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

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Abstract of Main Results

Mean WAZ, HAZ and WHZ of rural children were with -1.7 ± 1.1, -1.6 ± 1.6 and -0.9 ± 0.9 significantly worse ($p \leq 0.000$) than those of urban children (-1.1 ± 1.2, -1.1 ± 1.4, -0.5 ± 1.0). The prevalence of severe forms of malnutrition, like marasmus and kwashiorkor, was higher in the rural areas than in town. A significant difference was noted between rural and urban areas concerning some of the variables assessed, e.g. a higher percentage of rural households suffering from food shortage ($p \leq 0.000$). On average, all children had an insufficient energy intake and did not meet their calcium-, phosphorus-, potassium- and zinc-requirements. Fat intake was on average insufficient and significantly lower for rural children ($p \leq 0.000$).

Keywords: Malnutrition, children < 5 years, Ethiopia, diet, anthropometry

Introduction

Due to changes in the administrative structure of Ethiopia over the last decade, regional boundaries have shifted and new regions were founded. One of these is Harari National Regional State (HNRS) which is located in the east of Ethiopia. This region with an area of 304.5km² was established in 1994/95. So far, no randomised study to obtain general data about the health and nutritional status of the population of children under five has been conducted. From clinical observations it is however suspected, that marasmus and kwashiorkor as well as Vitamin A- and iron-deficiency are health problems in the area (Abdosh, 1999; Ayele, 1999). From the results of other studies, one would expect that the situation in town was better than in the rural areas. Therefore, the present randomised community based study was conducted with the agreement of the regional council and the health bureau of HNRS to obtain reliable and generalisable data on the health and nutritional status and diet of children under five as well as on possible causes of malnutrition in urban and rural areas of HNRS. The collected information was to be used to give some practical recommendations on how to improve the situation based on the study findings.

Methods

Sampling

The minimum sample size to obtain representative and generalisable data was calculated to be 391 children (World Vision, 1996). The data was collected in 6 out of 19 randomly selected urban areas (Kebele) and 6 out of 17 randomly selected rural areas (Peasant Associations = PAs). The respective household, interview partner and child were selected in a random manner as well.

Data collection

At the end of the study 411 interviews had been conducted with mothers or caretakers of children under five using a pre-tested questionnaire including a 24-hour-recall form. General data about the child, including family background, health status of the child, breastfeeding-history, complementary feeding and childcare practices and information on the child's diet were collected. In addition, the child's weight, length and mid-upper-arm circumference (MUAC) were measured. Length instead of height was assessed for all children due to difficult field conditions. To adjust the measured length to the respective height-data used in the NCHS-tables, the procedures of Lawrence et al. (1994) were applied. Further in-depth information was collected through key informant interviews with members of the health care staff and focus group discussions with mothers of four study areas.

Data analysis

The data of the study population were compared to the data of the NCHS reference population and standard deviation scores as well as % of expected value were calculated. To classify the children according to the degree of malnutrition, the modified Wellcome classification (Hendrickse, 1991) and the recently published scheme by WHO (1999) were used. Dietary information was collected using the 24-hour-recall format. For the analysis of the energy and nutrient content of the diet the program 'NutriSurvey' was used. The integrated German food database was complemented as far as possible by data of the Ethiopian food table (Gobezie, 1997 and 1998). Children who had been breastfed, who had eaten from a shared plate or both the day before the interview were excluded for dietary analysis as it exceeded the scope of the study to calculate energy and nutrient contributions from these types of meals. The analysis of the micronutrient content of the diet was limited to the micronutrients available from the Ethiopian food tables. To calculate the fulfilment of age specific energy and nutrient requirements, the most current recommendations of the WHO or, if not available, of the USA RDA/minimum requirements were used.

Statistics

The statistical tests were performed with SPSS 9.0 for Windows using Student t-test, one-way ANOVA, Mann Whitney U and Kruskal Wallis tests depending on the type of variable. An observation was considered significant if the level of significance was < 0.05.

Results

General Data and Anthropometry

Overall, 411 interviews were completed, 194 in Harar town and 217 in the rural areas. 47% of the interviewed children were boys and 53% girls.

The health and nutritional status of rural children in HNRS was significantly worse than the one of urban children, indicated by a significantly lower mean weight-for-age (WAZ, indicator of underweight), height-for-age (HAZ, indicator of stunting) and weight for height (WHZ, indicator of wasting) and by a significantly higher percentage of underweight (WAZ < -2 SD), stunted (HAZ < -2 SD) and wasted (WHZ < -2 SD) children. The mean percentage of children with MUAC ≤ 13.5cm was more than twice as high in the rural (27.7%) than in the urban (10.4%) areas.

Table 1: Mean WAZ, HAZ and WHZ and prevalence of underweight (WAZ < -2 SD), stunting (HAZ < -2 SD) and wasting (WHZ < -2 SD) among children under five in urban and rural areas of HNRS

Variable	**Urban**	**Rural**	**Variable**	**Urban**	**Rural**
	Mean ± SD	**Mean ± SD**		**%**	**%**
WAZ	-1.1 ± 1.2	-1.7 ± 1.1	Underweight	20.0	40.0
HAZ	-1.1 ± 1.4	-1.6 ±1.6	Stunted	20.0	42.7
WHZ	-0.5 ± 1.0	-0.9 ± 0.9	Wasted	5.8	12.1

There was, however, a considerable variation in the prevalence of malnutrition within both the urban and rural areas. For example, the PA with the best results of the rural region had a lower prevalence of all types of malnutrition except stunting than the urban district with the worst results for the town survey.
In all except one category used for the classification of severe types of malnutrition, the situation was worse in the rural areas as compared to Harar town (refer to table 2).

Table 2: Percentage of severely malnourished children under five in urban and rural areas according to the modified Wellcome classification (Hendrickse, 1991) and WHO 1999)

	Modified Wellcome classification		WHO		
	All types of kwashiorkor	Marasmus	Oedematous malnutrition	WHZ < -3 SD	HAZ < -3 SD
Urban	2.1%	2.1 %	2.1%	1.1%	8.8%
Rural	4.8%	2.4%	4.8%	1.0%	18.0%

A significant difference was noted between rural areas and urban areas concerning some of the general variables assessed (refer to table 3). These factors very likely contributed to the higher prevalence of the above-mentioned types of malnutrition in the rural areas.

Table 3: Differences between the urban and rural area

Variable	Urban	Rural	Level of significance
Number of children born alive per family	2.7 ± 2.1	4.9 ± 2.8	**≤ 0.000**
Time available to the mother to care for the index child in hours	3.5 ± 2.2	2.0 ± 1.5	**≤ 0.000**
Percentage of illiterate mothers	20.6%	97.2%	**≤ 0.000**
Percentage of households suffering from food shortage at some point during the year	32.3%	91.7%	**≤ 0.000**
Percentage of infants receiving pre-lacteal feeding	49.2%	86.2%	**≤ 0.000**
Total duration of breastfeeding in months	16.5 ± 9.1	18.7 ± 6.6	**< 0.05**
Number of meals for children who were no longer breastfed	4.4 ± 0.9	3.9 ± 1.0	**≤ 0.000**
Percentage of index children sick during the 7 days before and the day of the interview	34.0%	45.2%	**< 0.05**

Diet

After applying the exclusion criteria outlined in the methods section, a total of 212 children, 105 boys and 107 girls were included in the dietary analysis.

When looking at the source of energy in percent of total energy intake, carbohydrates and protein were within the desirable range. Protein quality was, however, much better in town with 44% as opposed to 9% in the rural areas derived from animal sources. An additional factor that might make the rural children prone to a specific amino acid deficiency is that maize or sorghum often is the sole source of protein. Fat was with 24% of total energy intake in town and 10% in the rural area far below the recommended value of about 30% of total energy intake (FAO/WHO, 1994).

As for micronutrients, the intake did on average not cover the age-specific requirements for calcium, phosphorus, potassium and zinc in all children, of vitamin B2 in urban children and of vitamin C in rural children (refer to table 4). The vitamin B1 requirements were on average marginally covered by all children (refer to table 4).

Table 4: Percentage fulfilment of age specific energy and nutrient requirements in urban and rural areas of HNRS (fulfilment below the requirement marked in bold letters)

Percentage fulfilment of age specific requirements of	Urban	Rural
Energy	**70.2 ± 28.3**	**70.0 ± 30.5**
Protein	108.6 ± 52.3	109.5 ± 53.4
Fat	**65.4 ± 49.7**	**28.7 ± 21.3**
Vitamin A	130.1 ± 205.3	127.3 ± 327.5
Vitamin B1	**94.5 ± 45.9**	**98.9 ± 45.1**
Vitamin B2	**70.2 ± 42.8**	**99.3 ± 58.8**
Vitamin C	229.0 ± 251.7	**84.7 ± 141.7**
Calcium	**57.8 ± 33.3**	**39.2 ± 48.4**
Copper	220.4 ± 120.0	400.1 ± 256.0
Iron	554.3 ± 599.2	382.1 ± 296.0
Phosphorus	**78.5 ± 30.0**	**90.8 ± 47.5**
Potassium	**88.7 ± 53.6**	**77.5 ± 51.2**
Zinc	**72.0 ± 35.5**	**89.4 ± 42.4**

Complementary foods were studied qualitatively by asking the mothers what types of food or fluid they had first fed to their child in addition to breastmilk. While in town, potatoes, cow-milk and eggs were most frequently named by the mothers, the rural mothers listed cow-milk, injera and potatoes as the most important first complementary foods. Fruits and vegetables played a very subordinate role in town and were basically not used for complementary feeding in the rural regions. Overall, the variety of foods used in complementary feeding was much higher in the town area.

Discussion

There are a lot of frameworks and models explaining possible causes of childhood malnutrition (UNICEF, 1998, Smith et al., 2000). Among the potential risk factors for the development of child malnutrition discussed in those frameworks are maternal and childcare practices (UNICEF, 1998), the educational level of the mother (WHO/NUT, 1998, Richmann et al., 1992, Ruel et al, 1992, Guldan et al., 1993), the health and nutritional status of the child (Khan et al., 1986, UNICEF, 1998) and the food security situation of the household (Smith et al., 2000, UNICEF, 1998).

According to the findings of this study, the health and nutritional status of rural children in HNRS was significantly worse than the one of urban children. This difference can be explained by significant differences (refer to table 3) assessed during the survey, which are counted among the potential risk factors for childhood malnutrition.

Unfortunately, water, tea and juices are often given to infants soon after birth before initiating breastfeeding (WHO, 1991), because the mothers fear that the small amounts of breastmilk produced at the beginning may not be sufficient to satisfy the infant’s fluid, energy and nutrient needs. In addition to the potential negative effects of this practice on the development of the infant's immune competence, it has been proven 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). When comparing urban and rural areas in HNRS, significantly more mothers in the rural area gave pre-lacteal feedings to their new-borns. The total duration of breastfeeding was with 19.0 months significantly higher in the rural area. 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).

There was a significantly larger percentage of illiterate rural than urban mothers. It has been assumed 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 high as 43.0% between 1970 and 1995. In comparison, the contribution of the national food availability to reductions in child malnutrition in developing countries was estimated to be 26.1% during the same period.

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. 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.
The study in HNRS showed that there was a significantly higher level of morbidity in rural than in urban children during the 7 days preceding the interview and the day of the interview.

Overall, a single 24-hour-recall protocol permits statements about the mean intake of a group of individuals (Thompson et al., 1994).
It is impossible to estimate, whether and to which extent the differences in nutrient intake identified in this study 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 in the case of vitamin C). Some reasons for the differences identified, their possible effects and some implications of the findings shall, however, be discussed in the following.
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). 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 diet is that low in fat and essential fatty acids, prolonged

breastfeeding could improve the dietary quality by enlarging the fat and essential fatty acid supply. Breastmilk should therefore be available to children as long as possible.

As fat requirements were only met to about 60-80% in town and 25-30% in the rural area, vitamin A absorption of the children in this study is probably impaired (de Pee et al, 1995). The consumption of breastmilk before or after complementary feeding 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.

Children in the rural area probably suffer from vitamin C deficiency, at least seasonally, when wild fruits (or vegetables) are not available.

Rural children in HNRS are also very likely to be deficient in calcium. In addition to their low intake, calcium bioavailability from plant sources, on which they mainly rely for their calcium supply, is worse than from animal sources (WHO/NUT, 1998). Children in town probably suffer from calcium deficiency as well, but less severely.

Whether the high amounts of copper found in the children’s diet are due to soil contaminations or part of the foods is unknown. It is therefore recommended to verify the data from the Ethiopian food tables concerning this nutrient or to analyse the copper status of the children themselves biochemically.

Though the iron-intake of all children exceeded their needs by far, there were differences in the iron quality between urban and rural areas. About 8% of iron in the urban and only about 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).

It is impossible to know from dietary data alone whether the iron intake in combination with 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.

The average fulfilment of zinc requirements was below 100% for all children in this study. Though rural children had a significantly better coverage of their needs than urban children, they are very likely to suffer from zinc deficiency because their diet was mostly vegetarian (zinc bioavailability from vegetarian diets is low), 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.

According to estimates from previous studies about 10% of rural households in Ethiopia can be considered as food secure (Bekele, 1991). Yet only about 8% of the rural households in this study in HNRS did not complain about food security problems for the period of the last 12 months.

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.

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