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Prevalence and Causes of Malnutrition in Urban and Rural Areas of Harari National Regional State, Ethiopia

- A community based study -

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Diploma Thesis submitted by

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Abbreviations and Explanations

ALRI	Acute lower respiratory infections
Atmit	Semi-liquid porridge with varying ingredients, i.e. milled cereals, beans and/or pulses; sugar/honey; milk/water/milk powder, oil/butter/oilseeds.
Asymp. Sig.	Asymptotic significance
Birr	Ethiopian currency; at the time of the study, about 4 Birr were equivalent to one German Mark
BLS	Bundeslebensmittelschlüssel (German food table)
CHA	Community health agent
CHO	Carbohydrates
CSA	Central Statistical Authority of Ethiopia
E(H)N(R)I	Ethiopian (Health and) Nutrition (Research) Institute
Ethiopian Calendar (= E.C.)	The Ethiopian Calendar comprises 12 months with 30 days and an additional month with 5 days. Ethiopian New Year is on September 11. On September 11 of our year 1999, the year 1992 according to the Ethiopian calendar started.
Fafa	Commercially available pap-powder developed by the E(H)N(R)I
FAO	Food and Agriculture Organization
HAZ	Height for Age z-Score
HFA	Height for Age
HNRS	Harari National Regional State
Injera	Flatbread made from fermented dough, staple food in Ethiopia
IUGR	Intrauterine growth retardation
Kebele	Term for the urban administrative districts in Harar
Kita	Flatbread made from unfermented dough, similar to a pancake
MoA	Ministry of Agriculture
MUAC	Mid-Upper-Arm Circumference
NCHS	National Centre for Health Statistics
Nefro	A dish prepared from cereals, e.g. wheat or sorghum, and/or maize plus haricot beans
NGO	Non-governmental organisation
PA	Peasant Association, term for the rural administrative districts in HNRS

PEM	Protein-Energy-Malnutrition
RDA	Recommended Dietary Allowance = dietary intake level that meets the daily nutrient requirements of almost all of the individuals in a specific life stage or gender group
RE	Retinol equivalent; 1 µg RE = 1 µg Retinol = 6 µg ß-carotene = 12 µg other provitamin A carotenoids
RNI	Recommended Nutrient Intake
SD	Standard Deviation
TBA	Trained birth attendant
Tef	Eragrostis tef, indigenous grain of Ethiopia, rich in iron
UNICEF	United Nation Children’s Fund
UNU	United Nations University
WAZ	Weight for Age z-Score
WFA	Weight for Age
WFH	Weight for Height
WHO	World Health Organisation
WHZ	Weight for Height z-Score
Wot	General term for ‘sauce’ in Ethiopia

1. Introduction

Famine and malnutrition is what most people associate with Ethiopia. And indeed, Ethiopia as a whole or parts of it have periodically been struck by severe droughts and, as a consequence, by famine over the last decades. The consequences of these disasters particularly show up when looking at the anthropometric data of the children, because they are the nutritionally most vulnerable group.
Two nation-wide Nutrition Surveys have been conducted in Ethiopia in 1982/83 and 1992 (MoH 1985 and CSA 1993), assessing age, weight and height of children between 6 and 59 months of age. When comparing the data of the two surveys for all regions combined, the results are as follows:

Table 1: Prevalence of stunting, underweight and wasting among Ethiopian children under five (MoH 1985 and CSA 1993)

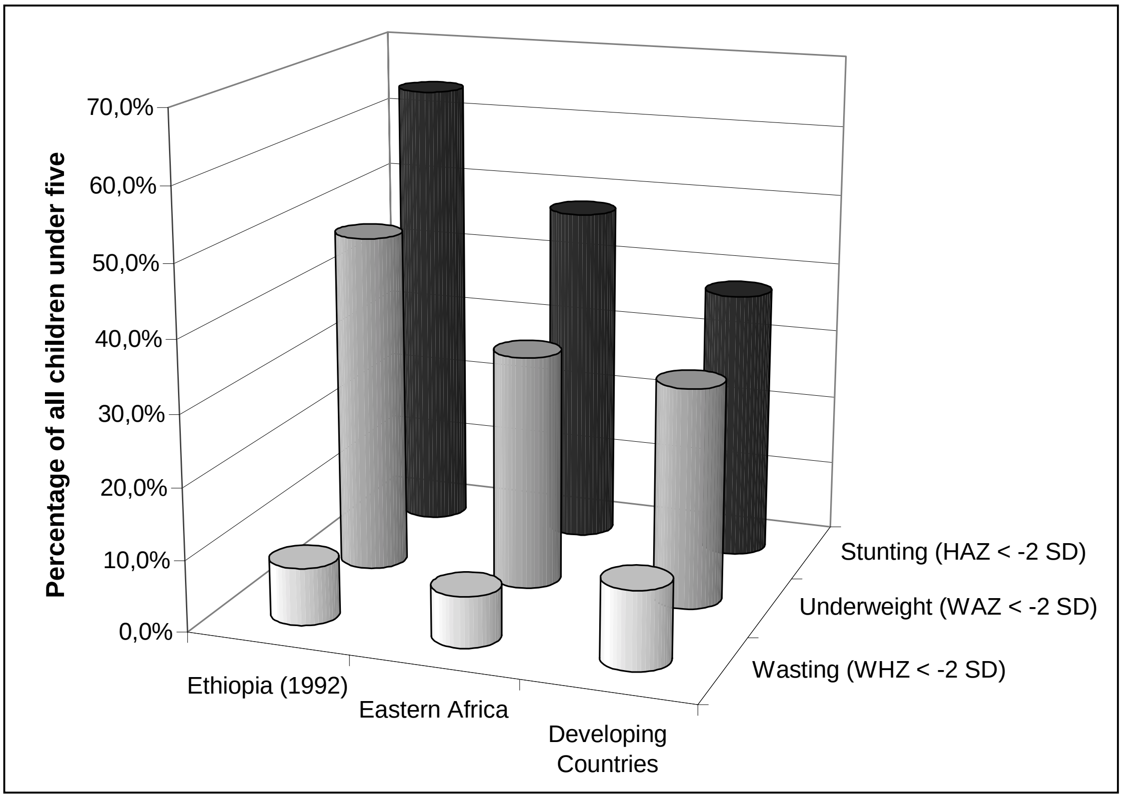
Indicator	1983	1992	Trend
stunting[a]	59.8%	64.0%	↑
underweight[b]	37.3%	46.9%	↑
wasting[c]	8.1%	7.6%	↘

In general, a country is considered to have a nutritional problem when the prevalence of stunting is > 40%, the prevalence of underweight is > 30% or the prevalence of wasting is > 15%, (WHO, 1997). The data of the CSA surveys therefore confirm that underweight and chronic malnutrition (indicated by the level of stunting) are severe problems in Ethiopia.
When comparing the situation in Ethiopia to other East African countries, Ethiopia ranks first for the prevalence of stunting and underweight and fifth for the prevalence of wasting after Eritrea, Mauritius, Djibouti and the Comoros (for graphs showing all East African countries in comparison refer to Appendix 9.1).

[a] Defined as HFA z-score < -2 SD
[b] Defined as WFA z-score < -2 SD
[c] Defined as WFH z-score < -2 SD

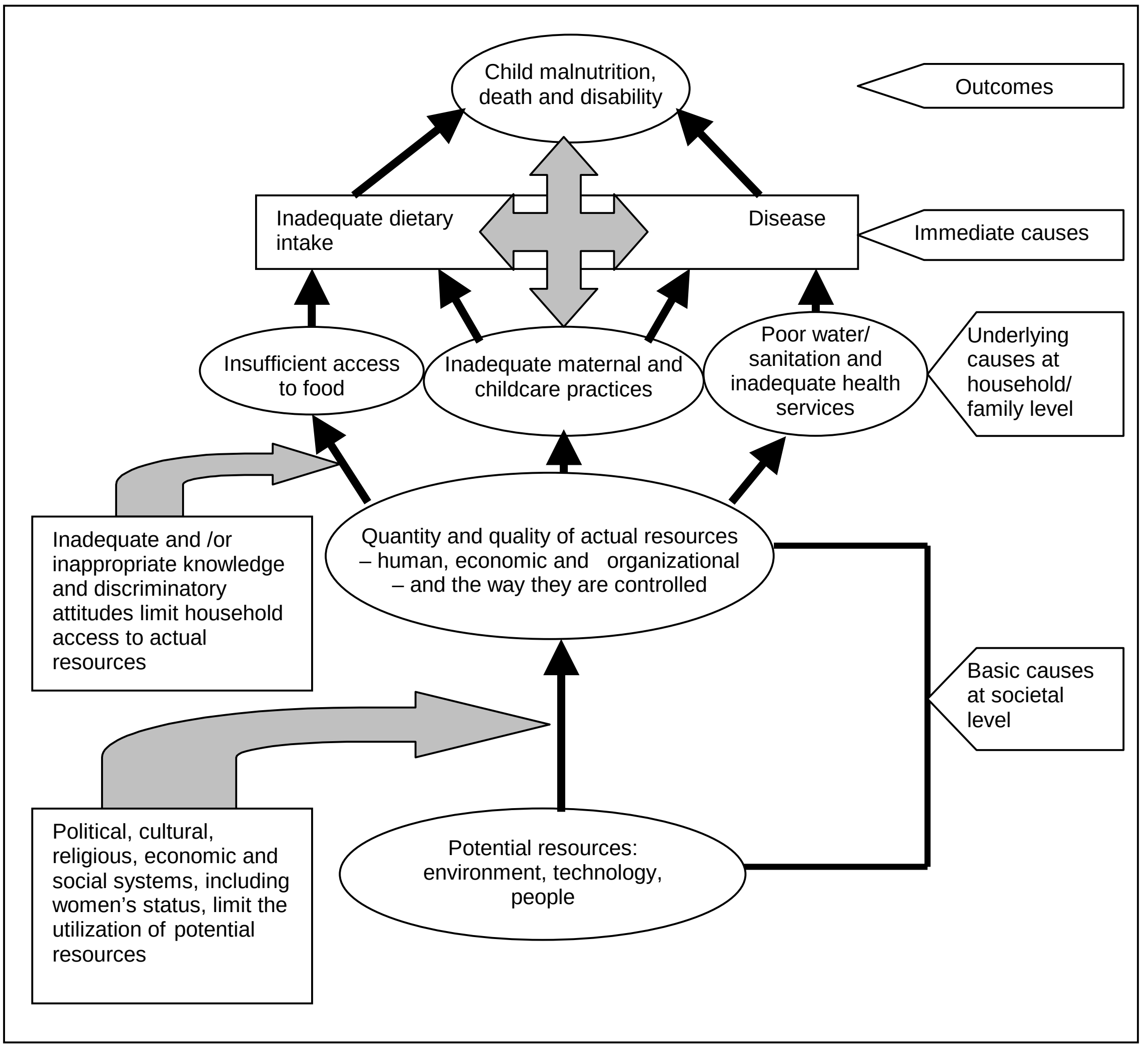
As can be seen in graph 1, Ethiopian children, like children in most developing countries, suffer from chronic rather than from acute nutritional problems.

Graph 1: Stunting, underweight and wasting in Ethiopia as compared to Eastern Africa and all developing countries (WHO, 1997 and UNICEF, 1999)



There are various factors involved in the development of under- and malnutrition and models have been derived to describe the possible causal relationships (UNICEF, 1998) on a generalised level.

Figure 1: Causes of child malnutrition (adopted from UNICEF, 1998)



In different studies, the factors outlined in this model were found to be applicable in a concrete setting and additional ones were identified. In Ethiopia for example (CSA, 1993), the prevalence of stunting and wasting in the National Rural Nutrition Survey was, according to the CSA, dependent on altitude, on the dominant agricultural products of the communities, on the primary source of household income, on the size of the cultivated area in farmer's households and on the mother's ethnic group. The survey also enumerates some practices which might exert a negative influence on a child's growth and development like pre-lacteal feeding and late initiation of breastfeeding. Late introduction of complementary food was thought to be a problem as well.

Kidane (1988) listed 'low family income', the 'prevalence of nutrition-related diseases' and the 'lack of feeding nutritious food due to unbalanced eating habits, nutritional taboos and wrong beliefs about particular types of food' as major causes of nutritional problems in Ethiopia. Similarly, UNICEF (1993) identified poverty, household food insecurity, lack of education, inadequate health, water and sanitation services as well as traditional beliefs and practices as important factors related to malnutrition among children in Ethiopia.

The causal relationship of these factors to the development of under- and malnutrition in children has to be verified for each specific setting in order to develop measures appropriate to improve a given situation.

As for the evaluation of anthropometric data, several schemes have been worked out classify the nutritional status of children based on one or more anthropometric indices. Examples are the Gómez classification (Gómez et al.,1956), introducing the conception of underweight and the Waterlow classification (Waterlow, 1972), introducing the terms stunting and wasting. Shakir and Morley (1974) (Appendix 9.2) proposed a classification scheme based on Mid-upper-arm circumference which was modified in 1994 by Gorstein.

The Wellcome classification (Anonymous, 1970) (Appendix 9.2), using % expected weight for age and the presence or absence of oedema was the forerunner of one of the schemes used in this study for the classification of malnutrition. Hendrickse (1991) (Appendix 9.2) took up its idea and divided the % expected weight for age section into three instead of previously two categories.

However, this categorisation was abolished later though because the differentiation of oedematous malnutrition in different weight categories does not have any significance for the therapy needed. According to WHO (1999), oedematous malnutrition is always a serious condition independent of the body weight. In 1999, WHO therefore published a new scheme for the classification of malnutrition.

Table 2: Classification of malnutrition (WHO, 1999)

	Moderate Malnutrition	Severe Malnutrition[a]
Symmetrical oedema	No	Yes (oedematous malnutrition)[b]
Weight-for-Height	-3 ≤ SD-score < -2 [c] (70-79%) [d]	SD-score < -3 (< 70%) (severe wasting) [e]
Height-for-Age	-3 ≤ SD-score < -2 (85-89%)	SD-score < -3 (< 85%) (severe stunting)

This scheme does no longer include the index weight for age, and the formerly used terms kwashiorkor and marasmus have been abolished. Furthermore, kwashiorkor, underweight kwashiorkor and marasmic kwashiorkor are no longer differentiated either because this distinction, as mentioned before, has no implication for the therapeutic treatment (see also footnotes a-e).

In addition, the WHO (1995) has published a ‘Severity index for malnutrition in emergency situations based on prevalence of wasting and mean weight-for-height z-score for children under 5 years’ (refer to point 4.3.6) which helps decide whether to take relief action or other measures based on the anthropometric results.

According to the Early Warning Department (1995), who has issued the ‘Guidelines on Nutritional Status Data and Food Relief’ to be used in Ethiopia, there is no need for relief action if the mean % expected WFH in children is ≥ 95% and the percentage of children with expected WFH < 80% is < 5%. Some kind of relief action should be initiated if the mean % expected WFH is < 90% and the percentage of children with expected WFH < 80% is more than 10%. Lawrence et al. (1994) however caution that already a decline in mean % expected WFH from one assessment to the next can go along with an increase in mortality even if mean % expected WFH stays above or at

[a] The diagnoses are not mutually exclusive.

[b] This includes kwashiorkor and marasmic kwashiorkor in older classifications. However, to avoid confusion with the clinical syndrome of kwashiorkor, which includes other features, the term ‘oedematous malnutrition’ is preferred.

[c] Below the median NCHS/WHO reference; the SD-score is defined as the deviation of the value for an individual form the median value of the reference population, divided by the standard deviation of the reference population.

[d] Percentage of the median NCHS/WHO reference

[e] This corresponds to marasmus (without oedema) in the Wellcome clinical classification and to grade III malnutrition in the Gómez system. However, to avoid confusion, the term ‘severe wasting’ is preferred.

the cut-off of 90%. They recommend that emergency interventions should be triggered earlier than at present.

In addition to the above-mentioned population-related recommendations, the Early Warning Department (1995) sets 80% expected WFH as the ‘criterion for selective supplementary feeding on-site or a supplementary take-home ration’ for individuals. It is recommended to refer children with expected WFH below 70% and/or oedematous forms of malnutrition to therapeutic or intensive feeding.

The area designated for this community based study was Harari National Regional State (HNRS), which is situated in the eastern part of Ethiopia. As HNRS is a newly established region of Ethiopia and did not exist as such before 1994/1995, the two nation-wide Nutrition Surveys (MoH 1985 and CSA 1993) cannot be used to get specific information about the nutritional status of children under five in this region. The HNRS Health Bureau collects weight-for-age data for children under five, but as the collection takes place in hospitals and other health facilities during routine checks or treatment, the coverage remains rather low (41,8% for the last collection period 1998/1999) (Abdosh, 1999). As data collection is in addition not randomised, the results cannot be generalised to the whole population of children under five.

Therefore, the first step of the study was to conduct a baseline survey to obtain valid and reliable data on the nutritional status of the children under five in HNRS. In addition to the collection of anthropometric data, information about general factors affecting the health and well-being of children (family background, socio-economic data, disease status) and about the dietary intake of children was collected through interviews with the children’s mothers. Key informant interviews and focus group discussions were conducted to get an in-depth understanding of the situation.

After evaluation of the anthropometric data, the severity of the nutritional status of children under five in HNRS will be stated. Through the analysis of the general and dietary information collected, the risk factors for children in urban and rural areas of this region to become malnourished will be identified. Finally, suitable measures to improve the health and nutritional status of the children under five in HNRS will be proposed.

2. Background

2.1 Geographical and demographic data

Figure 2: Map of Ethiopia (modified from Parker, 1995)

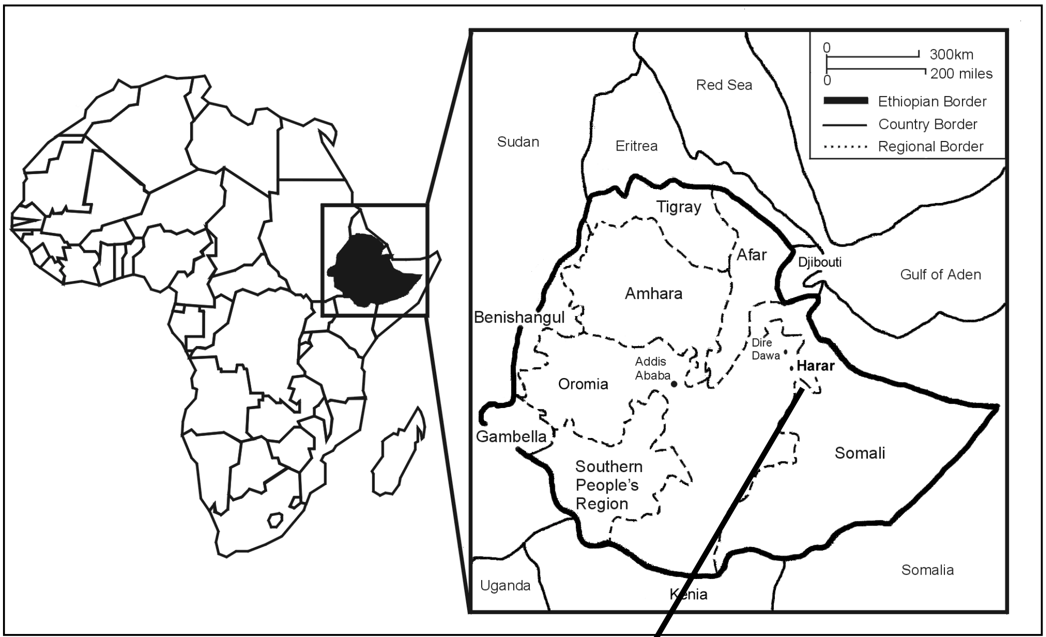
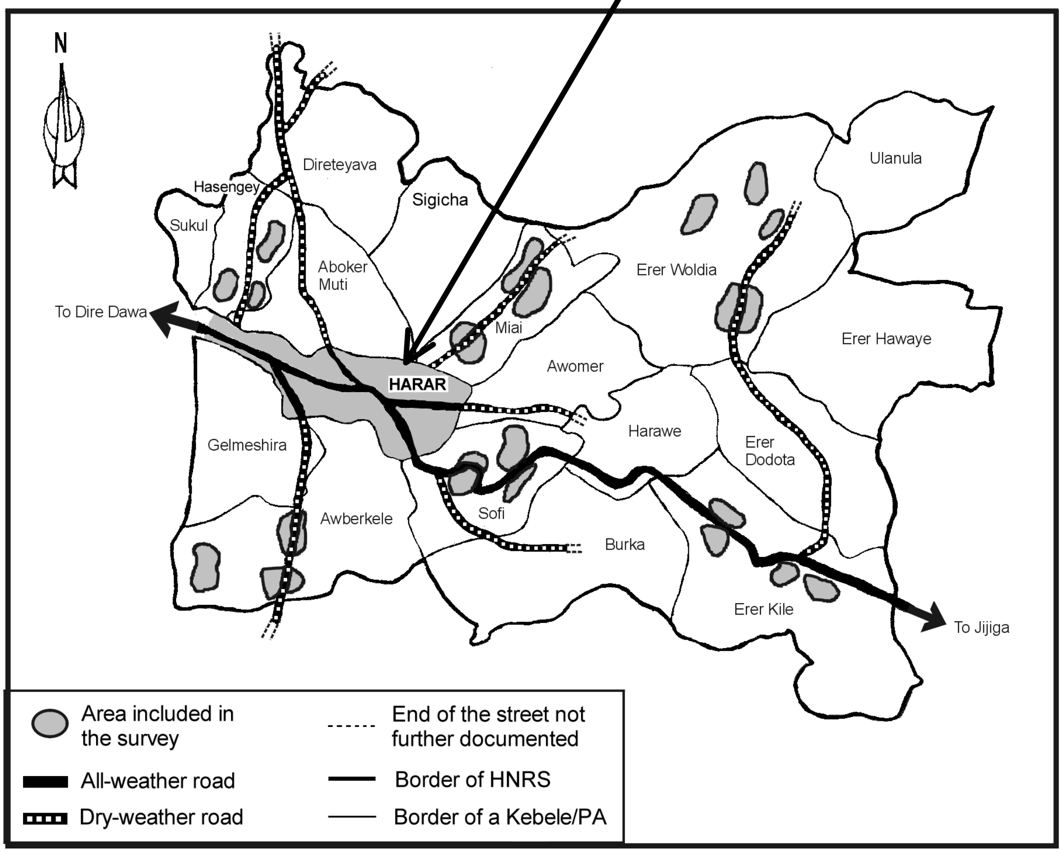


Figure 3: Map of HNRS (modified from Ayele, 1999)



Ethiopia has an area of 1 098 000 km² and a total population of 53 123 253 (CSA, 1998). The country is subdivided into administrative regions, one of them being Region 13 or Harari National Regional State (HNRS) with the regional capital of Harar.
HNRS was founded in 1994/1995 (Bekri, 1999). It has an area of 304.5 km² (MoA, 1999) and is divided into 3 urban Highers with 19 Kebeles (urban administrative districts) and 17 rural Peasant Associations (PAs, rural administrative district). Higher one consists of Kebele 1-7 and it is mainly inhabited by Harari. Higher 2 includes Kebele 14-19 and Higher 3 Kebele 8-13 respectively. Both are inhabited by a mix of ethnicities (Ayele, 1999). The altitude of the area ranges from 1300 to 2200 m above sea level (Appendix 9.3) (MoA, 1999).
According to the Harari Health Bureau (Abdosh, 1999), the total population of HNRS is about 150 685. 60% of the population are living in the urban and 40% in the rural area. 15% of the total population are estimated to be children under five years of age.
The major ethnic groups living in HNRS are the following:

Table 3: Major ethnic groups of HNRS (CSA, 1998)

Ethnic group	Percentage of urban population	Percentage of rural population
Amhara	**55.1**	1.2
Oromo	22.0	**94.6**
Harari	11.9	0.5
Other	11.0	3.7

They differ in their traditional ways of living and in some of their dietary habits. Each of these three ethnicities speaks its own dialect, but the members of the town population are usually able to speak at least one more dialect in addition to their mother language. In the rural area, people speak almost exclusively Oromiffa (Abdosh, 1999).

2.2 Diet-related information

In Amhara society, the staple food is injera, preferably from tef. It is always prepared from fermented dough and thus has a typical sour taste. The sauces are very hot and berbere (red chilli pepper) as well as other spices are used generously.
For the Oromos, the staple food is injera as well, though it is usually prepared from sorghum and maize and not fermented or only for a short time. The typical ingredient of Oromo cooking is fenugreek[a], which is used for the preparation of sauces. Usually, the dishes are not as hot and spicy as in Amhara cooking.
For the Harari, the staple food is not injera, but rice and pasta. If there is injera, it is made from sorghum and tef and only fermented over night. Fenugreek is used frequently for sauces and drinks. With the exception of the Harari, who prefer a sweet breakfast consisting of sugary pasta or couscous, there is no special liking for sweet foods in the other ethnic groups. (Abdosh, 1999)

2.3 Water supply in HNRS

In Harar, there is no town-wide public water distribution. Even to people with access to piped water, the public water supply is not always available, in particular if there is a general water shortage. Households without a water pipe have to buy their water from households with tape-water or to fetch it from springs out of town. As for the quality, the water in Harar has been tested and found ‘unfit for human consumption’.
In the rural area, the situation concerning water-safety is similar. When a ‘protected source’ is available, protection only refers to prevention of contamination from outside. It does not guarantee that the water is safe to consume.
As at present there is no way to provide safe water for the whole population, there are various efforts from the government and NGOs to teach the people how to process the water to make it safe. (Tolessa, 1999)

[a] In other regions like West Wollega, fenugreek extracts are traditionally given as pre-lacteal and therapeutic food to prevent and cure colics of the new-born and indigestion (Scherbaum, 1996).

2.4 Religious groups in HNRS

The two major religions are the Islam (32.8% of the urban and 98.4% of the rural population) and the Ethiopian Orthodox Church (64.4% of the urban and 1.4% of the rural population) (CSA, 1998). Both religions know and practise two weekly fasting days, which do however not apply to children (Abdosh, 1999). None of the other religious holidays which prescribe certain dietary rules were observed during the survey period.

2.5 Ecological and economic data

In Ethiopia, there are three seasons: the ‘Belg’ season (small rains) from February to May, the ‘Keremt’ season with the ‘Mehr’ rains (big rains) from June to September and the ‘Bega’ season (dry period) from October to January. The average rainfall in HNRS is 600 – 800 mm per year (MoA, 1999) (Appendix 9.4). In 1999 however, some PAs, particularly those in the lowlands, were suffering from lack of rain up to the time when the study began and were expecting a bad harvest.

According to FAO/WFP (2000), the Belg rains were considerably reduced in 1999. This led to a reduction in Belg crop production, which normally accounts for 5-10% of the annual production. In addition, land preparation was disrupted by the dry conditions and the sowing of high yielding crops (maize, sorghum) for the long rainy season was delayed. Overall, the given weather conditions resulted in lower nation-wide average yields of sorghum and maize, while tef yields were stable and wheat yields even increased as compared to the previous agricultural year.

In HNRS, Belg rains failed as well and the Mehr rains came late in 1999. Long cycle maize and sorghum had to be replaced by early maturing varieties. Overall however, cereal production rose from 8000 t to 10500 t when comparing the Mehr harvest 1998/1999 to the one of 1999/2000. The forecast of grain surplus/deficit for HNRS in the year 2000 is as follows:

- estimated consumption need: 26000 tons
- net production: 9000 tons
- deficit: 17000 t (whole population) or 190 kg per caput.

It is estimated that in 2000, about 46600 out of 160000 people in HNRS and 10% of the rural population will be in need of food aid. The average duration of food aid needed in HNRS in 2000 is estimated to be 3 months with a food requirement of 318 tons. (FAO/WFP, 2000)

140 km² out of the 304.5 km² (= 46%) are presently used for farming in HNRS. The major cash crops are chat (all PAs), coffee (Sofi, Burka, Ulanula and Awomer) and peanuts (all Erers, Harawe, lowland of Burka, Sofi and Awomer). The main types of staple foods cultivated are maize, sorghum, sweet potatoes, tef and wheat (MoA, 1999).

2.6 Definition of marasmus and kwashiorkor

The next table shows the main general characteristics of marasmus and kwashiorkor.

Table 4: Main general characteristics of marasmus and kwashiorkor (Scherbaum, 1995)

Characteristic	Marasmus	Kwashiorkor
Age at risk	0 – 18 months	12 – 36 months
Oedema	**None**	**Markedly present**
Appetite	Usually fine	Little
Activity	Little	None
Anaemia	Rare	Frequent
Liver	Mostly unchanged	Enlarged, fat-infiltration
Psychological changes	No	Apathy
Face	Hollow cheeks	Round cheeks
Skin changes	Rare	Frequent
Hair changes	Usually markedly present	Markedly present
Infections (e.g. diarrhoea)	Frequent	Very frequent

The most important characteristic to distinguish between the two forms of PEM is the presence or absence of oedema.

2.7 Health related data

The following table contains the data of infant and under five mortality rates and life expectancy at birth in Ethiopia and HNRS (CSA, 1998).

Table 5: Infant and under five mortality rates and life expectancy at birth in Ethiopia and HNRS (CSA, 1998)

	Infant Mortality		Under Five Mortality		Life expectancy at birth	
	Male	Female	Male	Female	Male	Female
Ethiopia						
Urban	109/1000	87/1000	153/1000	128/1000	52.7	56.0
Rural	130/1000	112/1000	186/1000	170/1000	48.8	51.0
HNRS						
Urban	87/1000	80/1000	119/1000	117/1000	56.8	57.6
Rural	128/1000	**129/1000**	182/1000	**199/1000**	49.4	**47.7**

The comparison shows that except for rural females in HNRS, infant and under five mortality rates as well as life expectancy at birth point to a more favourable situation for the children in HNRS than for Ethiopian children in general. This study might reveal some causes for the less favourable situation of rural females in HNRS, e.g. cultural reasons.

Under five mortality in Ethiopia ranks with 175/1000 eighteenth after countries like Niger (320/1000), Mali (239/1000), Somalia (211/1000) and Nigeria (187/1000). At the other end of the range are countries like Canada (7/1000), Israel (6/1000) and France (5/1000).

The total fertility rate amounts to 7.0 for Ethiopian women and thus ranks among the highest in the world after Yemen (7.6), Oman (7.2), Niger (7.1) and Uganda (7.1). (UNICEF, 1999)

The ten leading causes of morbidity in outpatients under five and of under five mortality in inpatients in HNRS from July 8, 1998 to July 7, 1999 is shown in the next table.

Table 6: Ten leading causes of morbidity in outpatients under five and of under five mortality in inpatients in HNRS (Ayele, 1999)

Rank	Under five morbidity	Under five mortality
1	Upper Respiratory Tract Infections	Pneumonia
2	Pneumonia	Gastro-enteritis and Colitis
3	Gastro-enteritis and Colitis	**Malnutrition**
4	Dysentery	Tuberculosis
6	A.F.I. Malaria	Tetanus
5	Bronchitis	Septicaemia and pyaemia
7	Otitis media and mastoditis	Disease of the heart
8	Diverse helminth infections	Infection of newborns and disease of early infancy
9	Infection of skin and subcutaneous tissue	Dysentery
10	Inflammatory diseases of the eye (except trachoma)	**Anaemia**

The following table gives an overview of the number of kwashiorkor and marasmus cases brought to medical institutions over the last three years in HNRS.

Table 7: Number of kwashiorkor and marasmus cases registered over the last three years in HNRS (Ayele, 1999)

Year	Kwashiorkor				Marasmus			
	outpatients		inpatients		outpatients		inpatients	
	male	female	male	female	male	female	male	female
1996/97	83	66	52	41	53	**54**	38	29
1997/98	73	58	24	13	74	51	28	11
1998/99	72	57	69	50	64	59	41	36

The table shows that with the exception of marasmic female outpatients in 1996/97, the absolute case number is always higher for male than for female patients. Two explanations for this phenomenon are possible: boys suffer more often from malnutrition than girls or boys are brought more often to health facilities for treatment. The answer might be found in the results of this study.

The majority (about 90%) of the under- or malnourished children are treated at Hiwot Fana Hospital in Harar town (Ayele, 1999). As the most recent WHO guidelines (1999) underline the importance of hospitals during the first stages of treatment, this is an adequate address for the acute initial phase during the treatment of a severely malnourished child. Nevertheless, as there is, up to now, no Nutrition Rehabilitation Centre (NRC) for the rehabilitation phase of malnourished children in HNRS, the question remains how to follow up the process of a child's recovery after discharge from hospital. In addition, the accessibility of the hospital is probably rather low for mothers from remote areas.

The treatment of kwashiorkor and marasmus in Hiwot Fana Hospital is as follows (Laike, 1999):
Mild to moderate cases of kwashiorkor are admitted for some days up to one week and fed a 'kwash – porridge', consisting of locally available cereals and pulses, oil and sugar (no detailed recipe was available). In addition, the mothers are taught how to feed their children properly to avoid a relapse after discharge from hospital. In severe cases of kwashiorkor, the average time spent at hospital until disappearance of the oedema is about one month. Initially, the children are fed about 500 ml of the special semi-fluid kwash – porridge per day. If they respond well to this diet and develop appetite, the amount of porridge is gradually raised to 1000 ml/day. After further improvement, the patients are fed egg and milk in addition to the porridge. If the patient is an infant, the mothers are advised to continue breastfeeding. General advice on proper child nutrition is provided as well.
Concerning the treatment of marasmus, there is no special diet fed to the children. As their appetite is usually fine, they are given the 'kwash – porridge' in unrestricted amounts. The treatment of marasmus is however rendered more difficult by concomitant diseases like diarrhoea, acute respiratory tract infections, pneumonia and TB, because the mothers usually do not seek medical care for their children if they are only wasted. More often, the children have already been malnourished for a long time and then have, in addition, developed an infection, before they are brought to hospital. Usually, the number of cases seen at hospital peaks from May to July, which is at the beginning of the long rainy season (Laike, 1999). This corresponds with the statements of a community health agent in Awomer and a health assistant in Sofi that during this season, children in their areas are suffering most from infections like worms, diarrhoea and febrile illnesses.

According to one of the health assistants of Sofi, the mothers in the rural areas usually first seek help at the local health facility, e.g. the health station, before undertaking the long walk to town.

Concerning the organisation of the health care system, there is a health station in most of the Kebeles in town and in addition, there are hospitals and private clinics. The health services offered at health stations by one to three health assistants or junior nurses are limited to primary health care activities like vaccinations, antenatal care or distribution of free oral contraceptives.
As for the PAs, there is a Health Centre in Erer Woldia, there are Health Stations in Direteyava, Sofi, Burka, Awberkele, Erer Dodota and Erer Kile, Health Posts in Hasengey and Erer Hawaye and one Community Health Agent (CHA) in Awomer and Gelmeshira respectively. No health personnel and health facilities are available in six of the PAs (Sukul, Sigicha, Aboker Muti, Miai, Harawe and Ulanula). A Health Centre offers, on a smaller scale, a lot of the services of a regular hospital, including delivery services, but is restricted in the number of admissions and the overall facilities. A Health Post as opposed to a Health Station is restricted to offering first aid and handing out some basic drugs like antihelminthics or antiparethics. It is run by a CHA.
The qualification of the health personnel ranges from specialist physicians over physicians, special nurses, health officers, senior nurses, junior nurses, health assistants and CHAs to trained traditional birth attendants (TBA) (Abdosh, 1999).
If a mother cannot afford the treatment of her child at a medical facility, the Kebele or PA she is living in can issue a paper for her to obtain free medical care, including the drugs required (Ayele, 1999).

2.8 Design of the study

The main purpose of this community based study was to obtain figures for the prevalence of malnutrition (stunting, underweight, wasting and oedematous malnutrition) in HNRS and to ascertain etiologic risk factors leading to malnutrition in urban and rural settings. Particular attention was paid to family background, environmental factors and diet.
The eligible study population were all children under five in HNRS who had already started eating complementary food in addition to breastmilk. Data collection took place through interviews with the mothers or care-givers of the selected index children.

Three approaches to collect data were used: structured interviews collecting general, anthropometric and dietary data, focus group discussions and key informant interviews. The information gathered during the study will be used for developing practical recommendations on how to reduce the prevalence of malnutrition among the children under five in HNRS.

2.9 Objectives

a) To establish a prevalence rate for the different types and degrees of malnutrition in HNRS.
b) To ascertain specific risk factors for the development of malnutrition in urban and rural areas by assessing the main differences between the children in the two different environments.
c) To consider relevant information about specific causes of malnutrition in order to give practical recommendations on how to prevent malnutrition and how to improve the nutritional situation of the children in the study area.

3. Methods

3.1 Survey schedule

The schedule of the survey was as follows:

- 1 – 16 July, 1999: Key informant interviews
- 8 – 16 July, 1999: Interviewer training and pilot testing of the questionnaire
- 19 July – 2 August, 1999: Urban Survey
- 3 – 10 August, 1999: Rural Survey
- 12 – 18 August, 1999: Focus Group Discussions and Key Informant Interviews

3.2 Selection procedures

In the urban area, two Kebeles were selected of each Higher using random number tables.

The PAs in the rural area were first stratified into three sub-regions of approximately the same size, group 1 consisting of Gelmeshira, Awberkele, Sofi and Burka, group 2 of Sukul, Hasengey, Direteyava, Aboker Muti, Sigicha, Miai, Awomer and Harawe and group 3 of all Erers. From each group, two PAs were selected using random number tables. The PA Ulanula had to be excluded because it was not accessible during the rainy season. This could introduce a selection bias into our sample as the least accessible region might also be the one that is worst of.

Table 8 gives an overview over the Kebeles and PAs selected for the survey and the number of children assessed in each of them. For a complete list of the Kebeles and PAs including their main characteristics (number of households, number of inhabitants, number of children), please refer to Appendix 9.5.

Table 8: Total number of children under five assessed in each Kebele and PA

Urban Survey		**Rural Survey**	
Kebele	Number of children < 5	PA	Number of children < 5
Kebele 02	29	Hasengey	36
Kebele 06	18	Miai	36
Kebele 08	41	Sofi	36
Kebele 13	34	Awberkele	36
Kebele 17	36	Erer Kile	37
Kebele 19	36	Erer Woldia	36
TOTAL URBAN	**194**	**TOTAL RURAL**	**217**

As neither exact maps of the town nor of the rural area were available, the EPI Style Random Walk Method (World Vision, 1996) was used for the selection of a dwelling. In town, every 3rd to 5th dwelling was selected, in the PAs every dwelling was visited as they often were very wide-spread and difficult to reach. If there was more than one mother/caretaker with a child under five living in the selected dwelling, one of them was chosen randomly. If the selected mother/caretaker had more than one eligible child under five, one of the children was chosen randomly. The interview was conducted with the mother/caretaker of the selected index child after informed consent had been obtained.

3.3 Sample size

For the calculation of the sample size, the formula used to estimate baseline statistics from the MICAH-Guide (World Vision, 1996) was used:

a) Anticipate the proportion you are about to measure

According to UNICEF (1999), the percentage of Ethiopian children under five (1990-1997) suffering from moderate to severe wasting[a] were 8%. Wasting was chosen as the basis for sample size calculation because it is the anthropometric index that decisions whether to take relief actions are usually based on (WHO, 1995 and Early Warning Department, 1995).

The level of confidence was set at $\pm$ 5%.

p = known prevalence = 0.08

E = % within = ± 0.05

for a confidence interval of 95%, Z = 1.96 (2-tailed)

$$n = \frac{1.96^2 \cdot (1-P) \cdot P}{E^2} = \frac{1.96^2 \cdot (1-0.08) \cdot 0.08}{0.05^2} = 113{,}10 = 114$$

b) Add 10% for non-responders

114 + (114 * 10%) = 125.4 = 126

c) Choose an appropriate design effect

126 * 2 = 252

d) Estimate the number of households you must visit

The average household size in HNRS is 4.3 (Abdosh, 1999).

15% of the population is made up of children under five (Abdosh, 1999).

Then the number of households that should be visited is at least

$$n = \frac{252}{(4.3 \cdot 0.15)} = 390.70 = \mathbf{391}$$

3.4 Design of the survey questionnaire

The questionnaire is adopted from the computer program ‘NutriSurvey for Windows 95_98 and NT’. NutriSurvey is a program written at the University of Hohenheim, which helps to determine the types, prevalence and causes of malnutrition. It helps in preparing a suitable questionnaire, entering the data and evaluating the results. The program was based on the 'Guidelines for Nutrition Baseline Surveys in Communities' (Gross et al., 1997).

The questionnaire (Appendix 9.6) was modified to suit the requirements of this study and consists of the following parts:

- Identification section
- Data concerning all children in the house:
    - Number and age of all children of the interviewed mother
    - Number of all own children of the mother under five years of age
    - Number of all own children of the mother who died before reaching the age of five

[a] z-score < - 2 SD for each index

- Index child questionnaire
    - General data:
        - Sex of the index child
        - Date of birth of the index child
        - Birth-order of the index child (i.e. first, second... child born alive of this mother)
    - Breastfeeding and weaning practice:
        - Pre-lacteal feeding
        - Feeding of colostrum
        - Duration of exclusive breastfeeding
        - Age when first complementary foods were introduced and the type of foods given
        - Age when breastfeeding was stopped completely
    - Health of the index child during the last seven days preceding the interview
    - Recommended treatment of marasmus and kwashiorkor according to the mother
    - Childcare
        - Time that the mother spends caring for the index child
        - Additional caretakers
    - 24 hour recall for the index child
- General questions concerning the family
    - Age (refer to Appendix 9.7 for the calendar of events used in age estimation of the parents), ethnicity, religion, schooling, occupation and marital status of the parents
    - Times of food scarcity
- Anthropometry of the child
    - Existence of EPI/growth monitoring charts
    - Weight, length and MUAC measurements
    - Existence and location of oedema

To ensure a standardised protocol for the interviews, the questionnaire was translated into the two main dialects spoken in this region, Amharic and Oromiffa. The Amharic version was mainly used in town, as both the Harari and the Amhara speak this dialect. In the PAs, almost everybody speaks Oromiffa and if not, Amharic.

The translations were done by persons who had a good knowledge of English and spoke the respective dialect as their mother language.
In general, the mothers were both able and willing to answer our questions. As most of the interviewers had previous work experience in the study area, they had also a good feeling for the honesty of the answers. Mostly the impression was that the mothers answered the questions frankly. Though the mothers might have been tempted to describe the situation the worst possible in order to receive relief aid, we think that we reduced this bias by explaining before the interview that no immediate benefit would result from our interviews.

3.5 Anthropometry

All measurements were performed according to the procedures outlined in 'How to Weigh and Measure Children: Assessing the Nutritional Status of Young Children in Household Surveys' (United Nations, 1986).
After completion of the interviewer training, each team took the anthropometric measurements of three children (two children of about 12 months, one child of about 30 months) independently in the absence of the other teams. The results were written down and compared. The inter-team variation was 1-2 mm for MUAC, 1-3 cm for length and 100-300 g for weight (the latter two strongly depended on the activity level and resistance of the child). Overall, the dimensions of these variables were rather over- than underestimated.
When looking at the anthropometric indices of breastfed infants, one important point to keep in mind is that the NCHS reference data which are used to calculate the z-scores were based on a mainly formula fed population of infants and children. It has been recognised that the growth pattern of breastfed infants differs from that of formula fed infants. Breastfed infants often seem to suffer from growth faltering when compared to the currently recommended NCHS reference while they may actually only exhibit different growth patterns. A new international growth reference is currently being established, but not yet available (WHO Working Group on the Growth Reference Protocol et al., 2000).

3.5.1 Assessment of age

It was very difficult to assess the age of the parents in the rural area. Though we had a list with key events of the past years to help the mothers remember their own and their husbands' age often very rough estimates had to be made.
To assess the age of the index child, the mother was asked if she knew the exact birthday. If she was not sure, she was asked to show the birth-certificate to the interviewer. If a birth certificate was not available or the date of birth missing, a calendar of local events and religious holidays (Appendix 9.8) was used to help her remember. This way, the age could be assessed at least to the closest month for most of the children. The time-data referring to the children were easier to assess because the events lay back five years at maximum and the mothers could, for example, count the number of agricultural seasons that had passed since the birth of the child or use the calendar of local events we had prepared.

3.5.2 Assessment of weight

For weighing the children, hanging scales (25 kg max., 100 g gradation, CMS Weighing Equipment Ltd, 18 Camden High Street, London NWI OJH, England) with weighing pants made from nylon (average weight: 46 g) were used. Each morning, the scales were checked for accuracy using two 1 kg standard weights. Before weighing a child, the mother was asked to take off the child's clothes as far as she felt it appropriate. The majority of the children was weighed naked or in underwear. The weight of remaining clothes was not subtracted from the total weight of the child. Weight was recorded to the nearest 100 g.
The overall effect of neglecting the weight of the children's remaining clothes is an overestimation of their body weight and thus an underestimation of the prevalence of underweight and wasting.

3.5.3 Assessment of length

To assess length, locally made wooden measuring boards with flexible headboards were used. Length was assessed to the nearest mm. Due to difficult field conditions, length was assessed for all children independent of their age.
To compensate for the differences between the NCHS weight-for-length/length-for-age and weight-for-height/height-for-age data, the procedures of Lawrence et al. (1994)

were adopted. In his study among 5455 Ethiopian children under five, length was measured for the whole sample irrespective of age as this was more convenient under the given field conditions. For children ≤ 100cm, he calculated weight-for-length using the NCHS weight-for-length reference data. For children > 100cm the researchers calculated height from length by subtracting 1.5 cm and then used the NCHS Weight-for-Height reference tables. The 1.5 cm were derived as an empirical factor that gave a reasonable continuity between the two NCHS tables according to the researchers.
It is recommended to take height measurements at a standardised time during the day for all children of a sample (Gibson, 1990) because of diurnal variations in height. It is not certain whether this recommendation applies to length measurements as well. For logistic reasons however, it was not possible to measure all index children of an area at one point during the day and every day at the same time. We were only able to take the measurements during the interviews, i.e. from about 9 a.m. to 4 p.m.

3.5.4 Assessment of mid-upper-arm circumference

Mid-upper-arm circumference (MUAC) was measured using a 20 cm flexible non-stretch tape with mm gradation. The measurement was recorded to the nearest mm. The MUAC represents both the subcutaneous fat stores and the muscle tissues at the site assessed. An overall decrease in MUAC can therefore be due to a reduction in subcutaneous fat or muscle tissue. If, as is common in developing countries, fat stores are small, changes in MUAC directly reflect changes in muscle mass and can be used to diagnose wasting (McDowell, 1982). As the reference curve for MUAC is relatively stable only from 1 to 5 years, this is the age range recommended for the usage of MUAC as an ‘age-independent’ assessment tool for malnutrition in children (Savage King et al., 1993).

3.5.5 Anthropometric indices

In the present study, weight-for-age (WAZ)-, height-for-age (HAZ)-, and weight-for-height (WHZ) -z-scores were used to classify the children according to their nutritional status. The z-scores were calculated with the following formula (WHO, 1997):

z-score (SD-score) = (observed value – median value of the reference population)/
standard deviation value of reference population

The data of the Ethiopian children were compared to the NCHS reference population (WHO, 1983).
HAZ is an indicator of linear growth and reflects the degree of chronic malnutrition. WHZ is an indicator of acute malnutrition as it reflects the body proportion. WAZ indicates the level of underweight and thus reflects both linear growth and body proportion.

3.6 24 hour recall

For a sample 24-hour recall form, please refer to Appendix 9.9.
The following table provides an overview of strengths and weaknesses of this dietary assessment method.

Table 9: Advantages and disadvantages of the 24-hour recall method (Gibson, 1990)

Advantages	Disadvantages
Low respondent burden	Reliance on memory
High compliance	Errors in the estimation of portion sizes possible
Low cost	Flat slope syndrome[a] of reporting dietary intake
Ease and speed of use	Omission of foods which are infrequently consumed and of snacks
Standardised procedure	Adding foods
No changes in diet due to the interview = element of surprise	Trained interviewers required
	Coding errors may occur

A 24-hour recall provides information on the respondent's food intake during the 24 hours preceding the interview or during the day preceding the interview. The information can be used to characterise the mean intake of a group. To assess the habitual intake of an individual, multiple replicate 24-hour recalls are needed (Gibson, 1990).

[a] Individuals appear to overestimate low intakes and underestimate high intakes (= 'talking a good diet' (Gersovitz et al., 1978)

Only one single 24-hour recall was collected for every index child, thus not accounting for day-to-day or seasonal variation. The survey was conducted at the end of the rainy season, when stocks are low and the next harvest is still some time off. The situation found is therefore probably the worst possible in a one year cycle. This should be taken into account when looking at the results.

Before starting the recall, the mother was asked, whether the last day was a usual day concerning the child’s diet, e.g. did the child eat less due to illness or more/different food due to a holiday. Then she was asked to remember all foods and drinks that the index child had consumed, starting from the previous day when the child woke up to the present morning before it had its first meal of the day.
First, a list of all the foods and drinks consumed was obtained. Every food was described as detailed as possible, e.g. injera made from sorghum and tef. For composite dishes, a list of all ingredients was recorded. In the next step, the amounts of all foods consumed and of the single ingredients of the recipes were estimated in household-measures as cups, teaglasses, spoons (level or mounted), ladles (big, medium, small; level or mounted) or in cm, e.g. an injera bread with a diameter of 52 cm and a thickness of 1 cm. For food items with an approximately round shape like tomatoes, kale, red beets, potatoes, oranges, onions or garlic, a graduated round model (Appendix 9.10) was used to estimate the size. The use of graduated food models is recommended to reduce errors in the estimation of portion sizes of foods (Gibson, 1990). The model was validated during pre-test by first asking the mother to describe the size of some food items used for the meals of the previous day and then to show food items from her stock which she estimated to be of the same size as the ones described. We then compared the item shown with the model to see whether her description had been correct. The mothers were in general able to perform the abstraction from three dimensional foods to a two-dimensional model and the descriptions were usually correct. We found that it was easier for the respondents to remember and describe the items when using the visual aid.
Through random observations of meals taking place during the interviews we were able to check whether the portion sizes that the respondents had specified were possibly true.
For children who were still breastfed, the number of breastfeeds during the last 24 hours was noted down if the mother could remember it exactly.

If a child had shared a meal with other persons, number, age and sex of all participants sharing the meal was assessed.
The 24-hour recall data of children who had breastfed and/or participated in a shared meal during the 24 hours before the interview will not be part of the results section as the analysis of energy and nutrients from breastmilk or shared plates would exceed the scope of a diploma thesis.
In a third step, the recall was read all over again to the mother and she was asked, whether she had anything to add, like snacks or drinks.
For the transformation of household-measures and centimetres into grams, food items similar to the ones described in the recalls were weighed on a digital household dietary scale (Soehnle domino, max. 2 kg, 0-1000g d = 2g, 1000-2000g d = 5g) and the weight was recorded.
Overall, we cannot be sure that the 24-hour recalls were always complete. Particularly in older children who are able to walk around and are separated from the mother some time during the day, there is a high probability that the children had little snacks in between without the mother’s knowledge. In the urban area, these additional foods are most likely to be sweets and biscuits received from neighbours or begged from other adults in the street, thus adding to the overall energy rather than to the micronutrient intake. In the rural area, for example, there were wild cactus fruits growing around the dwellings from which the children could have served themselves. In other areas, where there were a lot of mango trees, the children might have picked up some fallen fruits. In the rural area, the overall effect of additional snacks would therefore be an improvement of the micronutrient content rather than the energy content of the diet.
As we did not work on weekends, the dietary intake of children under five on Fridays and Saturdays was not assessed. The general opinion of the key persons asked beforehand as to the dietary habits of the different ethnicities in the area (Abdosh, Ayele and Tolessa 1999) was that especially in the rural area there were no changes in the diet at any point during the week. Nevertheless, about 21% of the days assessed with the 24-hour recall were Sundays (through data collection on Mondays) thus accounting for any changes of the diet (e.g. elevated meat consumption, more food) during the weekend.
The dietary protocols were evaluated using ‘NutriSurvey for Windows 95_98 and NT’. With this program, the total of calories consumed and the nutrient content of the diet can be calculated. Food composition data of Ethiopian-specific food items like the different types of injera were added to the initial database from the ‘Food Composition

Table for Use in Ethiopia, Part IV' (Gobezie A et al., 1998). For all other foods, the German food composition table (Bundeslebensmittelschlüssel) included in the program was used as a basis and substituted by data from the 'Food Composition Table for Use in Ethiopia, Part III' (Gobezie A et al., 1997) as far as possible. The analysis of the dietary recalls was restricted to energy, protein, fat, carbohydrates, fibre, vitamin A, vitamin B1, vitamin B2, vitamin C, calcium, copper, phosphorus, potassium, iron and zinc because these are the nutrients included both in the Ethiopian and in the German food composition tables and of interest in the concerning area of malnutrition. One limitation of all of the food tables used is that they only partly account for nutrient losses during food processing, i.e. data for both raw and boiled/fried/dried etc. foods is only available for a limited number of foods, and for others not.

The dietary intake was evaluated for its quantity as well as its quality. The WHO recommendations and, if these were not available, the USA RDA/USA minimum requirements (in: Garrow et al., 1993; Savage King et al., 1993) were used to estimate whether the children met their needs of energy and of the above mentioned nutrients (except CHO and fibre).

To examine dietary quality, the nutrient density per 1000 kcal was calculated for protein, fat, carbohydrates, fibre, vitamin A, vitamin B1, vitamin B2, vitamin C, iron, calcium and zinc and compared to the desirable ranges (FAO/WHO, 1996). When using nutrient density to judge dietary quality the assumption is made that a diet which provides for the energy needs of all family members will also satisfy the RNI for all essential nutrients. The reference nutrient densities used refer to the total diet and were set in a way that if energy needs are met, nutrient requirements of all members of a family can be fulfilled, except probably that of infants of < 2 years of age (FAO/WHO, 1996).

In addition, the diet was screened for possible inhibitors of nutrient absorption like phytates or tannins.

It seems that the performance was similarly good in all teams as no significant difference in the mean percentage fulfilment of energy and nutrients for the recalls of the different interviewers could be identified. In addition, recipes and portion sizes were similar between different teams in the same area. There was no trend of a higher percentage fulfilment of energy requirements identified towards the end of the study which would have been a sign that with growing experience and probing the interviewers got a more complete assessment of the real intake.

Due to the exclusion of children who had been breastfed and/or participated in a shared meal the day before the interview and of children whose age was unknown, the sample size for the dietary analysis was considerably reduced from 411 to 212 children. Therefore, statistical analyses for differences in dietary intake between groups had to be limited to factors where the sub-samples were still large enough to make valid statements. It was decided to look mainly at the differences between urban and rural children as this grouping yielded samples of nearly equal and overall sufficient size (108 urban and 104 rural children).

3.7 Focus Groups

The focus groups were used as a means to collect in-depths information on topics which the survey had pointed out to be key-issues in child malnutrition, but for which the structured questionnaire did not deliver enough details. Therefore, the focus group took place at the end of the data collection period after preliminary analysis of the results. The meetings in town were organised beforehand by the health assistants of the selected Kebeles. They were asked to invite 8-12 women of all ages with different occupations and origins who lived presently in that Kebele and had children of their own. In the rural areas, women whom we knew from our data collection period helped us organise the meetings. The broad topics chosen for discussion were 'childhood illnesses' and 'breastfeeding and complementary practices and diet of young children'. To be sure to cover all relevant points for each topic, a catalogue of questions was composed to serve as a guideline during the discussions.

The sessions were moderated by Sister Abdosh, who had already been a member of the interviewer team. Two note-takers for each discussion were also recruited from the former interviewer team. In addition, the sessions were recorded on tape after informed consent of the participants had been obtained. All discussions were conducted in the dialect that most participants preferred.

For time constraints, only four focus groups could be scheduled. They were to take place in the Kebeles and PAs with the best and the worst mean WHZ, as both WHO (1995) and the Ethiopian Early Warning Department (1995), are using mean WHZ of children under five to define a severity index for malnutrition in a specific population. In comparing the extremes it should be easiest to detect differences in knowledge, attitude or behaviour as related to the selected topics. After preliminary analysis, the Kebeles and PAs with the best and worst mean WHZ were Kebele 08/Kebele 02 in town and Miai/Erer Kile in the rural area.

The information gained during the focus group discussions will not be presented separately in this thesis but will be quoted where appropriate to enhance the understanding of the quantitative results.

3.8 Key informant interviews

Additional information on traditional habits, Ethiopian culture and health topics was collected during unstructured interviews with members of the personnel of the HNRS Health Bureau.

3.9 Survey Teams

3 to 4 teams with two interviewers each were thought sufficient to conduct the survey within the time available. The personnel, except one interviewer, was made available by the HNRS Health Bureau from their own staff. Due to personal reasons, some of the interviewers had to drop out from the survey and were partly replaced. All interviewers except one were working in the health care area and/or had previous experience with similar surveys as the one to be conducted. They all spoke Amharic and Oromiffa at least ‘well’ and four of them spoke in addition Harari. We aimed at always having one male and one female interviewer per survey team and to combine persons who would complement each other in their language skills.

3.10 Interviewer Training

During interviewer training, all sections of the survey, i.e. general questionnaire, 24-hour recall and anthropometric assessment, were explained and discussed. After a theoretical introduction, the interviewers practised all parts at home with mothers and children in their neighbourhood.

3.11 Pilot-Test

The pilot-test was conducted in one Kebele and one PA that had not been chosen for the survey, i.e. Kebele 16 and Awomer. 12 interviews (3 per team) were conducted in each of the two areas. Difficulties encountered during this phase were written down and solutions discussed.

It had for example become obvious, that it was not good to place the 24-hour recall at the end of the interview as it was one key component of the study and needed the full attention and concentration of the mother. After answering the whole questionnaire though, the attention span of most mothers was usually low. Therefore, the interview was restructured and the information that was easiest for the mother to recall, like the general questions about the family background, were placed at the end.

3.12 Statistical analysis

The analyses were performed with SPSS 9.0 for Windows.

3.12.1 Statistical analysis of metric data

To test for normal distribution, the Kolmogorov Smirnov Test was used. A variable was considered to be normally distributed for $p \geq 0.05$.
To test for homogeneity of variances of a variable between samples, the Levene Test was applied. Two or more samples were assumed to have homogenous variances for a certain variable if $p > 0.1$.
The following table gives an overview of the statistical tests applied depending on whether the variables were normally distributed and whether there was homogeneity of variances.

Table 10: Statistical tests used for metric data

	Homogeneity of variances	No homogeneity of variances
Normal distribution	2 samples: Student t-test for independent samples	2 samples: Mann Whitney U
	> 2 samples: One-way ANOVA with Tukey as post hoc test	> 2 samples: Kruskal Wallis with Mann Whitney U as post hoc test
No normal distribution	2 samples: Mann Whitney U	2 samples: Mann Whitney U
	> 2 samples: Kruskal Wallis with Mann Whitney U as post hoc test	> 2 factors: Kruskal Wallis with Mann Whitney U as post hoc test

A result of any of these tests was considered significant if the level of significance was < 0.05.

3.12.2 Statistical analysis of ordinal data

Ordinal data was analysed using the chi-square test. If all frequencies were ≥ 5, the asymptotic significance (2-tailed) of the Pearson chi-square was used. If one or more frequencies were < 5, the exact significance (2-sided) of the Fisher’s Exact Test was calculated. In both tests, the results were considered significant if the level of significance was < 0.05.

4. Results

During the survey, a total number of 411 interviews was completed with a respondent rate of 100%. Though we explained to the mothers before starting the interview that they would have no immediate benefit from answering our questions, none of the mothers refused her participation.

There was no questionnaire that had to be excluded for all analyses. Thus, the number of questionnaires included is always stated separately at each occasion.

4.1 Description of the sample

4.1.1 Characteristics of the parents

Table 11 shows the ethnicity of the parents in the families visited. The predominant ethnicity in the urban area were the Amharas whereas in the rural area, there were almost exclusively Oromos.

Table 11: Ethnicity of the parents (n = 411)

Ethnicity	Urban				Rural			
	Mother (n = 194)		Father (n = 194)		Mother (n = 217)		Father (n = 217)	
	Number	%	Number	%	Number	%	Number	%
Harari	28	14.4	26	13.4	0	0	0	0
Oromo	53	27.3	57	29.4	217	**100**	200	**92.2**
Amhara	94	**48.5**	67	**34.5**	0	0	0	10
Tigray	4	2.1	8	4.1	0	0	0	0
Gurage	10	5.2	11	5.7	0	0	0	0
Other	5	2.6	1	0.5	0	0	0	0
No answer	0	0.0	24[a]	12.4	0	0	17[a]	7.8

[a] Overall, there were 41 women, who were divorced, widowed or had been abandoned by the father of the index child. For these families, the data of the father of the index child was not assessed.

Table 12 shows the level of education of the parents. Though illiteracy ranked highest for mothers and fathers, the percentage of illiterate mothers was about 1.7 times higher.

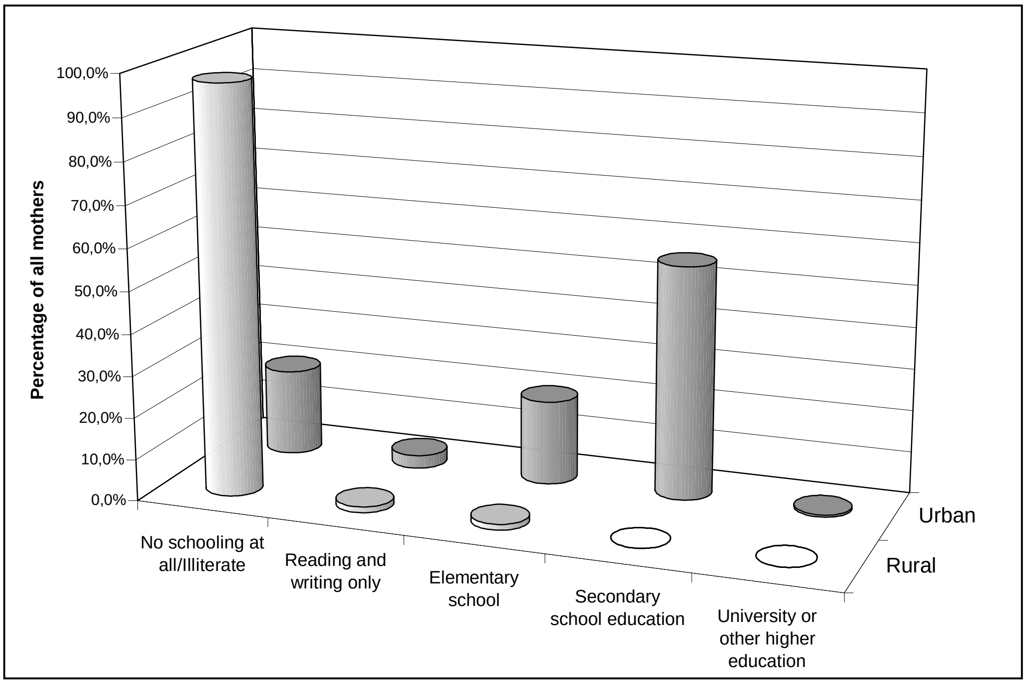
Table 12: Schooling of the parents

Schooling	Mother (n = 411)		Father (n = 411)	
	Number	Percentage	Number	Percentage
Reading and Writing only	9	2.2	28	6.8
Elementary school (grade 1 – 6)	42	10.2	60	14.6
Secondary school	108	26.3	109	26.5
University or other higher education	1	0.2	23	5.6
No schooling at all/illiterate	251	**61.1**	149	**36.3**
No answer	0	0.0	42[a]	10.2

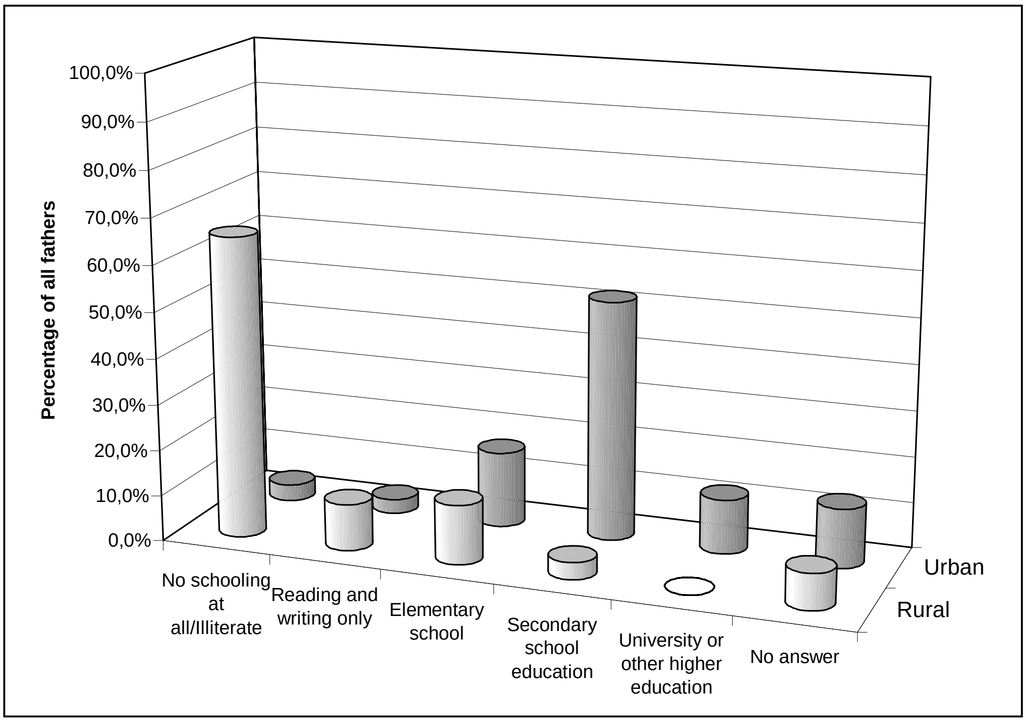
The following graphs compare the level of education of mothers and fathers in urban and rural areas. For both sexes, the educational level is higher in the urban than in the rural setting. Overall, the urban fathers have the best educational level and the rural mothers the worst with over 90% of them being illiterate.

[a] Overall, there were 41 women, who were divorced, widowed or had been abandoned by the father of the index child. For these families, the data of the father of the index child was not assessed. In addition, the data of one father is missing.

Graph 2: Schooling of the mothers in urban and rural areas (n = 411)



Graph 3: Schooling of the fathers in urban and rural areas (n = 411)



The following table shows the religion of the parents in the urban and rural areas. While in town, the Ethiopian Orthodox and Muslim faith are represented nearly equally, Muslim faith is the predominant religion in the rural area.

Table 13: Religion of the parents in the urban and rural areas

Religion	Urban (n = 388)		Rural (n = 434)	
	Number	Percentage	Number	Percentage
Muslim	167	**43.0**	416	**95.9**
Ethiopian Orthodox	171	**44.0**	1	0.2
Other Christian Denom.	24	6.2	0	0
Other	2	0.5	0	0
No answer	24[a]	6.2	17[a]	3.9

Table 14: Occupation of the parents

Occupation	Mother (n = 411)		Father (n = 411)	
	Number	Percentage	Number	Percentage
No formal occupation	267	**64.2**	11	2.7
Sells wood and/or cactus fruits	35	8.5	0	0
Trader	31	7.5	36	8.8
Farming	20	4.9	189	**46.0**
Domestic servant	13	3.2	1	0.2
On daily wages	12	2.9	24	5.8
Lower work	9	2.2	10	2.4
Sells chat	6	1.5	0	0
Civil servant	0	0	45	10.9
Military or police	0	0	20	4.9
Daily wages and farming	0	0	5	1.2
Industrial worker	0	0	4	1.0
Farmer and trader	0	0	3	0.7
Other	18	4.4	22	5.4
No answer	0	0	41[a]	10.0

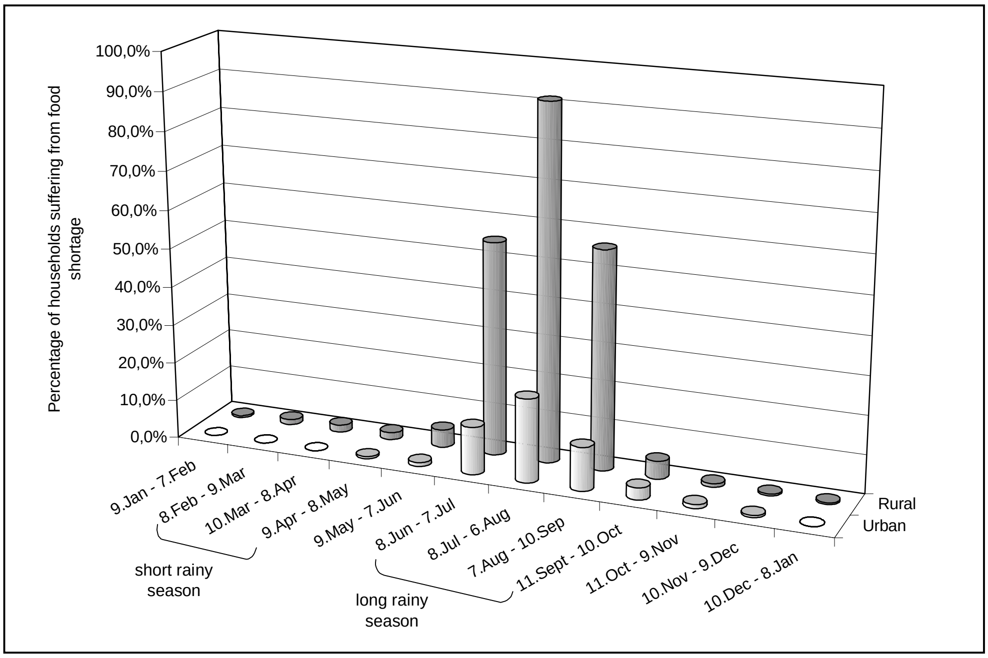
[a] Overall, there were 41 women, who were divorced, widowed or had been abandoned by the father of the index child. For these families, the data of the father of the index child was not assessed.

The previous table shows that the majority of the income or food generating activities is performed by the fathers. Most of the work done by women is summarised under ‘no formal occupation’, which basically means all sorts of household chores. Only about one third of the mothers contributes financially to the living of her family.
68.0% (n= 132) of the urban as opposed to 62.2% (n = 135) of the rural mothers were without formal occupation.

4.1.2 Household food security[a]

In the interview, usual times of food insecurity were assessed. 31.4 % (n = 61) of urban and 91.7% (n = 199) of rural households reportedly suffered from times of food shortage at some point during the year.
Graph 4 shows during which months this food shortage is experienced in urban and rural households.

Graph 4: Times of food shortage in urban and rural households (n = 411, multiple specifications possible)



Overall, there were at all times during the last year about 4 times more rural than urban households suffering from food shortage. The peak times of food shortage were the same in urban and rural areas, i.e. June to September.

9.3% (n = 18) of the urban and 25.8% (n = 56) of the rural mothers outlined that they did not keep any stocks at all at the time of the interview. They always bought the food for the next day (or few days) only. The mothers in the rural area often mentioned that food from the next agricultural season was not yet ready to be harvested and the stocks of the last harvest were already used up.

4.1.3 Characteristics of the children

4.1.3.1 Age and sex of the children

The age distribution is shown in table 15.

Table 15: Age distribution of the children assessed in the study

Age (months)	HNRS		Urban		Rural	
	Number of children	%	Number of children	%	Number of children	%
Age unknown	6	1.5	0	0.0	6	2.8
< 12	53	12.9	31	16.0	22	10.1
12 to 23.9	119	29.0	57	29.4	62	28.6
24 to 35.9	114	27.7	50	25.8	64	29.5
36 to 47.9	74	18.0	32	16.5	42	19.4
48 to 59.9	45	10.9	24	12.4	21	9.7
Total	411	100.0	194	100.0	217	100.0

The next table shows the sex distribution of the surveyed children.

Table 16: Sex distribution of the children assessed in the study

	HNRS		Urban		Rural	
	Number	Percentage	Number	Percentage	Number	Percentage
Boy	193	47.0	88	45.4	105	48.4
Girl	218	53.0	106	54.6	112	51.6
Total	411	100.0	194	100.0	217	100.0

[a] Household food security is defined as accessibility of households at all times to adequate foods both in terms of quantity and quality for a healthy life (UNICEF, 1993).

4.1.3.2 Mother and child parameters

Table 17: Overview over some mother and child parameters (n = 411)

	HNRS		Urban		Rural	
	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD	Range
Age of the mother (years)	27.8 ± 6.4	16 - 49	27.0 ± 6.3	16 - 48	28.5 ± 6.4	16 - 49
Number of children born alive per family	3.9 ± 2.7	1 – 15	2.7 ± 2.1	1 – 11	4.9 ± 2.8	1 – 15
Children under five per family	1.5 ± 0.7	1 – 4	1.4 ± 0.6	1 – 3	1.7 ± 0.7	1 – 4
Children who have died under five years of age per family	0.7 ± 1.2	0 – 7	0.2 ± 0.6	0 – 3	1.1 ± 1.4	0 – 7

Table 17 shows that though the average age of urban and rural mothers is comparable, rural mothers had on average about twice as many children as urban mothers.
In rural families, about 5.5 times as many children as in urban families had died before reaching the age of five.

4.1.3.3 Childcare

Table 18: Hours available for childcare (n = 399)

HNRS		Urban		Rural	
Mean ± SD	Range	Mean ± SD	Range	Mean ± SD	Range
2.7 ± 2.0	0 – 12	3.5 ± 2.2	0 - 12	2.0 ± 1.5	0 - 8

On average, urban mothers spent about twice as much time caring for the index child as rural mothers.
77.8% (n = 151) of urban and 82.9% (n = 180) of rural mothers had somebody to care for their child when they were not available.

Main care persons in addition to the mother were the following:

Table 19: Main caretakers in addition to the mother (multiple specifications possible, n = 411)

Caretakers	Urban		Rural	
	Number	Percentage	Number	Percentage
Older siblings	50	**33.1**	84	**46.7**
Grandparents	43	28.5	48	26.7
Other relatives	26	17.2	29	16.1
A non-relative	25	16.6	14	7.8
Father	9	6.0	6	3.3

In the urban as well as in the rural area, main care persons in addition to the mother were older sisters or brothers, the grandparents or other relatives.

4.1.3.4 Health of the children

39.9% (n = 164) of all children had been sick during the seven days prior to the interview or during the day of the interview, 34.0% (n = 66) of all children in the urban and 45.2% (n = 98) of all children in the rural area. Table 20 shows from which diseases the children suffered according to their mothers' recall (multiple specifications possible).

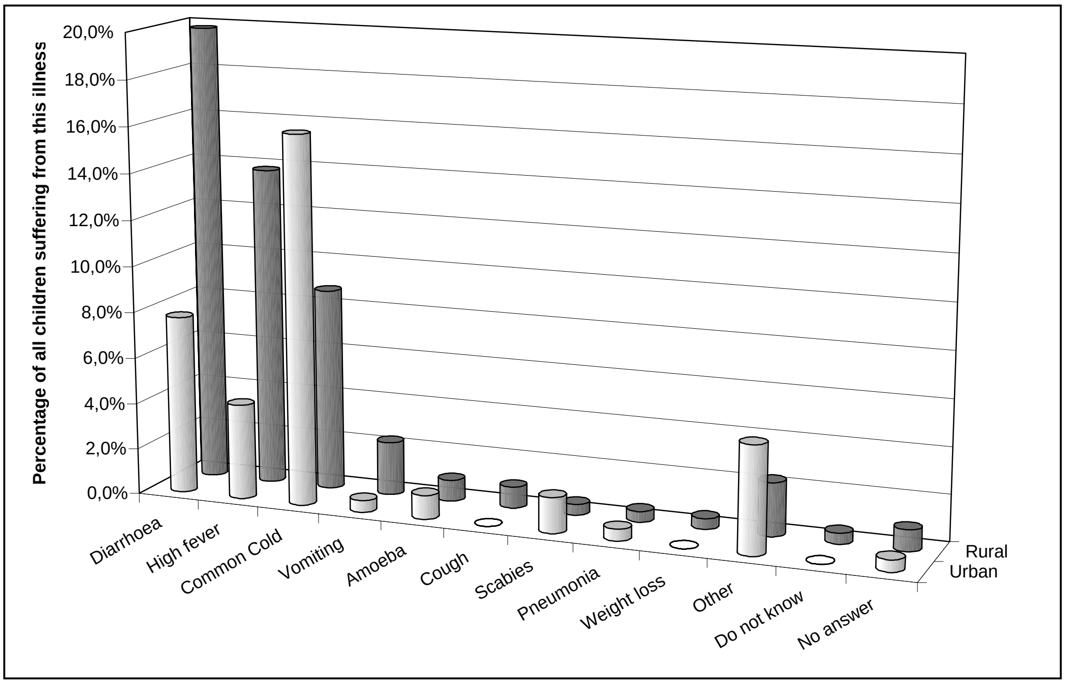
Table 20: List of diseases the sick children suffered from according to their mothers' recall during the seven days prior to the interview or during the day of the interview (n = 164)

Kind of Disease	Number	Percentage
Common Cold	50	30.4
Diarrhoea (> 3 watery stools per day)	59	35.9
High Fever	37	22.6
Vomiting	7	4.3
Amoeba	4	2.4
Scabies	4	2.4
Cough	2	1.2
Pneumonia	2	1.2
Weight Loss	1	0.6
Other	14	8.5
No Answer	3	1.8
Do Not Know	1	0.6

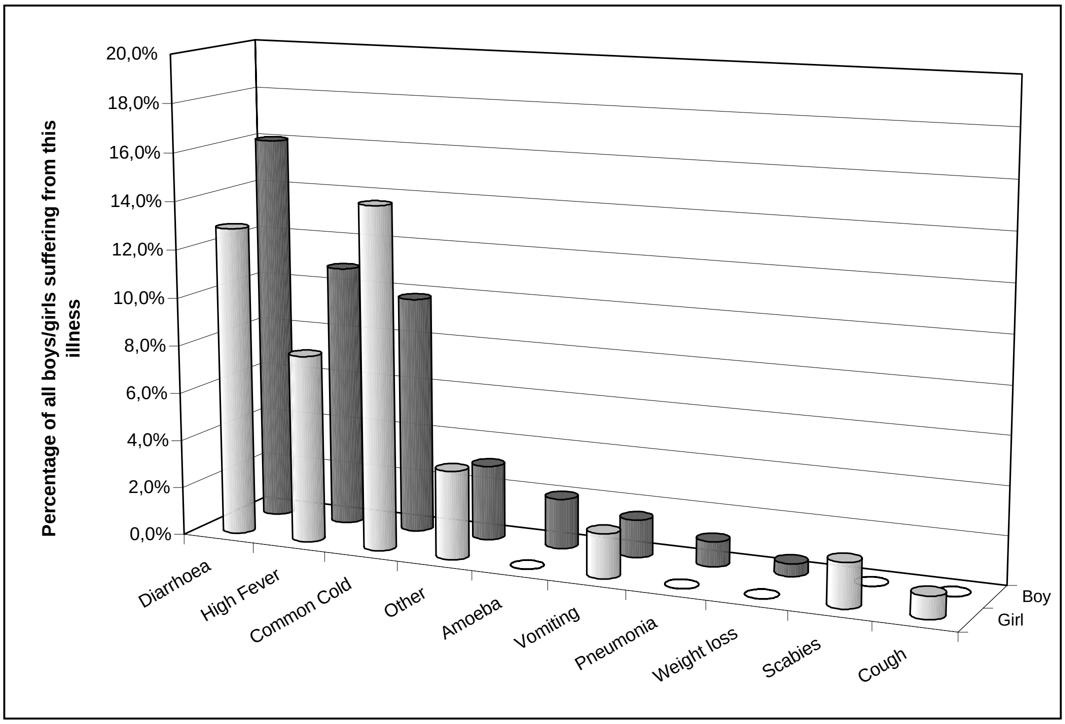
As graph 5 on the following page shows the top three diseases in the urban area were common cold, diarrhoea and high fever, whereas in the rural area most children suffered from diarrhoea followed by high fever and common cold.
Graph 6 on the next page displays the sex specific morbidity. Though the ranking of the diseases varied among boys and girls, a similar percentage of both sexes, i.e. 39.4% (n = 76) of all boys and 40.6% (n = 88) of all girls, was sick in the assessment period.
Graph 7 and graph 8 show the kind of treatment the mothers would choose for a child if it suffered from marasmus or kwashiorkor. The mothers were shown pictures of children with marasmus and kwashiorkor and explained the symptoms of the diseases to be sure that they referred to the treatment of these conditions.

41.2% (n = 80) of the urban mothers said that they gave a special diet to their children when they were sick as opposed to only 14.3% (n = 31) in the rural area. The rural mothers often outlined that they simply could not afford it to buy special or extra food for a sick child.

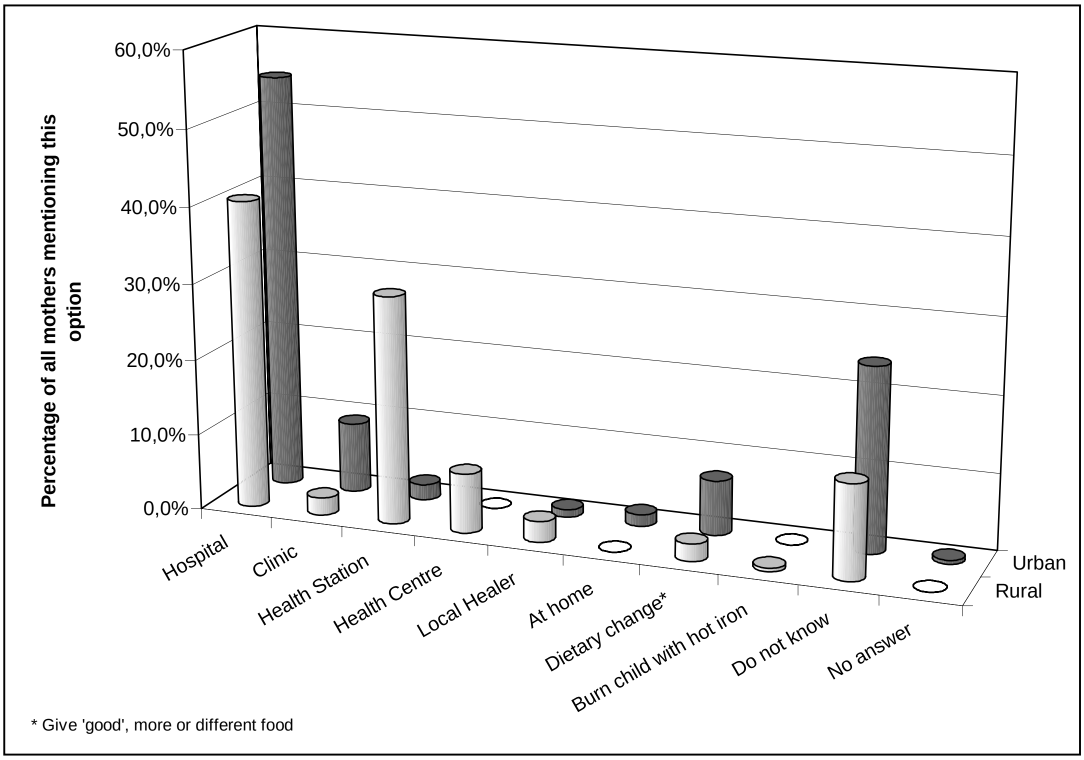
Graph 5: Prevalence of different diseases among children under five in the urban and rural areas (n = 164, multiple specifications possible) during the seven days prior to the interview or during the day of the interview



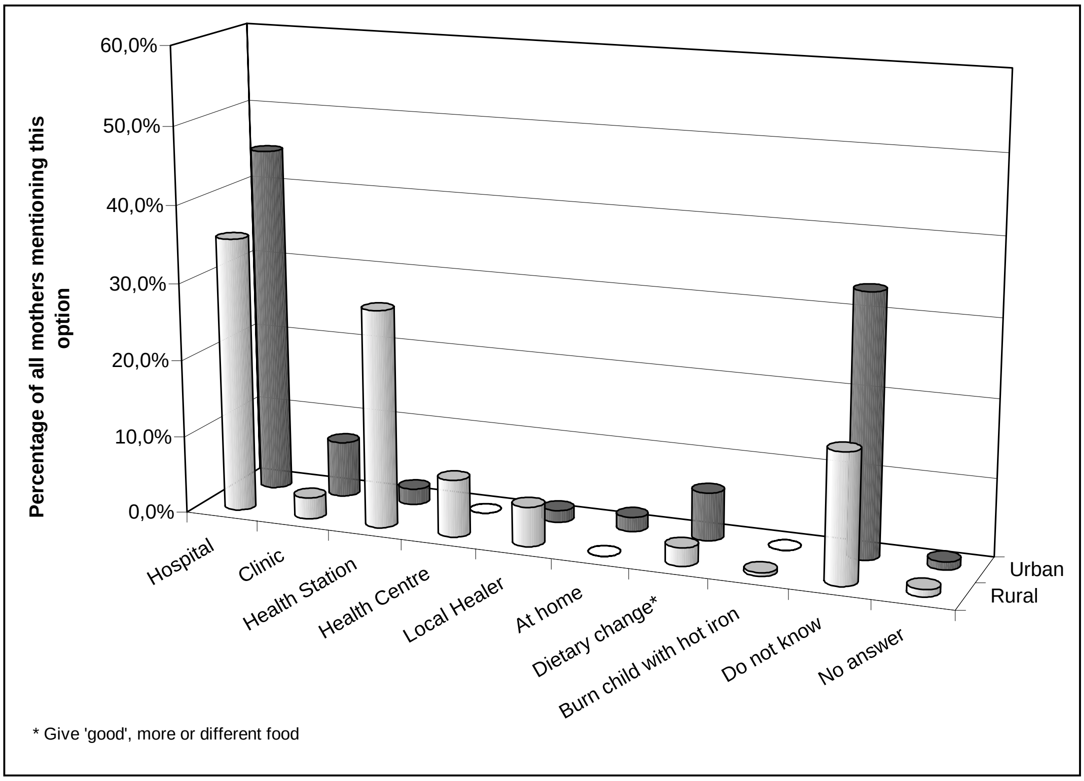
Graph 6: Prevalence of different diseases among boys and girls during the seven days prior to the interview or during the day of the interview (n = 164, multiple specifications possible)



Graph 7: Marasmus treatment that the interviewed mothers would choose for a child having the condition (n = 411, multiple specifications possible)



Graph 8: Kwashiorkor treatment that the interviewed mothers would choose for a child having the condition (n = 411, multiple specifications possible)



4.2 Infant and child feeding practices

4.2.1 Practice of pre-lacteal feeding

The following tables show, how many children received pre-lacteal feeding and what kind of food/fluids they received.

Pre-lacteal feeding was about 1.8 times more common in the rural than in the urban area. A solution of water and sugar was the type of feed most frequently given in both areas.

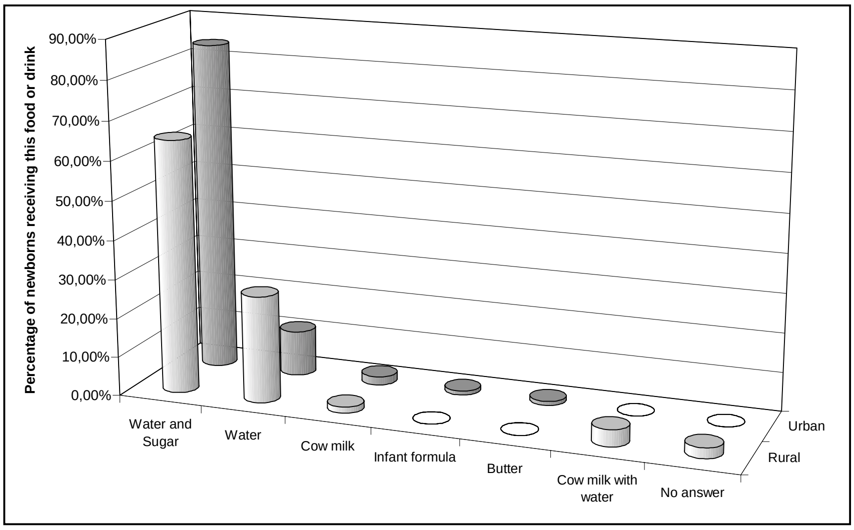
Table 21: Children receiving pre-lacteal feeding

HNRS		Urban		Rural	
Number	Percentage	Number	Percentage	Number	Percentage
282 of 411	68.6	95 of 194	49.0	187 of 217	86.2

Table 22: Kind of pre-lacteal feeds (n = 282, multiple specifications possible)

Kind of pre-lacteal feeds	Number of children	Percentage of children
Water and sugar	201	**71.3**
Water	62	22.0
Cow milk with water	8	2.8
Cow milk	5	1.8
Butter	1	0.35
Infant formula	1	0.35
No answer	5	1.8

Graph 9: Type of pre-lacteal foods given to newborns in the urban and rural area (n = 282, multiple specifications possible)



4.2.2 Breastfeeding and complementary[a] feeding practice

95.6% (n = 393) of all children were fed colostrum.

The reasons for not feeding colostrum were that

- the baby might get sick of it (n = 4)
- it is not good (n = 5)
- it is fatty and discoloured and therefore not good for the baby (n = 1)
- the mother did not like the colour and consistency (n = 2)
- the mother was sick after birth (n = 1)
- the mother had breast pain (n = 2) or
- the baby refused to drink it (n = 2).

One mother did not want to explain the reason why she had not fed colostrum to her baby.

Of all children, 64.2% (n = 264) were not fed breastmilk any more at the time of the interview, 35.8% (n = 147) were still breastfed.

Table 23: Overview over breastfeeding parameters

	HNRS		Urban		Rural	
	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD	Range
Exclusive/predominant breastfeeding[b] in months (n = 411)	5.1 ± 2,6	0 – 26	5.1 ± 2.9	0 – 26	5.0 ± 2.3	0 – 24
Total duration of breastfeeding in months[c] (n_{urban} = 119 and n_{rural} = 145)	17.7 ± 7.9	0 – 38	16.5 ± 9.1	0 – 38	18.7 ± 6.6	0 – 36

[a] The formerly used term ‘weaning’ has been replaced by the term ‘complementary feeding’, because weaning often implied that the children did not receive breastmilk any more at all. If the term weaning is used in this thesis it is quoted from a study.

[b] Exclusive breastfeeding means per definition that no other foods/fluids, including pre-lacteal feedings, are given to the child except breastmilk whereas predominant breast-feeding means that a child does receive breastmilk and water or water-based drinks (WHO/NUT, 1996).

[c] The duration of exclusive/predominant breastfeeding in months is approximately equivalent to the age at introduction of complementary foods in months.

Table 24: Overview over some complementary feeding[a] parameters

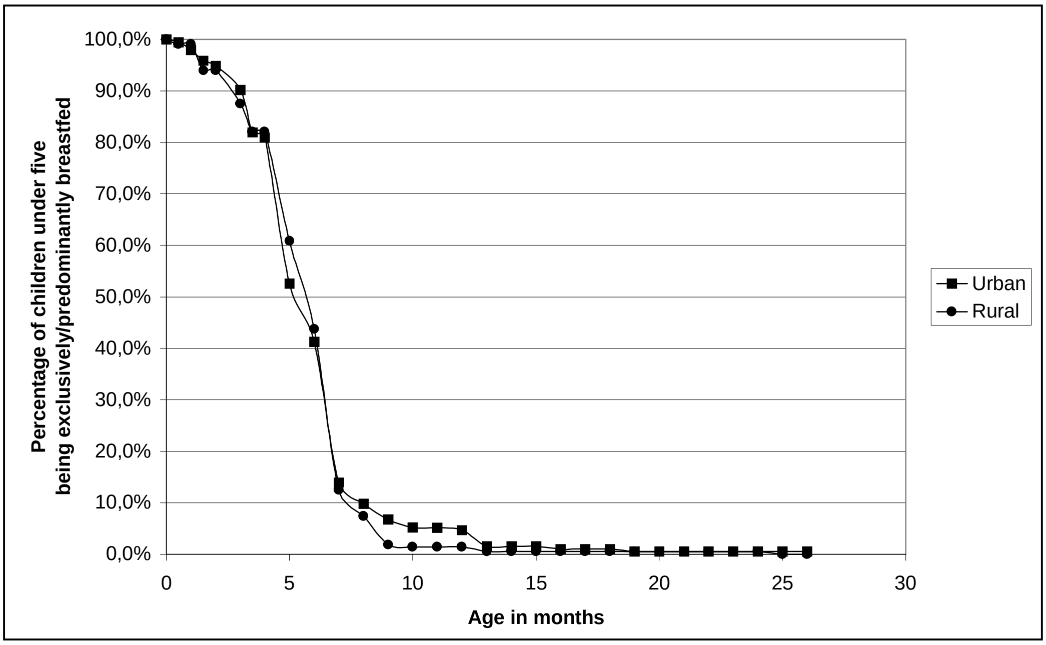
	HNRS		Urban		Rural	
	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD	Range
Age (months) at introduction of complementary food	5.1 ± 2,6	0 – 26	5.1 ± 2.9	0 – 26	5.0 ± 2.3	0 – 24
Number of complementary meals per day	3.9 ± 1.0	2 – 6	3.9 ± 1.0	2 – 6	3.9 ± 0.8	2 – 5
Age of children (months) still breastfed at the time of interview	15.5 ± 7.2		15.8 ± 7.8		15.1 ± 6.4	
Age of children (months) no longer breastfed at the time of interview	34.7 ± 12.1		35.2 ± 13.4		34.3 ± 11.0	
Number of meals/day	3.9 ± 1.0	2 – 7	4.4 ± 0.9	3 – 7	3.9 ± 1.0	2 – 5

Overall, the breastfeeding parameters were similar in urban and rural areas. One marked difference though was that children in town who were no longer breastfed at the time of interview received about one meal more per day than the respective children in the rural area.

The following graphs show what percentage of the children was still exclusively/predominantly breastfed at a certain age, the time of introduction of complementary food for all children under five and the total time of breastfeeding for all children who were no longer breastfed at the time of the interview.

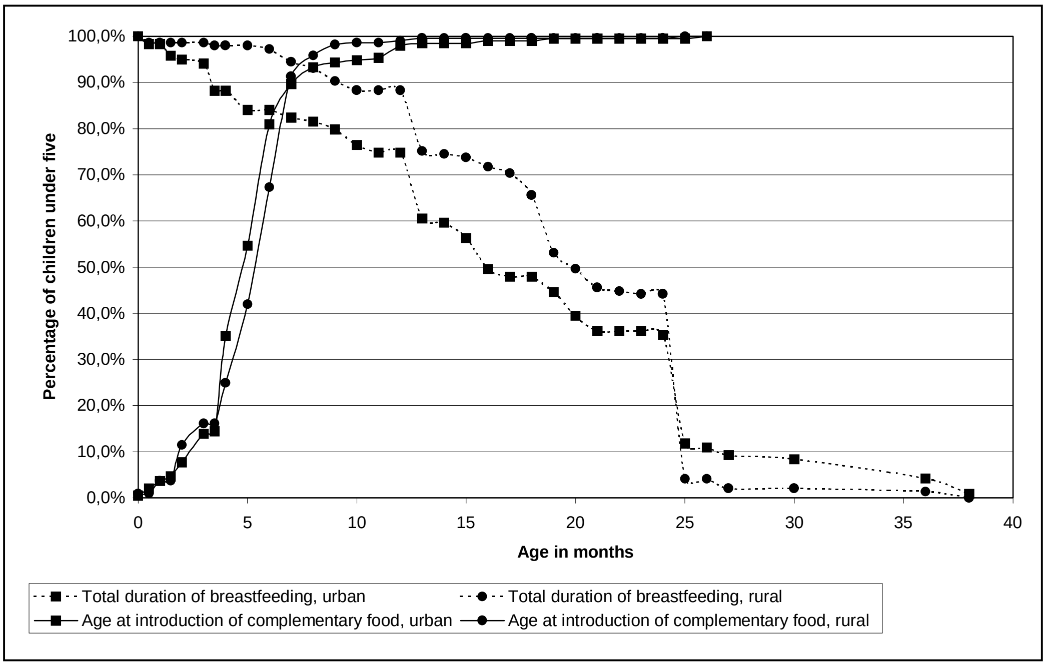
[a] Complementary foods are any non-breastmilk foods or fluids given to young children in order to gradually replace breastmilk (Academy for Educational Development, 1999).

Graph 10: Duration of exclusive/predominant breastfeeding (n = 411)



The duration of exclusive/predominant breastfeeding was similar in urban and rural areas. From seven months onwards, the percentage of mothers who were still exclusively/predominantly breastfeeding was slightly higher in town.

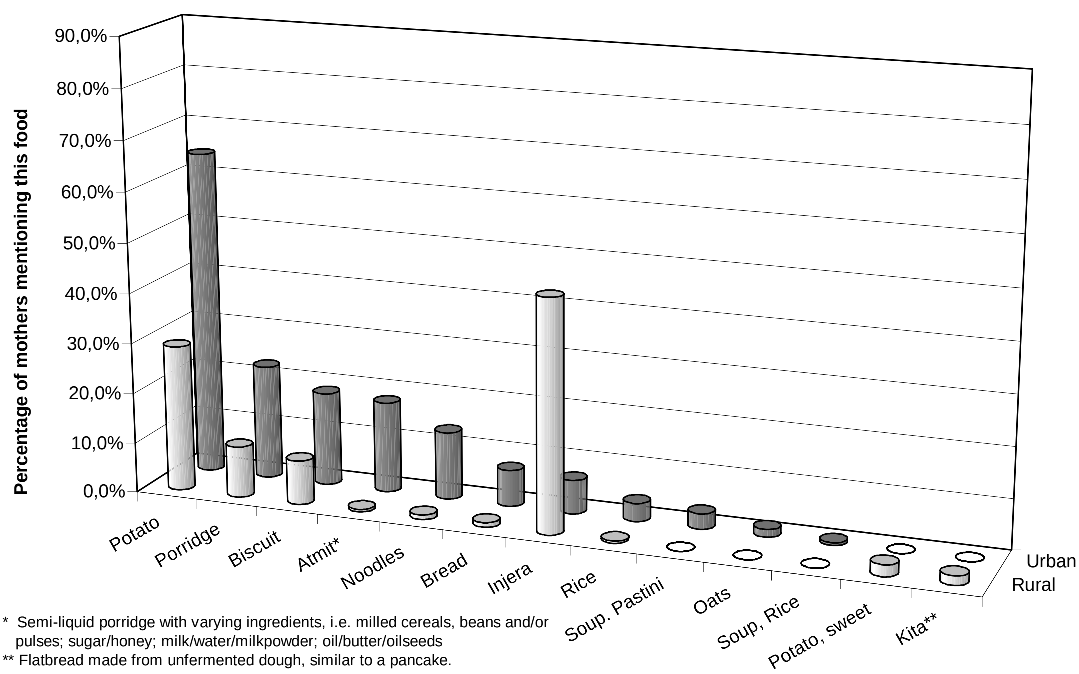
Graph 11: Total duration of breastfeeding (n = 264) and age at introduction of complementary food (n = 411) urban versus rural



Overall, the mothers in town introduced complementary food at a slightly earlier age. The total duration of breastfeeding was in general higher in the rural area.

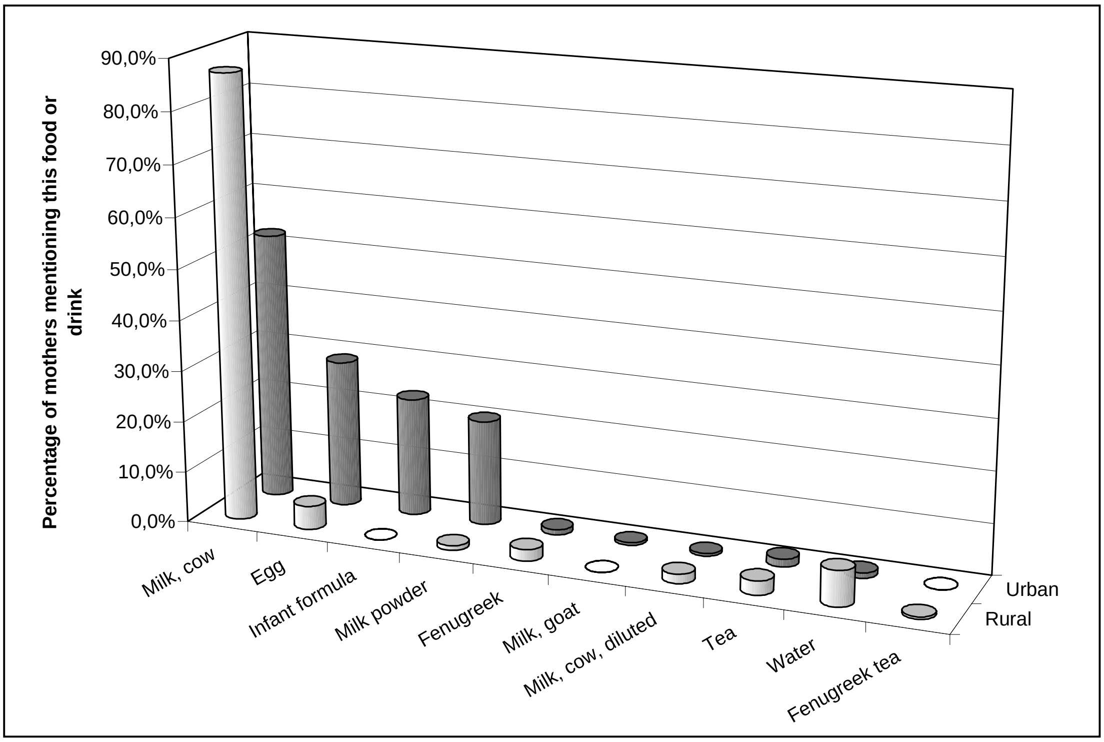
As for the type of first complementary foods given, the following graphs demonstrate that there were differences between the rural and the urban area both in the overall number of complementary foods and in the ranking of the foods. Multiple specifications of complementary foods given to the child were possible.
In the urban area, potatoes, porridge and biscuits ranked first among the starchy foods. In the rural area, the favourites were injera, potatoes and biscuits. Among the protein rich foods, cow milk, egg and infant formula were mentioned most in the urban area and cow milk, egg and cow milk with sugar in the rural area. As for fruits and vegetables, carrots, oranges and mangoes were the favourites in town. In the rural area, only three fruits and vegetables (kale, mango and 'vegetables' without further specification which ones) were mentioned at all. There were some foods of other categories as well, like Wot, butter or linseed, but only a very small number of mothers (n = 6) mentioned them.

Graph 12: Ranking of first complementary foods – starchy foods

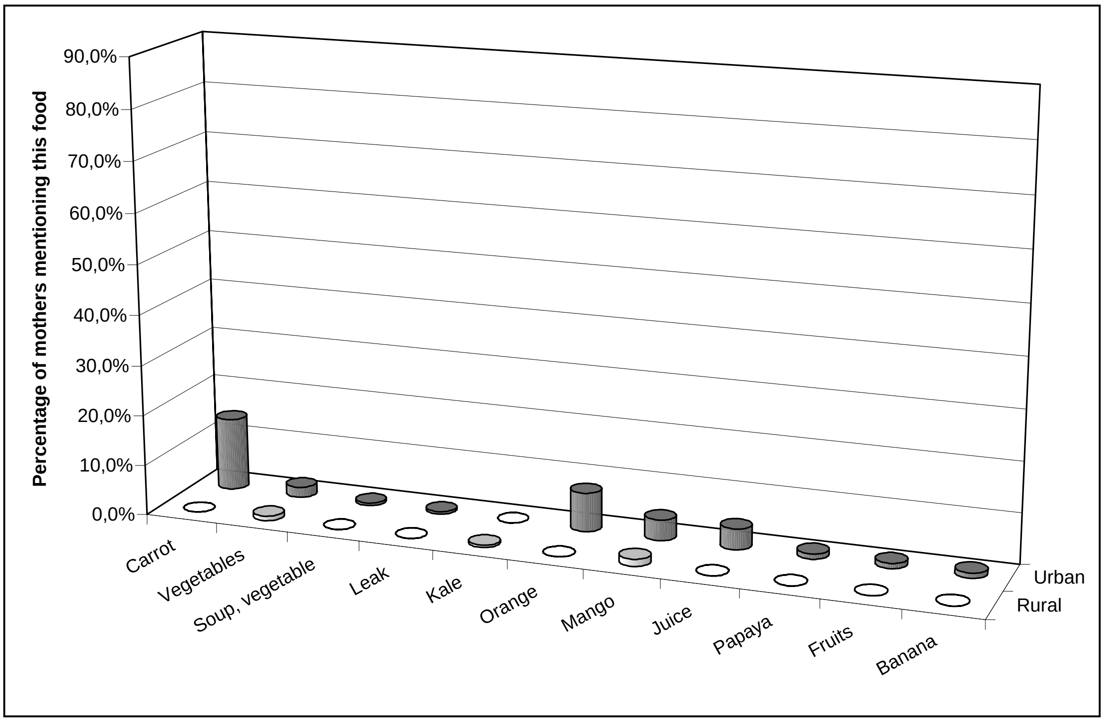


* Semi-liquid porridge with varying ingredients, i.e. milled cereals, beans and/or pulses; sugar/honey; milk/water/milkpowder; oil/butter/oilseeds
** Flatbread made from unfermented dough, similar to a pancake.

Graph 13: Ranking of first complementary foods – protein rich foods and drinks



Graph 14: Ranking of first complementary foods – fruits and vegetables



4.3 Anthropometry

The following tables give an overview over the total number of questionnaires for the different study variables, the number of valid questionnaires for each index and indicator of malnutrition assessed and the number and percentage of children whose WAZ, HAZ and WHZ was < -2 SD, whose MUAC was ≤ 13.5 cm and who had oedema. All children < 12 months (n = 53) were excluded for the assessment of MUAC, as MUAC is relatively independent of age only from one to five years of age (Savage King et al., 1993). 6 children whose age could not be assessed were excluded as well from MUAC analysis. Children with oedematous malnutrition (n = 14) were excluded from MUAC analysis, because the oedema distort the WAZ/WHZ index. The MUAC - classification would in these cases not correspond to the classification with WAZ/WHZ.

Table 25: Overview over the total number of questionnaires for sex and age, the number of valid questionnaires for each index and indicator of malnutrition assessed and the number and percentage of children whose z-scores were < -2 SD, whose MUAC was ≤ 13.5 cm and who had oedema

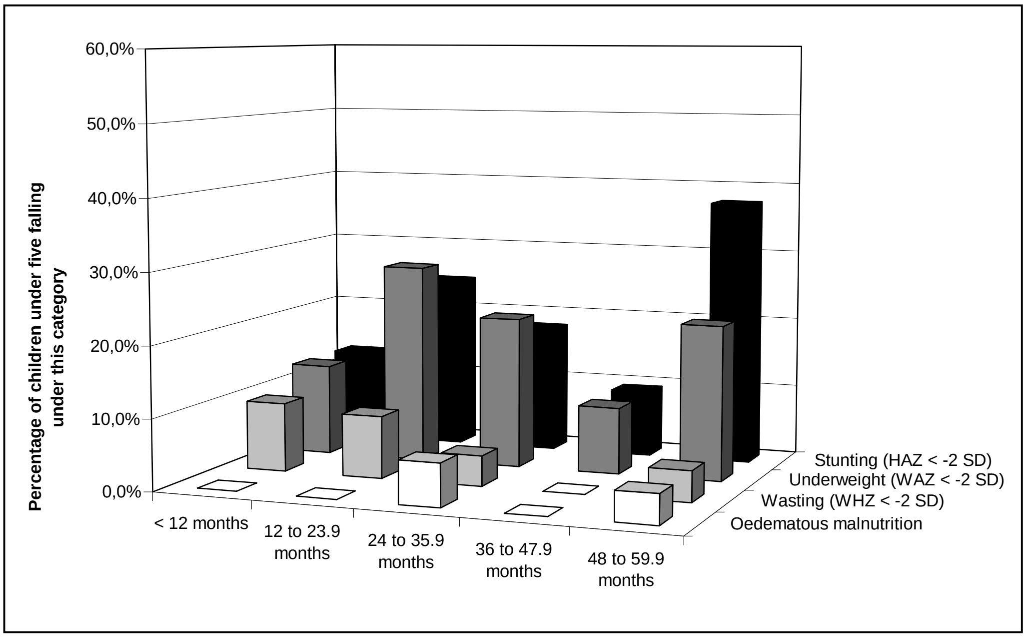
Variable (total n)	WAZ < -2 SD	HAZ < -2 SD	WHZ < -2 SD	MUAC ≤ 13.5 cm	Oedema
Sex					
Male (n = 193)	33.9% (n = 62/183)	35.4% (n = 67/189)	10.2% (n = 19/187)	15.8% (n = 25/158)	2.6% (n = 5/193)
Female (n = 218)	27.1% (n = 56/208)	28.7% (n = 62/216)	8.1% (n = 17/209)	23.9% (n = 43/180)	4.1% (n = 9/218)
Age (months)					
< 12 (n = 53)	17.0% (n = 9/53)	15.1% (n = 8/53)	9.4% (n = 5/53)	-	0.0% (n = 0/53)
12 – 23.9 (n = 119)	32.5% (n = 37/114)	36.1% (n = 43/119)	**9.6%** (n = 11/114)	**34.2%** (n = 36/114)	4.2% (n = 5/119)
24 – 35.9 (n = 114)	**38.3%** (n = 41/107)	33.3% (n = 38/114)	8.4% (n = 9/107)	18.5% (n = 20/108)	5.3% (n = 6/114)
36 – 47.9 (n = 74)	25.7% (n = 19/74)	28.4% (n = 21/74)	8.1% (n = 6/74)	12.2% (n = 9/74)	0.0% (n = 0/74)
48 – 59.9 (n =45)	28.6% (n = 12/42)	**42.2%** (n = 19/45)	4.8% (n = 2/42)	7.1% (n = 3/42)	**6.7%** (n = 3/45)

Table 26: Survey of the total number of questionnaires for the different study regions, the number of valid questionnaires for each index and indicator of malnutrition assessed and the number and percentage of children whose z-scores were < -2 SD, whose MUAC was ≤ 13.5 cm and who had oedema

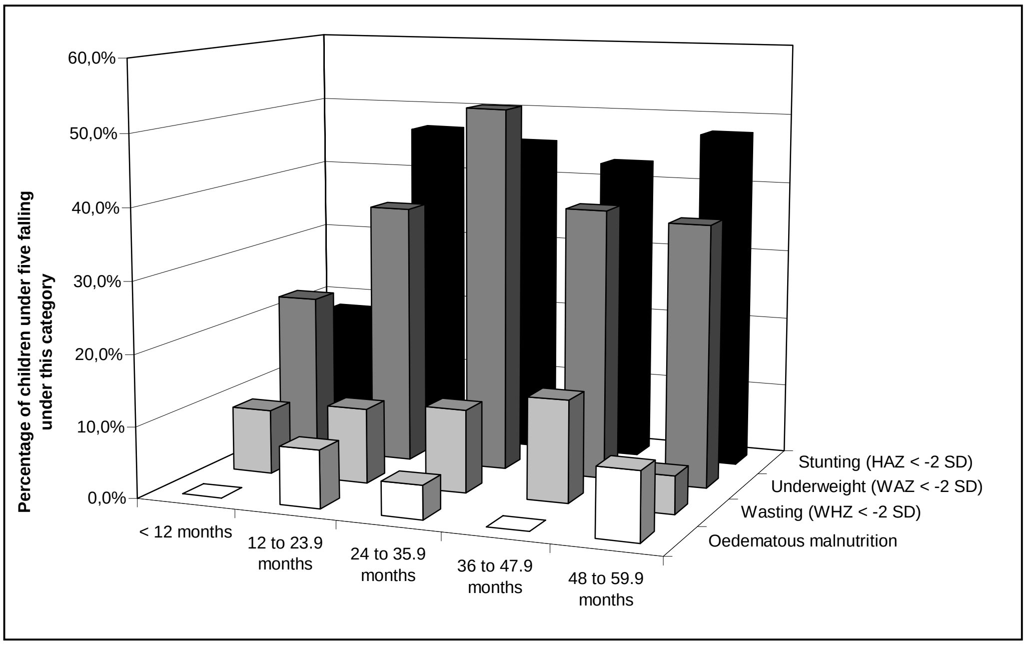
Variable (total n)	WAZ < -2 SD	HAZ < -2 SD	WHZ < -2 SD	MUAC ≤ 13.5 cm	Oedema
Urban (n = 194)	20.0% (n = 38/190)	20.6% (n = 40/194)	5.8% (n = 11/190)	11.3% (n = 18/159)	**2.1%** (n = 4/194)
Kebele 02 (n = 29)	14.3% (n = 4/28)	20.7% (n = 6/29)	7.1% (n = 2/28)	4.0% (n = 1/25)	**3.4%** (n = 1/29)
Kebele 06 (n = 18)	11.8% (n = 2/17)	16.7% (n = 3/18)	5.9% (n = 1/17)	6.7% (n = 1/15)	**5.6%** (n = 1/18)
Kebele 08 (n = 41)	20.0% (n = 8/40)	17.1% (n = 7/41)	5.0% (n = 2/40)	**20.6%** (n = 7/34)	**2.4%** (n = 1/41)
Kebele 13 (n = 34)	20.6% (n = 7/34)	17.6% (n = 6/34)	2.9% (n = 1/34)	7.7% (n = 2/26)	0.0% (n = 0/34)
Kebele 17 (n = 36)	16.7% (n = 6/36)	22.2% (n = 8/36)	5.6% (n = 2/36)	13.3% (n = 4/30)	0.0% (n = 0/36)
Kebele 19 (n = 36)	**31.4%** (n = 11/35)	**25.0%** (n = 9/36)	**8.6%** (n = 3/35)	10.3% (n = 3/29)	**2.8%** (n = 1/36)
Rural (n = 217)	40.0% (n = 80/200)	42.7% (n = 100/211)	12.1% (n = 25/206)	27.9% (n = 50/179)	**4.6%** (n = 10/217)
Hasengey (n = 36)	39.4% (n = 13/33)	41.7% (n = 15/36)	12.2% (n = 4/33)	**41.9%** (n = 50/179)	**5.6%** (n = 2/36)
Miai (n = 36)	28.6% (n = 10/35)	44.4% (n = 16/36)	5.7% (n = 2/35)	9.75% (n = 3/31)	**2.8%** (n = 1/36)
Sofi (n = 36)	37.5% (n = 12/32)	41.7% (n = 15/36)	**15.6%** (n = 5/32)	39.3% (n = 11/28)	**11.1%** (n = 4/36)
Awberkele (n = 36)	55.6% (n = 20/36)	**55.6%** (n = 20/36)	11.1% (n = 4/36)	36.4% (n = 12/33)	0.0% (n = 0/36)
Erer Kile (n = 37)	38.2% (n = 13/34)	41.7% (n = 15/36)	14.3% (n = 5/35)	20.0% (n = 6/30)	**5.4%** (n = 2/37)
Erer Woldia (n = 36)	**40.0%** (n = 12/30)	29.0.% (n = 9/31)	14.3% (n = 5/35)	19.2% (n = 5/26)	**2.8%** (n = 1/36)

4.3.1 Prevalence of stunting, underweight, wasting (HAZ, WAZ or WHZ < -2 SD) and oedematous malnutrition according to age

Graph 15: Prevalence of stunting, underweight, wasting (HAZ, WAZ or WHZ < -2 SD) and oedematous malnutrition in the different age categories, urban

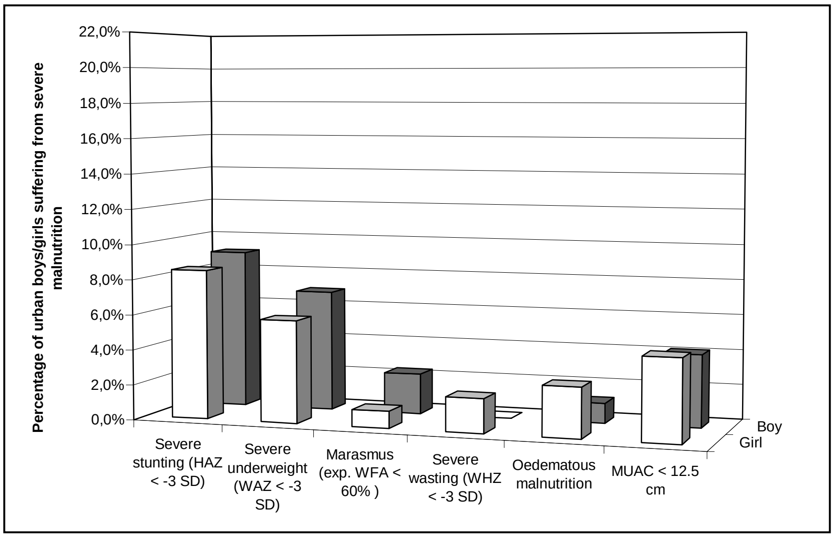


Graph 16: Prevalence of stunting, underweight, wasting (HAZ, WAZ or WHZ < -2 SD) and oedematous malnutrition in the different age categories, rural

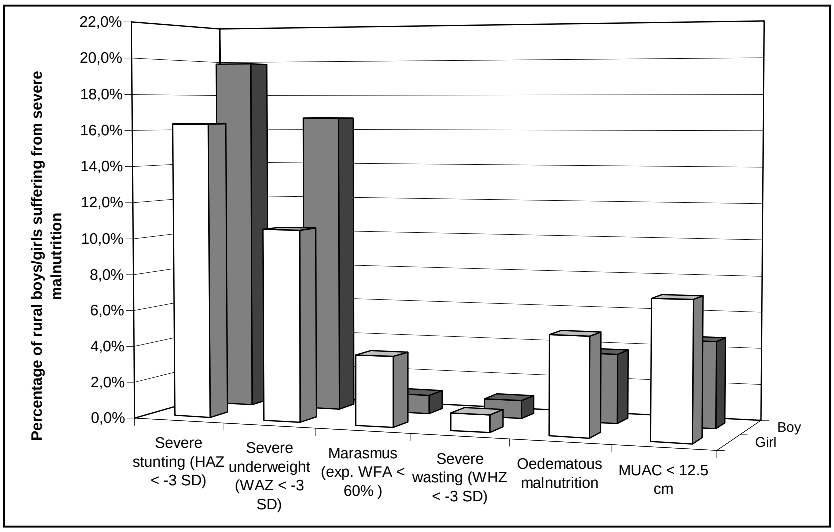


4.3.2 Prevalence of severe malnutrition (HAZ, WAZ or WHZ < -3 SD, oedematous malnutrition, MUAC < 12.5 cm) according to sex

Graph 17: Prevalence of severe malnutrition (HAZ, WAZ or WHZ < -3 SD, marasmus, oedematous malnutrition, MUAC < 12.5 cm) according to sex, urban



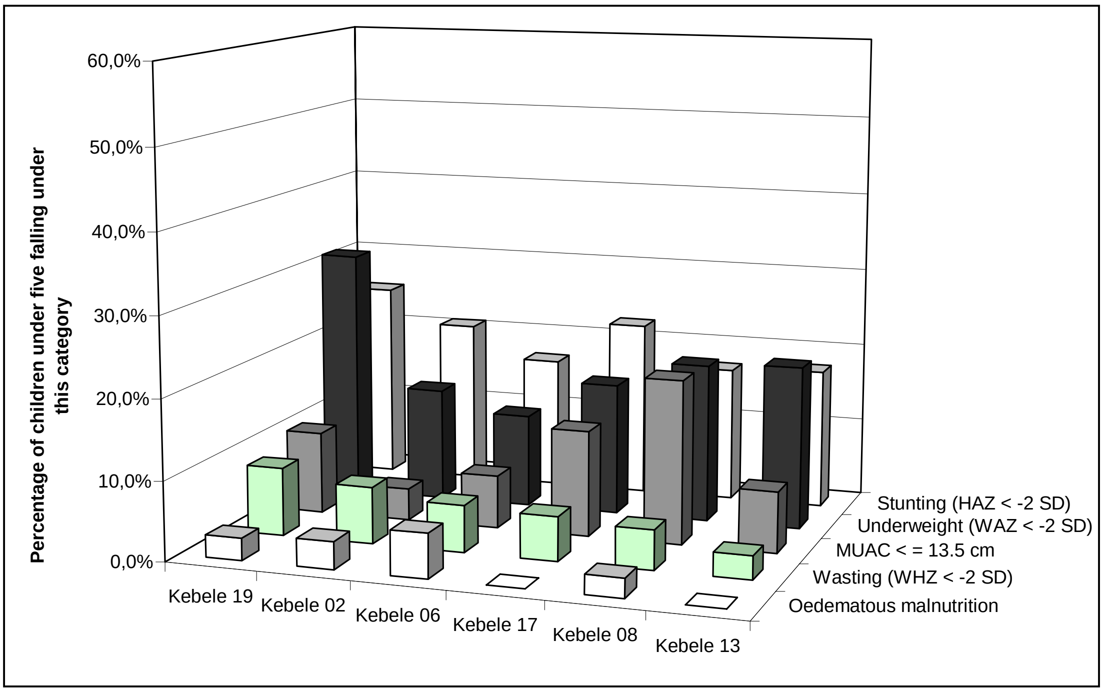
Graph 18: Prevalence of severe malnutrition (HAZ, WAZ or WHZ < -3 SD, marasmus, oedematous malnutrition, MUAC < 12.5 cm) according to sex, rural



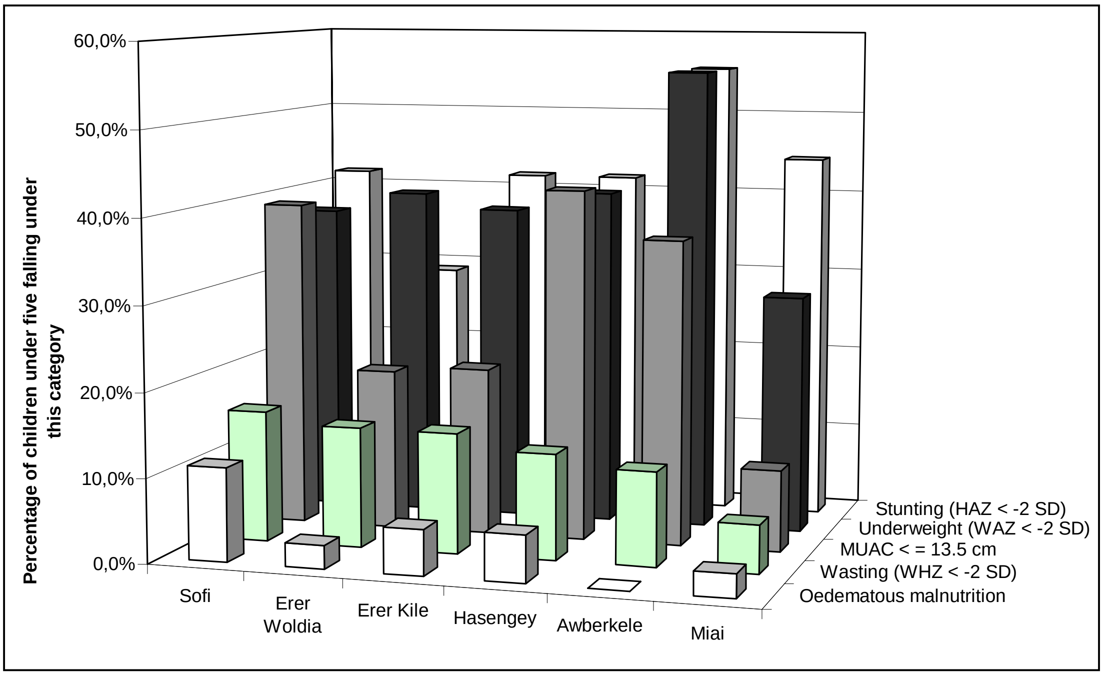
In urban and rural areas, boys suffered more from severe stunting and underweight than girls did. Girls however were overall more affected by oedematous malnutrition and in town also suffered more from severe wasting. The percentage of girls with marasmus and MUAC < 12.5 cm was only higher in the rural area. The percentage of boys and girls in town with MUAC < 12.5 cm as well as the percentage of rural boys and girls affected by severe wasting was comparable.

4.3.3 Overall prevalence of malnutrition (HAZ, WAZ or WHZ < -2 SD, oedematous malnutrition, MUAC ≤ 13.5 cm) in urban and rural areas

Graph 19: Overall prevalence of malnutrition (HAZ, WAZ or WHZ < -2 SD, oedematous malnutrition, MUAC ≤ 13.5 cm) in the urban area

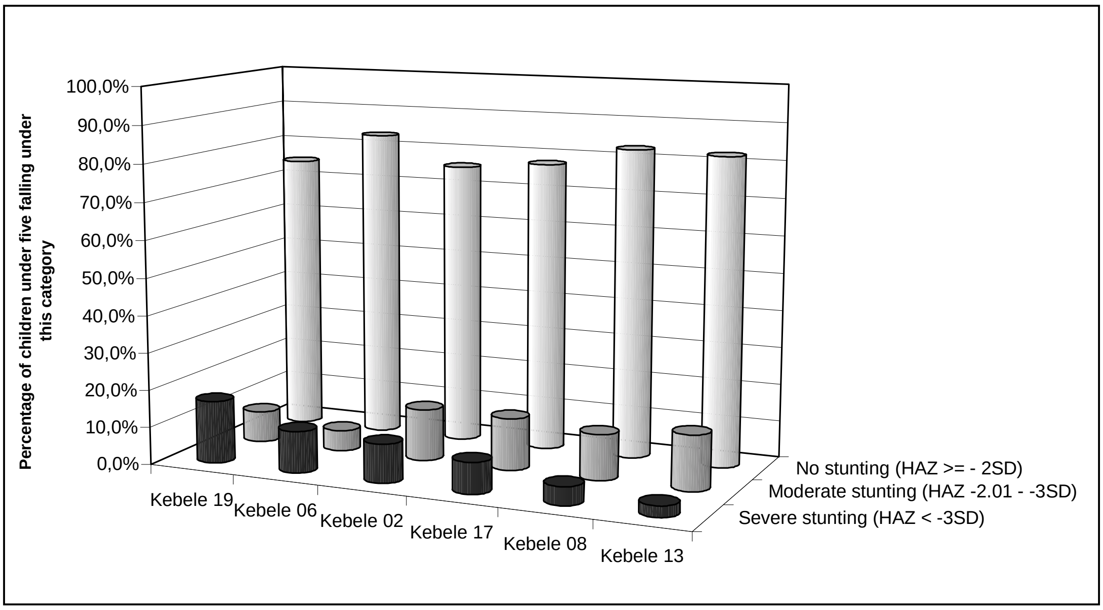


Graph 20: Overall prevalence of malnutrition (HAZ, WAZ or WHZ < -2 SD, oedematous malnutrition, MUAC ≤ 13.5 cm) in the rural area

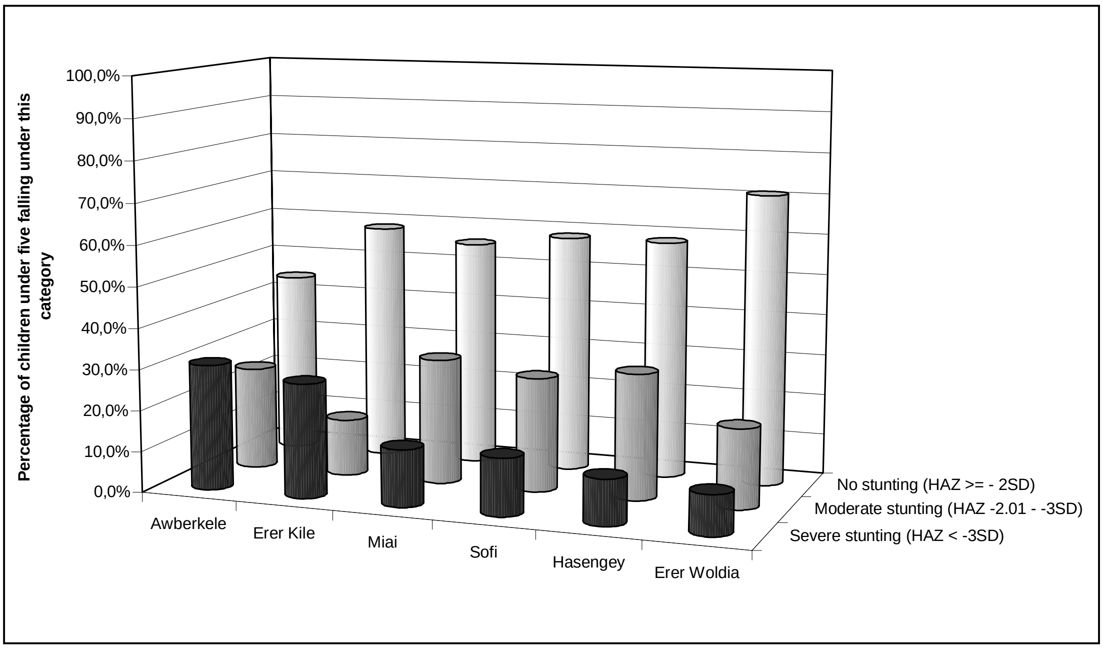


4.3.4 Prevalence of stunting, underweight and wasting according to administrative districts

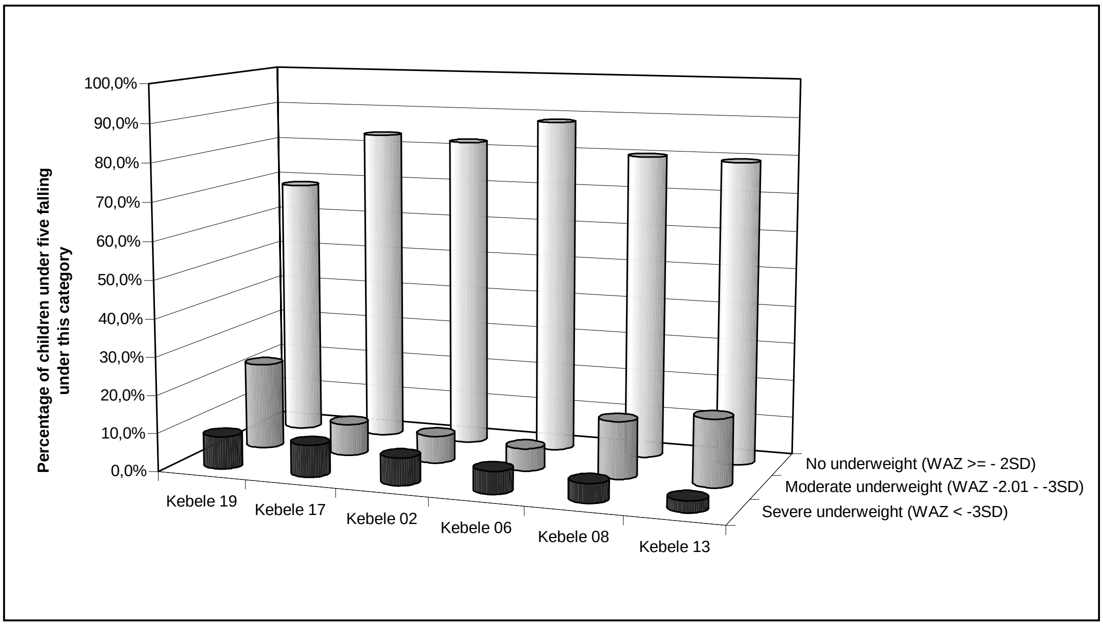
Graph 21: Prevalence of stunting (HAZ < -2 SD) according to urban administrative districts (Kebeles) (n = 194)



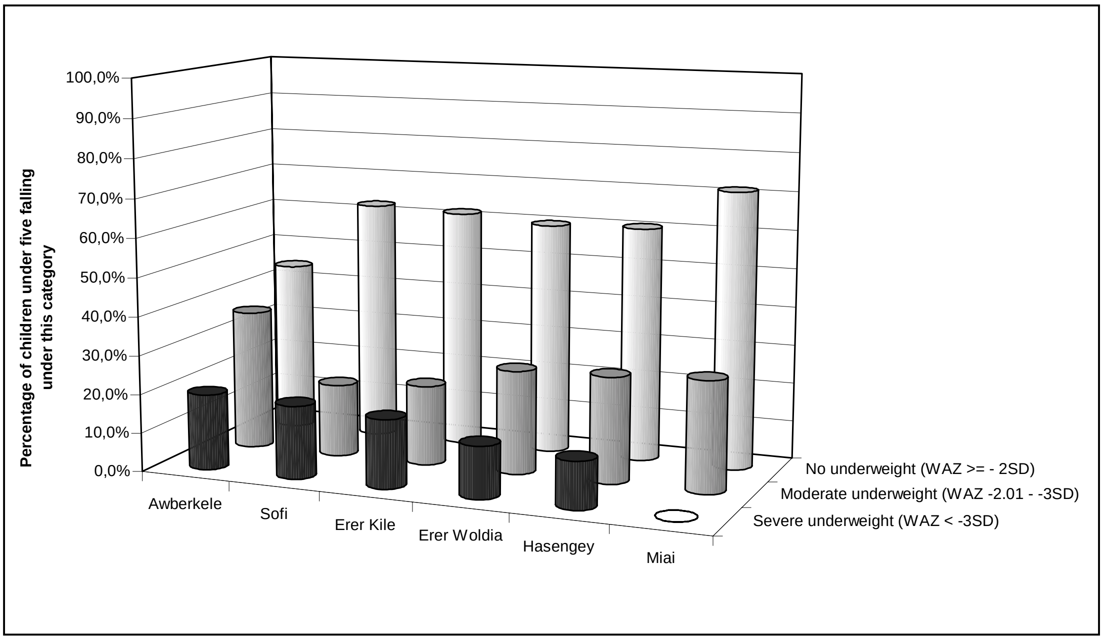
Graph 22: Prevalence of stunting (HAZ < -2 SD) according to rural administrative districts (Peasant Associations) (n = 211)



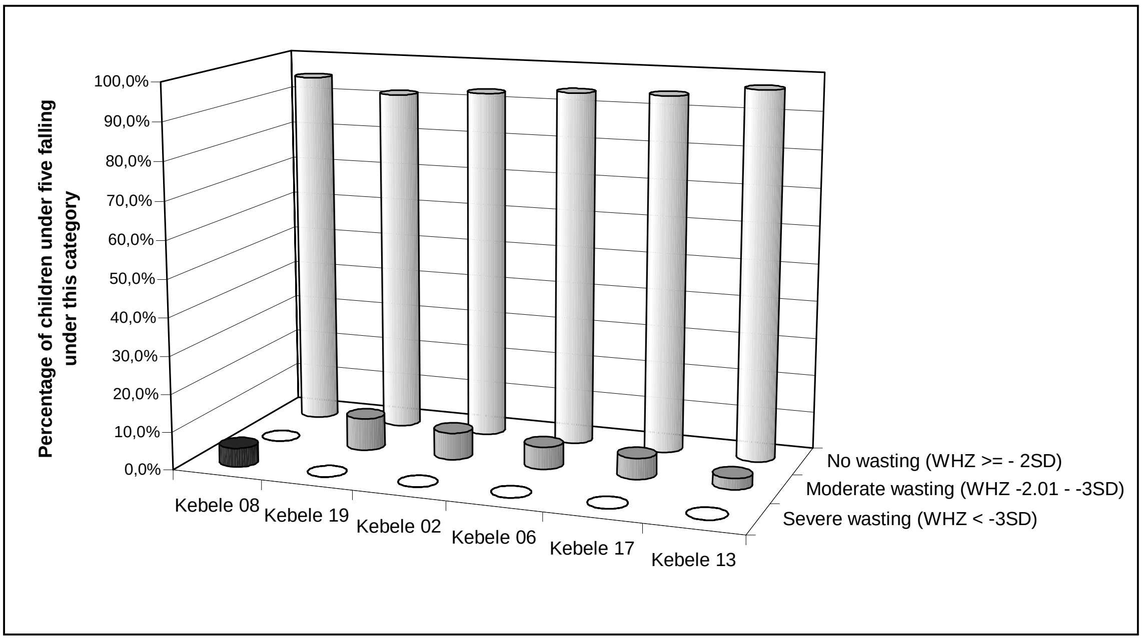
Graph 23: Prevalence of underweight (WAZ < -2 SD)) according to urban administrative districts (Kebeles) (n = 190)



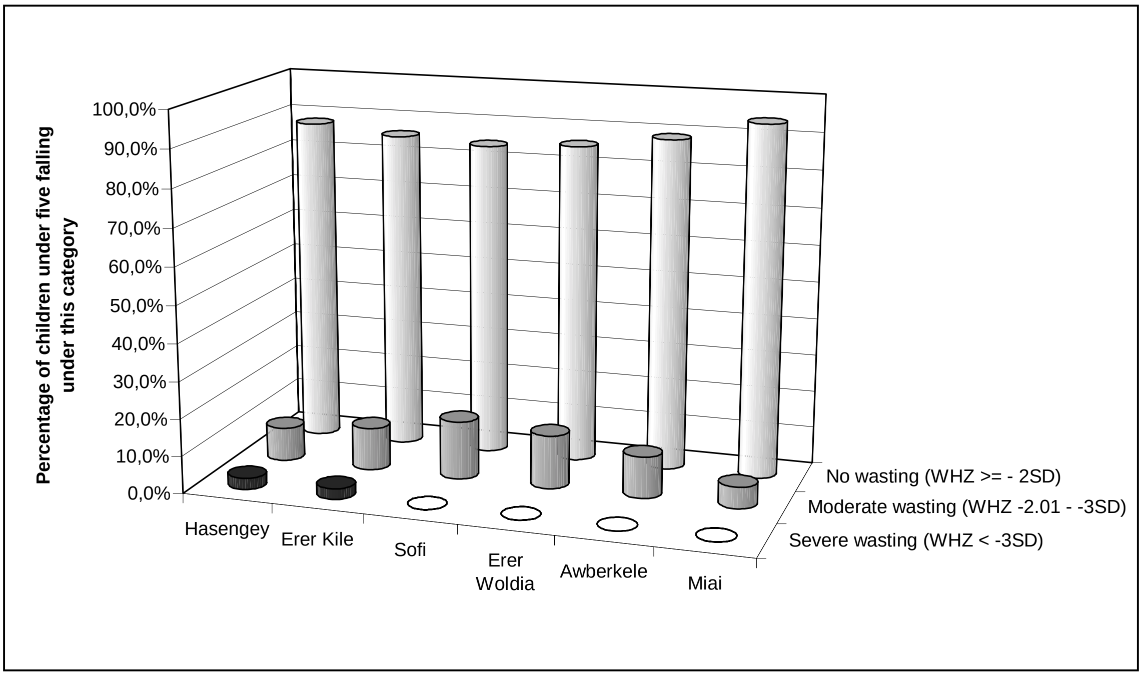
Graph 24: Prevalence of underweight (WAZ < -2 SD) according to rural administrative districts (Peasant Associations) (n = 200)



Graph 25: Prevalence of wasting (WHZ < -2 SD)) according to urban administrative districts (Kebeles) (n = 190)

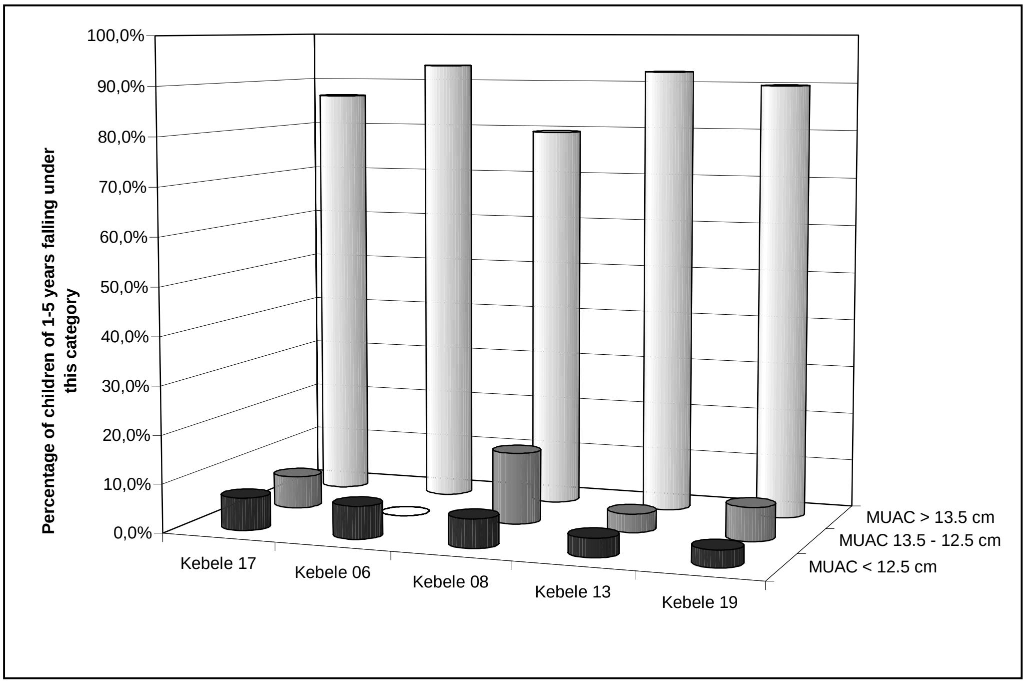


Graph 26: Prevalence of wasting (WHZ < -2 SD) according to rural administrative districts (Peasant Associations) (n = 206)

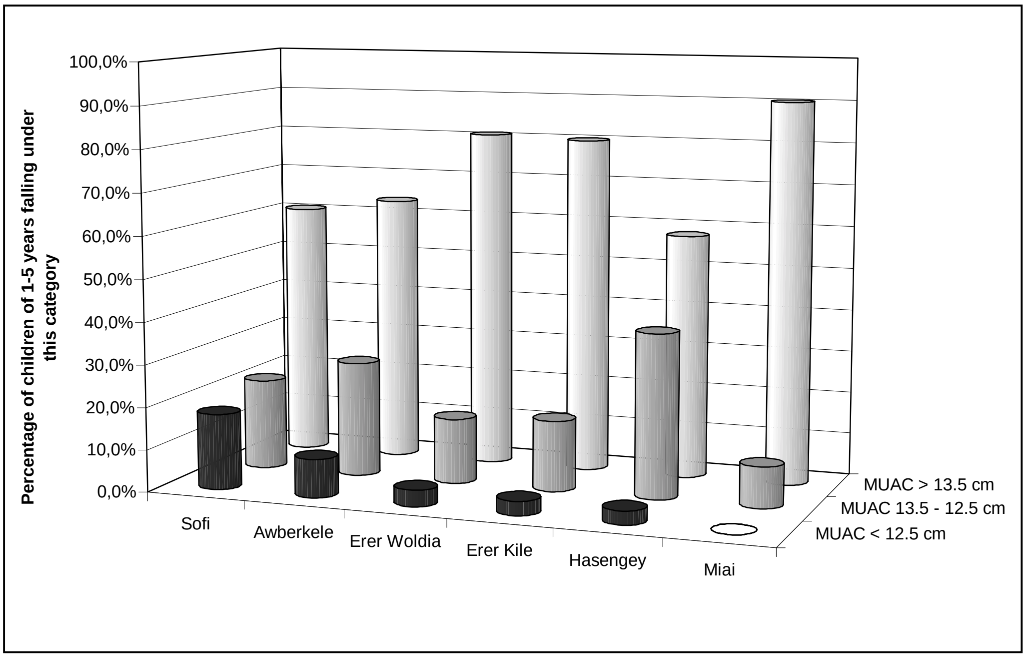


4.3.5 MUAC classification of children aged 1-5 years according to administrative districts

Graph 27: MUAC classification of children aged 1-5 years according urban administrative districts (Kebeles) (n = 159)



Graph 28: MUAC classification of children aged 1-5 years according rural administrative districts (Peasant Associations) (n = 179)



To summarise the key information of the previous graphs, the following table displays the regions with the highest and lowest prevalence of **severe malnutrition** (HAZ, WAZ or WHZ < -3 SD, MUAC < 12.5 cm (children 1-5 years), oedematous malnutrition).

Table 27: Regions with the highest and lowest prevalence of severe malnutrition (HAZ, WAZ or WHZ < -3 SD, MUAC < 12.5 cm (children 1-5 years), oedematous malnutrition)

	Stunting	Underweight	Wasting	MUAC < 12.5 cm	Oedematous malnutrition
highest urban	Kebele 19	Kebele 19	Kebele 08	Kebele 17	Kebele 6
lowest urban	Kebele 13	Kebele 13	All others 0.0%	Kebele 02	Kebele 13 and 17 both 0.0%
highest rural	Awberkele	Awberkele	Hasengey	Sofi	Sofi
lowest rural	Erer Woldia	Miai	All others except Erer Kile 0.0%	Miai	Awberkele

4.3.6 Severity index for malnutrition in emergency situations based on prevalence of wasting (WHZ < -2 SD) and mean WFH z-scores of children under five (WHO, 1995)

Table 28: Severity index for malnutrition in emergency situations based on prevalence of wasting and mean WFH z-scores of children < 5 (WHO, 1995)

Classification of Severity	Wasting (% of Children < -2 SD)	Mean WFH-z-Score	Relief Action Proposed
Acceptable	< 5	> -0.40	
Poor	5-9	-0.40 to – 0.69	Supplementary feeding if possible
Serious	10-14	-0.70 to – 0.99	Selective supplementary feeding of the malnourished is of high priority
Critical	≥ 15	≤ -1.00	Improve basic food supply. Additional food to all children and vulnerable groups

Table 29: WHO classification (1995) of the nutritional situation of children < 5 in HNRS based on percentage of children under five with WHZ < – 2 SD and average WHZ of children under five in the urban (n = 190) and rural area (n = 206)

Study area	% of children under five with WHZ < -2SD	Classification of the status	Mean WHZ of children under five in this region	Classification of the status
Urban				
Kebele 19 (n = 35)	8.6% (n = 3)	Poor	-0.61	Poor
Kebele 02 (n = 28)	7.1% (n = 2)	Poor	-0.52	Poor
Kebele 06 (n = 17)	5.9% (n = 1)	Poor	-0.40	Poor
Kebele 17 (n = 36)	5.6% (n = 2)	Poor	-0.40	Poor
Kebele 08 (n = 40)	5.0% (n = 2)	Poor	-0.57	Poor
Kebele 13 (n = 34)	2.9% (n = 1)	Acceptable	-0.44	Poor
Rural				
Sofi (n = 32)	15.6% (n = 5)	Critical	-0.88	Serious
Erer Woldia (n = 35)	14.3% (n = 5)	Serious	-1.13	Critical
Erer Kile (n = 35)	14.3% (n = 5)	Serious	-1.11	Critical
Hasengey (n = 33)	12.1% (n = 4)	Serious	-0.82	Serious
Awberkele (n = 36)	11.1% (n = 4)	Serious	-0.91	Serious
Miai (n = 35)	5.7% (n = 2)	Poor	-0.47	Poor

According to this classification, the prevalence of wasting was highest in Kebele 19 and in the PA Sofi. The lowest prevalence was found in Kebele 13 and Miai.

4.3.7 Modified Wellcome Classification of PEM (Hendrickse, 1991)

Table 30: Classification of PEM according to Hendrickse (1991), urban (n = 194)

% Expected Weight for Age	Oedema	
	Present	Absent
> 80%	Kwashiorkor 1.5% (n = 3)	Normal Nutrition[a] 73.2% (n = 142)
80-60%	Underweight Kwashiorkor 0%	Underweight 22.7% (n = 44)
< 60%	Marasmic Kwashiorkor 0.5% (n = 1)	Marasmus 2.1% (n = 4)

Table 31: Classification of PEM according to Hendrickse (1991), rural (n = 207)

% Expected Weight for Age	Oedema	
	Present	Absent
> 80%	Kwashiorkor 1.4% (n = 3)	Normal Nutrition[a] 54.1% (n = 112)
80-60%	Underweight Kwashiorkor 2.9% (n = 6)	Underweight 38.2% (n = 83)
< 60%	Marasmic Kwashiorkor 0.5% (n = 1)	Marasmus 2.4% (n = 5)

The bold lines of these tables separate sections of the classification that are not comparable to each other.

For oedematous malnutrition this scheme serves merely to categorise different forms of the same condition, it does not imply the degree of severity of a certain case. Kwashiorkor is always a serious condition independent of the body weight of the child (WHO, 1999).

In contrast, in the non-oedematous form of malnutrition, a case is supposed to be the more severe the lower the body weight.

[a] 'normal' nutrition includes all children whose WAZ ranges between –2 SD and +2 SD or whose expected WFA is between 80% and 120% of the reference values.

Overall, these considerations led to the development of a new scheme which classifies all children with oedema as severely malnourished and, for the non-oedematous forms, differentiates between different degrees of severity depending on the HAZ and WHZ (WHO, 1999).

4.3.8 Classification of malnutrition according to the new WHO classification (WHO, 1999)

Table 32: Classification of malnutrition according to WHO (1999), urban

	Moderate Malnutrition	Severe Malnutrition
Symmetrical oedema	No 97.9% (n = 190/194)	Yes (oedematous malnutrition) 2.1% (n = 4/194)
Weight-for-Height	-3 ≤ SD-score < -2 (70-79%) 4.7% (n = 9/190)	SD-score < -3 (< 70%) (severe wasting) 1.1% (n = 2/190)
Height-for-Age	-3 ≤ SD-score < -2 (85-89%) 11.9% (n = 23/194)	SD-score < -3 (< 85%) (severe stunting) 8.8% (n = 17/194)

Table 33: Classification of malnutrition according to WHO (1999), rural

	Moderate Malnutrition	Severe Malnutrition
Symmetrical oedema	No 95.4% (n = 207/217)	Yes (oedematous malnutrition) 4.6% (n = 10/217)
Weight-for-Height	-3 ≤ SD-score < -2 (70-79%) 11.2% (n = 23/206)	SD-score < -3 (< 70%) (severe wasting) 1.0% (n =2/206)
Height-for-Age	-3 ≤ SD-score < -2 (85-89%) 24.6% (n = 52/211)	SD-score < -3 (< 85%) (severe stunting) 18.0% (n = 38/211)

The occurrence of all types of malnutrition except severe wasting was about twice as high in the rural compared to the urban area. The prevalence of oedematous malnutrition was about twice as high as the prevalence of severe wasting both in urban and rural areas.

4.3.9 Comparison of the classification of severe forms of malnutrition according to Hendrickse (1991) and WHO (WHO, 1999)

The following table contrasts the classification of severe malnutrition according to the old scheme by Hendrickse (1991) with the classification according to the new scheme by WHO (1999).

Table 34: Number and percentage of severely malnourished children in urban and rural areas according to Hendrickse (1991) and WHO (1999) (differing results are printed in bold letters)

	Modified Wellcome classification (Hendrickse, 1991)		WHO (1999)	
	Kwashiorkor, underweight kwash., marasmic kwash.	Marasmus	Oedematous malnutrition	WHZ < -3 SD (severe wasting)
Urban	2.1% (n = 4/194)	**2.1 %** (n = 4/194)	2.1% (n = 4/194)	**1.1%** (n = 2/190)
Rural	4.8% (n = 10/210)	**2.4%** (n = 5/207)	4.8% (n = 10/217)	**1.0%** (n = 2/206)

As shown in table 34 the category of severe wasting in the new WHO (1999) scheme does not correspond to the category of marasmus in the Hendrickse classification (1991). In the urban and rural area, one child each with marasmic kwashiorkor was excluded from WHZ and therefore did not appear in the WHO scheme. Three children in town who were classified as having marasmus according to the Hendrickse classification (1991) were only classified as moderately wasted by WHO (1999). On the other hand, one child with severe wasting was only classified as moderately underweight and not as having marasmus. In the rural area, four children who were classified as suffering from marasmus were only classified as moderately wasted (n = 1) or not wasted (n = 3). In turn, one child who was only moderately underweight by the Hendrickse classification (1991) was classified as severely wasted by WHO (1999).

4.4 Results of the dietary assessment (24 hour recall)

For the analysis of the 24-hour recall, those children were excluded who had been breastfed, who had eaten from a shared plate or both the day before the interview. The reason for the exclusion of these children was that energy and nutrient intake from breastmilk and shared plates can only be estimated in a very inaccurate way when using the 24 hour recall method.

In addition, all children whose age could not be assessed were excluded as it was not possible to calculate the percentage fulfilment of the age specific energy and nutrient requirements for them. Children with an incomplete 24-hour recall were excluded as well.

When presenting age specific data, the values for the group < 12 months are not included as this group comprised only three urban children.

Table 35 gives an overview over the number of included and excluded questionnaires according to different study variables as well as the reasons for exclusion.

Table 35: Overview over the number of included and excluded questionnaires and the reasons for exclusion according to different study variables

Variable	Total	Included	Excluded because...		
			age unknown	breastfed and/or ate from shared plate	24 hour recall not complete
Total	411	212	6	192	1
Sex					
Male	193	105	4	84	0
Female	218	107	2	108	1
Age					
< 12 months	53	3	-	50	0
12 – 23.9 months	119	43	-	76	0
24 – 35.9 months	114	73	-	41	0
36 – 47.9 months	74	56	-	17	1
48 – 59.9 months	45	37	-	8	0
Study area					
Urban	194	108	0	86	0
Rural	217	104	6	106	1

4.4.1 Contribution of carbohydrates (CHO), protein and fat to the total energy intake of children under five

Table 36 shows the percentage contribution of different forms of energy to total caloric intake in urban and rural areas as compared to the recommended range.

Table 36: Source of energy in percent of total energy intake for urban and rural children (values below the recommended range are marked in bold print, values above the recommended range are marked in *italics*)

Nutrient	Urban	Recommended range	Rural
Carbohydrates	64%	55 – 75%[a]	*78%*
Protein	11%	10 – 12%[a]	11%
Fat	**24%**	30 – 40%[b]	**10%**

Protein contributes equally to total energy intake of urban and rural children. Protein quality however differs (refer to chapter 4.4.4.2). Fat contributes too little to total energy for all children, particularly in the rural area whereas carbohydrates are above the recommended range for rural children.

4.4.2 Fulfilment of energy and nutrient requirements

Table 37 shows the recommendations used for energy and each nutrient. The requirements of energy and protein are specified in two different ways: they can be calculated from age and weight specific recommendations or they are specified according to age only. All other recommendations are given as age-specific requirements.

[a] FAO/WHO 1996
[b] FAO/WHO 1994

Table 37: Energy and nutrient requirements of children from 6 – 59.9 months

	6 - 12 months	12 – 23.9 months	24 – 35.9 months	36 – 47.9 months	48 – 59.9 months
Energy/kcal[a]	960	1250		1510	
Protein/g[b]	-	23		26	
Fat (g)[c]	-	35		42	
Vitamin A (µg RE)[d]	350	400			
Vitamin B1 (mg)[e]	0.3	0.5		0.7	
Vitamin B2 (mg)[e]	0.5	0.8		1.0	
Vitamin C (mg)[f]	20				
Calcium (mg)[g]	600	400		450	
Copper (mg)[h]	0.6	0.56		0.57	
Iron (mg)[i]	11	7			
Phosphorus (mg)[j]	500	800		800	
Potassium (mg)[k]	700	1000		1400	
Zinc (mg)[l]	5.6	5.5		6.5	

[a] James et al., 1990.
[b] WHO/FAO/UNU, 1985
[c] In: Savage King et al., 1993
[d] WHO safe level (FAO, 1988a)
[e] FAO, 1988b
[f] WHO RNI (FAO, 1970)
[g] WHO RNI (1961). In: Garrow et al. (1993).
[h] WHO normative requirement (1992). In: Garrow et al. (1993).
[i] For a diet with medium iron availability, containing mostly non-haem iron and enough vitamin C to enhance non-haem iron absorption. (FAO, 1988a).
[j] USA RDA (no WHO values available). In: Garrow et al. (1993).
[k] USA minimum requirement (no WHO values available). In: Garrow et al. (1993).
[l] Normative requirement on diet of moderate zinc availability. (WHO, 1996).

The following table shows the number of children per age group.

Table 38: Number of children per age group in urban and rural areas

Age group	Urban (n = 108)	Rural (n = 104)	Total (n = 212
< 12 months (not included)	3	0	3
12 – 23.9 months	22	21	43
24 – 35.9 months	36	37	73
36 – 47.9 months	27	29	56
48 – 59.9 months	20	17	37

The following tables show the mean intake with standard deviation for energy and all nutrients analysed and the percentage fulfilment of WHO/USA recommendations with standard deviation according to the age-ranges as pre-set by the recommendations used. The intake of urban and rural children is listed separately.

Table 39: Mean intake with standard deviation and percentage fulfilment of WHO/USA recommendations and with standard deviation and requirements according to WHO/USA for energy, protein and fat, urban

	12 – 35.9 months			36 – 59.9 months		
	Mean ± SD	% of Requirement	Requirement	Mean ± SD	% of Requirement	Requirement
Energy/kcal	898.3 ± 325.3	71.9 ± 26.0	1250	995.7 ± 384.6	65.9 ± 25.5	1510
Protein/g	25.2 ± 10.5	109.4 ± 45.5	23		107.7 ± 60.0	26
Fat/g	25.7 ± 18.4	73.5 ± 52.6	35	23.3 ± 18.7	55.5 ± 44.6	42

Table 40: Mean intake with standard deviation and percentage fulfilment of WHO/USA recommendations and with standard deviation and requirements according to WHO/USA for energy, protein and fat, rural

	12 – 35.9 months			36 – 59.9 months		
	Mean ± SD	% of Requirement	Requirement	Mean ± SD	% of Requirement	Requirement
Energy/kcal	909.1 ± 408.7	72.7 ± 32.7	1250	1005.9 ± 414.5	66.6 ± 27.4	1510
Protein/g	25.6 ± 12.3	111.3 ± 53.3	23	27.9 ± 14.0	107.2 ± 53.9	26
Fat	11.0 ± 8.5	31.4 ± 24.4	35	10.6 ± 6.9	25.2 ± 16.3	42

Table 41: Mean intake with standard deviation and percentage fulfilment of WHO/USA recommendations and with standard deviation and requirements according to WHO/USA for vitamins and minerals, urban

	12 – 35.9 months			36 – 59.9 months		
	Mean ± SD	% of Requirement	Requirement	Mean ± SD	% of Requirement	Requirement
Vitamin A/µg RE	500.4 ± 757.9	125.1 ± 189.5	400 µg RE	561.7 ± 921.6	140.0 ± 230.4	400 µg RE
Retinol/µg RE	104.2 ± 125.9	26.1 ± 31.5		54.9 ± 79.9	13.7 ± 20.0	
Carotene/mg	2.3 ± 4.2			3.0 ± 5.5		
Vitamin B1/mg	0.5 ± 0.2	101.1 ± 47.0	0.5	0.6 ± 0.2	83.8 ± 33.5	0.7
Vitamin B2/mg	0.6 ± 0.4	78.4 ± 44.0	0.8	0.5 ± 0.3	54.3 ± 30.8	1.0
Vitamin C/mg	41.9 ± 47.9	209.4 ± 239.3	20	50.1 ± 54.3	250.4 ± 271.7	20
Calcium/mg	255.9 ± 149.0	64.0 ± 37.3	400	226.7 ± 122.9	50.4 ± 27.3	450
Copper/mg	1.1 ± 0.7	197.7 ± 122.3	0.56	1.5 ± 0.6	256.3 ± 106.8	0.57
Iron/mg	29.7 ± 33.7	424.3 ± 482.0	7	52.1 ± 48.2	744.8 ± 688.4	7
Phosphorus/mg	598.7 ± 232.3	74.8 ± 29.0	800	650.2 ± 234.2	81.3 ± 29.3	800
Potassium/mg	934.8 ± 522.1	97.9 ± 57.1	1000	1101.4 ± 688.1	78.7 ± 49.1	1400
Zinc/mg	4.1 ± 2.1	74.7 ± 38.2	5.5	4.5 ± 2.1	69.9 ± 32.1	6.5

Table 42: Mean intake with standard deviation and percentage fulfilment of WHO/USA recommendations and with standard deviation and requirements according to WHO/USA for vitamins and minerals, rural

	12 – 35.9 months			36 – 59.9 months		
	Mean ± SD	% of Requirement	Requirement	Mean ± SD	% of Requirement	Requirement
Vitamin A/µg RE	281.5 ± 683.4	70.4 ± 170.9	400 µg RE	796.5 ± 1785.0	199.1 ± 446.3	400 µg RE
Retinol/µg RE	24.1 ± 43.0	6.0 ± 10.7		19.0 ± 50.4	4.8 ± 12.6	
Carotene/mg	0.9 ± 4.0			4.2 ± 10.8		
Vitamin B1/mg	0.5 ± 0.2	105.8 ± 49.2	0.5	0.6 ± 0.3	90.3 ± 38.1	0.7
Vitamin B2/mg	0.9 ± 0.5	115.4 ± 61.8	0.8	0.8 ± 0.5	79.0 ± 48.1	1.0
Vitamin C/mg	12.1 ± 24.5	60.7 ± 122.4	20	23.0 ± 31.8	115.0 ± 159.1	20
Calcium/mg	172.8 ± 237.0	43.2 ± 59.3	400	153.5 ± 132.9	34.1 ± 29.5	450
Copper/mg	2.3 ± 1.4	408.0 ± 246.6	0.56	2.2 ± 1.5	390.1 ± 269.8	0.57
Iron/mg	27.2 ± 22.1	387.9 ± 315.3	7	26.2 ± 19.1	374.6 ± 273.1	7
Phosphorus/mg	702.2 ± 393.5	87.8 ± 49.2	800	756.2 ± 364.7	94.5 ± 45.6	800
Potassium/mg	817.5 ± 571.9	81.8 ± 57.2	1000	1009.2 ± 595.3	72.1 ± 42.5	1400
Zinc/mg	5.0 ± 2.6	91.7 ± 46.6	5.5	5.6 ± 2.4	86.5 ± 36.8	6.5

For energy and all macronutrients, the percentage fulfilment of requirements is lower for children aged 36 to 59.9 months than for children aged 12 – 35.9 months. As for vitamins and minerals, the percentage fulfilment of requirements is lower (and below 100%) for urban children aged 36 to 59.9 months for vitamin B1 and B2, calcium, potassium and zinc as compared to the children aged 12 – 35.9 months. In the rural area, the percentage fulfilment of requirements is lower (and below 100%) for children aged 36 to 59.9 months than for children aged 12 – 35.9 months for vitamin B1, vitamin B2, calcium, potassium and zinc.

The graphs on the next pages present the average percentage fulfilment of WHO recommendations/USA RDA/USA minimum requirements and the average actual intake for energy and each nutrient with its SD. The average percentage fulfilment of requirements according to WHO/USA RDA/USA minimum requirements is calculated for the age ranges as pre-set by the WHO recommendations/USA RDA/USA minimum requirements, which are 12 – 35.9 months and 36 – 59.9 months. The average actual intake was calculated for age groups of one year.
The graphs are to be read as follows:

- The bars show the average percentage fulfilment of the WHO recommendations/ USA RDA/USA minimum requirements for the respective age range.
- The line shows the trend of actual intake for the age groups of 12 – 23.9 months, 24 – 35.9 months, 36 – 47.9 months and 48 – 59.9 months.

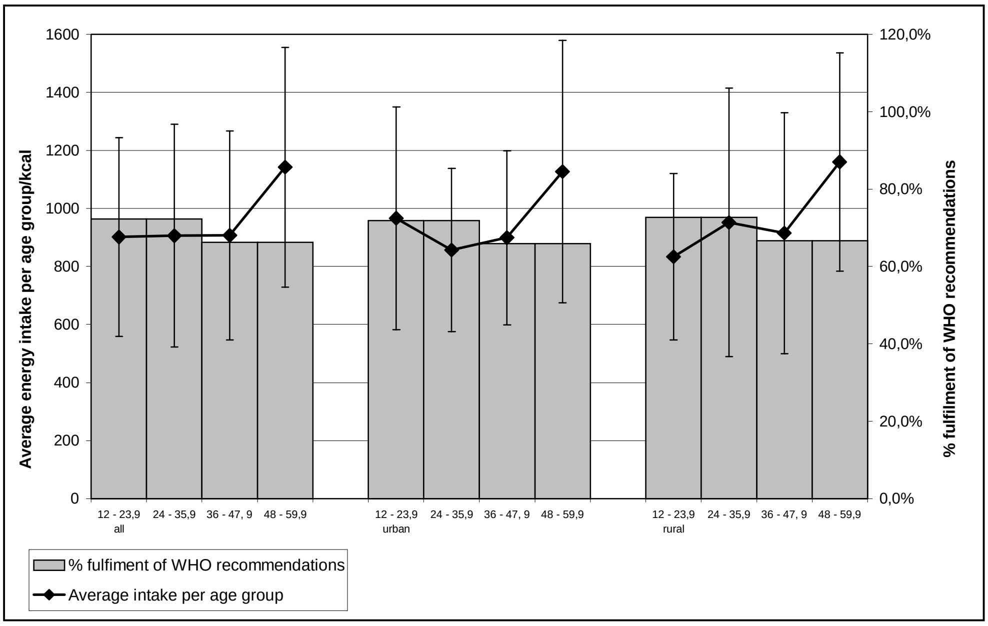
The energy and nutrient requirements of children in a certain age category are met:

- If the average percentage fulfilment of the WHO recommendations/USA RDA/USA minimum requirements for a certain age range is close to, equal to or > 100% and
- If the overall trend of average actual intake per age group is rising.

If the average percentage fulfilment of the WHO recommendations/USA RDA/USA minimum requirements for a certain age range is far beyond 100% the trend of average actual intake per age group of one year is less important.

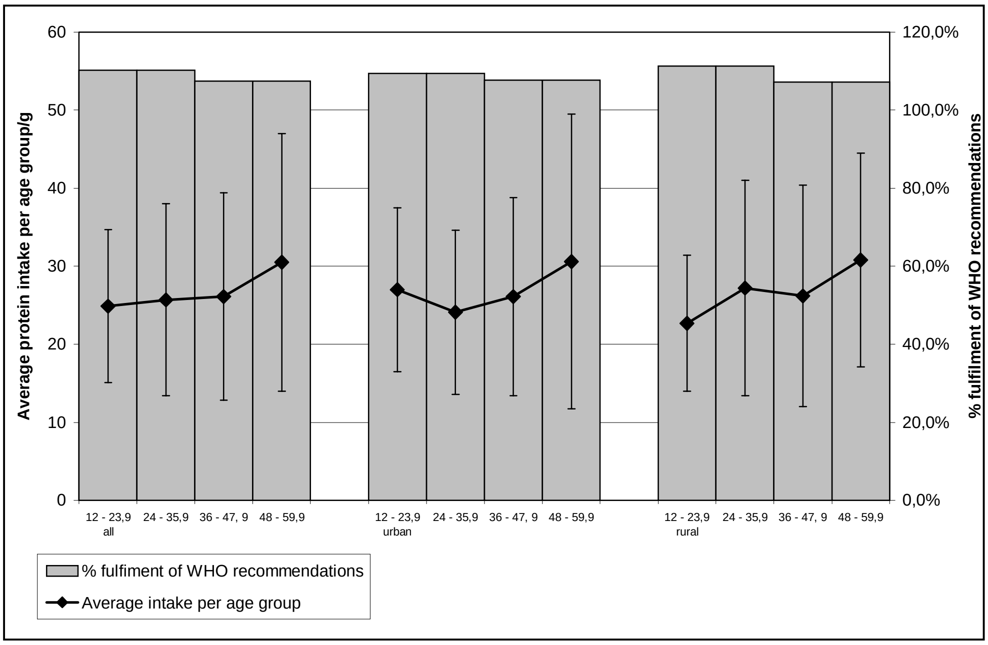
The data is first presented for all children included in the dietary analysis and then separately for the urban and rural areas.

Graph 29: Fulfilment of energy requirements



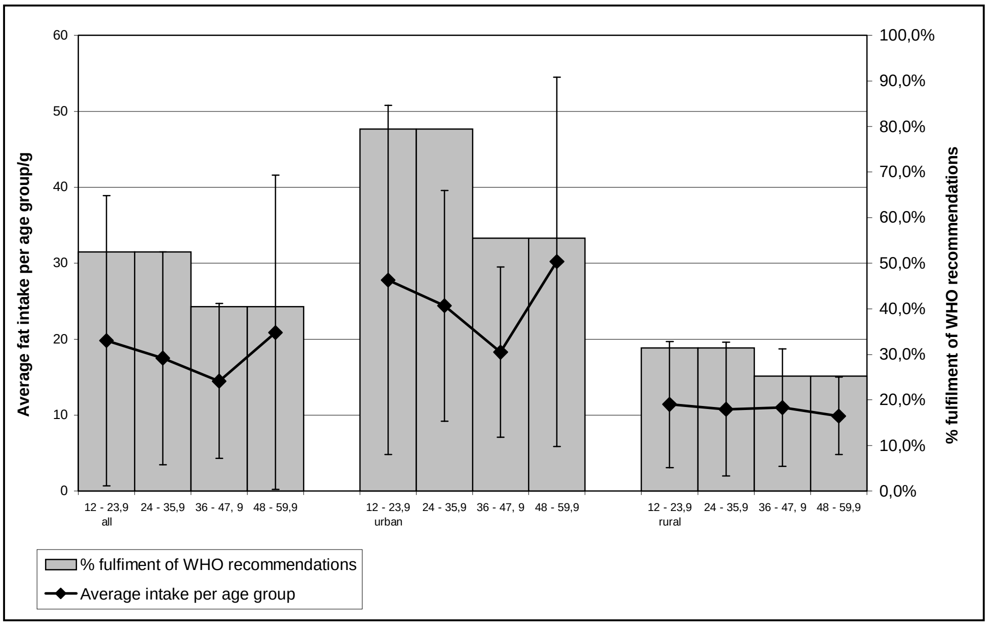
None of the age-groups was able to meet its energy requirement fully. Children of 24 – 47.9 months were especially bad off with an energy intake of only about 66% of their requirement. When looking at the whole sample, the average actual energy intake in kcal was basically stagnant from 12 to 47.9 months and only rose considerably from the 4th to the 5th year of life.

Graph 30: Fulfilment of protein requirements



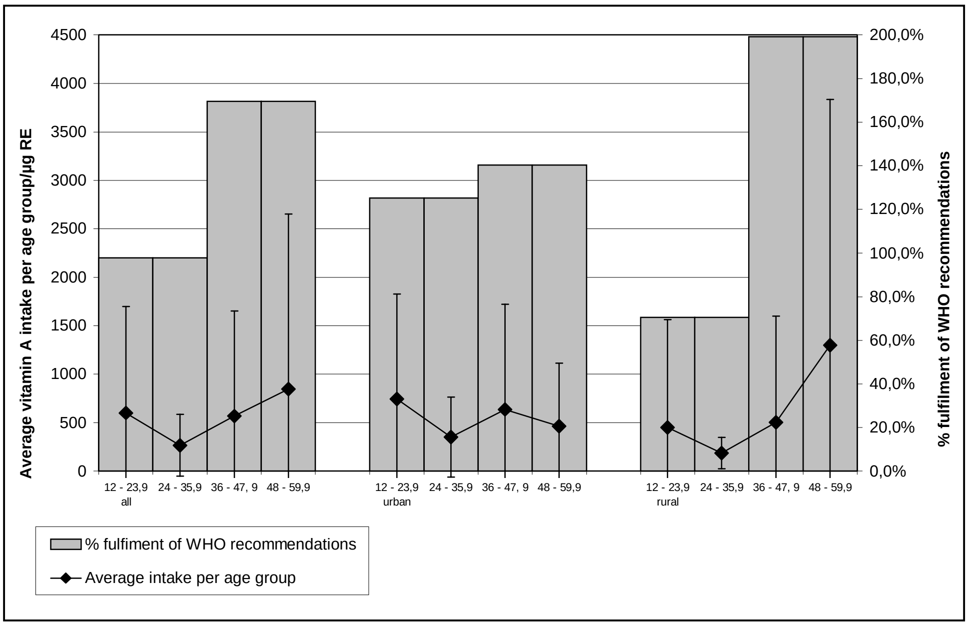
On average, all children met their protein requirements. As for protein quality, refer to chapter 4.4.4.2.

Graph 31: Fulfilment of fat requirements



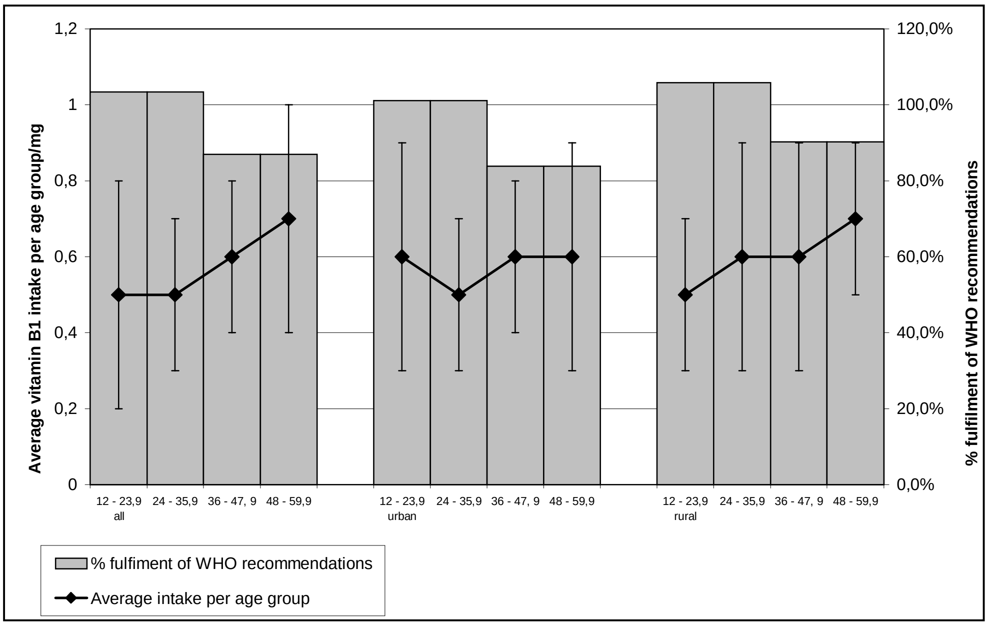
Fat intake was about twice as high in the urban as compared to the rural areas. Still, none of the subgroups met its fat requirements. In the urban area, the age group of 36 – 47.9 months was the one that was worst off, whereas in the rural area the children of 48 – 59.9 months had the lowest intake and fulfilment of their requirements.

Graph 32: Fulfilment of vitamin A requirements



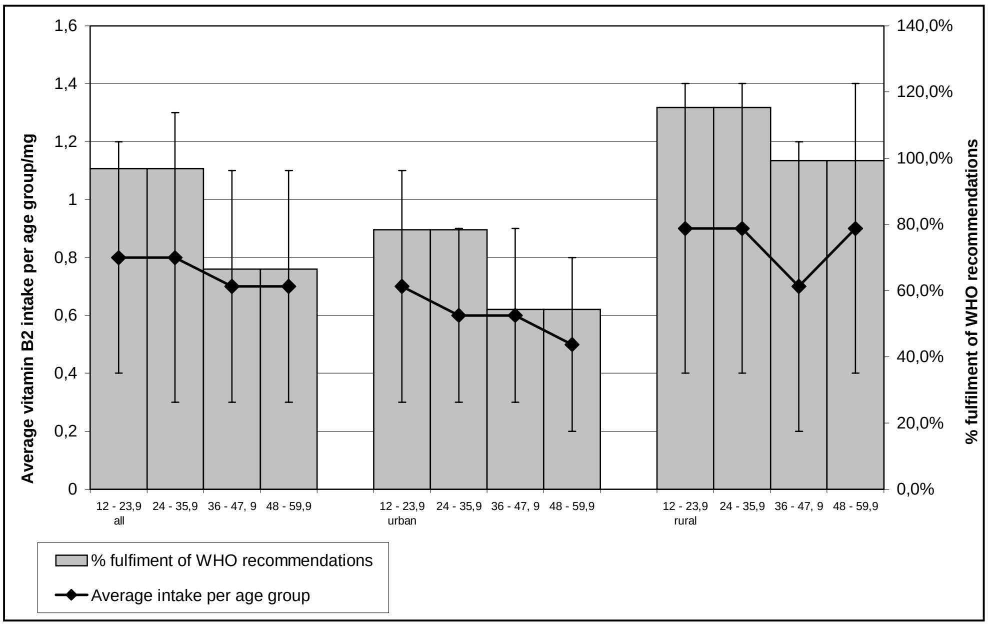
All children except the two youngest age groups in the rural area met on average their vitamin A requirements. In the rural area, the vitamin A intake of children between 24 and 35.9 in particular was far below their needs.

Graph 33: Fulfilment of vitamin B1 requirements



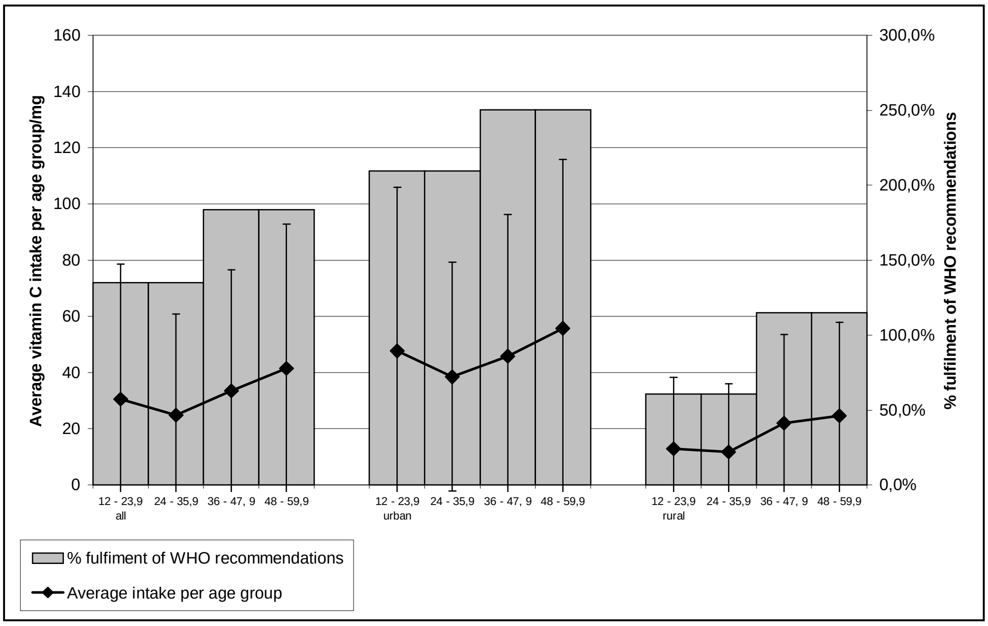
Overall, the situation of rural children, who met on average at least 90% of their vitamin B1 requirement, was better than that of urban children. In town, all children over 36 months did on average not meet their needs to more than 83%.

Graph 34: Fulfilment of vitamin B2 requirements



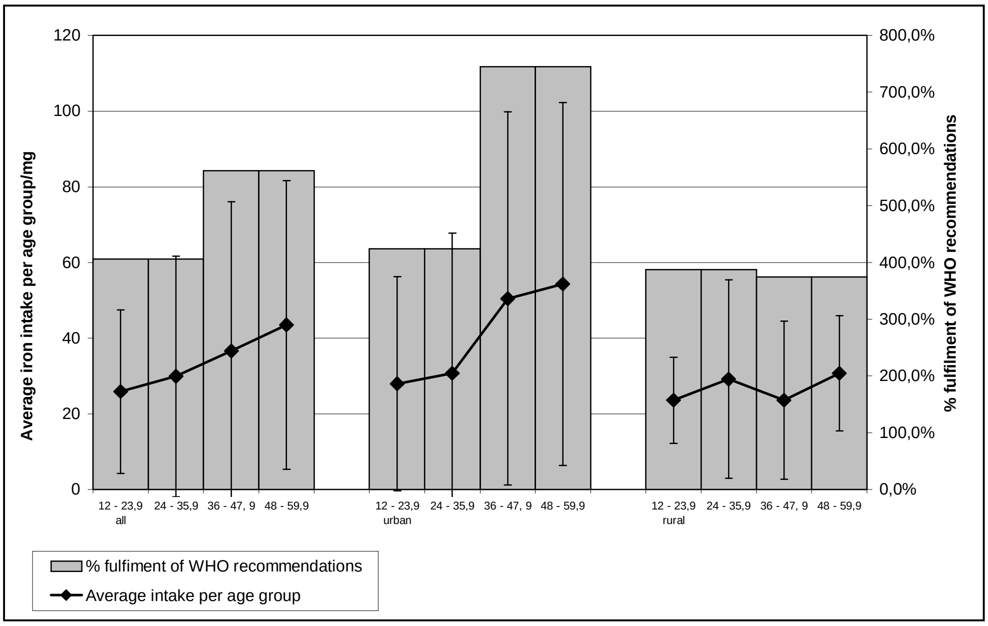
While on average all children in the rural area met their vitamin B2 requirements, children in town were only able to fulfil their vitamin B2 needs to 54 – 78 % with an overall declining trend of absolute actual intake.

Graph 35: Fulfilment of vitamin C requirements



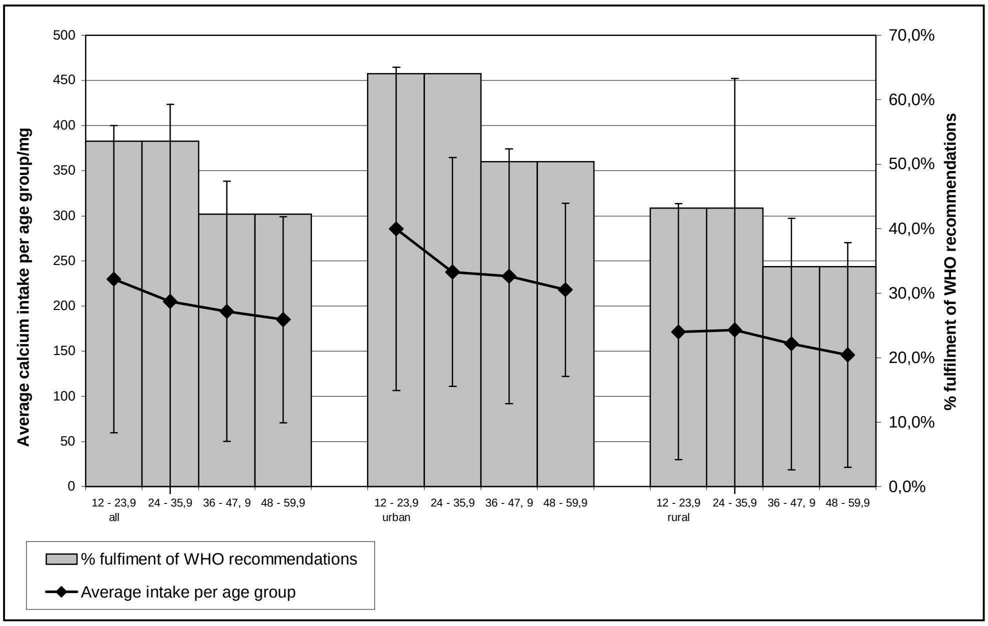
In the urban area, the average vitamin C intake exceeded the needs of all children. As for children in the rural area, the age-group of 12 – 35.9 months was only able to meet its requirements to about 60% with a declining trend of actual average intake in this age-range. Rural children ≥ 36 months met on average their requirements.

Graph 36: Fulfilment of iron requirements



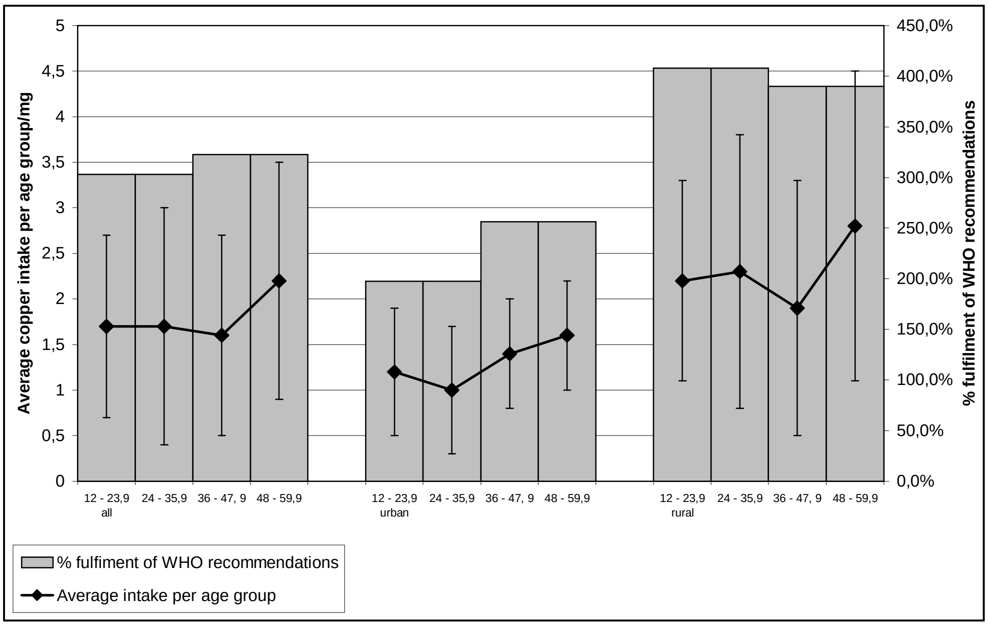
The average iron intake exceeded the needs of all children by far. Concerning the quality of the iron, please refer to chapter 4.4.4.3.

Graph 37: Fulfilment of calcium requirements



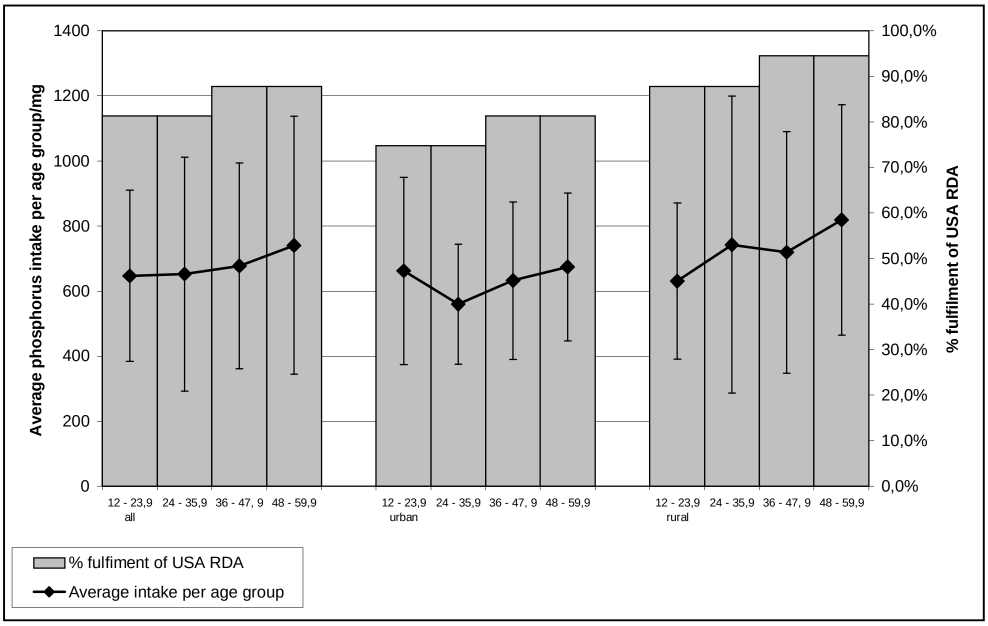
None of the subgroups met its calcium requirements in combination with an overall declining trend of actual intake. This means that the older the children were, the less their calcium requirements were met.

Graph 38: Fulfilment of copper requirements



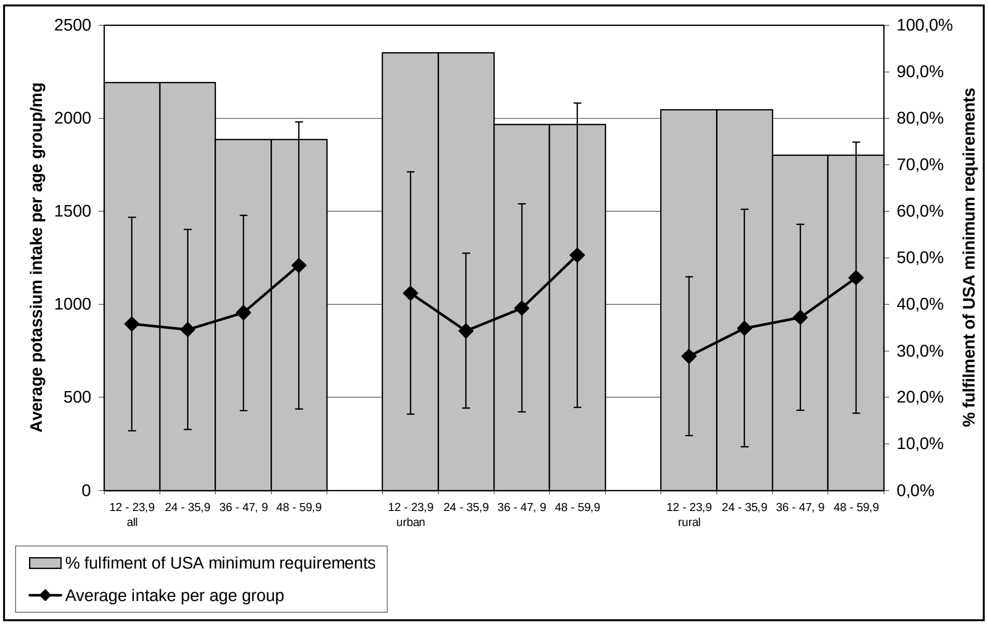
On average, the copper intake exceeded by far the needs of all children.

Graph 39: Fulfilment of phosphorus requirements



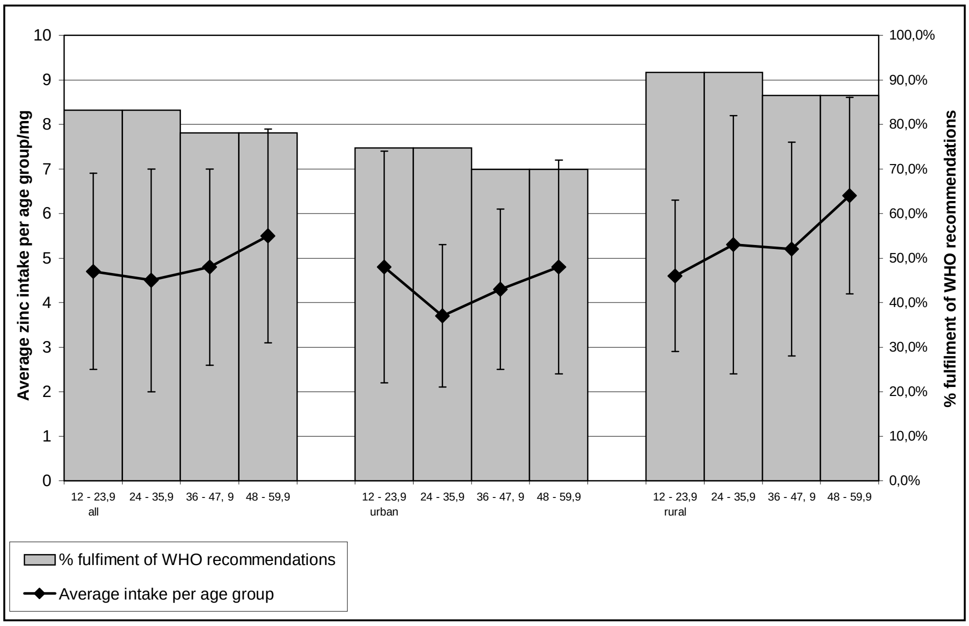
None of the subgroups met its phosphorus requirements fully. The supply was better in the rural than in the urban area and higher for children ≥ 36 months compared to the younger children.

Graph 40: Fulfilment of potassium requirements



Potassium intake was too low for all children. The intake was overall slightly less in the rural area as compared to the urban area.

Graph 41: Fulfilment of zinc requirements



The fulfilment of zinc requirements was below 100% for all children with an overall better supply of children in the rural area.

4.4.3 Nutrient density of the diet as a marker of dietary quality

Table 43 shows the recommended nutrient density of a diet.

Table 43: Reference nutrient densities per 1000 kcal[a] (FAO/WHO, 1996)

Nutrient	per 1000 kcal	Nutrient	per 1000 kcal
Carbohydrates	140 – 190 g	Vitamin B1	0.5 – 0.8 mg
Protein[b]	25 – 30 g	Vitamin B2	0.6 – 0.9 mg
Fat	16 – 39 g	Calcium	250 – 400 mg
Fibre	8 – 20 g	Iron[c]	5.5 mg
Vitamin A	350 – 500 µg RE	Zinc[d]	10 mg
Vitamin C	25 – 30 mg		

[a] These nutrient densities refer to the total diet. If dietary intake is sufficient to meet energy needs, the diet will also meet the nutrient needs of all family members except possibly infants <2 years of age and pregnant or lactating women.
[b] If animal protein intake is low
[c] For diets with intermediate bioavailability of iron
[d] For diets with low bioavailability of zinc

Table 44 and 45 show the average nutrient density of urban and rural diets according to age groups of one year.

Table 44: Mean nutrient density of urban diets according to age groups of one year (nutrient densities below the recommended range are marked in bold print, nutrient densities *above* the recommended range are marked in *italics*)

Nutrient	12 – 23.9 months	24 – 35.9 months	Reference nutrient density	36 – 47.9 months	48 – 59.9 months
CHO	155.5 ± 40.5	**132.9 ± 52.6**	140 – 190 g	175.4 ± 21.1	164.2 ± 29.3
Protein	28.7 ± 6.3	27.7 ± 6.5	25 – 30 g	28.3 ± 5.7	26.9 ± 6.3
Fat	28.0 ± 17.5	29.0 ± 15.4	16 – 39 g	19.3 ± 8.4	25.1 ± 13.6
Fibre	8.6 ± 6.7	8.0 ± 3.8	8 – 20 g	9.6 ± 3.1	9.2 ± 1.9
Vitamin A	*637.9 ± 772.8*	392.5 ± 420.7	350 – 500 µg RE	*567.2 ± 774.0*	**348.1 ± 353.3**
Vitamin B1	0.6 ± 0.1	0.6 ± 0.2	0.5 – 0.8 mg	0.6 ± 0.2	0.6 ± 0.3
Vitamin B2	0.7 ± 0.4	0.7 ± 0.3	0.6 – 0.9 mg	0.6 ± 0.2	**0.5 ± 0.3**
Vitamin C	*43.9 ± 52.9*	*43.1 ± 42.9*	25 – 30 mg	*49.2 ± 58.8*	*45.3 ± 31.9*
Calcium	291.4 ± 142.7	290.4 ± 151.7	250 – 400 mg	**244.9 ± 85.0**	**202.5 ± 69.4**
Iron	*28.5 ± 27.3*	*37.9 ± 49.4*	5.5 mg	*59.5 ± 55.3*	*51.2 ± 42.4*
Zinc	**4.9 ± 1.1**	**4.3 ± 1.2**	10 mg	**4.8 ± 1.0**	**4.3 ± 0.8**

Table 45: Mean nutrient density of rural diets according to age groups of one year (nutrient densities below the recommended range are marked in bold print, nutrient densities *above* the recommended range are marked in *italics*)

Nutrient	12 – 23.9 months	24 – 35.9 months	Reference nutrient density	36 – 47.9 months	48 – 59.9 months
CHO	*190.7 ± 21.2*	*193.2 ± 25.2*	140 – 190 g	*192.6 ± 16.7*	*200.6 ± 12.1*
Protein	28.0 ± 5.3	28.5 ± 4.6	25 – 30 g	28.5 ± 5.7	26.4 ± 6.7
Fat	**13.3 ± 7.9**	**11.9 ± 9.8**	16 – 39 g	**12.2 ± 8.3**	**9.6 ± 6.1**
Fibre	11.4 ± 8.4	10.0 ± 5.8	8 – 20 g	12.0 ± 6.9	10.5 ± 4.9
Vitamin A	*533.0 ± 1067.7*	**203.1 ± 122.2**	350 – 500 µg RE	*654.4* ± 1429.9	*975.6* ± 1772.5
Vitamin B1	0.7 ± 0.3	0.6 ± 0.2	0.5 – 0.8 mg	0.7 ± 0.3	0.6 ± 0.2
Vitamin B2	*1.0 ± 0.4*	*1.0 ± 0.4*	0.6 – 0.9 mg	0.8 ± 0.4	0.8 ± 0.3
Vitamin C	*35.2 ± 101.7*	**12.3 ± 21.6**	25 – 30 mg	*50.2 ± 117.1*	**20.8 ± 30.2**
Calcium	**221.3 ± 167.9**	**169.8 ± 193.2**	250 – 400 mg	**194.5 ± 154.7**	**122.9 ± 80.4**
Iron	*26.7 ± 9.3*	*28.6* ± 18.3	5.5 mg	*25.0* ± 17.8	*26.3* ± 9.6
Zinc	**5.8 ± 1.7**	**5.6 ± 1.5**	10 mg	**5.7 ± 1.5**	**5.5 ± 1.1**

4.4.4 Sources of carbohydrates, protein and iron

The values shown are only a rough approximation as the Ethiopian food tables do not distinguish between the different forms of carbohydrates and the EBIS-program does not calculate the amount of animal and vegetable protein or haem and non-haem iron separately.

4.4.4.1 Carbohydrates

Table 46 shows the average contribution of mono-, oligo- and polysaccharides to total carbohydrate intake.

Table 46: Contribution of mono-, oligo- and polysaccharides to total carbohydrate intake

	Urban	Rural
Mono-and Oligosaccharides	19%	4%
Polysaccharides	81%	96%

Sources of monosaccharides like fructose were especially fruits, sources of oligosaccharides were mainly sucrose (to sweeten tea, milk and porridge; from biscuits and other sweets) and lactose (milk and milk powder). The polysaccharides issue from cereals, beans, pulses, vegetables and fruits.

4.4.4.2 Protein

Table 47 shows the average contribution of animal and plant protein to total protein intake.

Table 47: Contribution of animal and plant protein to total protein intake

	Urban	Rural
Animal protein	44%	9%
Plant protein	56%	91%

Sources of animal protein were mostly milk and egg and sometimes meat, sources of plant protein were for example rice, tef, sorghum, beans and peas in town and mainly maize and sorghum in the rural area.

4.4.4.3 Iron

Table 48 shows the contribution of haem and non-haem iron to total iron intake.

Table 48: Contribution of haem and non-haem iron to total iron intake

	Urban	Rural
Haem iron	8%	2%
Non-haem iron	92%	98%

4.4.5 Inhibitors of nutrient absorption

Table 49 displays dietary factors reducing the absorption of essential nutrients from foods.

Table 49: Antagonists of the uptake or utilisation of inorganic elements from foods (FAO/WHO, 1996)

Nutrients	Inhibitors of uptake or utilisation
Calcium	• Excessive dietary fibre • Excessive consumption of phytates in maize, beans, whole wheat flour or sorghum
Iron	• Excessive consumption of phytates in maize, beans, whole wheat flour or sorghum • Tannins from tea
Zinc	• Excessive consumption of phytates in maize, beans, whole wheat flour or sorghum if accompanied by high calcium

4.4.5.1 Fibre

Table 50 shows fibre intake in urban and rural areas as calculated by the EBIS program.

Table 50: Fibre intake in urban and rural areas

	Urban	Rural
Mean intake ± SD	8.3 ± 4.9	9.7 ± 6.1
Median intake	7.6	8.3
Range	0.6 – 34.6	1.3 – 39.8

4.4.5.2 Phytates

There is no analytic data for the phytate content of the diets assessed in this study. As nevertheless all of the above mentioned phytate-rich foods are part of the staple diet, one can assume that the diets in the study area are comparably rich in phytates.

4.4.5.3 Tannins

The average consumption of black tea which is rich in tannins was 111.3 ml per child and day in town, but only 8.4 ml per child and day in the rural area.
Tea in town was mostly consumed with the breakfast, consisting mostly of white wheaten bread and butter, and not at lunch or dinner, where iron rich foods like tef or sorghum injera were served. Therefore the influence of tannins on iron absorption of children in this study is estimated to be overall negligible.

4.5 Statistical evaluation

The following tables show all factors that have been tested for significant differences between the urban and rural area. In the right column, the level of significance is given. A result was considered significant when the level of significance was < 0.05.
The statistical evaluation refers to the data presented in the previous chapters, i.e. data of the interviewed mother and the selected children. The respective chapters are listed in the tables. Some numbers differ from the data presented so far in the results section. This is due to the fact, that only ‘Yes’ and ‘No’-answers were contrasted in the statistical test. Other options like ‘No answer’ or ‘Do not know’ were not considered.

Similarly, only the valid questionnaires for the respective index were included in the analysis of the anthropometric data.

Table 51: Differences between the urban and rural area, background data

Factors tested	Urban	Rural	Refer to chapter	Level of significance
Background				
Children				
Age of the selected child	27.7 ± 15.0	28.0 ± 13.3		≥ 0.05
Birth-order of the selected child	2.5 ± 2.1	4.6 ± 2.8		**≤ 0.000**
Number of children who died < 5 years per family	0.2 ± 0.6	1.1 ± 1.4	4.1.3.2	**≤ 0.000**
Percentage of sick index children	34.0% (n = 66/194)	45.2% (n = 98/217)	4.1.3.4	**< 0.05**
Mother				
Age of the mother	27.0 ± 6.3	28.5 ± 6.4	4.1.3.2	**< 0.05**
Number of children born alive per family	2.7 ± 2.1	4.9 ± 2.8	4.1.3.2	**≤ 0.000**
Time available to care for the index child	3.5 ± 2.2	2.0 ± 1.5	4.1.3.3	**≤ 0.000**
Percentage of illiterate mothers	20.6% (n = 40/194)	97.2% (n = 211/217)	4.1.1	**≤ 0.000**
Food security				
Percentage of households suffering from food shortage	32.3% (n = 61/189)	91.7% (n = 199/217)	4.1.2	**≤ 0.000**

Table 52: Differences between the urban and rural area, breastfeeding and complementary feeding practice and anthropometry

Factors tested	Urban	Rural	Refer to chapter	Level of significance
Breastfeeding and complementary feeding practice				
Percentage of children receiving pre-lacteal feeding	49.2% (n = 95/193)	86.2% (n = 187/217)	4.2.1	**≤ 0.000**
Percentage of mothers discharging the colostrum	8.2% (n = 16/194)	0.9% (n = 2/215)	4.2.2	**≤ 0.000**
Duration of exclusive breastfeeding (months) (= age at introduction of complementary food)	5.1 ± 2.9	5.0 ± 2.3	4.2.2	≥ 0.05
Total duration of breastfeeding	16.5 ± 9.1	18.7 ± 6.6	4.2.2	**< 0.05**
Number of complementary meals for children who were still breastfed	3.9 ± 1.0	3.9 ± 0.8	4.2.2	≥ 0.05
Number of meals for children who were no longer breastfed	4.4 ± 0.9	3.9 ± 1.0	4.2.2	**≤ 0.000**
Anthropometry				
Mean WAZ	-1.1 ± 1.2	-1.7 ± 1.1		**≤ 0.000**
Mean HAZ	-1.1 ± 1.4	-1.6 ± 1.6		**≤ 0.000**
Mean WHZ	-0.5 ± 1.0	-0.9 ± 0.9		**≤ 0.000**
Percentage of underweight children (WAZ < -2 SD)	20.0% (n = 38/190)	40.0% (n = 80/200)	4.3	**≤ 0.000**
Percentage of stunted children (HAZ < -2 SD)	20.0% (n= 39/194)	42.7% (n = 90/211)	4.3	**≤ 0.000**
Percentage of wasted children (WHZ < -2 SD)	5.8% (n = 11/190)	12.1% (n = 25/206)	4.3	**< 0.05**
Percentage of children with oedema	2.1% (n = 4/194)	4.6% (n = 10/217)	4.3	≥ 0.05

Table 53: Differences between the urban and rural area, diet

Factors tested	Urban	Rural	Level of significance
Percentage fulfilment of energy requirements	70.2 ± 28.3	70.0 ± 30.5	≥ 0.05
Percentage fulfilment of protein requirements	108.6 ± 52.3	109.5 ± 53.4	≥ 0.05
Percentage fulfilment of fat requirements	65.4 ± 49.7	28.7 ± 21.3	**≤ 0.000**
Percentage fulfilment of vitamin A requirements	130.1 ± 205.3	127.3 ± 327.5	≥ 0.05
Percentage fulfilment of vitamin B1 requirements	94.5 ± 45.9	98.9 ± 45.1	≥ 0.05
Percentage fulfilment of vitamin B2 requirements	70.2 ± 42.8	99.3 ± 58.8	**≤ 0.000**
Percentage fulfilment of vitamin C requirements	229.0 ± 251.7	84.7 ± 141.7	**≤ 0.000**
Percentage fulfilment of calcium requirements	57.8 ± 33.3	39.2 ± 48.4	**≤ 0.000**
Percentage fulfilment of copper requirements	220.4 ± 120.0	400.1 ± 256.0	**≤ 0.000**
Percentage fulfilment of iron requirements	554.3 ± 599.2	382.1 ± 296.0	≥ 0.05
Percentage fulfilment of phosphorus requirements	78.5 ± 30.0	90.8 ± 47.5	**< 0.05**
Percentage fulfilment of potassium requirements	88.7 ± 53.6	77.5 ± 51.2	≥ 0.05
Percentage fulfilment of zinc requirements	72.0 ± 35.5	89.4 ± 42.4	**≤ 0.000**

5. Discussion

5.1 Family background

Certain factors from the family environment, e.g. education and occupation of the parents are discussed as potential risk factors for the development of malnutrition. The following table compares some important variables concerning the family background that were collected during this study with those that were assessed during the second National Rural Nutrition Survey (CSA, 1993).

Table 54: Situation of the parents in HNRS and Ethiopia (CSA, 1993)

	Ethiopia (1993)	HNRS (1999)		
		Urban	Rural	Total
Percentage of mothers with three or more children under five under their direct care	7.7%	4.6% (9/194)	10.1% (22/217)	7.5% (31/411)
Percentage of mothers under 20 years of age	4.6%	7.7% (15/194)	5.1% (11/217)	6.3% (26/411)
Percentage of mothers with no formal education	91.9%	23.7% (46/194)	98.6% (214/217)	63.3% (260/411)
Percentage of fathers with no formal education	64.1%	7.7% (13/169)	82.0% (164/200)	48.0% (177/369)
Percentage of mothers who are de facto responsible for the household	15.7%	12.4% (24/194)	7.8% (17/217)	10.0% (41/411)

Overall, the data of the above listed parameters from this study, except the percentage of mothers under 20 years of age[a], points to a more favourable situation of the parents in HNRS as compared to parents in Ethiopia on average (CSA, 1993). When looking at the HNRS data for urban and rural areas separately though, one can see that there are large differences. While the percentage of mothers with three or more children under five under their direct care and the percentage of parents with no formal education is

[a] It was very difficult to assess the age of the parents in the rural area. Though we had a list with key events of the past years to help the mothers remember their own and their husbands' age often very rough estimates had to be made.

much higher in the rural area, single parent households are more frequent in town. From the above mentioned parameters, only the percentage of mothers under 20 years of age is higher in HNRS than in Ethiopia on average (CSA, 1993) for both urban and rural areas, i.e. more women are married at a young age in HNRS than overall in Ethiopia.

5.2 Health, water and sanitation

As the UNICEF model (chapter 1, figure 1) shows, health and nutritional status are closely linked. Diseases[a] are one of the immediate causes of malnutrition. Smith et al. (2000) estimate that the contribution of the health environment to reductions in child malnutrition in developing countries was 19.3% between 1970 and 1995 (refer to Appendix 9.12).

39.9% of all children from 6-59 months in HNRS (1999) were reported to have suffered from illness during **one week prior to the interview** as opposed to 38.3% of all children during the **two weeks prior to the survey** in Ethiopia during the CSA survey (CSA, 1993).

The following table compares the prevalence of different illnesses in children under five (% of total in the respective age-range) in HNRS and Ethiopia (CSA, 1993).

[a] In each team there was a member of the health bureau staff to confirm acute illnesses. Illnesses that lay further back in the week, however, were noted down as reported by the mothers. It is possible that the mothers made mistakes in reporting the conditions. Therefore, the true morbidity of the children under five in this study might be higher or lower as the determined one.

Table 55: Prevalence of different illnesses in children under five (% of total in the respective age-range) in HNRS and Ethiopia (CSA, 1993)[a]

Illness	Age (months)									
	6-11		12-23		24-35		36-59		All ages	
	Eth. %	HNRS %	Eth. %	HNRS %	Eth. %	HNRS %	Eth. %	HNRS %	Eth. %	HNRS %
Diarrhoea	10.6	**13.2**	14.3	**16.8**	9.4	**15.8**	4.8	**6.7**	8.6	**13.1**
Fever	9.2	**11.3**	8.6	6.7	9.1	7.0	8.2	**11.8**	8.5	**9.0**
Kwashiorkor	0.7	0.0	0.8	**4.2**	1.0	**5.3**	1.3	**2.5**	1.0	**3.4**
Diarrhoea and vomiting	6.0	3.8	6.1	1.7	4.6	0.9	2.1	0.0	4.0	1.2
Cough	4.3	0.0	4.0	0.0	4.9	0.9	5.0	0.8	4.7	0.5
Vomiting	3.0	0.0	2.7	1.7	2.5	0.0	2.5	0.0	2.6	0.5
Other	16.1	20.8	15.2	14.3	12.4	14.9	10.9	16.0	12.9	15.8
Not sick	56.1	50.9	54.4	58.8	60.7	60.5	67.3	64.7	61.7	60.1

As the CSA survey (1993) assessed the occurrence of illnesses in a larger time frame than the present study in HNRS, the results are not fully comparable. One can conclude that the prevalence of a certain illness was indeed higher in HNRS than in Ethiopia in general (CSA, 1993) when the percentage of children suffering from a certain illness was higher in HNRS, i.e. diarrhoea, fever and kwashiorkor. On the other hand, a prevalence that is lower in HNRS as compared to the data of the CSA (1993) might be indeed lower, equal to or higher than the latter due to the different assessment frame of one week versus two weeks.

Diarrhoea was, in addition to the surveys in HNRS and in Ethiopia in general, also the most important cause of morbidity in children under five identified in another Ethiopian study in Butajira (Shamebo, 1993).

As table 55 shows the prevalence of oedematous malnutrition in HNRS peaks in the age groups from 24 – 35 months, the age-range which is considered to be the most vulnerable for this condition (Scherbaum et al., 1999, refer to chapter 2.6, table 4). In Ethiopia as a whole, however, the peak prevalence of oedematous malnutrition occurs in the group of the oldest children from 36 to 59 months. In all age groups (except the children under 12 months), the prevalence of oedematous malnutrition was at least

[a] In the CSA survey, the morbidity data were split up into age-ranges of different dimension, i.e. 6, 12 and 24 months and are therefore presented for HNRS in the same way in the following table.

twice as high in the children of this study than in Ethiopian children on average (CSA, 1993). This is a surprising result as the region around Harar has an arid/semi-arid climate and the prevalence of kwashiorkor is rather supposed to be high in humid and warm regions (Lindtjorn, 1987). Though the prevalence of oedematous malnutrition was higher among girls (4.1%) than in boys (2.6%) (refer to chapter 4.3.2) in HNRS, the percentage of girls admitted to hospitals in HNRS with this condition was over the last three years lower (43% on average) than that of boys (57% on average). Similarly, the percentage of girls admitted with oedematous malnutrition to Nejo Clinic, Ethiopia (Scherbaum, 1996a) and in a Sudanese hospital (Abdel Sayed et al., 1995) was much lower than that of boys. According to these clinical observations it was assumed that boys are probably more susceptible to kwashiorkor. When studying the results of the present study, however, one could come to the conclusion that the situation in the hospitals does not reflect the situation in the country properly. There is some evidence from the present randomised community-based study that girls suffer equally or even more from kwashiorkor than boys, the parents consider it, however, less important to seek medical care for them. The issue of gender differences was not examined further in the present study but should be taken into account more intensely in upcoming projects.
When looking at morbidity data from HNRS one important fact has to be born in mind: the data in HNRS was collected at the middle and towards the end of the rainy season when there are reportedly the highest numbers of children seen at health facilities (refer to chapter 2.7). This is consistent with findings from the Sudan where the highest prevalence of diarrhoea was observed during the rainy season (July to September) (El Samani et al., 1989) and the peak admission of children with kwashiorkor at hospitals occurred during the wet season (Scherbaum, 1996a). Similarly, mortality in children under five in a rural area of Butajira, Ethiopia, was among the highest in July (Shamebo et al., 1991). The data of the CSA survey (1993), however, was collected mid to end March, when the overall situation is better. Therefore, the above table compares general data from Ethiopia (CSA, 1993) to the worst possible situation in HNRS.

As the immune system of a young human organism is still immature, the foetus receives boosters of antibodies from the mother through the placenta and the baby after birth from colostrum. Afterwards, antibodies from breastmilk play an important role for the support of the infant’s immune system. So far, it is not really clear at what age children are fully immuno-competent. Therefore, it is important that the protection through the anti-infectious properties of breastmilk is maintained as long as possible. Usually, morbidity is highest in children from 6 to 36 months. Even if children are still protected at that age by the mother's antibodies through breastmilk, they are confronted with a much higher amount and variety of micro-organisms than before because they start to crawl on the floor and to eat complementary foods. In the children under five in HNRS the morbidity was with 49.1% indeed highest in children from 6-11 months. In the Ethiopian survey (CSA, 1993), however, morbidity peaked in the 12-23 months age-group. This might be due to the later introduction of complementary foods in Ethiopia, because in hot climates all foods other than breastmilk are potentially unsafe and can be a major source for pathogens.

The study in HNRS showed that there was a significantly higher level of morbidity in rural than in urban children. Diseases are per se a potential risk factor for a child to become malnourished due to increased requirements and/or increased losses as well as a loss of appetite.

Several different explanations for the differences in the morbidity level between urban and rural areas can be deduced from this study and others. Both Khin Maung et al. (1994) and El Samani et al. (1989) found out that a low educational level of the mother was associated with an increased risk for the child to suffer from diarrhoea. As the educational level was lower in rural mothers, this is one plausible explanation for the higher prevalence of diarrhoea in the rural area. Overall, a lower educational level does not only lead to a limited knowledge about health and hygiene practices per se. It means as well that the mothers do not have access to a large part of the available information, because they cannot read and write.

As for the town population, Khin Maung et al. (1994)observed that persistent diarrhoea and PEM were 4.4 times more frequent in single-parent households. Due to the small percentage of single-parent households in this study, the data could not be examined for this correlation. The results of the above mentioned study, however, might point to one vulnerable group among the urban population.

From the focus group discussions it became clear that there was a large difference in the perception of causes and treatment of certain diseases. Urban mothers and the mothers in the PA Miai (PA with the highest mean WHZ) were able to identify correctly causes of diarrhoea and to offer proper suggestions for treatment, while in the other rural PA with the lowest WHZ, the mothers suggested that a child got diarrhoea when the mother breastfed it while her body was still hot from the sun. They also preferred traditional remedies to modern medical treatment.

Urban mothers and the mothers in the PA Miai also recognised the role of hygiene (keeping the kitchen clean, boiling the water, protecting the food from flies etc.) in the prevention of diarrhoea, while the mothers in the other rural PA did not see a correlation between hygiene practices and diarrhoea.

The important role of the above-mentioned health seeking and hygiene behaviours was revealed in a study from Addis Ababa (Abate, 1999). A significantly higher proportion of well nourished than malnourished children was brought to hospital by their parents during a diarrhoeal episode and significantly more households with well nourished as opposed to households with malnourished children displayed good hygiene practices.

Some researchers (Khan et al.,1986 and Scherbaum, 1996b) report that the mother withholds all or certain foods from a child during illness. Also, in some areas of Ethiopia, superstition plays an important role in the way people perceive causes of illnesses and in the way the treatment is chosen (Sircar et al. 1987). These findings could, however, not be confirmed in the focus group discussions conducted at the end of this survey, either because they are not a problem in the study area or because the mothers had not enough confidence in the researchers to talk about their true motivations.

The availability of safe water and sanitation facilities as well as health care services count among the underlying causes of malnutrition (refer to the UNICEF model chapter 1, figure 1).

The general structure of the health care system and the availability of health facilities in the specific PAs were outlined in chapter 2.7. The accessibility and acceptability of the health care services was however not investigated in detail.

The availability and usage of sanitation facilities was not investigated in this study either. Furthermore, it was not possible to assess the water quality in the different areas. The only information available is the general one mentioned in chapter 2.3, i.e. that the piped water in town was tested unfit for human consumption and that other protected sources are available in the urban and rural area, but they do not provide potable water either.

5.3 Childcare, breastfeeding and complementary feeding practice

Care can be defined as all of the behaviours performed by caregivers that result in nutrient intake, health and the cognitive and psychosocial development of the child. These behaviours can be classified into the following major categories(WHO/NUT, 1998):

- ‘Hygiene practices
- Home health practices, including diagnosis of illness and health seeking behaviours
- Psychosocial stimulation of children and support for their development
- Breast-feeding and feeding practices
- Food preparation and food storage behaviours
- Care for women, such as providing appropriate rest time or increased food intake’

Only some of these aspects were considered in the interviews and in the focus group discussions of the present study.

The differences between urban and rural mothers in hygiene and health seeking behaviours have already been outlined in the previous chapter.
Time spent by the mothers with caring for the index child was significantly lower in the rural than in the urban areas (2.0 and 3.5 hours respectively). As the families in the rural areas were on average significantly larger than in town (4.9 and 2.7 children resp.), the mothers were probably not able to allocate the same amount of time to each child as a mother in town.
Whether the mother has a formal occupation or not probably plays a subordinate role as the level of employment is similar in urban and rural mothers (32% and 37.8%). Nevertheless, the quality of care given in the absence of the mother by additional caretakers might vary as more small children in the rural than in the urban area were left to their older siblings (38% versus 25% in town) and not in the care of adults. Some studies indicate that leaving a child in the care of a pre-teen caregiver is associated with a lower nutritional status if the child is under 2 years of age, even when controlling for the mother’s education and socio-economic status (Engle, 1991; LaMontagne et al., 1998). In addition, it was often observed in the rural area that young children were left alone and outside the closed house when the mother was away.
There was a significantly larger percentage of illiterate rural than urban mothers (97.2% and 20.6% respectively). Though a large number of studies have demonstrated a positive association between the mother’s educational level and her children’s health

and nutritional status, it is so far not proven whether this association indicates a causal relationship or whether formal education is a marker for other variables that up to now have not been identified (WHO/NUT, 1998). It has been assumed, for example, that educated women have different styles of interaction with their children which are conducive to their developmental progress (Richmann et al., 1992), that they have a greater nutritional knowledge (Ruel et al, 1992) or that they have better feeding practices (Guldan et al., 1993).
Smith et al. (2000) estimate that the contribution of women's education to reductions in child malnutrition in developing countries was 43.0% between 1970 and 1995 (refer to Appendix 9.12).

The following table compares pre-lacteal foods given to newborns in HNRS to those that are common in Ethiopia as a whole (CSA, 1993).

Table 56: Comparison of pre-lacteal foods given to newborns in HNRS and in Ethiopia (CSA, 1993)

Type of food/fluid	Ethiopia	HNRS		
		Urban	Rural	Total
Butter	**48.2%**	0.5% (1/194)	0.0% (0/217)	0.2% (1/411)
Warm water	10.8%	5.7% (11/194)	23.5% (51/217)	15.1% (62/411)
Water and sugar	0.0%	**41.2%** (80/194)	**55.8%** (121/217)	**48.9%** (201/411)
Milk	1.6%	1.0% (2/194)	1.4% (3/217)	1.2% (5/411)
Milk with water	0.0%	0.0% (0/194)	3.7% (8/217)	1.9% (8/411)
Fenugreek	0.2%	0.0% (0/194)	0.0% (0/217)	0.0% (0/411)
Infant formula	0.0%	0.5% (1/194)	0.0% (0/217)	0.2% (1/411)
Other	5.5%	0.0% (0/194)	0.0% (0/217)	0.0% (0/411)
No answer	0.0%	0.0% (0/194)	2.3% (5/217)	1.2% (5/411)
No pre-lacteal feeding	**33.8%**	**51.0% (99/194)**	**13.8% (30/211)**	31.4% (129/411)

While on average the percentage of children receiving no pre-lacteal feeding in Ethiopia and HNRS was comparable, there were nevertheless differences between the urban and rural areas of HNRS and the nation-wide average. In town, the percentage of children not receiving any kind of pre-lacteal feeding was with 51.0% much higher than in Ethiopia, whereas the percentage in the rural areas of HNRS was with 13.8%

much lower. When comparing urban and rural areas in HNRS, significantly more mothers in the rural area gave pre-lacteal feedings to their new-borns. The lower prevalence of pre-lacteal feeding in town could be due to an educational effect. When talking about pre-lacteal feeding in the focus group discussions, the urban mothers outlined first the different ways of pre-lacteal feeding that were common in their families, but then added that these practices were disappearing because the health workers were strongly discouraging them. In contrast, the rural mothers outlined that pre-lacteal feeding was necessary both because it was part of their tradition and because it was needed to prevent the baby from starving when the breastmilk was not available right after birth. While the mothers of one of the rural focus groups believed that a mixture of unboiled cow milk and water was appropriate for a baby and would cleanse the intestine from dirty things swallowed intra uteri and during birth, the mothers in the other rural focus group rejected cow milk as being too heavy for a new-born and preferred a sugar solution to prevent the baby from starving immediately after birth.

The most common pre-lacteal feeding in HNRS was water with sugar as opposed to butter in the nation-wide survey (CSA, 1993).

Even though the majority of neonates in Africa, Asia and Latin America are breastfed, exclusive breastfeeding is rare. Water, tea and juices are often given to infants soon after birth before initiating breastfeeding. The motives are various, e.g. traditional practices, quenching the infant's thirst or relieving colics (WHO, 1991). It has been proven though that even in environments with a hot and dry climate infants do not need anything in addition to breastmilk during the first 6 months of life (Sachdev et al., 1991). Infants who consume enough breastmilk to satisfy their energy needs will also cover their fluid requirements. Moreover, studies have shown that the prevalence of diarrhoea in infants < 6 months of age who received supplemental fluids was twice as high if compared to children of the same age who were exclusively breastfed (WHO, 1991). In addition, a study in India showed that the supplementation of non-nutritive fluids lead to a decline in breastmilk-consumption and thus to a decline in the overall energy and nutrient intake (Sachdev et al., 1991).

The percentage of mothers in HNRS who had not given colostrum to the index child was with 4.4% very low, but significantly higher in town as opposed to the rural area (8.2% versus 0.9%). In addition, more mothers in town had the idea that colostrum was not good for their baby. This observation could be due to cultural differences between the ethnicities (mainly Amhara/Harari in town and Oromo in the rural area), this was, however, not further investigated.

The following table compares important breastfeeding and weaning parameters in HNRS with those in Ethiopia as a whole (CSA, 1993).

Table 57: Comparison of breastfeeding and weaning practice in HNRS and in Ethiopia (CSA, 1993)[a]

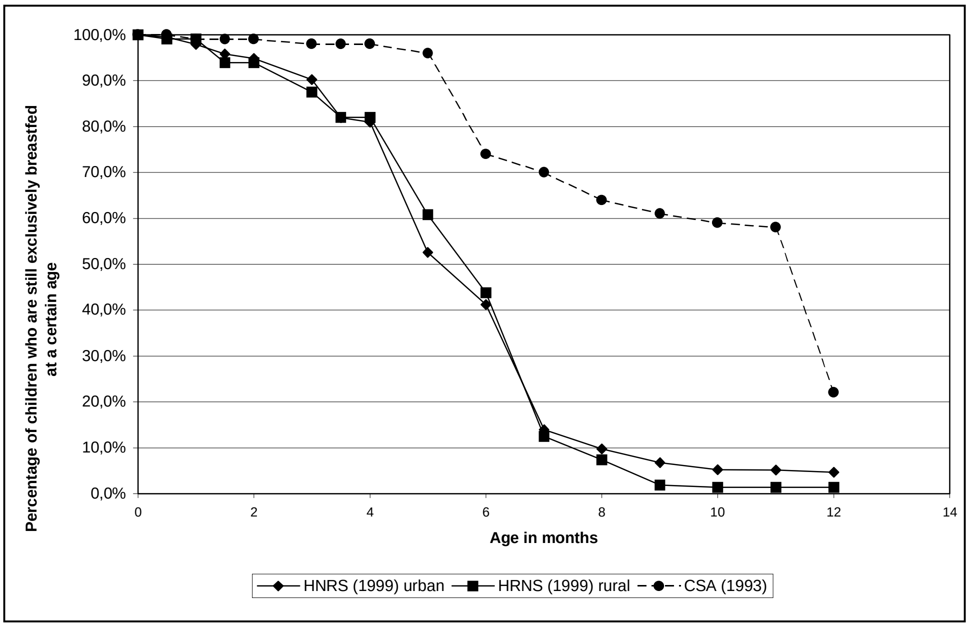
Parameter	Ethiopia	HNRS		
		Urban	Rural	Total
Median age for the introduction of first complementary foods	7.1 months	5.0 months	5.0 months	5.0 months
Median age for termination of breastfeeding	25.3 months	15.0 months	19.0 months	18.0 months

When comparing the median age for the introduction of first complementary foods in Ethiopia and HNRS to the recommended age of 6 months (recommended since the 45th World Health Assembly in 1992)(WHO/NUT, 1998), the mothers in Ethiopia on average started complementary feeding one month later and the mothers in HNRS started one month sooner than recommended. The median age for termination of breastfeeding was higher in Ethiopia as a whole than in HNRS, too. In the CSA study (1993), exclusive breastfeeding remained high during the first 6 months, but declined in importance throughout the first year, while in HNRS exclusive breastfeeding already declined sharply after 4 months (refer to graph 42). When looking at the data of HNRS alone, the duration of exclusive breastfeeding was similar in town and the rural areas, whereas the total duration of breastfeeding was with 19.0 months significantly higher in the rural area. In these studies in HNRS and in Ethiopia and also in other studies (WHO, 1991) one can observe the trend that the sooner complementary feeding starts, the shorter the overall duration of breastfeeding is (see graphs 42 and 43). The recommended duration of total breastfeeding, however, is at least 24 months. Between 6 and 24 months the food quantity and the frequency of complementary meals should be gradually raised, but breastfeeding on demand should be continued (Academy for

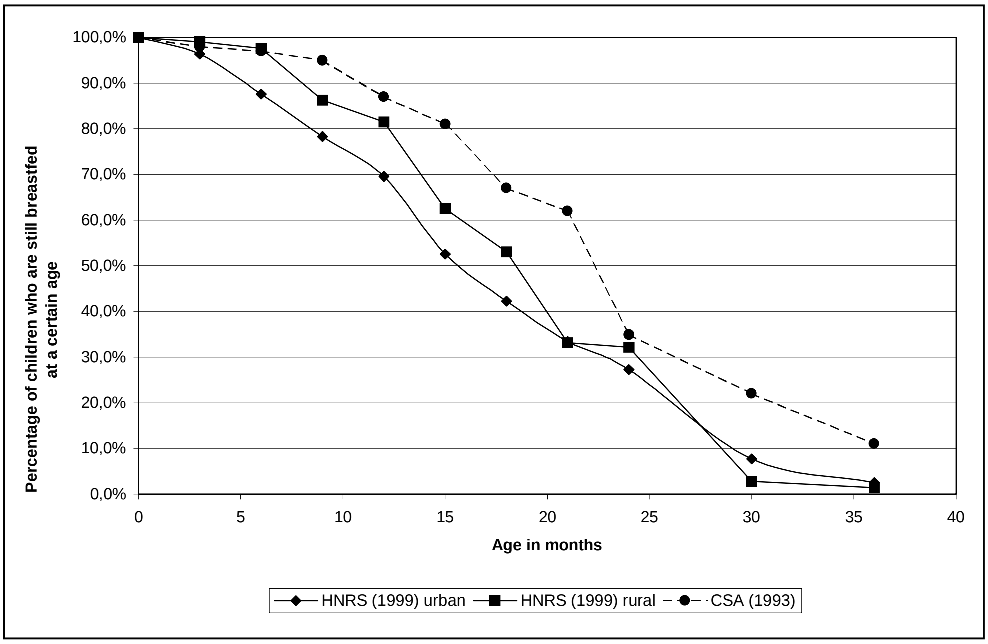
[a] From the CSA (1993) survey, only the median values of the above mentioned parameters were available and are therefore used instead of the mean.

Educational Development, 1999). A long total duration of breastfeeding is a positive habit, because breastmilk is still an important source of energy, fat, high quality protein and micronutrients after the age of 6 months, especially in areas where the quality of available complementary food is low (Academy for Educational Development, 1999). Accordingly, a study in Senegal made the observation that the positive impact of continued breastfeeding on growth in children up to 3 years was higher in children of lower socio-economic classes (Simondon et al., 1999). Furthermore, exclusive breastfeeding during the first 6 months of life has been found to be a major protective factor against diseases in early childhood like diarrhoeal and respiratory infections (Perera et al., 1999). Likewise, breastfeeding during the first year of life was shown to protect against diarrhoeal illness and otitis media, even in a relatively affluent and highly educated population (Dewey et al., 1995).

Graph 42: Duration of exclusive breastfeeding in HNRS and in Ethiopia (CSA, 1993)



Graph 43: Percentage of children still breastfed at a certain age in HNRS and in Ethiopia (CSA, 1993)



The topic of complementary feeding is very complex. The amount of breastmilk consumed at different stages of weaning, the energy and nutrient density of the foods given, the frequency of feeding, the variety of foods offered, snack foods, feeding practices, hygiene aspects of food preparation and poor appetite during illness are all factors that play an important role.

As complementary feeding was not the focus of this study, only some of the above mentioned aspects were investigated and will be shortly discussed.

In Ethiopia as a whole (CSA, 1993), the use of cow milk increased through five months of age with the decline of breastmilk consumption, and milk plus cereal and other solids were added during the second half of infancy. As to complementary foods reportedly used by the mothers in this study in HNRS, please refer to chapter 4.2.2, graphs 12 - 14. As a general observation, the variety of complementary foods used in town was much larger as compared to the rural area, particularly when looking at fruits and vegetables. They seemed to play virtually no role as a complementary food in the rural area. This observation from the interviews was supported by the results of the focus groups. While mothers in town mentioned fruits and vegetables among the foods that should be given to young children, the mothers in the rural area mostly mentioned starchy foods and milk to start with. In one of the rural focus groups, the mothers outlined that they also gave mangoes to their young children during mango season, but that they did not consider mangoes as necessary and that mangoes were not counted as ‘real food’.

The number of complementary meals given to children who were still breastfed was similar in the urban and rural areas, about 4 times a day. This is according to the recommended frequency of 2-5 times a day, depending on the age of the child (Academy for Educational Development, 1999). During the focus groups, the mothers explained that the number of meals given to young children depended on different factors according to their opinion: first, the question was how many meals the family could afford; secondly, the frequency of feeding depended on whether the mother was at home during the day or not; thirdly, it was important whether there was somebody to feed the child in the mother’s absence. Depending on these factors, the number of complementary meals could range from 1 per day in the most disadvantaged families up to 4 meals or more under better circumstances. When asking the mothers to compare the quality of their home-made baby food to commercial baby food (e.g. Fafa), the mothers in town ranked their own food equal to the commercial one, while the rural mothers thought the commercial one much better, though they could not afford it. The majority of mothers in all focus groups agreed that a child was old enough to eat family foods at about 2 years of age.

When looking at the children who did not receive breastmilk any longer, there was a significant difference in the number of meals available between the urban and rural area. While children in town on average received one meal more per day when being completely weaned as compared to children who were still breastfed, the number of meals for children in the rural area stayed the same. Considering that breastmilk as an additional source of energy and nutrients is no longer available, it makes sense to raise the number of meals in order to assure a sufficient energy and nutrient supply. For a young child, it is better to receive small and frequent meals, because the capacity of its stomach is limited. When looking at the results of the focus group discussions, the restricting factors for the rural mothers, however, are probably not lack of insight or knowledge to consider the needs of their children, but a lack of resources and time.

Though the issue of bottle feeding was not addressed during the interviews, it became obvious during the focus group discussions that some mothers did use bottles to feed their children. Further studies should therefore include this aspect as well in order to estimate the potential negative impacts of bottle feeding on the health of the children under five in HNRS.

The CSA (1993) found a highly significant association between delayed (defined in the study as after 4-6 months) introduction of weaning foods and stunting. This is an important issue deserving further investigation.

A study in Honduras, however, suggested that babies who are exclusively breastfed up to the age of 6 months grow as well as those who receive complementary foods between the age of 4-6 months (Cohen et al., 1994). Not even in small-for-gestational-age infants was there a growth advantage when they received complementary food in addition to breastmilk between 4 and 6 months of age (Dewey et al., 1999).

Considering the risk of infection due to food-borne pathogens most experts presently do recommend exclusive breastfeeding for about the first six months of life (Academy for Educational Development, 1999). In addition, several studies in Thailand, Peru, Honduras and the USA indicated that the introduction of complementary foods before 6 months of age does not increase caloric intake (WHO/NUT, 1998). This is mainly due to the fact that breastmilk has a higher nutritional value than most complementary foods available. Introducing complementary foods at an early age thus means depriving the infant of a valuable source of energy, fat, protein and micronutrients and replacing it by foods of less nutritional value.

The reason for growth failure in children who are exclusively breastfed beyond 6 months is not necessarily that breastmilk is insufficient after the recommended duration of exclusive breastfeeding. Other possible explanations are that in areas where the mothers do not carry their babies, the infants are more and more left to themselves or to older siblings as they grow older. That way, there are fewer occasions to breastfeed the baby and it might not get the quantity to fulfil its growing needs, though the quality of breastmilk might still be sufficient. The critical point when infants are older than 6 months might therefore rather be the access to breastmilk than the insufficient quality of it. This issue was no focussed in the present study, from observations one can state, however, that there is no general rule whether the mothers, both urban and rural, take their breastfed children with them when they are not at home, e.g. when they are at the market or when they are working on the field.

There was a statistically significant difference between urban and rural areas in the fulfilment of requirements of some nutrients. The intake of fat, vitamin C and calcium was significantly higher in town while the intake of vitamin B2, phosphorus and zinc was significantly higher in the rural area. It is not possible to estimate, whether and to which extent these concrete differences in nutrient intake contribute to the different prevalence of malnutrition in urban and rural children, in particular because though the

differences were significant, the intake was still sub-optimal for all children (except vitamin C).The diet will be discussed more detailed in chapter 5.5.
One factor that might contribute to a disadvantaged situation of younger children in the rural area is that often all children or the whole family share one plate. If the child is not fed by a caretaker who makes sure that the child receives its share, a small child might be easily outdone by older siblings who are quicker and more skilled to eat. This issue deserves further investigation.

5.4 Anthropometry

Anthropometric indices are relatively simple tools to assess the overall nutritional status of a child, though they cannot identify single nutrient deficiencies. They are widely used in developing countries to identify those individuals who are at risk of developing more serious forms of malnutrition.

5.4.1 Prevalence of different forms of malnutrition in HNRS and in Ethiopia

Table 58 compares the prevalence of underweight (WAZ < -2 SD), stunting (HAZ < -2 SD) and wasting (WHZ < -2 SD) in HNRS in 1999 and in Ethiopia in 1993 (CSA,1993)[a].

Table 58 : Comparison of the prevalence of underweight (WAZ < -2 SD), stunting (HAZ < -2 SD) and wasting (WHZ < -2 SD) in HNRS (1999) and in Ethiopia (CSA,1993) according to age-groups

Variable	6-11 months		12-23 months		24-36 months		36-59 months		All ages	
	Eth. %	HNRS %	Eth. %	HNRS %	Eth. %	HNRS %	Eth. %	HNRS %	Eth. %	HNRS %
WAZ < -2SD	39.5	17.0	55.0	32.5	50.4	39.3	44.9	25.0	47.7	30.3
HAZ < -2 SD	56.5	15.1	72.7	37.0	64.3	32.7	62.0	33.6	64.2	31.9
WHZ < -2 SD	6.3	**9.4**	11.7	8.8	6.9	**9.3**	7.0	6.9	8.0	**9.1**

[a] The age ranges are defined according to the age-groups used in the CSA survey.

Comparing the data of HNRS to the one of Ethiopia as a whole, the prevalence of underweight and stunting are much lower for all age groups in HNRS than in the whole country. One can therefore conclude that underweight and chronic malnutrition seem to be a smaller problem in HNRS than in Ethiopia as a whole. On the other hand, the prevalence of wasting and thus of acute malnutrition is overall higher in HNRS than in Ethiopia. This can be explained along the same lines as the higher prevalence of illnesses, but it is important to note as well that 6 years lie between the two surveys.

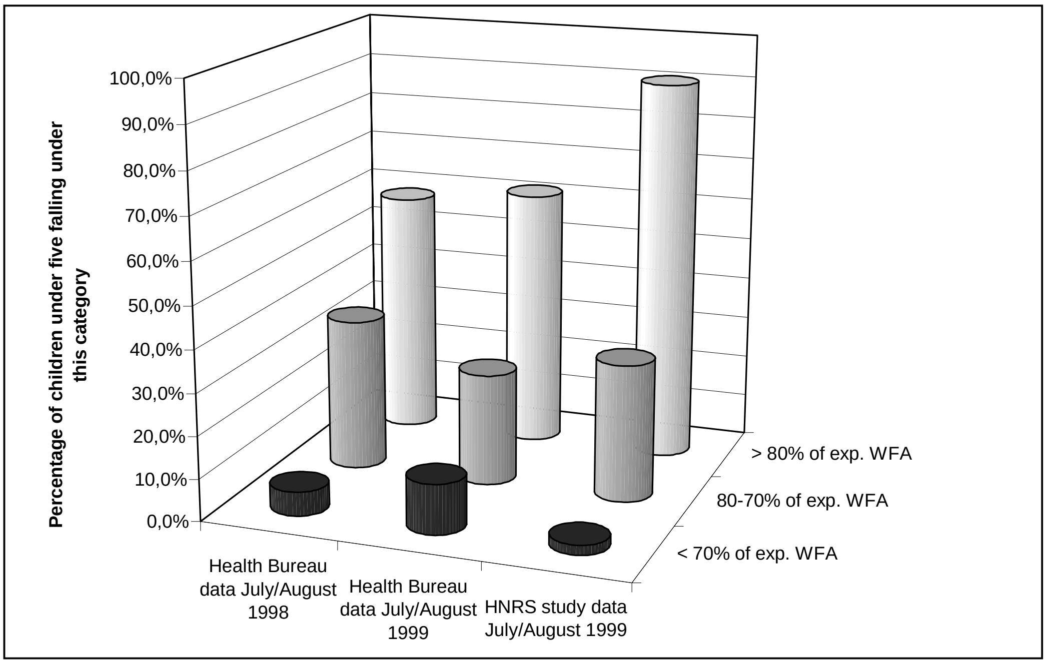
According to the Academy for Educational Development (1999), children between the age of 6 and 23 months are at the highest risk of nutritional deficiency and growth retardation. This statement can be confirmed by the findings of the present study and the one by CSA (1993) where in both cases the prevalence of stunting was highest in the age—group of 12-23 months.

There were differences in the percentage of children identified as severely malnourished in this study, depending on the classification scheme used (Hendrickse, 1991 or WHO, 1999; refer to chapter 4.3.9), i.e. there were some children who were classified as being severely malnourished by one, but not by the other scheme and vice versa. As the WHO scheme (1999) has been introduced just recently, only experience over time can show whether the new criteria will help to improve the diagnosis of severely malnourished cases.

5.4.2 Comparison of % expected WFA data from the present study to data collected by the HNRS health bureau

The following graph compares the data for %expected WFA of children under five that was collected in the present study to data that is routinely collected at health facilities in HNRS during the whole year.

Graph 44: Comparison of % expected WFA data from this study (July/August 1999) to data from the health bureau (July/August 1998 and July/August 1999)[a]



This chart shows that the prevalence of severe forms of malnutrition (% expected WFA < 70%) was lower in the present (randomised) study if compared to the respective data collected at health facilities in HNRS. In clinic-based studies, the prevalence of severe forms of malnutrition is usually higher, as the children are already sick when the assessment is made. Therefore, anthropometric data collected in clinical settings and randomised studies are not comparable. To get a general picture of the whole population (e.g. of the situation of all children under five), only randomly collected data can considered as a useful basis for further decisions.

[a] The data for % expected WFA are presented in the graph with the cut-offs used at the health facilities in HNRS. The definition of severe malnutrition (marasmus) when using this index is, however, exp. WFA < 60% and not < 70%. The mildly malnourished category is therefore usually defined as 60 – 80% and not 70 – 80% exp. WFA.

5.4.3 Connections between anthropometry and health status of children under five

Numerous studies have demonstrated the relationship between low nutritional status and increased morbidity and mortality in children and vice versa (refer also to Appendix 9.11). Khan et al. (1986) for example found out that the number of diarrhoea episodes the children suffered from increased with the severity of malnutrition. In contrast to the earlier assumption that children catch up growth soon after illnesses, the children in his study often suffered from a new episode of diarrhoea before a rise in weight was registered. Catch up growth up to the children's weight before onset of the disease was therefore not observed. In the study of Yoon et al (1997), low WFA was a significant risk factor for ALRI and diarrhoea mortality in children under two years of age. Similarly, the degree of malnutrition was positively related to the risk of mortality in respiratory tract patients in the study of Groenewold et al. (1990). Schroeder et al. (1994) stress that 40-55% of young children who die in developing countries are malnourished. Likewise, Pelletier et al. (1995) state that, according to their findings, a weighed average of 56% of deaths in children is due to the potentiating effects of malnutrition. They outline, however, that at least 75% of the total population-attributable risk is due to mild-to-moderate malnutrition. These findings stress the importance of early intervention, even before the child has reached a severe status of malnutrition.

5.5 Dietary Assessment (24-hour recall)

The 24-hour recall is a retrospective method assessing the dietary intake of the day before the interview. The general strengths and weaknesses of the 24-hour recall method have already been outlined in chapter 3.6.

5.5.1 Energy intake

The children in this study had an average energy intake of 900-1000 kcal, i.e. they covered about 66-73% of their requirements. From 12 to 47.9 months, there was on average no increase in energy intake.
According to FAO/WHO (1994), 1699 kcal were on average available per caput per day in Ethiopia in 1988-1990.
According to a study by Hautvast et al (1999) stunted children under 20 months had a lower energy intake than their non – stunted age-mates. Hautvast et al. (1999) did

however not explain, whether the lower energy intake was a cause or a result of stunting. Due to our small sample size, we could not test for this correlation.
Concerning the flat-slope syndrome (refer to chapter 3.6), there was an interesting observation when comparing the mean WHZ and the mean energy intake per age group. As the dietary data from the 24-hour recall can be used to derive the average usual intake (during a limited period of time, e.g. a season) of a group of individuals (Gibson, 1990) and WHZ is an indicator of acute malnutrition these two variables should be, in some way, correlated. Looking at the two data sets, a high mean energy intake always appeared together with a low mean WHZ and vice versa (refer to Appendix 9.13). When splitting up the data according to urban and rural settings, this opposite trend was much stronger for the rural area.
The observation might be interpreted in two different ways. First of all, the flat-slope syndrome (Thompson et al., 1994) itself would explain the opposite trend. Mothers who were aware that their children were malnourished might have overestimated their children's intake while mothers whose children were well nourished underestimated their dietary intake. As the problem of wasting was more severe in the rural area, the magnitude of the flat-slope syndrome is expected to be larger there. Secondly, the mothers with wasted children might have indeed fed their children more in order to help them recover while mothers with comparably well nourished children did not take extra care to make them eat a lot. As it takes some time for the children to recover even if the diet is improved, this could explain the opposite trends of the two data sets as well.
While mothers in town only complained about acute food shortage, i.e. during the long rainy season, households in the rural area of HNRS suffered from both acute and chronic food shortage. Generally, the rural households suffered from food shortage four times more than the urban ones throughout the year (91.7% and 32.3% respectively) (refer to chapter 4.1.2). According to estimates from previous studies about 10% of rural households in Ethiopia can be considered as food secure (Bekele, 1991). Yet in rural HNRS, only about 8% of rural households did not complain about food security problems.
The precarious situation in the rural area has already caused a large number of people to migrate from the rural areas to Harar town, hoping for support.
Smith et al. (2000) estimate that the contribution of the national food availability to reductions in child malnutrition in developing countries was 26.1% between 1970 and 1995 (refer to Appendix 9.12).

5.5.2 Macronutrient intake

5.5.2.1 Carbohydrates

Carbohydrates (CHO) were the major source of energy in urban and rural areas with 64% and 78% of total energy intake respectively. In the rural area, the lack of fat as a source of energy was counterbalanced by a higher contribution of CHO to total energy intake which was even above the recommended range of 55-75%. This excess intake was also reflected in a CHO nutrient density above the recommended range for all rural children.

The contribution of mono- and oligosaccharides was about 5 times higher in town (19%) as opposed to the rural area (4%). This was mainly due to a higher consumption of sucrose in tea, biscuits and other sweets. The consumption of whole grain cereals probably contributed to the higher supply of vitamin B2 and zinc in the rural area. Rural children had an overall better coverage of their requirements for these two nutrients when compared to children in town.

5.5.2.2 Protein

The fulfilment of protein requirements was on average over 100% for all children. The protein quality varied between the urban and rural area though. While in town, about 44% of the protein were of animal origin, animal protein contributed only about 9% to total protein intake of children in the rural area. Animal protein is considered to be of higher nutritional value for humans, because its amino acid patterns on average fit the human requirements very well. Plant protein in the contrary often lacks some of the amino acids that are essential for the human body or contains too little of them, particularly if the diet is very monotonous.

The old concept that children who develop kwashiorkor have normal caloric and low protein intake could not be confirmed in this study. Children suffering from oedematous malnutrition covered on average only 47.7% of their energy and 70.3% of their protein requirements. The overall number of children with oedematous malnutrition for whom dietary data was evaluated is however too small to generalise these results. In addition, the data of this study represents the dietary intake of children who have already developed the full clinical picture of kwashiorkor, probably including a reduced appetite and underlying diseases. Information about the diet of children who develop kwashiorkor could only be obtained by a prospective study.

5.5.2.3 Fat

The fat requirements of children under five in HNRS were covered to 25 – 74% with an average intake of 11 – 26g. In the rural area, the fulfilment of fat requirements was significantly lower than in town (28.7% and 65.4% respectively).
According to FAO/WHO (1994), the proportion of dietary energy supply derived from fat was 14% in Ethiopia 1988-1990 and on average, 26g of fat were available per caput per day.
Dietary fat is the source of essential fatty acid and aids in the absorption of the fat-soluble vitamins A, D, E and K. In addition, fat is a substrate for the production of hormones and mediators. In infancy and childhood, fat is essential for the neurological development and brain function (Milner et al., 1999). Information on the nature of the cooking oils used (= the main source of fats in the diets assessed) was not available. Therefore, it is impossible to make any statements on the fatty acid patterns of these oils or to estimate whether they contain enough essential fatty acids to cover the requirements of children under five.
It is recommended that during complementary feeding the fat component should provide 30-40% of the energy intake and similar levels of essential fatty acids as are found in breastmilk from appropriate foods until at least two years of age (FAO/WHO, 1994). The analysis of the data of children under five in HNRS revealed that, only 24% and 10% of total energy in the urban and rural area respectively came from dietary fat. If the weaning food is so low in fat and essential fatty acids, prolonged breastfeeding could improve the dietary quality enlarging the fat and essential fatty acid supply. Breastmilk should therefore be available to children as long as possible.
When looking at the global picture, excess body fat is a major risk factor of morbidity and mortality in most affluent countries and, increasingly, in many developing countries (FAO/WHO, 1994). Obesity and excess visceral fat are conditions that predispose individuals to chronic diseases. In Harar town, one could observe that some children in the richer families already showed a tendency to overweight. The problem probably is that the mothers associate fatness with health. Considering the background of the Ethiopian people which has been affected by recurrent droughts, famine and emergency situations, one can yet understand whence this notion comes.

5.5.3 Vitamin intake

5.5.3.1 Vitamin A

All children except the age group of 12 – 36.9 months in the rural area met their needs. The vitamin A density of the diet was above the recommended range for the children from 12-23.9 months. Their low vitamin A intake was therefore rather due to a lack in energy intake. For the children from 24-36.9 months, the vitamin A density of the diet was far below the recommended range and therefore the deficient vitamin A intake probably due to insufficient dietary quality.
As fat requirements were only met to about 60-80% in town and 25-30% in the rural area, vitamin A absorption in the children of this study is probably impaired (de Pee et al, 1995). The consumption of breastmilk together with the meal could increase absorption of vitamin A (WHO/NUT, 1998).
The finding that most children covered their vitamin A requirements is surprising because vitamin A deficiency has been suspected to be a major problem in the area (Bekri, 1999). Yet it is possible that the observed intake was due to a seasonal high, e.g. the end of the mango season, and is not representative for the whole year.
Only biochemical or clinical tests can help to find out whether the vitamin A status of the children under five in HNRS is indeed satisfactory.

5.5.3.2 Vitamin B1 and B2

With the exception of the age group of 36 – 59.9 months in town the vitamin B1 needs of all children were satisfied. The lower vitamin B1 intake of the older children in town might be due to a higher intake of sugar and sweets and white flour/rice instead of whole grain cereals. In addition according to the Ethiopian food tables, the types of injera mainly consumed in town contained considerably less vitamin B1 than the types of injera common in the rural area.
Children in town had significantly lower vitamin B2 intake as opposed to the children in the rural area (70.2% and 99.3% respectively). This difference is mainly due to the fact that according to the Ethiopian food tables the type of injera consumed in town contained less vitamin B2 as the ones in the rural area.

5.5.3.3 Vitamin C

The vitamin C needs were covered in all children except the age group of 12 – 23.9 in the rural area. The vitamin C density of the diet was below the recommended range in children from 24 – 36.9 months and 48-59.9 months in the rural area. In older children however, the consumption of wild fruits could have added to the vitamin C intake. On average, the vitamin C intake was significantly lower in the rural area as opposed to Harar town (84.7% and 229.0% respectively).
Vitamin C is critical (Biesalski, 1996):

- During infections: the requirements go up
- During intestinal tract infections: the absorption is inhibited
- When carbohydrates intake is high :carbohydrates have the same cell receptors as vitamin C and may displace it.

Children of 12 – 23.9 months are very likely to suffer from vitamin C deficiency as their intake was low, they had a high rate of morbidity and especially a high prevalence of diarrhoea and the diet was high in carbohydrates. In addition, most other children in the rural area probably suffer from marginal vitamin C deficiency, at least seasonally, when wild fruits (or vegetables) are not available.

5.5.4 Mineral intake

5.5.4.1 Calcium

Calcium needs were only covered to 34-64%. The significantly higher fulfilment of requirements in town (57.8%) as opposed to the rural area (39.2%) was mainly due to the higher consumption of milk.
The calcium density was too low in the diet of all rural children and for the children of 36 – 59.9 months in town to cover their needs when meeting their energy requirements.
An additional adverse factor for the rural children is that the calcium bioavailability from plant sources, on which they mainly rely for their calcium supply, is worse than from animal sources (WHO/NUT, 1998).
Overall, rural children in HNRS are therefore very likely to be deficient in calcium. Children in town probably suffer from calcium deficiency as well, but less severely.

5.5.4.2 Copper

Copper intakes in the present study exceeded the needs of all children at least twofold. The source of these large amounts of copper were all types of injera. They contained at least 0.3mg and up to 0.9mg copper /100g. This is very high compared to an average European wholemeal or white wheaten bread with a content of about 0.3mg copper/100g. Whether these high amounts of copper found in Ethiopian injera are due to soil contaminations or come from the grain itself is unknown. It is therefore recommended to verify the data from the Ethiopian food tables concerning this nutrient. Another possibility is to analyse the copper status of the children themselves biochemically.

5.5.4.3 Phosphorus

The children in this study did not cover their requirements (USA RDA) though Prentice et al. (1994) claim that the phosphorus intake of children in developing countries is many times higher than their estimated needs. The coverage of phosphorus requirements was significantly higher in rural (90.8%) than in urban children (78.5%). This is in contradiction to the results of Ramachandran K et al. (1984). In their study, fermented tef and wheat batters yielded a higher dialysable fraction of phosphorus than the unfermented batters. If this principle applies to all types of cereal batters in general one would expect the children in town to have a higher phosphorus intake because the injera batter is fermented there but usually not in the rural households in HNRS.

5.5.4.4 Potassium

The coverage of potassium requirements was below 100%.The fulfilment of requirements was higher in urban (88.7%) than in rural areas (77.5%).
Potassium is most critical in diarrhoea when losses through the faeces are high.

5.5.4.5 Iron

The average iron intake exceeded the needs of all children at least threefold and the iron density of the diet was above the recommended range for all. There were differences in the iron quality between urban and rural areas though. Only about 8% of iron in the urban and 2% of iron in the rural area were haem-iron (bioavailability of haem-iron about 25% and of non-haem-iron about 2-8%, WHO/NUT, 1998). The iron intake in town was higher than in the rural area. This was mainly due the consumption of tef injera. Tef is a grain which is very rich in iron (red variety about 150mg/100g and white variety about 23.4mg/100g; Gobezie et al., 1997). The sorghum and tef containing injeras had an iron content of 6.3mg/100g up to 56mg/100g. All types of injera contained at least 2.7mg iron /100g as opposed to a maximum iron content of 2.7mg/100g for European whole meal or white wheaten bread. The high iron content of some Ethiopian cereal based foods is however only partly due to food iron. There are also a lot of contaminations from iron-rich soils (Ramachandran K et al., 1984).

The practice of fermentation might improve the bioavailability of non-haem iron from injera. Ramachandran K et al. (1984) found out that fermentation yielded a higher dialysable fraction of iron from tef and wheat. This effect can mainly be attributed to the breakdown of phytate by phytase during fermentation. As phytates reduce the absorption of non-haem-iron, fermentation probably enhances the bioavailability of non-haem-iron. The basic assumption made in this study though was that the bioavailability of food iron depends mainly on the ionisable component. This assumption was not proven by the researchers.

In HNRS, only the Harari and Amhara do ferment their injera. In the rural area, bread is eaten unfermented. If the assumption of Ramachandran et al. (1984) concerning the improved availability of non-haem-iron from fermented food is true, non-haem-iron absorption from the injera consumed in town should be a lot better than from the injera prepared in the rural area.

Consuming vitamin C together with non-haem iron can double the amount of non-haem-iron absorbed from maize, wheat and rice (Allen et al., 1997). As all types of injera contain virtually no vitamin C and about half of the vitamin C in the accompanying vegetable sauces is destroyed by cooking (Biesalski ,1996) this effect may be so far low in the given setting.

Black tea has strong inhibitory effects on iron absorption from foods consumed at the same meal (Dewey et al, 1997). Though children in town received tea in sometimes considerable amounts, they drank it mostly at breakfast with foods of low iron content

like French bread. The negative effect of black tea on iron absorption should therefore be low in town. In the rural area, the main beverage was water. Black tea very rarely appeared in the rural dietary protocols.
More important is however the role of parasites that can comprise the iron status severely, e.g. through intestinal bleedings caused by hookworms (Anke et al., 1999) or malaria. The present study did, however, not assess the children's disease status concerning these types of parasites.
It is impossible to know from dietary data alone whether the high iron intake in combination with the outlined inhibitors of iron absorption and the presence of parasites suffices to meet the requirements of the children.
Only clinical or biochemical signs of deficiency can be used to verify the net effect of all factors that may compromise the iron status of a child. In any case it has been suspected that iron deficiency anaemia could be a problem among women of reproductive age in HNRS (Abdosh, 1999) who supposedly have a similarly high iron intake as the children, but also higher iron losses.

5.5.4.6 Zinc

The average fulfilment of zinc requirements was below 100% for all children in this study. Rural children had a significantly better coverage of their needs than urban children (89.4% and 72.0% respectively). The zinc density of the diet was below the recommended range for all children, a sign of insufficient dietary quality for zinc. Ramachandran et al. (1984) yielded a higher dialysable fraction of zinc from tef through fermentation of the batter. They assumed that this went along with a higher bioavailability of zinc. If this assumption was right and one was able to prove it for other cereals as well, the bioavailability of zinc from fermented injera would be rather good. In HNRS however, only people in town would benefit from this effect as the Oromo in the rural area usually do not ferment the batter for injera.
Zinc deficiency has long been suspected to be prevalent in children in developing countries. Important factors contributing to zinc deficiency are diets low in animal products and high in phytates and zinc losses during episodes of diarrhoea (WHO/NUT, 1998). Children under five in HNRS, in particular in the rural areas, are very likely to suffer from zinc deficiency because their diet was mostly vegetarian, the zinc intake was below optimum and the prevalence of diarrhoea was high. In this context, the role of breastmilk has to be stressed again. Though it contains relatively small amounts, the zinc bioavailability is very high. Therefore breastmilk can play an

important role in sick children, particularly those suffering from diarrhoea, both as a comforter and as a source of micronutrients, e.g. zinc, to replace losses.
Zinc supplementation has been found to have a positive impact on children's growth in various studies in which physical growth was compromised (moderate stunting, low zinc plasma levels, recovery from severe malnutrition) (WHO/NUT, 1998). Before considering any kind of intervention, the findings of the present study should however be confirmed through a biochemical examination.

6. Recommendations

6.1 Improvement of the diet

In some of the rural areas, where maize porridge, often served even without sauce, was the staple diet, it was supposedly difficult for young children to eat enough to cover their energy and nutrient needs, due to the bulkiness of the food. Fermentation can reduce bulkiness and increase the bioavailability of iron and zinc from the diet (Fleischer Michaelsen et al., 1998). The same principle would be applicable to injera batter. It has to be investigated whether fermentation of flour before the preparation of maize porridge and injera would be a culturally appropriate measure and whether it would be accepted by the target population in the rural areas of HNRS. In any case, it is known that the Oromo of the eastern part of Ethiopia do eat fermented foods (Scherbaum, 1996b).

As outlined before the amount of fat in the diet of all children was lower (11 – 26 g) than the recommended intake (35 – 42 g, depending on age). In order to increase the fat and the essential fatty acid supply in particular, linseeds seem to be a good solution. First of all, they are already used in the diet of young children, i.e. mothers in town added it to Atmit-powder and mothers in the rural area often served injera or plain maize porridge with a sauce made from crushed linseeds. Secondly, they are affordable (5-6 Birr/kg[a]) if compared to butter or oil (32 and 12 Birr/kg respectively). In addition, they are not only good sources of fat but will also add energy and those micronutrients to the diet that are lacking in addition to fat, i.e. B-vitamins, calcium, phosphorus, potassium and zinc. Linseeds can also be used by mothers in more remote areas who do not have daily access to the market, because they can be easily stored and do not spoil quickly. In addition, they can be used in the family diet in general and will thus improve the diet of all members of the family. Sunflower seed, sesame or groundnut paste might be used in a similar way; they are equally suited as sources for micronutrients in addition to fat though their usage seemed not to be as widely common as that of linseeds.

Promoting the use of linseeds or other oil seeds instead of butter or oil takes the focus off fat a little bit. Fat, particularly butter, is already considered a prestige food and added to the dishes whenever people can afford it. Particularly in town, one should be careful to promote a higher fat intake per se for children in order to avoid an excess fat

intake on the other side. If pure fat is used in the diet, one should choose high quality oil with a high content of essential fatty acids like sunflower seed oil. For the children with low vitamin A intake, butter might be a good choice too, because it contains considerable amounts of that micronutrient in addition to fat.
It has already been mentioned that it was virtually impossible to identify the nature of the oil available on the market. It is therefore highly recommended that the type of oil should be declared on the packing. Without knowing the quality of the oil it is not possible to estimate its value for the diet and it is difficult to decide whether it is appropriate to be used in therapeutic feeding.
The protein quality was generally lower in the rural area because there was little animal protein in the diet, often maize and sorghum were the only sources of protein. This lower dietary quality could be improved by combining cereals and pulses in one meal as is done when preparing Nefro[b]. The combination of cereals and pulses leads to a higher amino acid score of a meal which is a marker for the percentage of the meal protein that can be used to build human protein (Savage King et al., 1993). The price of chickpeas and haricot beans (about 3 Birr/kg) is not much higher than that of the staples maize and sorghum (about 2.5 Birr/kg) and this measure should therefore be economically feasible.
Concerning the sub-optimal vitamin C intake among young children in the rural area, it seems that first of all mothers have to be made aware of the essential role of fruits and vegetables in the diet. The mothers were not aware that these foods are as an essential part of the diet as starchy and protein rich foods. Though it might not be economically feasible for a majority of the rural mothers to buy fruits and vegetables in the required quantities for the whole family, there are a lot of wild fruits and vegetables which can serve to bridge the gap. Cactus fruits were growing abundantly in some areas. In one PA, the mothers were using wild leaves in their sauce which is a very good coping strategy to improve the diet when financial means are lacking.

6.2 Breastfeeding

As has been outlined in the discussion section, mothers should be encouraged to initiate breastfeeding right after birth, without giving pre-lacteal feeds, to exclusively

[a] Price as of July/August 1999 on Harar Central Market
[b] Nefro is a dish prepared from a mixture of cereals, e.g. wheat or sorghum, and/or maize plus haricot beans

breastfeed until about 6 months of age and to continue breastfeeding until at least two years of age (Academy for Educational Development, 1999).
It is very important to explain to the mothers that term infants are born with a high water and energy supply to survive the first days after birth until the milk comes in (WHO, 1989). Providing pre-lacteal feeding to a new-born is therefore not necessary and can even interfere with the protective effects of colostrum.
In addition, the mother should be made aware of the health benefits of colostrum and exclusive breastfeeding to reduce morbidity and mortality in the first six months of life. They should as well be encouraged to continue breastfeeding in particular to sick children after 6 months of life in increased amounts both as a comforter and as a means of supplying additional energy and nutrients. (Sircar et al., 1988)

6.3 Education

In order to make well-considered decisions about dietary and child rearing issues the mothers require information on the following topics:

- Breastfeeding and complementary feeding practice
- Energy and nutrient requirements of young children
- Food safety principles (Motarjemi, 1993)
- Visual signs of proper growth, i.e. of poor growth (in the CSA survey of 1993, only 59% of the children with WHZ < -2 SD were recognised by their mothers as growing poorly), of normal growth and of excessive weight gain
- Prevention, symptoms and treatment (equally for boys and girls, preferably at a health facility and as soon as possible) of the most common childhood diseases
- Recognition of early signs of severe malnutrition, e.g. hair changes, skin alterations, lack of appetite, aetiology and prevention of severe forms of malnutrition (Saito et al., 1997)

As most mothers mentioned health care personnel as a source of information on child rearing topics, the position of the health care staff should be strengthened and education should start there. Other researchers found out that volunteers from the community proved to be successful, too (Brown et al., 1992). In the present setting for instance, these volunteers could be older mothers from the community who had participated in a training course. Elders were named by most mothers as a trusted source of information. In any case, the traditional knowledge of the mothers should be considered and integrated as far as possible.

6.4 Topics of further research

The following topics are suggested for further research:

- Seasonal variation in food intake and its influence on nutritional status
- Consumption of wild fruits and vegetables in times of scarcity as a coping strategy
- Quality of water in HNRS and how it could be improved
- Reasons for gender differences in the treatment of malnourished girls and boys and how to eliminate these inequalities
- Influence of the mother's overall health and nutritional status on the health and nutritional status of her children
- Changes of dietary intake with urbanisation
- Biochemical signs of micronutrient deficiencies in children under five focussing on vitamin A, iron, copper and zinc
- Extension of the Ethiopian food tables for additional nutrients to the ones already available

7. Summary

The objectives of this randomised cross-sectional study in Harari National Regional State were:

- to establish figures for the prevalence of different types and degrees of malnutrition in the region;
- to ascertain specific risk factors for the development of malnutrition in urban and rural areas by assessing the main differences in family background, individual variables, child-care and child-feeding practices and dietary intake between the children in the two different environments;
- to consider relevant information about specific causes of malnutrition in order to give practical, culturally sensitive recommendations on how to prevent malnutrition and how to improve the nutritional situation of the children in the study area.

The target group were children under five years of age who had already started eating complementary food at the time of the survey. 6 out of the 19 urban administrative districts (Kebeles) and 6 out of the 17 rural administrative districts (Peasant Associations) were randomly selected for data collection. Structured interviews were conducted with 411 randomly selected mothers or care-takers for one of the children under five under their direct care in the chosen areas using a pre-tested questionnaire. General data about the child, including family background, health status of the child, breastfeeding, complementary feeding and childcare practices were collected. To assess the dietary intake of the selected child, a structured pre-tested 24-hour recall was conducted. In addition, the child's weight, length and mid-upper-arm circumference (MUAC) were measured. Further in-depth information was collected through key informant interviews and focus group discussions.

The nutritional status of rural children was significantly worse than the one of urban children, indicated by a significantly lower mean WAZ, HAZ and WHZ and by a significantly higher percentage of underweight (WAZ < -2 SD), stunted (HAZ < -2 SD) and wasted (WHZ < -2 SD) children. A significant difference was noted between rural areas on the one hand and urban areas on the other. The rural area accounted for a higher number of children per family, a higher rate of morbidity among children under five, lower amount of time available to the mother for child-care, a higher percentage of illiterate mothers, a higher percentage of households suffering from food shortage, a higher percentage of new-borns receiving pre-lacteal feeding and a lower number of meals given to children who were no longer breastfed at the time of the interview. These factors very likely contributed to the higher prevalence of the above-mentioned types of malnutrition. The focus group discussions revealed that some childcare, health-seeking and hygiene practices which were based on traditional lifestyles and views in the rural area were less conducive to child health than those in town.

On the other hand, significantly less mothers in the rural area were discharging colostrum and the total duration of breastfeeding was significantly longer in comparison to town. Possible risk groups for malnutrition in Harar town are children of single-parent mothers.

More boys were suffering from severe stunting and underweight whereas more girls were more affected by severe wasting and had a higher prevalence of MUAC < 12.5 cm.

There was a higher though not significantly different prevalence of kwashiorkor in the rural (0 – 11.1%) than in the urban (0 – 5.6%) areas, and clearly more girls (4.1%) as opposed to boys (2.6%) were suffering from this condition. This is in contradiction to admission data from health facilities in HNRS that registered a higher proportion of boys than girls as patients over the last three years. The finding might indicate that parents consider it more important to seek medical care for boys than for girls.

For all indicators of nutritional status (WAZ, HAZ, WHZ, MUAC, oedema) there was a large variation within the urban (Kebeles) and rural (PAs) districts respectively.

As for the diet, both urban and rural children were deficient of energy and some nutrients. On average, all children had an insufficient energy intake. The average energy intake was stagnant from 12 to 47.9 months and only rose during the 5th year of life. As for the macronutrients, the intake of carbohydrates was high enough and the contribution of carbohydrates to total energy intake exceeded the recommended range for rural children. The high contribution of carbohydrates was due to the lacking of calories from fat. Fat intake was insufficient for all children (10% of total energy in rural children and 24% in urban children; recommended range 30-40% for children up to two years of age) and significantly lower for rural children. The protein requirements were met by all children, but the quality of protein was lower in the rural area, because it relied more heavily on incomplete plant protein, mainly from cereals. A deficiency in some essential amino acids is therefore likely in rural children.

The fulfilment of vitamin C- and calcium requirements was significantly higher in town while the fulfilment of vitamin B2-, phosphorus- and zinc-requirements was significantly higher in the rural area. On average, none of the children met their needs for calcium (≤ 64%), phosphorus (≤ 95%), potassium (≤ 98%) and zinc (≤ 92%). Vitamin A and vitamin C intake were marginal for the children from 12 – 25.9 months in the rural area.

It is very likely that these energy and nutrient deficiencies contribute overall to the insufficient nutritional status of the children, but how exactly and to which extent remains to be investigated.

Most of the above mentioned nutrient deficiencies could be alleviated by two strategies: increasing the use of linseeds and other oilseeds in the children's diet and adding more fruits and vegetables particularly to the diet of younger children.

Furthermore, information on the following topics might be helpful to improve the mothers' care-practices:

- Breastfeeding and complementary feeding practice
- Energy and nutrient requirements of young children
- Food safety principles
- Visual signs of poor and normal growth
- Prevention, symptoms and treatment (equally for boys and girls, preferably at a health facility and as soon as possible) of the most common childhood diseases
- Recognition of early signs of severe malnutrition, e.g. hair changes, skin alterations, lack of appetite, aetiology and prevention of severe forms of malnutrition
- Prevention, symptoms and treatment (equally for boys and girls, preferably at a health facility and as soon as possible) of the most common childhood diseases

Care should be taken not only to pass on knowledge, but also to help mothers appreciate the new practices and to teach them how to translate their knowledge into practice. Traditional knowledge and practices should be incorporated as far as possible.

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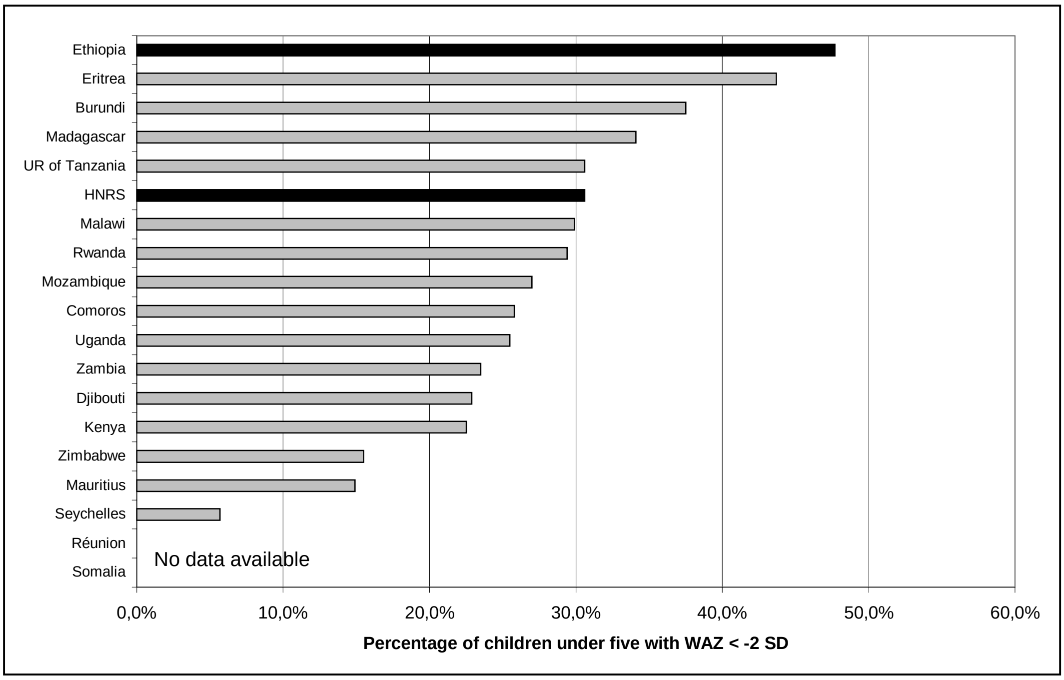
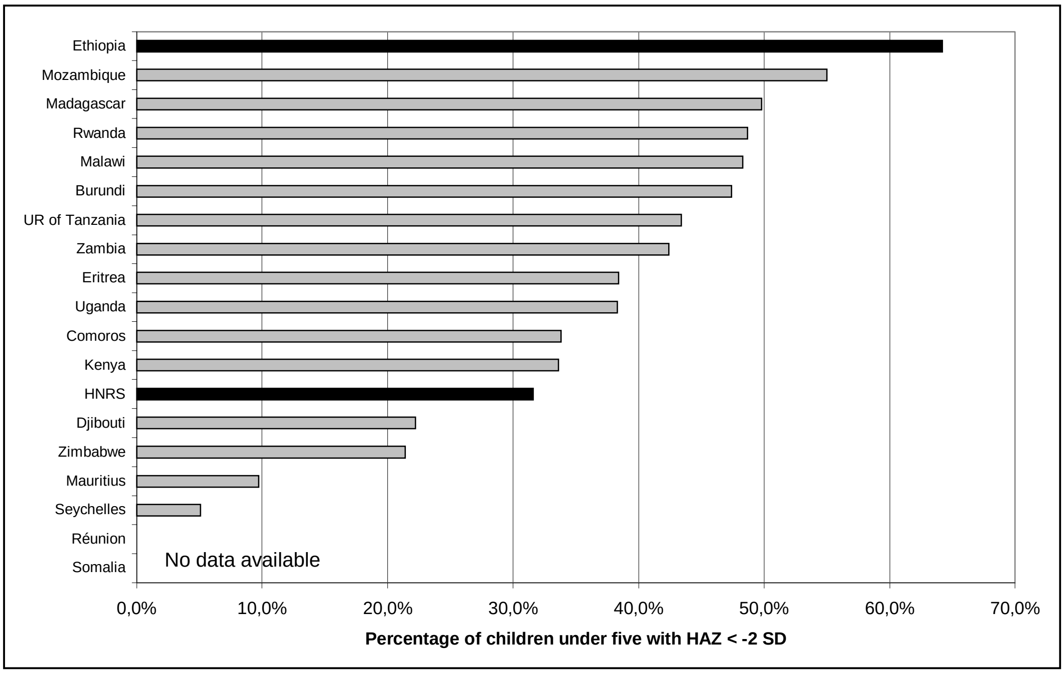
9. Appendix

9.1 Prevalence of different types of malnutrition in all East African countries

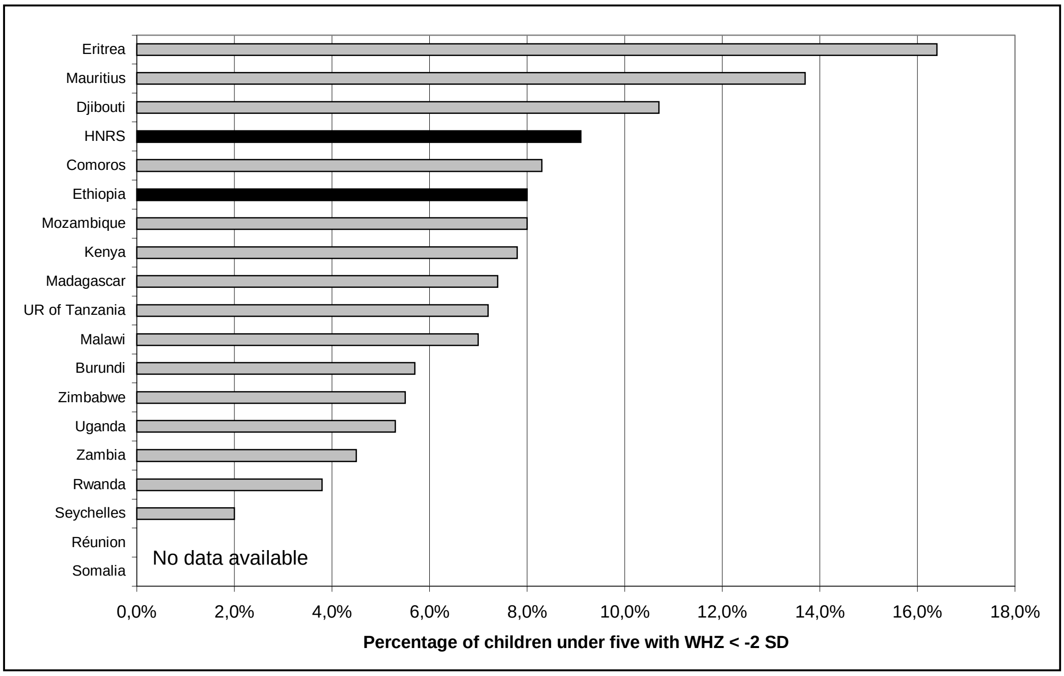
Graph 45: Prevalence of underweight (WAZ < - 2SD) in all East African countries (WHO, 1997; data for HNRS from this study)



Graph 46: Prevalence of stunting (HAZ < - 2 SD) in all East African countries (WHO, 1997; data for HNRS from this study)



Graph 47: Prevalence of wasting (WHZ < - 2 SD) in all East African countries (WHO, 1997; data for HNRS from this study)



9.2 Classification of malnutrition

Table 59: Classification of malnutrition according to Shakir and Morley (1974)

Mid-Upper-Arm Circumference	Category
> 13.5 cm	Normal
12.5 – 13.5 cm	Possibly mildly malnourished
< 12.5 cm	Severely Malnourished

Table 60: Classification of malnutrition according to Wellcome (1970)

% Expected Weight for Age	Oedema	
	Present	Absent
80-60%	Kwashiorkor	Underweight
< 60%	Marasmic Kwashiorkor	Marasmus

Table 61: Modified Wellcome Classification of PEM (Hendrickse, 1991)

% Expected Weight for Age	Oedema	
	Present	Absent
> 80%	Kwashiorkor	Normal Nutrition
80-60%	Underweight Kwashiorkor	Underweight
< 60%	Marasmic Kwashiorkor	Marasmus

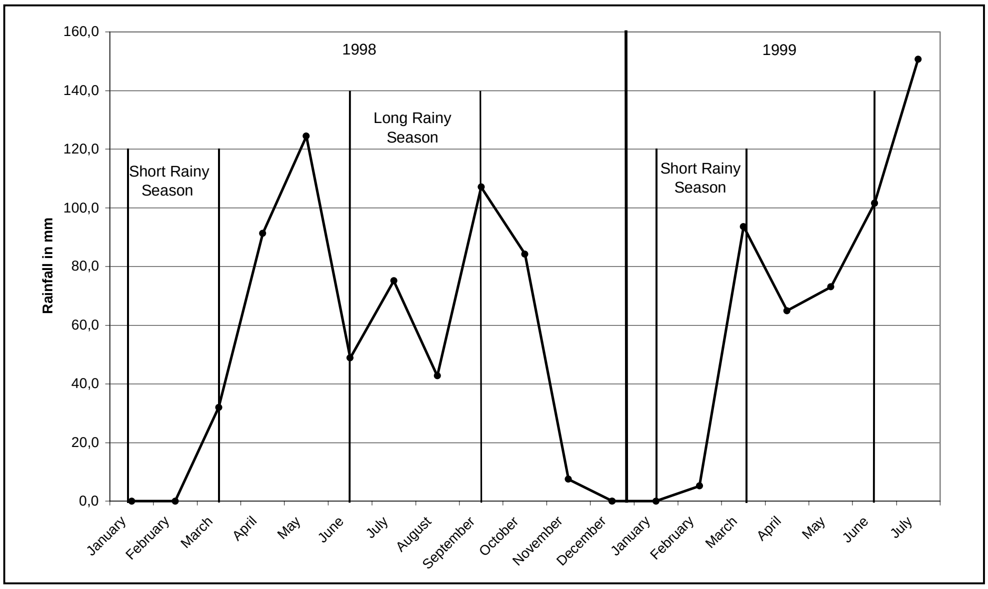
9.3 Average altitude of the administrative districts in HNRS

Table 62: Average altitude of the administrative districts in HNRS (MoA, 1999) (areas selected for the survey in bold print)

Name	Average altitude	Name	Average altitude
Harar town, (reference point)	**1750 m**	Burka, highland	1850 m
Erer Kile	**1300 m**	Gelmeshira	1850 m
Erer Hawaye	1350 m	**Sofi**	**1850 m**
Erer Dodota	1350 m	Sigicha	1900 m
Miai	**1350 m**	Sukul	2000 m
Burka, lowland	1400 m	**Hasengey**	**2050 m**
Erer Woldia	**1400 m**	Aboker Muti	2050 m
Harawe	1450 m	Direteyava	2100 m
Awomer	1500 m	Ulanula	2150 m
Awberkele	**1850 m**		

9.4 Rainfall in HNRS from January 1998 to July 1999

Graph 48: Rainfall in HNRS from January 1998 to July 1999 (MoA, 1999)



9.5 List of Kebeles and PAs displaying their main characteristics (Kebeles and PAs selected for the Survey in bold print) (Abdosh, 1999)

Table 63: List of the Kebeles, total population per Kebele, estimated number of households in each Kebele and estimated number of children under five in each Kebele

Number of the Kebele	Total population per Kebele	Estimated number of households in the Kebele	Number of children under five in the Kebele
1	6454	1574	968
2	**6047**	**1475**	**907**
3	2952	720	443
4	3956	965	593
5	5492	1340	824
6	**2476**	**604**	**371**
7	3936	960	590
8	**6145**	**1499**	**922**
9	6338	1546	951
10	6206	1514	931
11	3035	740	455
12	5931	1447	890
13	**3412**	**832**	**512**
14	4035	984	605
15	3638	887	546
16	4643	1132	696
17	**7876**	**1921**	**1181**
18	4505	1099	676
19	**3438**	**839**	**516**
Total	90515	22077	13577

Table 64: List of the PAs, total population per PAs, estimated number of households in each PAs and estimated number of children under five in each PAs

Number of the PA	Name of the PA	Total population per PA	Estimated number of households in the PA	Number of children under five in the PA
1	Sukul	1808	393	271
2	**Hasengey**	**2744**	**597**	**412**
3	Direteyava	5081	1105	762
4	Sigicha	4638	1008	696
5	Aboker Muti	3947	858	592
6	**Miai**	**3426**	**745**	**514**
7	Awomer	2439	530	366
8	**Sofi**	**4925**	**1071**	**739**
9	Harawe	2130	463	320
10	Burka	3789	824	568
11	**Awberkele**	**4236**	**921**	**635**
12	Gelmeshira	4957	1078	744
13	Erer Hawaye	3881	844	582
14	**Erer Woldia**	**5218**	**1134**	**783**
15	Erer Dodota	1661	361	249
16	**Erer Kile**	**3276**	**712**	**491**
17	Ulanula	2014	438	302
Total		60170	13808	9026

9.6 Survey Questionnaire

1. Questionnaire Number________________
2. First interviewer (conducting the interview, taking the measurements)_____________
3. Second interviewer(note taker)_________
4. Date and day of the week of the interview____________________________
5. Number/Name of Kebele/PA____________
6. If rural, name of the village_____________

<u>Data concerning the children</u> *(ask these questions to the mother concerning the children she has born)*

7. Question: How many children do you have? *(if she does not know, ask for the names of all her children and count the number yourself)***..**______

8. Question: How many children under 5 years old do you have?..............................______

9. Question: How many children who were born alive have already died before reaching the age of five?..______

<u>Index child questionnaire</u> *(ask these question to the mother concerning the chosen index child)*

<u>General data</u>

10. Observation: Is the chosen index child a boy or a girl?....................................._______

1] Boy 2] Girl

11. Question: When was the child born *(use local seasonal calendar if necessary; if impossible, try to get at least age in months; ask whether the child was born at the beginning, the middle or the end of the month)***............**________

12. Question: What is the birth order of this child *(e.g. first, second,... child born alive of this mother)***?...**________

<u>Breastfeeding and weaning practice</u> (*ask these questions to the mother concerning the chosen index child)*

13. Question: How long did you <u>exclusively</u> breast-feed this child (no other foods or drinks on a regular basis)?...................................._______**months**

14. Question: Did you offer other foods/fluids to the child <u>before the first breast-feeding</u>?..______

1] Yes 2] No 8] Don't know 9] No answer

If yes, what kind of food/fluid did you give to your child before breastfeeding it for the first time?

1] ________________________________ 2] ________________________________

15. Question: Did this child receive colostrum?..______

1] Yes 2] No 8] Don't know 9] No answer

If your child did not receive colostrum, why not?..______

1] ______________________________ 8] Don’t know
2] ______________________________ 9] No answer

16. Question: At what age did this child first receive <u>regularly other foods or fluids</u> (complementary food) in addition to breastmilk?...........____mo.

17. Question: What kind of food/fluids did the child first receive <u>regularly in addition to breastmilk</u>?...______

1] ____________________________ 8] Don't know
2]_____________________________ 9] No answer

18. If the index child is no longer breastfed, at what age did you stop breast-feeding this child?..______months

<u>Health of the child</u>

19. Question: Has this child been sick during the last seven days including today?...____

1] Yes 2] No 8] Don't know 9] No answer

20. Question: If this child is sick today or was sick during the last seven days, what kind of disease did he/she suffer from?............................______

1] High fever
2] Common cold
3] Diarrhoea (> 3 watery stools/day)
7] Other_____________
8] Don't know
9] No answer

<u>Diet during illness</u> *(ask these question to the mother about the chosen index child)*

21. Question: Do you feed a <u>special diet</u> to your child <u>or avoid certain food</u> when it is ill?..______

1] Yes 2] No 8] Don't know 9] No answer

22. Question: *(show photography of kwashiorkor child)* **Have you seen a child like this in your village/neighbourhood? How would you treat such a child?........______**

1] Local Healer
2] Treatment at home
3] Health Station/Post
4] Clinic
5] Hospital
7] Other_______________
8] Don’t know
9] No answer

23. Question: *(show photography of marasmic child)* **Have you seen a child like this in your village/neighbourhood? How would you treat such a child?................______**

1] Local Healer
2] Treatment at home
3] Health Station/Post
4] Clinic
5] Hospital
7] Other___________
8] Don’t know
9] No answer

<u>Childcare</u> *(ask these question to the mother about the chosen index child)*

24. Question: How many hours per day are you free to care <u>exclusively</u> <u>for this child</u>?...______hours

25. Question: Do you have somebody to care for this child when you can not be with him/her?...______

1] Yes 2] No 8] Don't know 9] No answer

26. Question: If the child is not with you, it is with...______

1] Father
2] Brother
3] Sister
4] Grandmother/Grandfather
5] Other relative
6] A non-relative
8] Don't know
9] No answer

Do the 24 hour recall before continuing with the General Questions

<u>General questions</u>

<u>Data of the mother</u> *(ask these questions to the mother for herself)*

27. What is your age?..._______(years)

28. Question: To which ethnic community do you belong?..______

1] Harari
2] Oromo
3] Amhara
7] Other______________
9] No answer

29. Question: To which religious community do you belong?...................................______

1] Muslim
2] Ethiopian Orthodox
3] Other Christian Denomination
4] Traditional
7] Other_______________
9] No answer

30. Question: What schooling do you have?..______

1] Reading and writing only
2] Elementary school (grade 1-6)
3] Secondary school education
4] University or other higher education
5] No schooling at all/illiterate
9] No answer

31. Question: What occupation have you been chiefly engaged in during the last four weeks?...______

0] No occupation
1] On daily wages
2] Farming
3] Domestic servant (maid, cook)
4] Lower works (craft etc.)
5] Housewife
6] Trader
7] Other______________
9] No answer

32. Question: What is your marital status?...______

1] Married
2] Divorced
3] Single parent
4] Widowed/Husband died
7] Other _______________
9] No answer

Data of the husband/father

(ask the questions to the mother concerning her father of the index child)

34. Question: What is the age of your husband?...______(years)

35. Question: To which ethnic community does your husband belong?...................______

1] Harari
2] Oromo
3] Amhara
7] Other________________
9] No answer

36. Question: To which religious community does your husband belong?................______

1] Muslim
2] Ethiopian Orthodox
3] Other Christian Denomination
4] Traditional
7] Other________________
9] No answer

37. Question: What schooling does your husband have?..______

1] reading and writing only
2] Elementary school (grade 1-6)
3] Secondary school education
4] University or other higher education
5] No schooling at all/illiterate
9] No answer

38. Question: What occupation has your husband chiefly been engaged into during the last four weeks?..______

1] No occupation
2] On daily wages
3] Farmer
4] Industrial worker
5] Domestic servant (e.g. guardian)
6] Lower works (craft etc.)
7] Trader
8] Civil servant
9] Military or police
77] Other______________
99] No answer

.

Food security

46. Question: Are there times during the year, when you have <u>not enough food</u> to <u>feed the whole family sufficiently</u>?..______

1] Yes 2] No, there are no supply problems 8] Don't know 9] No answer

If yes, in which months (*if the mother can not tell the months ask for seasons, e.g. short rainy season etc.; if she still cannot specify, note down 'cannot specify"*)?

____

Anthropometry of the child

54. Observation: Does the mother have the EPI/growth-monitoring chart in the house? (*check for date of birth of the index child*)**................______**

1] Yes 2] No 8] Don't know 9] No answer

55. Measurement: Mid-upper-arm circumference of the child (to the nearest mm)?..______mm

56. Measurement: Height/Length of the child (to the nearest mm).......................______mm

57. Measurement: Weight of the child (to the nearest 0.1 kg).................................______kg

58. Observation: Does the child have oedema?.._______

1] Yes 2] No

59. If the child has oedema, where are they? (you can enter more than one possibility)..______

1] Feet
2] Lower legs
3] Upper legs
4] Hands
5] Arms
6] Face

ADDITIONAL NOTES:

Clothes worn during weighing:____

____

____

____

____

____

____

____

9.7 Ethiopian calendar of events used for age estimation of the parents

Table 65: Ethiopian calendar of events used for age estimation of the parents

Event	Year of the Ethiopian calendar that the event took place	Age of the parents in 1991 E.C.
1. Ethiopian revolution	1966	25
2. Downfall of His Imperial Majesty (Haile Selassie)	1967	24
3. Literacy campaign	1967	24
4. ‘Land for Farmers’ (land reform)	1967	24
5. Confiscation of extra houses by the socialist government	1967	24
6. Death of King Haile Selassie	1967	24
7. War of Somalia and Ethiopia	1969	22
8. Establishment of Socialist Party	1972	19
9. The First Census	1976	15
10. Celebration of the 10th anniversary of the revolution	1977	14

9.8 Ethiopian calendar (E.C.) of local events for age estimation in children < 5

Table 66: Ethiopian calendar (E.C.) of local events for age estimation in children < 5

	1986 E.C. (1993/1994)	1987 E.C. (1994/1995)	1988 E.C. (1995/1996)	1989 E.C. (1996/1997)	1990 E.C. (1997/1998)	1991 E.C. (1998/1999)
Special event of this year		2nd nation-wide census		Heavy rain, flood	War with Eritrea	Drought
Meskerem (11. Sep – 10.Oct)	New Year	New Year	New Year	New Year	New Year	New Year
Tikimt (12. Oct – 9. Nov)						
Hidar (10. Nov – 9. Dec)						
Tahsas (10. Dec – 8. Jan)					Rhamadan (Tahsas 20 to Tir 20)	Rhamadan (Tahsas 10 to Tir 10)
Tir (9. Jan – 7. Feb)		Rhamadan (Tir 23 to Yakatit 23)	Rhamadan (Tir 12 to Yakatit 12)	Rhamadan (Tir 2 to Yakatit 2)		
Yakatit (8. Feb – 9. Mar)	Rhamadan (Yakatit 2 to Maggabit 2)					
Maggabit (10. Mar – 8. Apr)					Maggabit 28 = Id Aldha	Maggabit 17 = Id Aldha
Miyazya (9. Apr – 8. May)	drought		Miyazya 20 = Id Aldha	Miyazya 9 = Id Aldha		
Ginbot (9. May – 7. Jun)	Maggabit 12 = Id Aldha	Maggabit 1 = Id Aldha				
Sene (8. Jun – 7. Jul)					Sene 29 = Maulid	Sene 18 = Maulid
Hamle (8. Jul – 6. Aug)			Hamle 21 = Maulid	Hamle 10 = Maulid		
Nahase (7. Aug –5. Sep)	Nahase 13 = Maulid	Nahase 2 = Maulid				
Pagume (5. – 10. September)						

9.9 24-hour recall form

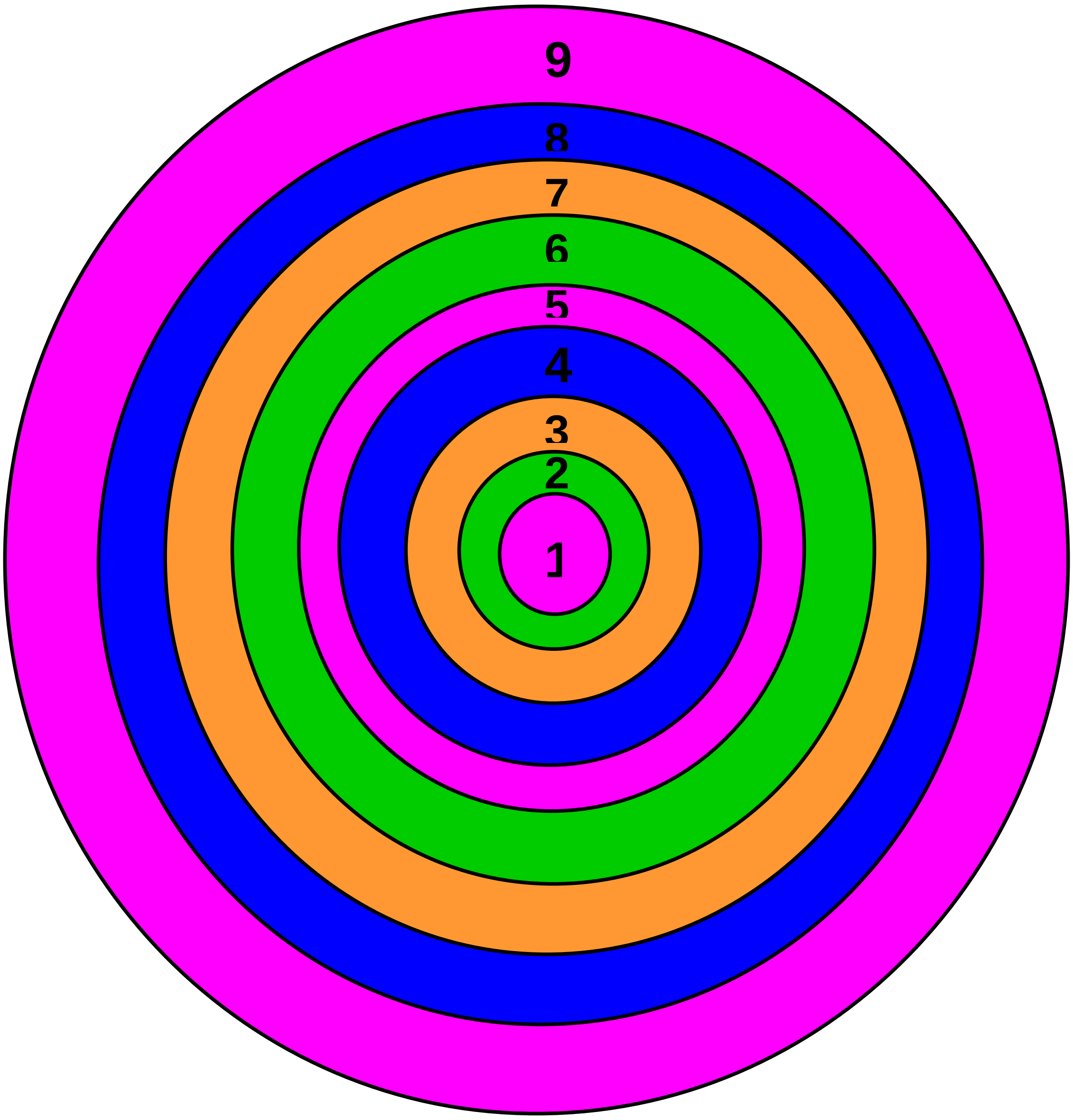
Please use the following abbreviations to classify the type of meal: S0 = Snack before Breakfast, BF = Breakfast or first main meal of the day, S1 = Snack between Breakfast and Lunch, L = Lunch, S2 = Snack between Lunch and Dinner, D = Dinner, S3 = Snack after Dinner
Before starting the interview, please ask the mother whether the child has been on a special diet for whatever reason during the time you want to assess with this 24 hour recall.

Was the child on a special diet yesterday?______ If yes, for what reason (illness, holiday...?)________________

Day of the week for which the 24 h recall is done (i.e. the day before the interview):____________________________ Questionnaire Number:_________ Child's name:____			
Time	Type of meal	Name of food or drink, list of ingredients for composite dishes	Amount of each item in grams, litres or household-measures, for **shared plates** list all persons sharing the dish

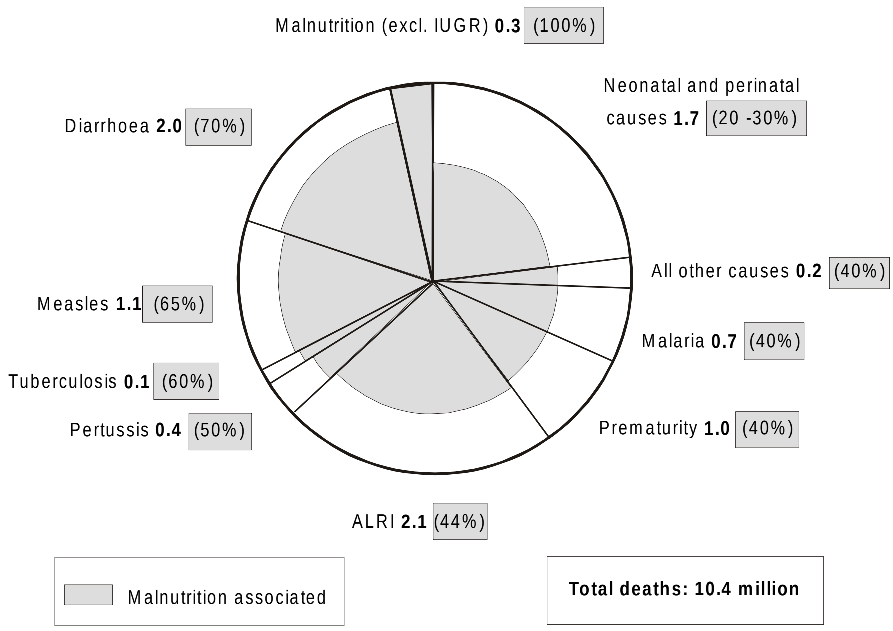
9.10 Graduated food model used for the estimation of portion size of foods with round shapes (about 75% of the actual size, original model in colour)

Figure 4: Graduated food model used for the estimation of portion size of foods with round shapes (about 75% of the actual size, original model in colour)



9.11 Main causes of death among children under the age of five in the developing world

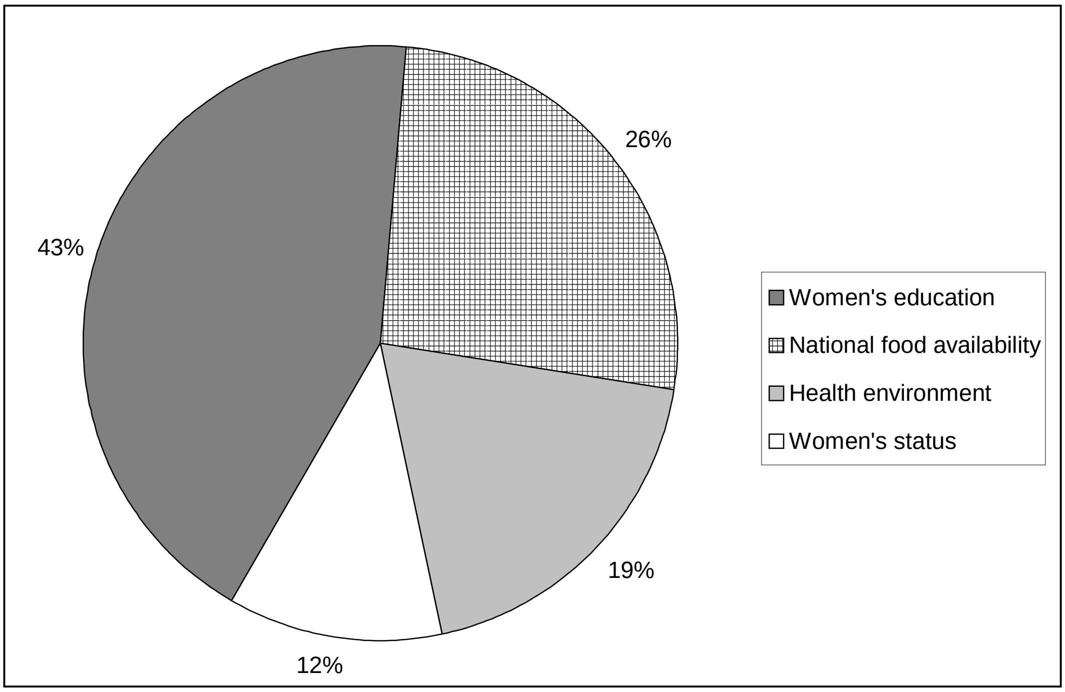
Figure 5: Main causes of death among children under the age of five in the developing world, 1995* (IUGR = intrauterine growth retardation, ALRI = acute lower respiratory infections) (WHO, 1998)



* Number of deaths in millions followed by % malnutrition-associated deaths in brackets

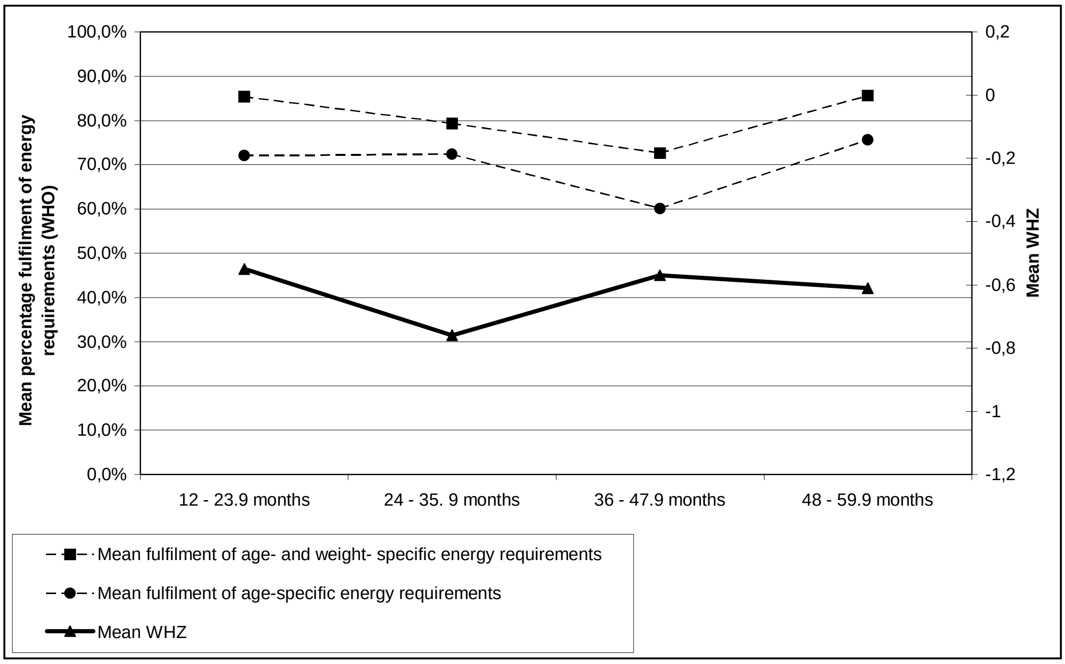
9.12 Estimated contributions of underlying-determinant variables to reductions in developing-country child malnutrition, 1970 – 95

Figure 6: Estimated contributions of underlying-determinant variables to reductions in developing-country child malnutrition, 1970 – 95 (Smith et al., 2000)

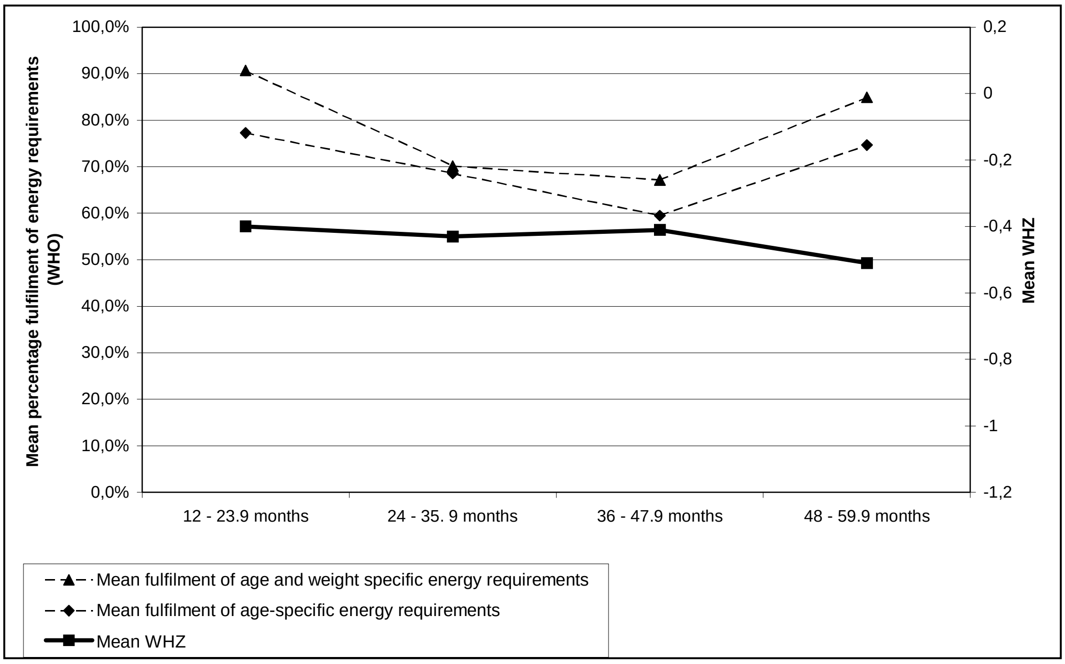


9.13 Comparison of dietary and anthropometric data

Graph 49: Comparison of dietary and anthropometric data, all children



Graph 50: Comparison of dietary and anthropometric data, urban children



Graph 51: Comparison of dietary and anthropometric data, rural children