diarrheal disease among Eritrean children under 3 years of age. Although a number of factors were associated with diarrheal disease in the bivariate analyses, the multivariate analysis showed that much of the variation in the prevalence of diarrhea can be explained by three factors: (1) child's age, (2) whether or not the child was bottle-fed, and (3) main floor material (Table 4.10). Living in Gash-Barka zone, a diet of breast milk and liquids or solids, the use of tap water for drinking purposes, and having no toilet facility were statistically significant at the 10 percent level.

Child's age was highly significant, with children between 6 and 11 months of age two and three times as likely, and children 12-17 months of age twice as likely, to have had diarrhea in the past two weeks compared with infants between 0 to 5 months of age. The increase in diarrheal disease with child age reflects the effect of the increased exposure to pathogens once the infant crawls or walks and when foods other than just breast milk form the child's primary diet. Bottle-feeding increases a child's risk of diarrhea by 68 percent compared with children who are not bottle-fed. Controlling for other factors, including child's age, children who received breast milk and solids or who were weaned were two-thirds and one-third more likely, respectively, to have had diarrhea in the past two weeks compared with children who were exclusively breastfed. However, children receiving liquids other than plain water with breast milk were 21 percent less likely to have had diarrhea recently compared with exclusively breastfed children. These results are surprising, but they also suggest that the solids that breastfeeding children receive may be more contaminated than the liquids they are fed (where the liquids exclude water). Also surprisingly, children whose families have a flush toilet facility in the home have roughly one-and-a-half times the risk of diarrhea than children with a latrine or no toilet. This could reflect a situation where toilet facilities in the home are unhygienically maintained and thus a health hazard. Children in families that drink tap water have a greater risk of diarrhea than children whose families use other sources, such as wells or tanker trucks. This increased risk from tap water may reflect poor water sanitation at the municipal level. Indeed, since families with flush toilets are likely to also have tap water, the increased risk seen for flush toilets may really be due to the water supply. The lack of an urban-rural differential points to the poor living conditions in many urban homes.

The fact that children in homes with natural floors (i.e., dirt and likely to be lower income households) face roughly one and a half times the risk of contracting diarrhea as children whose homes have a finished floor (likely to be wealthier households) may reflect both general economic effects and the particular effect of greater cleanliness, particularly for crawling children. Similarly, economic effects may also contribute to the result that children living in the Gash-Barka Zone have a 50 percent higher risk of diarrhea compared with children in the more developed Central Zone. It should be noted that some of these differences in diarrheal risks could be due to differential reporting among mothers with different residential characteristics, rather than to true differences in the risk of having diarrhea itself.

Table 4.10 Logistic regression results: Diarrhea

Results from a logistic regression model that examines the causes of diarrhea among children born in the three years preceding the survey, Eritrea 1995

Variable	Coefficient (B)	Standard error	Significance	Exp(B)
Zone			0.00	
Southern Red Sea	1.10	0.30	0.00	3.01
Northern Red Sea	0.30	0.22		1.35
Anseba	-0.31	0.27		0.74
Gash-Barka	0.42	0.23	0.06	1.53
Southern	0.22	0.21		1.24
Central				*1.00*
Residence				
Urban	0.00	0.22		1.00
Rural				*1.00*
Mother's education				
None	0.06	0.28		1.06
Primary	0.07	0.26		1.07
Secondary +				*1.00*
Father's education				
None	0.47	0.24	0.05	1.60
Primary	0.16	0.23		1.18
Secondary +				*1.00*
Age of child			0.02	
0-5 months				*1.00*
6-11 months	0.86	0.27	0.00	2.35
12-17 months	0.68	0.30	0.02	1.97
18-23 months	0.59	0.32	0.06	1.80
24-29 months	0.43	0.33		1.54
30-35 months	0.38	0.34		1.46
Bottle-fed				
No				*1.00*
Yes	0.52	0.24	0.03	1.68
Source of drinking water				
Bottled	0.94	1.30		2.56
Tap				*1.00*
Well	-0.33	0.20	0.10	0.72
Surface/rainwater	-0.23	0.21		0.79
Tanker	-0.42	0.23	0.07	0.66
Private source	0.75	1.02		2.11
Toilet facility				
Flush toilet				*1.00*
Latrine	-0.42	0.31		0.66
None/Other	-0.47	0.28	0.09	0.63
Socioeconomic status				
Low	0.32	0.30		1.38
Medium	0.06	0.27		1.07
High				*1.00*
Exposure to mass media				
One or more sources				*1.00*
No sources	-0.09	0.16		0.91
Type of floor material				
Finished/other				*1.00*
Natural	0.47	0.27	0.07	1.61
Diet last 24 hours			0.02	
Breastfed only				*1.00*
Breastfed + water	-0.09	0.34		0.92
Breastfed + liquids	-0.23	0.32	0.10	0.79
Breastfed + solids	0.51	0.31	0.10	1.66
Weaned	0.26	0.34		1.30

Note: Italics indicates reference category.

4.8 Summary and Recommendations

The results presented in this chapter show that infant and child mortality rates are high in Eritrea. High levels of malnutrition and the prevalence of dangerous childhood illnesses contribute to this elevated mortality. Diarrhea, cough, and fever followed similar age-specific patterns in which their prevalence peaked at around one year of age.

Roughly one-third of mothers sought treatment for their children who were ill with either a cough or diarrhea. A similar proportion of mothers gave their children some form of oral rehydration therapy when they were ill with diarrhea. Both the use of oral rehydration and the seeking out of treatment varied significantly across background characteristics. Urban women were far more likely to seek treatment or administer oral rehydration therapy than their rural counterparts. Knowledge of correct feeding patterns during diarrhea was higher than the application of these patterns.

Thus, the key recommendations to reduce infant and child mortality are as follows:

- Nutrition programs should be established to prevent and treat malnutrition. Reductions in malnutrition could have an important impact on child mortality.

- The percentage of women who sought treatment for either a fever or cough shows significant variation across zone, urban-rural residence, and socioeconomic status. The availability of basic care to the poor and to rural residents needs to be examined and improved.

- Knowledge of oral rehydration packets showed less variations across categories than use of oral rehydration packets. This suggests that there is a group of women who know about oral rehydration packets but lack access to them. A program to distribute oral rehydration packets through non-traditional outlets might increase usage.

- Overall knowledge of proper feeding practices during diarrhea is low. At the same time, mothers' knowledge of proper feeding practices exceed their implementation of these practices. Existing public information campaigns should be expanded in scope and their message should be refined to encourage mothers to apply what they have learned.

CHAPTER 5

FACTORS ASSOCIATED WITH MALNUTRITION

The direct causes of malnutrition are inadequate dietary intake and morbidity. The indirect causes are a number of biological, demographic, and socioeconomic factors. The relationship between these indirect factors and malnutrition is explored in this chapter using bivariate and multivariate statistical techniques.

5.1 Biological and Health Characteristics of Stunting

Stunting and wasting are associated with a large number of biological and health characteristics (Table 5.1). Differences in the age distribution of children may explain some of the biological bivariate findings, as stunting is a cumulative process that increases with age. In addition, many of these factors are highly correlated, which is not controlled for in a bivariate table.

Stunting among children less than three years of age is significantly associated with child age, maternal perception of small size at birth, twin birth, sex of child, maternal pregnancy status, preceding birth interval, and diarrhea or fever in the previous two weeks. Twenty-three percent of children under twelve months old are already stunted. In the age group 18 to 23 months, 58 percent of all children are stunted. The prevalence of stunting drops for children 24 to 29 months (44 percent) and rises again to peak at 69 percent for children 30 to 35 months.

Forty-seven percent of children perceived by their mothers to be very small at birth are stunted compared with 36 percent of those perceived by their mothers to be at least average size at birth. The number of multiple births is too small to give statistically reliable results, but twins appear to be at elevated risk of stunting, possibly because of their low birth weight. More female children (41 percent) than male children (36 percent) are stunted.

Table 5.1 Stunting and wasting by biological characteristics

Percentage of children under three years of age who are stunted and wasted, by biological characteristics, Eritrea 1995

Biological characteristic	Stunted	Wasted	Number of children
Child's age			
0-5	4.4	6.5	403
6-11	19.0	14.9	415
12-17	43.8	28.4	381
18-23	57.5	21.6	311
24-29	44.3	16.6	385
30-35	69.0	12.1	374
	p=0.00	p=0.00	
Size at birth			
Avg/large	36.4	14.0	1,622
Small	39.3	22.2	238
Very small	47.3	22.6	371
	p=0.00	p=0.00	
Birth weight			
Normal	20.2	9.2	276
Low	32.2	13.9	41
	p=0.11	p=0.27	
Type of birth			
Multiple birth	(55.0)	(16.0)	34
Single birth	38.1	16.4	2,235
	p=0.05	p=1.00	
Sex of child			
Male	36.4	16.2	1,162
Female	40.5	16.7	1,107
	p=0.04	p=0.78	
Mother currently pregnant			
No or unsure	36.3	16.0	2,041
Yes	57.2	20.0	228
	p=0.00	p=0.13	
Preceding birth interval (months)			
9-23	46.6	18.3	347
24-35	40.4	15.1	749
36+	34.4	17.0	672
	p=0.00	p=0.36	
Diarrhea (2 weeks)			
No	37.4	15.9	1,735
Yes	41.6	18.0	534
	p=0.08	p=0.26	
Fever (2 weeks)			
No	33.6	12.8	1,323
Yes	45.1	21.4	946
	p=0.00	p=0.00	
Total	38.4	16.4	2,269

Note: Level of significance determined using Chi-square test.

The mother's pregnancy status and preceding birth interval are correlated with stunting. The proportion stunted rises as shorter birth intervals shrink: Almost half (47 percent) of all children whose mother had a previous birth interval of less than 23 months are stunted, compared with one-third (34 percent)

of children where the previous birth interval was 36 months or more. Fifty-seven percent of children with currently pregnant mothers are stunted, compared with 36 percent of children with mothers who are not currently pregnant or who are unsure.

Both diarrhea and fever in the previous two weeks are positively associated with stunting. It is unlikely that diarrhea or fever in the previous two weeks is the direct cause of stunting, but children reported to have diarrhea or fever may be more likely than other children to have had repeated episodes of illness in the past, which would, over time, contribute to stunting. Both for fever and for diarrhea, more than 40 percent of children who suffered from either of these illnesses are likely to be stunted, compared with about 34 and 37 percent of children who did not suffer from diarrhea or fever, respectively, in the two weeks prior to the survey.

5.2 Biological and Health Characteristics of Wasting

The direction and magnitude of the associations of wasting with biological and health characteristics are different from those for stunting (Table 5.1). The prevalence of wasting peaks earlier than stunting, at 12 to 17 months of age (see also Figure 2.6), and then decreases consistently for children between the ages of 18 and 36 months. With the exception of the youngest age group, stunting is higher than wasting at all ages. According to the mother's evaluation of size at birth, children who were born small or very small are more likely to be wasted compared with children who are average size or large children. Except for fever, none of the other bivariate relationships that were statistically significant for stunting are significant for wasting. Children who had a fever in the previous two weeks are more likely to be wasted than children who did not have a fever (21 percent versus 13 percent).

5.3 Socioeconomic and Demographic Characteristics of Stunting

The associations between social and economic factors and stunting presented in Table 5.2 should be interpreted with caution as many of the factors are highly correlated. The results confirm that poverty, measured by factors such as maternal and paternal education and occupation, socioeconomic status score, water source, and type of toilet, is associated with stunting. Rural children are almost one and a half times more likely to be stunted compared with urban children (41 and 29 percent, respectively). Children living in the Central Zone are least likely to be stunted (32 percent) compared with children in any other Zone of the country. The Northern Red Sea Zone, in contrast, had the highest regional rate of stunting (47 percent).

Maternal education is negatively associated with stunting. The prevalence of stunting drops from 42 percent stunted for children whose mothers are uneducated to 29 percent for children whose mothers have a primary education. Children of mothers with at least a secondary education are slightly less than half as likely to be stunted (23 percent) as the children of mothers with no education. Children whose mothers are professionals have about one-third the stunting levels (14 percent) of children whose mothers have any other occupation.

Children living in households headed by women are 10 percentage points less likely to be stunted (30 percent stunted) than children living in male-headed households (40 percent). A possible explanation is that female-headed households allocate a greater share of resources to children. Another possibility is that these households are more urban and of higher socioeconomic status.

Access to media (TV, radio, or newspapers) is associated with stunting. Stunting levels drop by 8 to 11 percentage points per unit increase in the number of sources of media exposure. Children whose

mothers were exposed to no media source are a little over two and a half times as likely to be stunted as children whose mothers were regularly exposed to three sources of media (45 percent versus 17 percent, respectively).

Stunting is positively associated with the number of previous child deaths in a family and the number of children who are living in the household. The prevalence of stunting is higher in households with two or more children (39 to 43 percent) than in households with only one child living at home (31 percent). Children of mothers with one or more dead children are more likely to be stunted than those children of mothers with no dead children.

Paternal education has an effect similar to, but weaker than, maternal education. Stunting is less prevalent among children whose mothers use a health facility for delivery, children whose fathers are professionals, children who come from families with high socioeconomic status, children whose families have a flush toilet, and children in families where purchased water is the main source of drinking water.

5.4 Socioeconomic and Demographic Characteristics of Wasting

The findings for wasting are different than from for stunting (Table 5.2). Regional differences are more pronounced for wasting. The prevalence of wasting is lowest in the Central Zone (8 percent), and wasting is almost double this level or higher in all other zones, ranging from 15 percent (Anseba and Southern zones) to 23 percent (Southern Red Sea and Gash-Barka zones). Media exposure and socioeconomic status have a stronger bivariate relationship with wasting than with stunting. Maternal education, on the other hand, is significantly negatively associated with wasting, but the effect is not as strong as for stunting. Wasting levels decrease from 17 percent for children whose mothers are uneducated to 12 percent for children whose mothers have at least a secondary education. Urban-rural residence, father's occupation and education, source of drinking water, place of delivery, and the sex of the household head show similar but smaller differences for wasting relative to stunting. Mother's occupation and the number of dead children do not have a statistically significant bivariate relationship with wasting.

5.5 Multivariate Regression Analysis

The biological, health, social, and economic factors identified as important in the bivariate analyses were used in an ordered logit regression model to explain stunting and wasting among Eritrean children less than 3 years of age. The ordered logit model is a generalization of the logit or logistic regression model to allow for more than two possible outcomes. Outcomes are ranked in order of severity. In this analysis, the independent effects of various background characteristics on three outcomes (normal, moderate, and severe stunting or wasting, ranked in that order) are examined (see Appendix F for a fuller explanation of ordered logit regression models).

An ordered logit model was selected for two conceptual reasons. First, severe malnutrition is "worse" than moderate malnutrition and this difference in outcome should be captured. Second, the influence of background characteristics on risk factors may differ for moderate and severe malnutrition. The following variables were included in the model to explain childhood malnutrition in Eritrea. Sections 5.6 and 5.7 discuss only statistically significant variables.

- Age of child (0-5, 6-11, 12-17, 18-23, 24-29, 30-35 months)
- Size at birth (average/large, small, very small)
- Assistance at delivery (medical [doctor or nurse], traditional birth attendant, other, or no one)
- Preceding birth interval (9-23, 24-35, 36+ months)

Table 5.2 Stunting and wasting by background characteristics

Percentage of children under three years of age who are stunted and wasted, by selected background characteristics, Eritrea 1995

Background characteristic	Stunted	Wasted	Number of children
Zone			
Southern Red Sea	35.2	23.0	36
Northern Red Sea	47.2	22.2	281
Anseba	45.4	15.0	300
Gash-Barka	41.0	23.5	425
Southern	34.7	15.1	820
Central	32.2	8.3	408
	p=0.00	p=0.00	
Residence			
Urban	28.7	12.8	473
Rural	40.9	17.4	1,796
	p=0.00	p=0.01	
Mother's education			
None	41.8	17.3	1,735
Primary	29.2	14.6	364
Secondary+	22.9	11.7	170
	p=0.00	p=0.10	
Mother's occupation			
Not working	38.8	17.0	1,654
Professional	13.7	10.6	55
Manual labor	(43.3)	(14.2)	35
Agricultural	39.5	15.5	493
Domestic/services	(41.6)	(15.5)	30
	p=0.01	p=0.70	
Partner's education			
None	43.2	18.4	1,507
Primary	32.6	12.9	399
Secondary+	24.1	12.0	307
	p=0.00	p=0.00	
Partner's occupation			
Not working	*	*	10
Professional	29.9	11.9	272
Manual labor	30.9	13.0	289
Agricultural	42.8	18.1	1,431
Domestic/services	30.6	16.7	194
	p=0.00	p=0.05	
Media exposure			
No source	45.2	18.7	1,206
One source	34.5	14.8	729
Two sources	24.9	14.7	224
Three sources	17.0	5.8	110
	p=0.00	p=0.00	
Socioeconomic status			
Low	43.4	19.4	1,270
Medium	34.6	14.6	599
High	28.1	9.9	400
	p=0.00	p=0.00	

Continued

Table 5.2— *Continued*

Background characteristic	Stunted	Wasted	Number of children
Type of toilet facility			
Flush toilet	22.1	9.4	188
Latrine	31.1	16.3	104
None/other	40.3	17.1	1,973
	p=0.00	p=0.03	
Source of drinking water			
Purchased	27.1	12.9	172
Tap	31.5	12.8	432
Well	44.6	18.1	729
Surface/rainwater	38.8	17.4	933
	p=0.00	p=0.05	
Main floor material			
Natural	40.3	17.6	1,933
Finished/other	26.1	9.9	326
	p=0.00	p=0.00	
Assistance at delivery			
Doctor	24.0	14.4	176
Nurse/midwife	30.2	13.5	300
TBA	41.9	17.7	1,205
Other	39.1	13.6	546
No one	47.3	42.6	41
	p=0.00	p=0.00	
Place of delivery			
Home	41.2	17.3	1,868
Health facility	25.5	12.4	401
	p=0.00	p=0.02	
Sex of household head			
Male	40.1	17.3	1,891
Female	30.0	12.1	378
	p=0.00	p=0.02	
Number of children at home			
1	30.7	17.2	471
2	39.1	18.4	508
3	38.7	12.0	394
4	40.0	14.9	313
5+	42.5	17.9	579
	p=0.00	p=0.07	
Number of dead children			
0	35.2	15.8	1,553
1	43.5	17.6	424
2+	48.1	18.2	292
	p=0.00	p=0.45	
Total	38.4	16.4	2,269

Note: Level of significance determined using Chi-square test. Figures in parentheses are based on 25 to 49 unweighted children; an asterisk indicates that a figure is based on fewer than 25 unweighted children and has been suppressed.

- Number of children under three in household (0-1, 2-3, 4, 5+)
- Zone (Southern Red Sea, Northern Red Sea, Anseba, Gash-Barka, Southern, Central)
- Residence (urban, rural)
- Mother's education (none, primary, secondary+)
- Mother's occupation (not working, professional, agriculture, manual, domestic/service)
- Whether mother watches television weekly (no, yes)
- Whether mother listens to the radio weekly (no, yes)
- Whether mother reads a newspaper weekly (no, yes)
- Husband's education (none, primary, secondary+)
- Husband's occupation (not working, professional, sales, agriculture, other)
- Socioeconomic status score (low, medium, high)
- Toilet facilities (no, yes)
- Floor material (natural, finished/other)
- Sex of household head (male, female)

5.6 Risk Factors for Stunting

Table 5.3 presents the probabilities under the ordered logit model for normal, moderate, and severe stunting for various background variables and categories. Unlike in a binary logistic regression, the coefficient for the reference category is not presented as an odds ratio of 1. Rather, the model predicts the probability that an "average" (i.e., all other variables are set to their mean value) child from each category of each background variable will be normal, or moderately stunted, or severely stunted. The probabilities sum to 1. For example, for the background variable "child's age," for children age 6-11 months, the risk (or probability) of being normal is 0.81, the risk (or probability) of being moderately stunted is 0.13, and the risk (or probability) of being severely stunted is 0.06. The sum of these probabilities is 1.

Reference categories are shown in italics; statistically significant categories are in bold. The statistically significant determinants of stunting found in the multivariate analysis are child's age, residence in the Anseba Zone, a long birth interval, size at birth, a mother who performs manual labor or domestic service, a mother who has a partner in agriculture, a mother who listens to the radio weekly, and the sex of the household head.

The risk of stunting increases with age. Children between age 0 and 5 months have the lowest probability of both moderate and severe stunting (0.02 and 0.01, respectively). For children age 6-11 months, the probability of being moderately stunted (0.14) increases sevenfold. The probability of severe stunting also increases, but the probability does not increase as much as moderate stunting. For children age 18-23 months, the probability of being stunted is 0.56, with about a 1-in-4 chance of being severely stunted (0.27). For children in the oldest age group, 30-35 months, the probability of severe stunting (0.43) is much higher than moderate stunting (0.29), and almost double the probability of severe stunting for the previous age group of 24-29 months.

This pattern clearly reflects the increased exposure to stunting by age: Both moderate stunting and severe stunting probabilities increase with the child's age. By the third year of life the probability of being severely stunted is higher than the probability of being moderately stunted. This suggests that moderately stunted children progress to being severely stunted as they age. The first 17 months of life—particularly the first 11 months—are a critical period for interventions to prevent stunting. After this period, intervention should concentrate on preventing further erosion of stunted children's positions.

Stunting probabilities were significantly higher in the Anseba Zone than in the Central Zone. The distribution of moderate stunting and severe stunting also varies across these regions. The probability of

Table 5.3 Logistic regression results: Stunting

Results from a logistic regression model that examines the causes of stunting among children born in the three years preceding the survey, Eritrea 1995

Background characteristic	Estimated probabilities: Not stunted	Moderately stunted	Severely stunted	Significance of category
Child's age				
0-5	*0.97*	*0.02*	*0.01*	
6-11	0.80	0.14	0.06	0.00
12-17	0.57	0.26	0.18	0.00
18-23	0.44	0.29	0.27	0.00
24-29	0.50	0.28	0.22	0.00
30-35	0.28	0.29	0.43	0.00
Zone				
Southern Red Sea	0.72	0.15	0.12	0.31
Northern Red Sea	0.51	0.24	0.25	0.13
Anseba	0.52	0.23	0.25	0.08
Gash-Barka	0.56	0.23	0.21	0.80
Southern	0.62	0.22	0.16	0.49
Central	*0.70*	*0.18*	*0.12*	
Residence				
Urban	0.70	0.18	0.12	0.69
Rural	*0.54*	*0.23*	*0.23*	
Mother's education				
None	0.55	0.23	0.22	0.25
Primary	0.70	0.17	0.12	0.50
Secondary +	*0.79*	*0.14*	*0.08*	
Mother's occupation				
Not working	0.58	0.22	0.20	0.43
Professional	*0.86*	*0.09*	*0.05*	
Manual labor	0.57	0.23	0.20	0.04
Agricultural	0.60	0.23	0.17	0.96
Domestic/services	0.60	0.22	0.18	0.06
Partner's education				
None	0.54	0.23	0.23	0.59
Primary	0.63	0.21	0.16	0.51
Secondary +	*0.77*	*0.15*	*0.09*	
Partner's occupation				
Professional	*0.71*	*0.17*	*0.12*	
Manual labor	0.67	0.19	0.14	0.50
Agricultural	0.52	0.24	0.24	0.07
Other	0.69	0.18	0.13	0.82
Media exposure: television				
Doesn't watch	*0.57*	*0.22*	*0.21*	
Watches weekly	0.77	0.15	0.08	0.37

Continued

Table 5.3—*Continued*

Background characteristic	Estimated probabilities: Not stunted	Moderately stunted	Severely stunted	Significance of category
Media exposure: radio				
Doesn't listen	*0.52*	*0.24*	*0.25*	
Listens weekly	0.67	0.19	0.14	0.02
Media exposure: newspaper				
Doesn't read	*0.57*	*0.23*	*0.21*	
Reads weekly	0.76	0.15	0.09	0.45
Socioeconomic status				
Low	0.52	0.24	0.24	0.38
Medium	0.60	0.22	0.18	0.41
High	*0.72*	*0.17*	*0.11*	
Assistance at delivery				
Medical	*0.71*	*0.17*	*0.12*	
TBA	0.55	0.23	0.22	0.60
Other	0.57	0.22	0.21	0.46
Toilet facility				
No facility	0.56	0.23	0.21	0.45
Facility	*0.72*	*0.17*	*0.11*	
Floor material				
Natural	0.56	0.23	0.21	0.99
Finished/other	*0.73*	*0.16*	*0.11*	
Sex of household head				
Male	0.57	0.22	0.20	0.08
Female	*0.71*	*0.17*	*0.12*	
Preceding birth interval (months)				
9-23	*0.46*	*0.26*	*0.28*	
24-35	0.55	0.23	0.22	0.68
36+	0.69	0.18	0.13	0.00
Children at home				
1	*0.69*	*0.17*	*0.14*	
2	0.60	0.21	0.19	0.22
3	0.60	0.21	0.19	0.31
4	0.58	0.22	0.20	0.26
5+	0.58	0.22	0.20	0.45
Size at birth				
Average/large	*0.63*	*0.21*	*0.16*	
Small	0.49	0.23	0.27	0.01
Very small	0.48	0.23	0.28	0.00
Missing/Don't know	0.63	0.21	0.16	0.33

Note: Italics indicates reference category.

being moderately stunted is higher for children living in the Anseba Zone than in the Central Zone (0.23 compared with 0.15, respectively), but the probability of severe stunting is twice as high in the Anseba Zone as it is in the Central Zone (0.25 compared with 0.12, respectively).

Children whose mothers work in manual labor and domestic service have a much higher probability of being stunted than do children whose mothers are professionals. The probability of being moderately stunted is roughly three times as high for children of manual laborers as for children of professionals (0.23 compared with 0.09). This difference is fivefold for severe stunting (a probability of 0.20 for children of manual laborer mothers compared with 0.04 for children of professional mothers). The probabilities for children of mothers in domestic service are similar (0.22 for moderate stunting and 0.18 for severe stunting).

Children of mothers who listen to a radio weekly have a much lower stunting probability than do children of mothers without regular exposure to this media (0.33 versus 0.48). The probability differential is much higher for severe stunting than for moderate stunting (0.24 versus 0.19 and 0.25 versus 0.14, respectively).

The sex of the head of the household makes an important difference in the probability of being stunted. Children who are living in a female-headed household are substantially less likely to be stunted and severely stunted than are children who are living in a male-headed household (0.29 versus 0.43 and 0.12 versus 0.20, respectively).

A child's birth size is a strong determinant of stunting, particularly of severe stunting. Children who were perceived by their mothers as small or very small at birth are more likely to be both moderately and severely stunted than children who were perceived to be average or larger at birth (0.51 and 0.52 versus 0.37). These children are also more likely to be severely stunted than larger children (0.27 and 0.28 versus 0.16).

Another factor related to condition at birth, the duration of the preceding birth interval, is also related to the likelihood of being stunted. Children born 36 or more months after a preceding birth are much less likely to be stunted and severely stunted than children born after an interval of less than 24 months (0.31 versus 0.54, and 0.13 versus 0.28, respectively).

5.7 Risk Factors for Wasting

Risk factors for wasting reflect differences in the etiologies and age-specific patterns of wasting compared with stunting (Table 5.4). The probability of being moderately wasted is higher than the probability of being severely wasted in every category, suggesting that severe wasting (compared with moderate wasting) is a less serious problem than severe stunting (compared with moderate levels of stunting).

Infants less than 5 months of age are least likely to be wasted. This may reflect the protective nature of breastfeeding (which is nearly universal) during this period. The patterns of moderate wasting and severe wasting by age are very different to those for stunting. Wasting peaks at age 12-17 months with probabilities of 0.20 and 0.06 for moderate and severe wasting, respectively. This increase in risk may reflect the delayed introduction of complementary foods, a rapid rise in diarrheal disease, and the negative interactive effect of the two on child nutritional status. Diarrheal disease peaks at age 11-12 months and remains higher than at infancy for subsequent age groups. The delayed introduction of complementary foods results in insufficient intake for many children. By 24-29 months of age (when almost all children are receiving complementary foods) the risk of wasting drops but remains significantly higher than for the youngest infants. The probability of severe wasting is low (0.01 to 0.06) at all ages.

Table 5.4 Logistic regression results: Wasting

Results from a logistic regression model that examines the causes of wasting among children born in the three years preceding the survey, Eritrea 1995

Background characteristic	Estimated probabilities: Not wasted	Moderately wasted	Severely wasted	Significance of category
Child's age				
0-5	*0.95*	*0.04*	*0.01*	
6-11	0.84	0.13	0.03	0.00
12-17	0.74	0.20	0.06	0.00
18-23	0.79	0.17	0.04	0.00
24-29	0.84	0.13	0.03	0.00
30-35	0.89	0.09	0.02	0.12
Zone				
Southern Red Sea	0.84	0.13	0.03	0.51
Northern Red Sea	0.77	0.19	0.05	0.01
Anseba	0.88	0.10	0.02	0.79
Gash-Barka	0.75	0.19	0.05	0.00
Southern	0.85	0.12	0.03	0.11
Central	*0.92*	*0.06*	*0.01*	
Residence				
Urban	0.88	0.10	0.02	0.20
Rural	*0.82*	*0.15*	*0.04*	
Mother's education				
None	0.82	0.14	0.04	0.43
Primary	0.87	0.10	0.02	0.83
Secondary +	*0.92*	*0.07*	*0.01*	
Mother's occupation				
Not working	0.83	0.13	0.03	0.49
Professional	*0.93*	*0.06*	*0.01*	
Manual labor	0.89	0.09	0.02	0.45
Agricultural	0.83	0.14	0.03	0.54
Domestic/services	0.79	0.17	0.05	0.60
Partner's education				
None	0.81	0.15	0.04	0.64
Primary	0.89	0.09	0.02	0.44
Secondary +	*0.90*	*0.08*	*0.02*	
Partner's occupation				
Professional	*0.87*	*0.10*	*0.02*	
Manual labor	0.87	0.10	0.03	0.65
Agricultural	0.81	0.15	0.04	0.44
Other	0.88	0.10	0.02	0.78
Media exposure: television				
Doesn't watch	*0.82*	*0.14*	*0.04*	
Watches weekly	0.96	0.04	0.01	0.02

Continued

Table 5.4—*Continued*

Background characteristic	Estimated probabilities: Not wasted	Moderately wasted	Severely wasted	Significance of category
Media exposure: radio				
Doesn't listen	*0.80*	*0.16*	*0.04*	
Listens weekly	0.88	0.10	0.02	0.41
Media exposure: newspaper				
Doesn't read	*0.82*	*0.14*	*0.04*	
Reads weekly	0.93	0.05	0.01	0.01
Socioeconomic status				
Low	0.79	0.16	0.04	0.16
Medium	0.85	0.12	0.03	0.28
High	*0.91*	*0.08*	*0.02*	
Assistance at delivery				
Medical	*0.87*	*0.10*	*0.02*	
TBA	0.82	0.15	0.04	0.75
Other	0.84	0.13	0.03	0.20
Toilet facility				
No facility	0.82	0.14	0.03	0.75
Facility	*0.89*	*0.09*	*0.02*	
Floor material				
Natural	0.82	0.15	0.04	0.42
Finished/other	*0.91*	*0.07*	*0.02*	
Sex of household head				
Male	0.83	0.14	0.03	0.11
Female	*0.90*	*0.08*	*0.02*	
Preceding birth interval (monthes)				
9-23	*0.79*	*0.17*	*0.04*	
24-35	0.85	0.12	0.03	0.01
36+	0.85	0.12	0.03	0.02
Children at home				
1	*0.86*	*0.11*	*0.03*	
2	0.79	0.16	0.04	0.24
3	0.89	0.09	0.02	0.61
4	0.86	0.12	0.03	0.95
5+	0.83	0.14	0.03	0.28
Size at birth				
Average/large	*0.86*	*0.11*	*0.03*	
Small	0.79	0.16	0.04	0.06
Very small	0.77	0.19	0.05	0.01
Missing/Don't know	0.80	0.16	0.04	0.68

Note: Italics indicates reference category.

Region of residence appears to have a stronger impact on wasting than on stunting. The probabilities both of moderate stunting and severe stunting are lowest in the Central Zone. The highest probability of wasting is in the Northern Red Sea and Gash-Barka zones. The probability of moderate wasting is three times as high as in the Central Zone (0.19 compared with 0.06 in Central), and the risk of severe stunting is five times as high as in the Central Zone (0.05 compared with 0.01 in Central).

The duration of the preceding birth interval is an important determinant of wasting. Children born less than 24 months after a preceding birth are again half as likely to be wasted than children born after longer intervals (0.21 versus 0.15). Similarly, children who were small or very small at birth are more likely to be wasted. This latter relationship probably reflects the influence of food availability and/or illness that affect both the mother and the child.

The other statistically significant variables related to weekly newspaper and television exposure, which is associated with higher socioeconomic levels in urban areas, suggest that poverty plays an important role in the risk of being wasted. Weekly exposure to television significantly decreases the probability of being wasted. Regular maternal exposure to television and newspapers decreases the chance of children being moderately wasted, in particular, compared with children of mothers who do not see television or read a newspaper at least once a week (0.04 and 0.05 versus 0.14, respectively).

5.8 Summary and Recommendations

Child nutritional status is largely associated with child age, birth size as perceived by the mother, exposure to infectious diseases such as diarrhea and fever, and several factors associated with poverty. Delayed introduction of complementary foods, poor sanitation, disease, and the interactive negative effect of malnutrition and disease result in a rapid rise both in stunting and in wasting at about 6 months of age. Risks both of stunting and of wasting remain high throughout the second year of life, suggesting that the first two years of life are a critical period for public health intervention. Moreover, the risks of severe stunting increase to alarmingly high levels for children from relatively deprived backgrounds, suggesting a role for policy interventions not only to target normal children but also to focus attention and resources to moderately malnourished children to prevent severe malnutrition. On the other hand, severe wasting appears to be less of a problem, suggesting that policy should concentrate largely on normal children to prevent moderate wasting.

Thus, the key recommendations to improve child nutritional status are as follows:

- Public health efforts to improve child feeding behaviors should focus on the first two years of life. Specifically, these efforts should concentrate on encouraging women to introduce nutritious weaning foods at about 6 months of age, increasing the frequency of breastfeeding, and using oral rehydration therapy during diarrheal episodes. Because poverty is an important factor in Eritrea, research is needed to identify low-cost, locally available nutritious foods that poorer women can afford.

- Over the long run, providing better education and income earning opportunities both to men and to women to improve household income will help bring down the rates of stunting and wasting in a sustainable way.

CHAPTER 6

NUTRITIONAL STATUS OF WOMEN

Women's nutritional status prior to conception and during pregnancy is an indicator of women's health and a predictor of pregnancy outcome. Women of childbearing age are particularly vulnerable to malnutrition because of the large nutritional costs associated with pregnancy and lactation. In Eritrea, the average woman bears a little over six (6.1) children during her reproductive years (NSO and MI, 1995). These women's bodies are repeatedly drained by the nutritional stress of reproduction. In this chapter, the nutritional status of women with children under 3 years of age is described and the implications for maternal health is discussed.

6.1 Background

Maternal nutritional factors (including low caloric intake or gestational weight gain, low prepregnancy weight, and small height) are the most important determinants of poor fetal growth or intrauterine growth retardation (IUGR) in rural areas of developing countries (Kramer, 1987). These factors account for over half of the difference between the rates of IUGR in developed countries compared with the rates of IUGR in rural areas of developing countries (Krasovec and Anderson, 1991). Infants with IUGR have a higher risk of perinatal mortality and other adverse outcomes. On the other hand, women who gain too much weight given their prepregnancy weight-for-height have a greater risk of delivering a high birthweight baby. This results in increased rates of prolonged labor, shoulder dystocia, caesarean delivery, and birth trauma (IOM, 1990).

Prepregnancy weight is an important determinant of birth weight both in developed and in developing countries (IOM, 1990). Gestational weight gain is an important determinant of fetal growth. To minimize poor pregnancy outcomes, women with lower prepregnancy weight-for-height need to gain more weight than do women with high prepregnancy weight-for-height. The recommended weight gain ranges for pregnant women are shown in Table 6.1. The recommended high pregnancy weight gains for women with low prepregnancy weight may be unrealistic for women in developing countries (Krasovec and Anderson, 1991). It is important to focus attention not only on pregnant women but also on improving the nutritional status of women in general so they do not enter pregnancy in a nutritionally disadvantaged state.

Table 6.1 Recommended total weight gain ranges for pregnant women

Recommended total weight gain ranges for pregnant women, by prepregnancy body mass index (BMI)

Prepregnant weight-for-height category	Recommended total gain (kg)
Low (BMI < 19.8)	12.5-18.0
Normal (BMI of 19.8 to 26.0)	11.5-16.0
High (BMI >26.0 to 29.0)	7.0-11.5

Source: IOM, 1990

The nutritional cost of pregnancy has been estimated at 85,000 kcals. This figure assumes that women will store some 35,000 kcals of fat for lactation (Hytten, 1980). More recent work suggests that the energy cost of pregnancy is closer to 55,000 kcals (IOM, 1990). The US Recommended Dietary Allowances (which are based on Hytten's estimates) recommend that pregnant women consume an additional 300 kcals per day during their second and third trimesters. The USRDA also recommends that lactating women consume an additional 300 kcals per day. This recommended increase in caloric consumption may also be unrealistic for many poor women in developing countries.

6.2 Data Collected

Maternal height and weight measures were collected from women who had at least one birth since January 1992. This selection criterion produces a sample that is biased toward women who are between 20 and 39 years of age, as women in this age group are most likely to have given birth in the last three years (Table 6.2).

Table 6.2 Percent distribution of mothers by age

Percent distribution of ages for all women and mothers with children under three years of age

Age group	Women with children under three years of age	All women
15-19	9.1	22.3
20-24	20.8	16.3
25-29	23.4	15.5
30-34	18.1	12.6
35-39	14.4	11.1
40-44	10.8	11.9
45-49	3.2	10.2
Total	100.0	100.0
Number	2,202	5,054

Women were weighed on a digital scale. Weight was recorded in kilograms to the nearest 100g. Height was measured using a standard anthropometer specifically made for the survey and recorded to the nearest millimeter. A total of 2,189 women were measured, of whom 402 (18 percent) were pregnant, 1,455 (66 percent) were lactating and 332 (15 percent) were neither pregnant nor lactating at the time of the survey (Tables 6.3 and 6.4). Since pregnancy does not affect height, height data are provided here for all women (Table 6.3). However, since weight is affected by pregnancy and by the stage of pregnancy (about which there is no information in these data), weight and BMI data are provided for nonpregnant women, both lactating and nonlactating (Table 6.4).

6.3 Indicators of Maternal Nutritional Status

To date, the assessment of nutritional status in nonpregnant women has been based on normative distributions (Krasovec and Anderson, 1991). Commonly used anthropometric references for adult women represent averages of healthy populations and should not be interpreted as "ideal" or desirable for all individuals.

Weight is predominantly a measure of current nutritional status and is often used as an indicator of overall health and nutritional status. Appropriate weights for different stages of the lifecycle are still unknown.

Height is a measure of past nutritional status and genetic potential of the individual. It also reflects the cumulative effect of social and economic status. No international standard exists for adult women's height; however, women whose height falls below 145 cm have been found to be at a greater risk of maternal mortality than have other women. This relationship reflects the association between short stature and small pelvic size (which can result in obstructed labor; WFPHA, 1983). Young women may have an immature pelvis, which can lead to cephalopelvic disproportion (Liljestrand, 1985). Short stature is correlated with low birth-weight infants, high risks of stillbirth, and high miscarriage rates (Krasovec and Anderson, 1991).

Body mass index (BMI) or Quetlet index, calculated as weight in kilograms divided by height in meters squared, is used to assess women's nutritional status. It was originally developed to diagnose obesity but James et al. (1988) have advocated its use for assessing chronic energy deficiency (CED), which has been defined ". . .as a steady state at which a person is in energy balance although at a cost either in terms of risk to health or as an impairment of functions and health" (James, 1988).

The advantage of using BMI to assess maternal nutritional status is that it is a self-contained ratio and does not require reference tables. Data from well-nourished populations show that a normal range maternal BMI is between 21.5 and 23.1. The International Dietary Energy Consultative Group suggests that Quetlet BMIs between 17.0 and 18.4 are indicative of Grade I CED, Quetlet BMIs between 16.0 and 17.0

of Grade II CED, and Quetlet BMIs below 16 of Grade III (severe) CED (James et al., 1988). A Quetlet BMI of 12 is the lowest limit compatible with life.

Women who are 20 percent overweight have BMIs between 25.8 and 27.3, whereas women who are severely overweight, that is, 40 percent overweight, have BMIs between 30.1 and 32.3. In the case of Eritrea, overweight is defined as a BMI of 25.0 or more (NSO and MI, 1995).

6.4 Height, Weight and Body Mass Index

Table 6.3 presents summary statistics on the heights of all women who gave birth in the last three years. About 2 percent of women fall below the critical lower level of 145 cm, and 13 percent are below 150 cm in height. One-third of the women are between 155-160 cm (33 percent). The mean and median height are both 156 cm.

Table 6.3 Distribution of mother's height

Percent distribution of mother's height, Eritrea 1995

Mother's height	All mothers
Height(cm)	
< 145	2.3
145-149.9	11.0
150-154.9	27.9
155-159.9	33.2
160-164.9	20.0
165-169.9	5.0
170+	.6
Total	100.0
Number	2,189
Mean	156.1
Standard deviation	5.78
Median	156.1

Note: Table includes only women who had a birth in the three years preceding the survey.

Table 6.4 shows summary statistics on the weights of nonpregnant women, both nonlactating and lactating. There is hardly any difference in weight between nonlactating and lactating women. The mean weight is 48 kg for nonlactating women and 47 kg for lactating women, and the medians are the same at 47 kg. Fifteen percent of nonpregnant women weigh less than 40 kg, 41 percent of nonpregnant women weigh less than 45 kg, and 70 percent of all nonpregnant women weigh less than 50 kg. Six percent of women weigh 60 kg or more, with twice as many nonlactating as lactating women weighing 60 kg or more (10 percent and 5 percent, respectively).

Since weight typically varies by height, the BMI is more useful in assessing nonpregnant women's nutritional status. There is little difference in mean BMI between nonlactating and lactating nonpregnant women (19.8 versus 19.4; Table 6.5). Forty-one percent of nonpregnant Eritrean women are undernourished (BMI less than 18.5). Seven percent of nonlactating women and 3 percent of lactating women are 20 percent

Table 6.4 Distribution of mother's weights

Percent distribution of body weight for nonpregnant mothers of children under three years of age, Eritrea 1995

Weight (kg)	Non-lactating mothers	Lactating mothers	All non-pregnant mothers
< 40	15.2	14.9	15.0
40-44.99	26.7	25.5	25.8
45-49.99	22.8	31.1	29.6
50-54.99	17.2	16.1	16.3
55-59.99	8.2	7.4	7.6
60+	9.8	4.9	5.8
Total	100.0	100.0	100.0
Number	332	1,455	1,787
Mean	48.1	47.0	47.2
Standard deviation	8.9	7.6	7.9
Median	46.8	46.5	46.5

Note: Table includes only women who had a birth in the three years prior to the survey. Pregnant women and women who are less than three months postpartum are also excluded.

Table 6.5 Distribution of mother's body mass index

Percent distribution of body mass index (kg/m^2) for non-pregnant mothers of children under three years of age, Eritrea 1995

Body mass index	Non-lactating mothers	Lactating mothers	All non-pregnant mothers
< 16	7.5	5.8	6.1
16-16.99	11.6	10.5	10.7
17-18.49	18.4	25.1	23.8
18.5-25	55.4	55.3	55.3
25.01-26.99	2.0	1.6	1.7
27+	5.1	1.8	2.5
Total	100.0	100.0	100.0
Number	331	1,448	1,779
Mean	19.8	19.4	19.5
Standard deviation	3.5	2.7	2.9
Median	19.2	19.0	19.0

Note: Table includes only women who had a birth in the three years prior to the survey. Pregnant women and those who are less than three months postpartum are also excluded.

or more overweight (BMI of more than 25.0). Fifty-five percent of nonpregnant Eritrean women fall within the normal BMI range of 18.5 to 25.0. The mean BMI is 19.5 for all nonpregnant women, which is slightly above the level of undernutrition of 18.5.

A number of social and economic factors were associated with low BMIs (Table 6.6). The bivariate analyses show that the youngest women are most likely to be undernourished (45 percent), while the oldest women are most likely to be overweight (6 percent). The highest prevalence of undernourishment is found among women living in the Southern Red Sea Zone, women living in rural areas, women who are uneducated or not working, women who live in families with a low socioeconomic status, and women whose partners have no education or work in agriculture. In contrast, women living in the Central Zone, women living in urban areas, women with at least a secondary education, women from families with a high socioeconomic status, and women whose partners have at least a secondary education or are professionals are most likely to be overweight. The variables identified as important in the bivariate analyses in Table 6.6 were included in multivariate logistic analyses to determine their independent effects on low and high BMIs.

Heights and BMIs of mothers of children under three years of age in Eritrea are compared with those in other countries of sub-Saharan Africa (Figure 6.1). About 2 percent of mothers in Eritrea are shorter than 145 cm, which is the fourth highest proportion of the countries with data. With regard to BMI, Eritrean mothers have the highest levels of low BMI among the countries with data (41 percent). Indeed, the level of maternal malnutrition as measured by BMI is double that of the next highest country (19 percent).

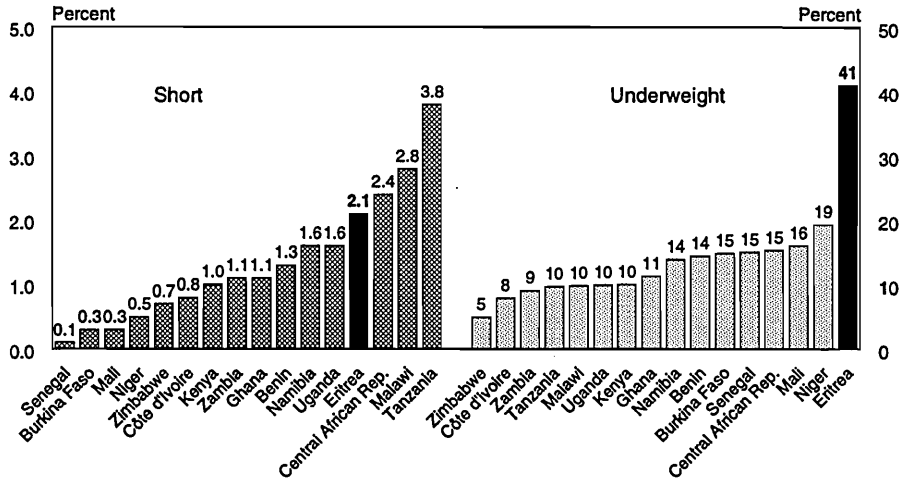
Table 6.6 Prevalence of low and high body mass among nonpregnant mothers

Percent of women who have low and high body mass among nonpregnant mothers who have had a birth in the three years preceding the survey, by background characteristics, Eritrea 1995

Background characteristic	BMI < 18.5	BMI > 25.0	Number of women
Mother's age group			
15-19	45.2	.3	158
20-24	42.4	1.9	363
25-29	43.7	3.6	402
30-34	41.3	5.9	322
35-49	35.3	6.0	534
	p=0.00	p=0.00	
Zone			
Southern Red Sea	63.9	5.1	48
Northern Red Sea	42.9	3.5	235
Anseba	47.5	3.4	232
Gash-Barka	51.6	2.6	327
Southern	38.0	.6	607
Central	24.6	12.9	329
	p=0.00	p=0.00	
Residence			
Urban	27.1	14.7	384
Rural	44.3	1.2	1,395
	p=0.00	p=0.00	
Education			
None	44.0	2.3	1,358
Primary	32.0	7.2	276
Secondary+	25.4	15.1	145
	p=0.00	p=0.00	
Woman's occupation			
Not working	42.2	4.7	1,303
Professional	(6.7)	(22.6)	44
Manual labor	(29.4)	(6.0)	37
Agricultural	41.3	.0	366
Domestic/services	(24.4)	(1.30)	30
	p=0.00	p=0.00[a]	
Partner's education			
None	45.3	1.7	1,183
Primary	34.9	6.1	298
Secondary+	24.9	12.5	253
	p=0.00	p=0.00	
Partner's occupation			
Not working	20.0	8.3	12
Professional	24.3	12.1	306
Manual labor	30.2	10.7	333
Agricultural	40.0	1.6	1,577
Domestic/services	33.5	2.2	222
	p=0.00	p=0.00	
Socioeconomic status			
Low	45.6	1.1	976
Medium	42.5	1.6	476
High	23.0	16.6	328
	p=0.00	p=0.00	
Number of live births			
1-4	42.9	3.1	1,113
5+	36.8	5.8	666
	p=0.01	p=0.01	
Total	40.6	4.1	1,779

Note: Table excludes women who are less than 3 months postpartum. Level of significance determined using Chi-square test.
[a] Chi-square statistic is unreliable due to small number of cases in one or more cells.

Figure 6.1 Malnutrition among Mothers of Children under 3 Years in Eritrea Compared with Other Sub-Saharan Countries



Note: *Short* is the percentage of mothers under 1.45 m;
underweight is the percentage of mothers whose BMI (kg/m^2) is less than 18.5.

Source: DHS Surveys 1991-1996

6.5 Maternal Chronic Energy Deficiency

The multivariate analysis suggests that the important characteristics associated with CED among Eritrean women are region of residence, mother's occupation, the socioeconomic status of the household, and the number of tetanus toxoid injections that the mother received during pregnancy, which probably reflects use of health services (Table 6.7).

Compared with the Central Zone, women in all other regions (except the Southern region) have a significantly higher risk of CED. This increased risk ranges from 88 percent in the Anseba Zone to 174 percent in the Southern Red Sea Zone. This variation may be due to regional differences in access to health care, information, and other resources and behavioral and social differences that are not explicitly captured by these data.

The number of tetanus toxoid (TT) injections a woman receives during pregnancy can be interpreted as a proxy for the kind of care accorded to her. Under this interpretation, the more injections a woman receives, the better her access to health care and the lower her risk of malnutrition. However, Table 6.7 shows that women who receive three or more TT injections (the recommended perinatal practice is two TT injections) have a 57 percent higher risk of low BMI than do women who receive no TT injections. One possible explanation is that women who are weak and sickly come to the health service more often, at which times they are given an additional shot, perhaps due to lack of records of previous injections or due to standard policy.

A woman's occupation significantly affects her chances of being undernourished. Professional women have the lowest risks of CED. Women who are not working or who are working in the domestic or service sectors are more than three times as likely to be undernourished as professional women. Women in agriculture are almost four times as likely to be undernourished as professional women. Professional women may face lower risks of CED because of the extra income they generate and because malnourished women are less able to get a professional job.

Table 6.7 Logistic regression results: Underweight mothers

Results from a logistic regression model that examines the causes of low body mass (BMI below 18.5) among mothers, Eritrea 1995

Variable	Coefficient (B)	Standard error	Significance	Exp(B)
Mother's age				
15-19				1.00
20-24	0.12	0.25		1.12
25-29	0.27	0.25		1.31
30-34	0.07	0.27		1.07
35-49	-0.09	0.28		0.91
Zone			0.00	
Southern Red Sea	1.01	0.35	0.00	2.74
Northern Red Sea	0.67	0.22	0.00	1.96
Anseba	0.63	0.24	0.01	1.88
Gash-Barka	0.75	0.22	0.00	2.11
Southern	0.15	0.22		1.16
Central				1.00
Residence				
Urban				1.00
Rural	-0.07	0.21		0.93
Mother's education				
None	0.27	0.29		1.30
Primary	0.10	0.27		1.10
Secondary+				1.00
Mother's occupation				
Not working	1.22	0.55	0.03	3.39
Manual labor	1.03	0.64		2.81
Agricultural	1.37	0.60	0.02	3.92
Domestic/services	1.19	0.66	0.07	3.27
Professional				1.00
Partner's occupation				
Professional				1.00
Manual labor	0.09	0.21		1.09
Agricultural	0.22	0.20		1.25
Other	0.08	0.23		1.08
Media exposure: television				
Watches weekly	-0.05	0.26		0.95
Doesn't watch				1.00

Continued

Table 6.7— *Continued*

Variable	Coefficient (B)	Standard error	Significance	Exp(B)
Media exposure: radio				
Listens weekly	-0.06	0.16		0.95
Doesn't listen				1.00
Media exposure: newspaper				
Reads weekly	0.06	0.23		1.07
Doesn't read				1.00
Tetanus shot				
0				1.00
1	0.19	0.20		1.21
2	0.05	0.19		1.05
3+	0.45	0.19	0.02	1.57
Socioeconomic status			0.08	
Low	0.63	0.30	0.03	1.88
Medium	0.59	0.27	0.03	1.80
High				1.00
Toilet facility				
No facility	0.29	0.23		1.34
Facility				1.00
Floor material				
Natural	-0.23	0.25		0.80
Finished/other				1.00
Sex of household head				
Male	-0.13	0.16		0.87
Female				1.00
Number of live births				
1-4				1.00
5+	-0.05	0.17		0.95
Currently breastfeeding				
No				1.00
Yes	0.12	0.15		1.13

Note: Only p<=0.10 are shown.

High household socioeconomic status has a protective effect on a woman's risk of CED. Women from low-wealth or medium-wealth households are at least 80 percent more likely to be undernourished than are women from high-wealth households.

6.6 High Body Mass

The statistically significant determinants of high body mass (or overnutrition) among Eritrean women are: type of floor in the home, the number of live births, and living in a household with a medium socioeconomic status score (Table 6.8).

Women's risks of being overweight increased significantly (at the 10 percent level) with the numbers of live births they had, with women who had five or more births having a 77 percent higher risk of being overnourished compared with women who had less than four births. This may reflect fewer work demands due to the presence of more children who could share the mother's work burden, or this could reflect the greater authority and social standing—and hence better care and food—that a woman with many children may get, or this may reflect a combination of these factors. A better explanation is that these women have put on additional weight with each child.

Table 6.8 Logistic regression results: Overweight mothers

Results from a logistic regression model that examines the causes of high body mass (BMI greater than 25.0) among mothers, Eritrea 1995

Variable	Coefficient (B)	Standard error	Significance	Exp(B)
Mother's age				
15-19				1.00
20-24	0.22	1.11		1.25
25-29	0.57	1.09		1.76
30-34	1.05	1.10		2.86
35-49	1.25	1.10		3.49
Zone				
Southern Red Sea	0.26	0.70		1.29
Northern Red Sea	0.77	0.49		2.16
Anseba	0.04	0.55		1.04
Gash-Barka	0.74	0.56		2.09
Southern	-0.50	0.48		0.61
Central				1.00
Residence				
Urban				1.00
Rural	-0.82	0.65		0.44
Mother's education				
None	-0.03	0.50		0.97
Primary	-0.33	0.40		0.72
Secondary+				1.00
Mother's occupation				
Not working	-0.24	0.46		0.79
Manual labor	-0.79	0.77		0.45
Agricultural	-5.72	13.92		0.00
Domestic/services	-1.67	1.12		0.19
Professional				1.00
Partner's occupation				
Professional				1.00
Manual labor	0.52	0.33		1.69
Agricultural	0.32	0.53		1.38
Other	-0.08	0.52		0.93
Media exposure: television				
Watches weekly	0.43	0.36		1.54
Doesn't watch				1.00

Continued

Table 6.8— *Continued*

Variable	Coefficient (B)	Standard error	Significance	Exp(B)
Media exposure: radio				
Listens weekly	0.11	0.46		1.11
Doesn't listen				1.00
Media exposure: newspaper				
Reads weekly	0.52	0.37		1.68
Doesn't read				1.00
Tetanus shot				
0				1.00
1	-0.49	0.40		0.61
2	-0.38	0.38		0.68
3+	-0.43	0.38		0.65
Socioeconomic status			0.07	
Low	-0.74	0.80		0.48
Medium	-2.03	0.88	0.02	0.13
High				1.00
Toilet facility				
No facility	-0.34	0.40		0.71
Facility				1.00
Floor material				
Natural	-1.05	0.52	0.05	0.35
Finished/other				1.00
Sex of household head				
Male	-0.06	0.34		0.94
Female				1.00
Number of live births				
1-4				1.00
5+	0.57	0.34	0.09	1.77
Currently breastfeeding				
No				1.00
Yes	0.09	0.29		1.09

Note: Only p<=0.10 are shown.

Women from households that have a natural or unfinished floor were two-thirds less likely to be overnourished as were women from households with a finished floor. Similarly, women from households with a medium socioeconomic status score were 87 percent less likely to be overnourished compared with women from wealthy households. These results are consistent with the patterns for undernutrition, which suggest that women from poorer households are more at risk of CED than are women from better-off households. Overall though, very few Eritrean women (less than 5 percent of all nonpregnant women) are obese.

6.7 Summary and Recommendations

These results indicate that undernutrition is quite common among Eritrean women, with 40 percent of nonpregnant women suffering from chronic energy deficiency, which exposes them and their current and future children to higher morbidity and mortality risks. The analyses conducted here also indicate that, as with child nutrition, poor nutritional status is closely linked to poverty and to lack of access to food and health resources. While poverty is an issue that can only be ameliorated in the long run, there are a number of short- and long-term health and social policy measures that could help improve Eritrean women's nutritional status.

Short-term recommendations include the following:

- Improve the energy balance of pregnant and lactating women by improving the quantity and quality of their diets; however, given the overriding role of poverty, research needs to identify locally available and inexpensive dietary foods that are also nutritionally rich.

- Improve the energy balance of nonpregnant nonlactating women by improving their dietary quantity and quality and minimizing their energy expenditure so that these women enter into pregnancy in the best possible nutritional state. This is particularly important given the fact that the caloric intake required for proper energy balance during pregnancy is likely to be unrealistic for many poor women.

- Improve access to reproductive health services to improve child spacing—ideally two years or more between births—thus allowing women time to recuperate nutritionally.

Long-term recommendations include the following:

- Improve the nutritional status and health of adolescent girls. This is particularly important where recommended gestational weight gains and increases in caloric intake during pregnancy are unrealistic due to household income constraints. Improving a woman's overall health before she reaches adulthood and pregnancy may be the most effective way to prevent CED.

- Promote women's income earning opportunities in an effort to improve the household's economic status and thereby improve the woman's nutritional status.

- Encourage households to increase the overall investment that they make in the care of young girls and women through public health campaigns. This would improve women's nutritional status and, with it, the nutritional status of their children.

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APPENDIX A

SAMPLE DESIGN

APPENDIX A

SAMPLE DESIGN

The EDHS employed a nationally representative, multi-stage probability sample of women between the ages of 15 and 49. The five main reporting domains are: the country as a whole, all urban areas, the capital Asmara, other urban areas outside Asmara, and rural areas. Estimates of selected variables were also produced for each of the six administrative zones in the country.

Since there has been no national census, the sampling frame used for the survey was constructed from a combination of data sources. In rural areas, the sampling frame consisted of a list of villages with population figures collected by the Ministry of Local Government and the sampling units were villages. In urban areas, data on *zobas* (administrative units) and *mimihidars* (smaller units within *zobas*) collected by the NSO between August 1994 and January 1995 were used in the selection of *mimihidars* as sampling units. In the capital, Asmara, the sampling units were also *mimihidars*; however, since reliable data on population size did not exist for these *mimihidars*, the measure of size used for sample selection was the number of registered voters. From this, the number of households and the population size were estimated. A mapping and household listing operation was implemented to update the population size of sampling units prior to selecting the households for the survey.

The sample for the EDHS was selected in two stages. In the first-stage sampling, 108 villages and 100 *mimihidars* were selected with probability proportional to size. When villages and *mimihidars* were very large (in population size), they were segmented and only one segment was selected for the survey, so that each cluster (sample point) corresponded generally to a village, a *mimihidar*, or part of a village or *mimihidar*. A complete listing of the households residing in the selected clusters was carried out. The list of households obtained was used as the frame for the second-stage sampling, the selection of households to be visited by the EDHS survey teams during the main fieldwork. Women in these households between the ages of 15 and 49 were identified and interviewed.

On average, 25 households were selected in each urban cluster and 35 households in each rural cluster. It was expected that the sample would yield interviews with approximately 5,000 women age 15 to 49. Because of the non-proportional distribution of the sample in the 10 *provinces* that existed at the time of the sample design, sample weights were applied to the data in this report.

APPENDIX B

HOUSEHOLD AND RESPONDENT BACKGROUND CHARACTERISTICS

Table B.1 Anthropometric measurement of children

Percentage of children under three years old for whom complete anthropometric data are available, and percent distribution of these children by sex, according to zone and residence, Eritrea 1995

Zone and residence	Complete anthropometric data	Complete anthropometric data			Number of children
		Male	Female	Total	
Zone					
Southern Red Sea	52.0	47.6	52.4	100.0	36
Northern Red Sea	82.4	48.1	51.9	100.0	281
Anseba	90.9	54.0	46.0	100.0	300
Gash-Barka	85.1	50.1	49.9	100.0	425
Southern	93.0	51.6	48.4	100.0	820
Central	88.9	52.1	47.9	100.0	408
	p=0.00				
Residence					
Urban	87.2	55.1	44.9	100.0	473
Rural	88.2	50.2	49.8	100.0	1,796
	p=0.55				
Total	88.0	51.2	48.8	100.0	2,269

Note: Level of significance determined using Chi-square test.

Table B.2 Mean number of living and dead children

Among women with children less than 5 years of age, the mean number of children living at home, the mean total number of children ever born, the mean number of dead children per mother, and the standard errors of each mean, by zone and residence, Eritrea 1995

Zone and residence	Number of children at home		Number of dead children		Total children ever born		Number of children
	Mean	SD	Mean	SD	Mean	SD	
Zone							
Southern Red Sea	3.4	.26	1.2	.16	4.7	.32	68
Northern Red Sea	3.0	.10	.7	.06	3.8	.13	341
Anseba	3.4	.12	.6	.06	4.2	.15	330
Gash-Barka	3.0	.08	.7	.05	3.8	.11	499
Southern	3.2	.06	.6	.03	4.1	.09	882
Central	3.4	.10	.4	.03	3.9	.12	459
	p=0.00		p=0.02		p=0.00		
Residence							
Urban	3.2	.09	.5	.04	3.8	.11	542
Rural	3.2	.04	.6	.02	4.0	.06	2,037
	p=0.67		p=0.07		p=0.03		
Total	3.2	.04	.6	.02	4.0	.05	2,580

Note: Level of significance determined using ANOVA.

Table B.3 Mother's age

Percent distribution of children under three years of age by mother's age, according to zone and residence, Eritrea 1995

Zone and residence	Mother's age (years)						Number of children
	15-19	20-24	25-29	30-34	35-49	Total	
Zone							
Southern Red Sea	5.3	13.4	24.1	33.5	23.7	100.0	68
Northern Red Sea	8.9	18.7	22.0	25.7	24.7	100.0	341
Anseba	8.1	21.1	22.6	17.1	31.0	100.0	330
Gash-Barka	9.3	20.4	24.9	22.6	22.8	100.0	499
Southern	10.6	20.9	25.8	13.4	29.4	100.0	882
Central	4.6	23.5	24.9	17.3	29.7	100.0	459
			p=0.00				
Residence							
Urban	4.9	21.6	26.1	18.8	28.6	100.0	542
Rural	9.6	20.6	24.1	18.4	27.3	100.0	2,037
			p=0.02				
Total	8.6	20.8	24.5	18.5	27.6	100.0	2,580

Note: Level of significance determined using Chi-square test

Table B.4 Mother's education

Percent distribution of children under three years of age by level of mother's education, according to zone and residence, Eritrea 1995

Zone and residence	Mother's education				Number of children
	None	Primary	Secondary+	Total	
Zone					
Southern Red Sea	87.1	5.7	7.2	100.0	68
Northern Red Sea	89.5	8.6	1.9	100.0	341
Anseba	80.5	16.5	2.9	100.0	330
Gash-Barka	90.3	8.0	1.7	100.0	499
Southern	83.3	13.9	2.8	100.0	882
Central	37.2	32.1	30.7	100.0	459
		p=0.00			
Residence					
Urban	36.7	33.7	29.6	100.0	542
Rural	87.7	10.6	1.7	100.0	2,037
		p=0.00			
Total	77.0	15.4	7.5	100.0	2,580

Note: Level of significance determined using Chi-square test

Table B.5 Mother's occupation

Percent distribution of children under three years of age by mother's occupation category, according to zone and residence, Eritrea 1995

Zone and residence	Mother's occupation						Number of children
	Not working	Profes-sional	Manual labor	Agricul-tural	Domestic/ services	Total	
Zone							
Southern Red Sea	97.9	1.4	0.0	0.0	0.7	100.0	68
Northern Red Sea	90.7	0.9	2.8	4.3	1.3	100.0	341
Anseba	96.8	0.9	0.9	0.6	0.8	100.0	330
Gash-Barka	89.6	0.7	1.3	7.0	1.5	100.0	498
Southern	44.6	1.3	0.4	53.1	0.6	100.0	882
Central	81.5	10.1	4.5	0.2	3.7	100.0	459
			p=0.00				
Residence							
Urban	78.8	11.1	5.4	0.3	4.4	100.0	541
Rural	72.8	0.4	0.7	25.5	0.7	100.0	2,036
			p=0.00				
Total	74.1	2.6	1.7	20.2	1.5	100.0	2,577

Note: Level of significance determined using Chi-square test

Table B.6 Usual caretaker of children of women working outside the home

Percent distribution of the caretakers of children whose mothers worked in the past 12 months, according to zone and residence, Eritrea 1995

Zone and residence	Caretaker					Number of children
	Respondent	Relative	Friend/ institution	Other child	Total	
Zone						
Southern Red Sea	0.0	0.0	100.0	0.0	100.0	0
Northern Red Sea	53.5	6.5	10.1	29.9	100.0	25
Anseba	16.4	58.4	18.9	6.3	100.0	11
Gash-Barka	47.3	34.1	0.0	18.6	100.0	48
Southern	65.7	10.9	4.4	19.0	100.0	459
Central	8.3	36.2	33.2	22.3	100.0	71
			p=0.00			
Residence						
Urban	17.6	34.1	28.6	19.7	100.0	95
Rural	63.3	13.0	4.2	19.5	100.0	519
			p=0.00			
Total	56.2	16.3	8.0	19.5	100.0	615

Note: Level of significance determined using Chi-square test

Table B.7 Sex of household head

Percent distribution of children under three years of age by sex of household head, according to zone and residence, Eritrea 1995

Zone and residence	Sex of household head			Number of children
	Male	Female	Total	
Zone				
Southern Red Sea	82.7	17.3	100.0	68
Northern Red Sea	85.7	14.3	100.0	341
Anseba	87.5	12.5	100.0	330
Gash-Barka	86.3	13.7	100.0	499
Southern	80.8	19.2	100.0	882
Central	77.7	22.3	100.0	459
	p=0.00			
Residence				
Urban	70.8	29.2	100.0	542
Rural	86.1	13.9	100.0	2,037
	p=0.00			
Total	82.9	17.1	100.0	2,580

Note: Level of significance determined using Chi-square test

Table B.8 Mother's marital status

Percent distribution of children under three years of age by mother's marital status, according to zone and residence, Eritrea 1995

Zone and residence	Marital status of mother					Number of children
	Never married	Married/ in union	Widowed	Divorced/ separated	Total	
Zone						
Southern Red Sea	1.5	91.8	2.3	4.4	100.0	68
Northern Red Sea	0.2	97.3	1.0	1.5	100.0	341
Anseba	0.0	95.6	1.6	2.9	100.0	330
Gash-Barka	0.7	93.1	1.2	5.1	100.0	499
Southern	0.4	95.0	1.0	3.6	100.0	882
Central	0.8	93.4	0.3	5.5	100.0	459
		p=0.14[a]				
Residence						
Urban	0.8	92.9	1.5	4.8	100.0	542
Rural	0.4	95.1	0.9	3.6	100.0	2,037
		p=0.18				
Total	0.5	94.6	1.0	3.9	100.0	2,580

Note: Level of significance determined using Chi-square test
[a] Chi-square statistics is unreliable due to small number of cases in one or more cells.

Table B.9 Husband's education

Percent distribution of children under three years of age by mother's partner's education, according to zone and residence, Eritrea 1995

Zone and residence	Partner's education				Number of children
	None	Primary	Secondary+	Total	
Zone					
Southern Red Sea	86.6	4.6	8.9	100.0	66
Northern Red Sea	77.7	13.1	9.2	100.0	326
Anseba	80.4	10.5	9.2	100.0	321
Gash-Barka	88.9	8.8	2.3	100.0	480
Southern	71.1	21.0	8.0	100.0	869
Central	23.9	32.6	43.6	100.0	444
		p=0.00			
Residence					
Urban	27.9	24.6	47.4	100.0	518
Rural	79.2	16.1	4.7	100.0	1,988
		p=0.00			
Total	68.6	17.9	13.5	100.0	2,506

Note: Level of significance determined using Chi-square test

Table B.10 Partner's education

Percent distribution of children under three years of age by mother's partner's occupation, according to zone and residence, Eritrea 1995

Zone and residence	Partner's occupation						Number of children
	Not working	Profes-sional	Manual labor	Agricul-tural	Domestic/ services	Total	
Zone							
Southern Red Sea	2.3	21.5	17.9	57.1	1.2	100.0	45
Northern Red Sea	0.2	15.9	10.0	65.9	7.9	100.0	316
Anseba	0.0	12.6	9.3	70.0	8.1	100.0	320
Gash-Barka	0.7	6.2	10.0	73.1	10.1	100.0	496
Southern	0.4	6.0	8.5	77.6	7.5	100.0	859
Central	0.8	28.2	32.5	25.4	13.1	100.0	448
			p=0.00[a]				
Residence							
Urban	0.9	37.6	34.6	11.5	15.5	100.0	518
Rural	0.4	5.8	8.0	78.4	7.3	100.0	1,966
			p=0.00				
Total	0.5	12.4	13.6	64.5	9.0	100.0	2,484

Note: Level of significance determined using Chi-square test
[a] Chi-square statistics is unreliable due to small number of cases in one or more cells.

Table B.11 Toilet facility

Percent distribution of children under three years of age by type of toilet facility, according to zone and residence, Eritrea 1995

Zone and residence	Type of toilet facility: Flush toilet	Latrine	None/ other	Total	Number of children
Zone					
Southern Red Sea	5.0	10.7	84.2	100.0	68
Northern Red Sea	4.4	5.4	90.2	100.0	340
Anseba	3.4	8.2	88.3	100.0	330
Gash-Barka	0.6	3.4	96.0	100.0	498
Southern	1.0	0.8	98.1	100.0	882
Central	36.7	8.7	54.6	100.0	457
		p=0.00			
Residence					
Urban	37.9	18.6	43.5	100.0	541
Rural	0.2	0.8	99.0	100.0	2,034
		p=0.00			
Total	8.1	4.5	87.3	100.0	2,575

Note: Level of significance determined using Chi-square test

Table B.12 Source of drinking water

Percent distribution of children under three years of age by source of household drinking water, according to zone and residence, Eritrea 1995

Zone and residence	Source of drinking water: Purchased	Tap	Well	Surface/ rainwater	Total	Number of children
Zone						
Southern Red Sea	3.8	22.1	50.2	23.9	100.0	68
Northern Red Sea	4.3	18.8	31.2	45.7	100.0	340
Anseba	1.4	19.1	44.7	34.8	100.0	330
Gash-Barka	2.4	12.3	53.9	31.4	100.0	498
Southern	3.8	9.4	28.9	57.8	100.0	882
Central	29.3	45.4	8.1	17.1	100.0	459
		p=0.00				
Residence						
Urban	32.5	56.6	10.0	1.0	100.0	541
Rural	1.3	9.3	39.0	50.4	100.0	2,034
		p=0.00				
Total	7.8	19.2	32.9	40.0	100.0	2,575

Note: Level of significance determined using Chi-square test

Table B.13 Type of floor

Percent distribution of children under three years of age by type of floor in household, according to zone and residence, Eritrea 1995

Zone and residence	Main floor material: Natural	Finished/ other	Total	Number of children
Zone				
Southern Red Sea	85.6	14.4	100.0	65
Northern Red Sea	90.3	9.7	100.0	341
Anseba	91.0	9.0	100.0	330
Gash-Barka	99.2	0.8	100.0	495
Southern	94.6	5.4	100.0	876
Central	46.7	53.3	100.0	459
	p=0.00			
Residence				
Urban	41.7	58.3	100.0	541
Rural	97.5	2.5	100.0	2,023
	p=0.00			
Total	85.7	14.3	100.0	2,565

Note: Level of significance determined using Chi-square test

Table B.14 Exposure to the mass media

Percentage of children under three years of age whose mothers read a newspaper, listen to the radio, or watch television on a weekly basis, according to zone and residence, Eritrea 1995

Zone and residence	Read newspaper weekly	Listen to radio weekly	Watch television weekly	Total	Number of children
Zone					
Southern Red Sea	6.4	10.1	9.3	100.0	68
Northern Red Sea	5.7	23.3	2.8	100.0	341
Anseba	7.7	35.3	0.8	100.0	330
Gash-Barka	4.9	26.6	0.8	100.0	499
Southern	6.0	48.1	2.3	100.0	882
Central	38.2	85.2	39.2	100.0	459
	p=0.00	p=0.00	p=0.00		
Residence					
Urban	40.6	81.2	37.3	100.0	542
Rural	4.0	34.9	1.0	100.0	2,037
	p=0.00	p=0.00	p=0.00		
Total	11.7	44.6	8.6	100.0	2,580

Note: Level of significance determined using Chi-square test

Table B.15 Socioeconomic status

Percent distribution of children under three years of age by the socioeconomic status of their household, according to zone and residence, Eritrea 1995

Zone and residence	Socioeconomic status				Number of children
	Low	Medium	High	Total	
Zone					
Southern Red Sea	75.9	6.1	18.1	100.0	68
Northern Red Sea	67.7	24.2	8.1	100.0	341
Anseba	68.1	24.3	7.5	100.0	330
Gash-Barka	77.4	18.8	3.8	100.0	499
Southern	60.5	32.3	7.3	100.0	882
Central	7.0	26.0	66.9	100.0	459
		p=0.00			
Residence					
Urban	10.0	16.7	73.2	100.0	542
Rural	68.9	28.2	2.9	100.0	2,037
		p=0.00			
Total	56.6	25.8	17.7	100.0	2,580

Note: Level of significance determined using Chi-square test

Table B.16 Antenatal care provider

Percent distribution of births in the last three years by their mother's antenatal care, according to zone and residence, Eritrea 1995

Zone and residence	Antenatal care provider					Number of births
	Doctor	Nurse/ midwife	TBA/aux. midwife/ other	No one	Total	
Zone						
Southern Red Sea	26.5	1.5	3.1	68.9	100.0	67
Northern Red Sea	14.7	20.4	3.0	62.0	100.0	341
Anseba	23.5	23.2	0.0	53.3	100.0	330
Gash-Barka	22.7	12.6	3.4	61.3	100.0	498
Southern	21.6	18.9	2.2	57.3	100.0	882
Central	42.7	42.5	0.6	14.1	100.0	458
			p=0.00			
Residence						
Urban	41.1	42.9	1.8	14.2	100.0	540
Rural	20.8	16.7	2.0	60.5	100.0	2,035
			p=0.00			
Total	25.0	22.2	2.0	50.8	100.0	2,575

Note: Level of significance determined using Chi-square test

Table B.17 Assistance at delivery

Percent distribution of births in the last three years by the type of assistance at delivery, according to zone and residence, Eritrea 1995

Zone and residence	Assistance at delivery						Number of births
	Doctor	Nurse/ midwife/ auxiliary midwife	TBA	Relative/ friend other	No one	Total	
Zone							
Southern Red Sea	1.5	21.8	69.6	7.1	0.0	100.0	67
Northern Red Sea	3.0	10.6	56.8	26.6	3.1	100.0	341
Anseba	2.1	12.0	54.3	29.9	1.7	100.0	330
Gash-Barka	3.0	8.2	63.1	22.0	3.8	100.0	498
Southern	5.8	6.2	55.7	31.3	1.0	100.0	882
Central	26.2	31.2	35.6	6.8	0.2	100.0	457
			p=0.00				
Residence							
Urban	27.0	36.6	26.5	9.7	0.3	100.0	540
Rural	2.9	6.4	61.2	27.4	2.1	100.0	2,034
			p=0.00				
Total	7.9	12.7	53.9	23.7	1.7	100.0	2,574

Note: Level of significance determined using Chi-square test

Table B.18 Urban-rural residence

Percent distribution of children under three years of age by urban-rural residence, according to zone, Eritrea 1995

Zone	Residence			Number of children
	Urban	Rural	Total	
Southern Red Sea	16.5	83.5	100.0	68
Northern Red Sea	15.4	84.6	100.0	341
Anseba	22.3	77.7	100.0	330
Gash-Barka	7.4	92.6	100.0	499
Southern	9.2	90.8	100.0	882
Central	62.5	37.5	100.0	459
		p=0.00		
Total	21.0	79.0	100.0	2,580

Note: Level of significance determined using Chi-square test

APPENDIX C

ANTHROPOMETRIC DATA VERIFICATION

Table C.1 Characteristics of children with missing anthropometric data

Percent distribution of children born in the three years preceding the survey by selected background characteristics, according to completeness of anthropometric data, Eritrea 1995

Background characteristic	Anthropometric data	
	Incomplete	Complete
Zone		
Southern Red Sea	10.6	1.6
Northern Red Sea	19.3	12.4
Anseba	9.7	13.2
Gash-Barka	24.0	18.7
Southern	20.0	36.1
Central	16.4	18.0
Residence		
Urban	22.3	20.8
Rural	77.7	79.2
Socioeconomic status		
Low	60.9	56.0
Medium	21.3	26.4
High	17.8	17.6
Size at birth		
Average/large	64.1	71.5
Small	9.1	10.5
Very small	20.3	16.3
Don't know/missing	6.5	1.7
Mother's education		
None	81.0	76.5
Primary	11.1	16.0
Secondary +	7.9	7.5
Total	100.0	100.0
Number of children	310	2,269

Table C.2 Digit preference in anthropometric data

Percentage of weight and height data falling as specific integers, Eritrea 1995

Decimal integer	Height data	Weight data
0	15.2	7.4
1	6.6	10.0
2	8.8	10.9
3	9.9	12.2
4	6.2	8.2
5	18.3	9.7
6	7.3	10.2
7	7.3	9.0
8	6.5	7.6
9	5.8	7.2
Missing	8.1	7.7
Total	100.0	100.0
Number of children	2,580	2,580

APPENDIX D

DIFFERENTIALS IN MALNUTRITION BY CHILD'S AGE, ERITREA, 1995

Table D.1 Malnutrition by zone and age

Percentage of children under three years of age who are stunted, wasted, and underweight, by zone and age, Eritrea 1995

Zone and age	Malnutrition			Number of children
	Stunted	Wasted	Underweight	
Southern Red Sea				
0-5	6.4	12.3	6.4	8
6-11	15.7	46.1	46.1	7
12-17	23.4	38.0	30.7	7
18-23	100.0	.0	100.0	1
24-29	50.7	14.0	50.2	7
30-35	83.2	8.4	75.3	6
Total	35.2	23.0	40.8	36
Northern Red Sea				
0-5	6.2	8.1	7.7	44
6-11	22.6	19.8	38.7	55
12-17	47.8	34.3	63.0	54
18-23	83.5	26.0	79.6	44
24-29	50.8	24.4	66.9	40
30-35	79.1	18.9	76.4	43
Total	47.2	22.2	54.7	281
Anseba				
0-5	5.0	.0	4.3	65
6-11	43.2	9.8	34.2	46
12-17	38.7	31.2	58.6	42
18-23	64.0	30.1	70.2	35
24-29	54.2	15.2	61.2	54
30-35	78.5	14.8	69.7	57
Total	45.4	15.0	47.0	300
Gash-Barka				
0-5	1.9	3.6	3.5	72
6-11	16.9	15.6	39.9	70
12-17	47.9	34.6	70.0	74
18-23	69.9	39.0	72.1	56
24-29	48.9	29.7	68.3	80
30-35	64.4	20.2	67.9	73
Total	41.0	23.5	53.4	425
Southern				
0-5	4.5	9.8	7.8	150
6-11	14.0	16.8	36.9	164
12-17	48.0	27.1	60.8	126
18-23	46.1	15.7	36.3	118
24-29	38.2	12.4	43.3	140
30-35	70.8	9.1	60.0	121
Total	34.7	15.1	39.7	820
Central				
0-5	5.1	6.8	6.3	64
6-11	14.7	6.4	25.9	74
12-17	34.6	17.9	36.0	77
18-23	44.1	8.4	43.4	57
24-29	38.7	6.3	35.9	64
30-35	56.0	3.0	44.2	73
Total	32.2	8.3	32.0	408
Eritrea				
0-5	4.4	6.5	6.2	403
6-11	19.0	14.9	35.5	415
12-17	43.8	28.4	57.1	381
18-23	57.5	21.6	54.2	311
24-29	44.3	16.6	52.3	385
30-35	69.0	12.1	62.1	374
Total	38.4	16.4	43.7	2,269

Table D.2 Malnutrition by urban-rural residence, sex and age

Percentage of children under three years of age who are stunted, wasted, and underweight, by residence, child's sex, and child's age, Eritrea 1995

Residence, child's sex, and age	Malnutrition			Number of children
	Stunted	Wasted	Underweight	
Urban				
0-5	2.7	5.1	4.8	78
6-11	11.7	14.7	23.1	88
12-17	30.3	21.6	37.2	82
18-23	48.3	17.9	41.7	72
24-29	37.7	10.5	39.2	82
30-35	46.2	6.0	41.9	71
Total	28.7	12.8	31.0	473
Rural				
0-5	4.9	6.9	6.6	325
6-11	20.9	14.9	38.9	328
12-17	47.4	30.2	62.5	299
18-23	60.3	22.7	57.9	239
24-29	46.1	18.3	55.9	303
30-35	74.4	13.5	66.8	303
Total	40.9	17.4	47.1	1,796
Male				
0-5	3.6	9.1	3.9	222
6-11	18.7	13.0	33.0	208
12-17	45.6	26.0	60.0	195
18-23	57.5	25.2	54.7	156
24-29	41.5	14.7	51.6	203
30-35	63.3	11.7	60.4	178
Total	36.4	16.2	42.3	1,162
Female				
0-5	5.5	3.3	9.1	180
6-11	19.3	16.7	38.0	207
12-17	41.8	30.8	54.0	185
18-23	57.4	18.1	53.7	155
24-29	47.4	18.8	53.2	183
30-35	74.2	12.4	63.7	196
Total	40.5	16.7	45.2	1,107
Eritrea				
0-5	4.4	6.5	6.2	403
6-11	19.0	14.9	35.5	415
12-17	43.8	28.4	57.1	381
18-23	57.5	21.6	54.2	311
24-29	44.3	16.6	52.3	385
30-35	69.0	12.1	62.1	374
Total	38.4	16.4	43.7	2,269

Table D.3 Malnutrition by socioeconomic status and age

Percent of children under three years of age who are stunted, wasted and underweight, by socioeconomic status and age, Eritrea 1995

Socioeconomic status and age	Malnutrition			Number of children
	Stunted	Wasted	Underweight	
Low				
0-5	5.8	7.0	8.4	228
6-11	24.2	17.2	41.3	243
12-17	50.3	33.0	67.5	200
18-23	61.2	30.2	61.9	160
24-29	50.5	19.2	55.7	207
30-35	75.8	14.6	70.7	232
Total	43.4	19.4	49.8	1,270
Medium				
0-5	3.5	5.4	2.6	112
6-11	9.9	13.7	31.1	102
12-17	39.7	26.1	53.1	108
18-23	59.5	13.9	50.1	91
24-29	41.7	15.8	57.2	111
30-35	66.6	11.8	55.2	76
Total	34.6	14.6	40.5	599
High				
0-5	1.2	6.6	4.6	63
6-11	14.2	8.5	22.2	71
12-17	31.8	19.1	34.2	72
18-23	44.6	10.8	39.9	61
24-29	29.4	10.1	34.0	67
30-35	48.0	3.3	39.9	66
Total	28.1	9.9	29.2	400
Eritrea				
0-5	4.4	6.5	6.2	403
6-11	19.0	14.9	35.5	415
12-17	43.8	28.4	57.1	381
18-23	57.5	21.6	54.2	311
24-29	44.3	16.6	52.3	385
30-35	69.0	12.1	62.1	374
Total	38.4	16.4	43.7	2,269

APPENDIX E

FEEDING PRACTICES BY AGE

Table E.1 Feeding practices by age

Percent distribution of children under 24 months by feeding practices, according to age, Eritrea 1995

Child's age	Breastfed and: Nothing	Water	Other liquids	Solids	Fully weaned	Total	Number of children
0-1	74.3	10.6	12.7	0.9	1.5	100.0	142
2-3	54.9	15.2	24.5	2.0	3.4	100.0	179
4-5	42.9	24.0	21.3	6.7	5.2	100.0	142
6-7	20.4	19.9	26.5	29.3	3.8	100.0	153
8-9	9.4	14.5	14.2	58.3	3.6	100.0	149
10-11	5.7	6.1	15.2	60.8	12.2	100.0	151
12-13	3.0	3.1	7.0	75.6	11.3	100.0	140
14-15	0.0	1.4	13.4	73.1	12.0	100.0	140
16-17	0.8	1.9	8.0	65.5	23.9	100.0	141
18-19	0.0	1.3	3.7	68.6	26.4	100.0	143
20-21	0.5	1.3	3.7	58.2	36.4	100.0	109
22-23	0.0	0.9	3.4	45.9	49.8	100.0	99

APPENDIX F

LOGISTIC REGRESSION MODELS

APPENDIX F

LOGISTIC REGRESSION MODELS

Logistic regression analysis is used when the dependent (or outcome) variable takes discrete values. Logistic regression models have been used in this report to examine the causes of six outcomes: bottle-feeding, diarrhea, stunting, wasting, low BMI, and high BMI. Bottle-feeding, diarrhea, low BMI, and high BMI were examined using binary logistic regression models. The outcome in these models was binary: either it occurred or it did not. Stunting and wasting were examined using ordered logistic regression models. These models take into account multiple outcomes (e.g., severe stunting, moderate stunting, no stunting) and their natural ordering (i.e., severe, moderate, none).

A reference category is selected for each independent variable in a logistic regression. Other values of that variable are compared against the reference category. The estimated coefficient for each category is then exponentiated to give the odds ratio for that category relative to the reference category (which takes a value of 1). Odds ratios greater than 1 imply elevated risk for that category vis-a-vis the reference category. Odds ratios less than 1 imply depressed risk for that category vis-a-vis the reference category. Ordered logistic regressions produce results that are more difficult to interpret and they are presented in this report as estimated probabilities. These probabilities are estimated at the point where all independent variables (other than the one under consideration) take their mean values.