

Nutritional status of school children in Addis Ababa who are and are not involved in a school feeding program

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Abstract

Introduction: One of the major issues facing developing countries today is under nutrition among children with unmet nutritional and healthcare need. Primary school age children are at vulnerable age where nutrition is especially important.

Objective: To determine the prevalence of acute malnutrition and chronic malnutrition among selected school children of Addis Ababa city.

Methods and Materials: School based descriptive cross sectional comparative study design was conducted from September 2014 to March 2015 in Addis Ababa, Ethiopia, among 7–14 years old, grades 1–8 primary school children. Multistage proportional stratified sampling technique was used after randomly identifying five sub-cities, within which ten primary schools providing school feeding were randomly selected. A total of 280 students were recruited for the study. Nutritional status of the two groups was compared, and the food diversity and nutrient composition of the food given to the children was determined.

Results: Prevalence of wasting among the overall school children in school feeding program was found to be 7.1% and was less than those involved in the feeding program (10%). Underweight was higher among those not involved in the program (10.5%) compared with those in the feeding program (5.6%). The prevalence of stunting involved in the school feeding was much higher (23.6%) as compared with group not involved in the feeding program (16.5%). The dietary diversity score was significantly influenced by educational status of the parents or caregivers (p-value, 0.0001). Children from the feeding group had better food diversity profile than those not involved in the program. Most of the school meal composition was not sufficient to meet the children's nutrient and energy needs.

Conclusion: The prevalence of acute malnutrition was found to be low whereas chronic malnutrition was moderate among the school children irrespective of their involvement in feeding programs. There were no statistically significant differences between the two studied groups regarding nutritional status. The school meals' protein content was adequate; however, these meals do not satisfy the daily requirement for most other nutrients and energy.

Key Words: School feeding, malnutrition, nutritional status, food composition, dietary diversity

Introduction

Malnutrition is a major public health problem in developing countries and assessing nutritional status is an important component of primary health care (Siddique et al. 2013). The school age is a period of physical growth and cognitive development for primary school children, during which nutritional demand is increased (Choi et al. 2008). Healthy and adequate dietary habit during childhood promotes optimal health, growth and cognitive development of the child, and contributes to the prevention of chronic diseases in later life (Sabinsky et al. 2013). Nutrition plays a vital role, as undernourishment in school-age children impacts their health and educational achievement (Mekonnen et al. 2013; Sridhar et al. 2014). Ensuring adequate nutrition to children is an important step towards a healthy population which can reduce public expenditure in tackling health problems secondary to malnutrition and hence promote economic growth. School feeding is one of the strategic interventions to prevent or treat malnutrition (Annim and Imai 2014; Acharya et al. 2013). School

children are often thought of as naturally healthy, but studies have shown that significant proportion of them are stunted, underweight, wasted, anemic, iodine and vitamin A deficient (Dabonéet al. 2011).

According to World Food Program (WFP) (Anonymous 2007), Ethiopia is amongst the countries in the world with the highest rate of school age children with special needs mainly attributed to impairments from malnutrition. There are numerous factors that contribute to children's nutritional status, among which socioeconomic status, parents' education, and diversification of nutrition are the major contributors. There are also low awareness levels among parents about the effect of poor health and nutrition on children's ability to learn (Babar et al. 2010). In Ethiopia, child under nutrition continues to be a major public health problem. Despite emergence of a number of advancements in areas of health and nutrition services in the country, nutritional status of school children is not yet improved and understudied (Mekonnen et al. 2013; Amare et al. 2012). Moreover, the health and nutrition needs of school-age children

have been largely ignored in Ethiopia, the focus has instead been on pre-school children because they are at greater risk of mortality. However, since more children are now attending school than ever before, the school is an opportune setting to provide health and nutrition services to disadvantaged children (Best et al. 2010). There is lack of ownership and coordination as well as ineffective utilization of resources in delivering comprehensive school health and nutrition interventions due to different standards being applied by different organizations (Ministry of Education 2012). This study was initiated based on information from different mass media and followed by observation and preliminary works. The preliminary work was done to identify and make sure the existence of hunger in the schools as a general problem. The randomly selected children were interviewed on how many times they eat per day and whether they usually eat their breakfast and evening snacks after school. The preliminary work revealed that there were children who came to school without having breakfast.

There is a food shortage problem in slum areas of Addis Ababa but most interventions have focused on the rural setting. Therefore, the aim of this study was three fold: determine the prevalence of acute malnutrition (wasting) and chronic malnutrition (stunting) among selected school children; to compare the nutritional status of children in the feeding program with those who are not included in the program and finally, to determine the food diversity and the nutrient composition of the food given to the children by proximate analysis. The study will elucidate the current school feeding practice and results of the study will inform interested parties like public decision makers, capable and willing citizens or humanitarian organizations to act on the identified gaps. In addition, it will serve as a baseline data for further future studies.

Materials and Methods

School based cross sectional comparative study design was used and the study was conducted from September 2014 to March 2015 in Addis Ababa, Ethiopia. The study participants were 7–14 years old, Grades 1–8 primary school children. Multistage proportional stratified sampling technique was used after randomly identifying five sub-cities (Arada, Kolfe-Keranio, Addis-Ketema, Lideta and Gulele), within which ten primary schools providing school feeding were randomly selected. A total of 280 study children were recruited proportional to the size of

Proximate analysis was done for the determination of the nutrient composition of the food given to the children who were involved in the feeding program, according to Association of Official Analytical

children involved in school feeding program from each school, among which 140 belong to the school feeding program (SFP) and the rest 140 were not involved in the SFP. The male to female sex ratio of study children were nearly one. The sample size was calculated using single population proportion formula considering a 24% prevalence of malnutrition among school children in Addis Ababa from previous study (Zerfu and Masresha 2006), 95% confidence level and 5% of margin of error and it was found to be 140 for each group. The study used direct method of nutritional assessment among which anthropometric method and dietary evaluation methods (24 hour dietary recall). Nutrient composition analysis was also done for the school meal given to the children.

Anthropometric measurements: Height was measured by prestige height scale (Model AIWA, made in India). The study participant stand erect and bare footed on the scale with a movable head piece & height was recorded to the nearest 0.5cm. Weight was measured by Seca weighting scale (Model 8811021659, made in Germany) and weighing balance was calibrated in kilogram and students were weighted into the nearest 0.1kg in light clothes and no shoes. Age of the children was determined using the school records. These anthropometric measurements were used to generate three indexes (weight for age, height for age and body mass index for age) for indicating nutritional status in comparison to the WHO Growth Reference (de Onis et al. 2007). Anthropometric data were analyzed using WHO Anthro plus software and expressed as Z-score. Weight for age (WAZ), height for age (HAZ) and body mass index for age (BAZ) with Z-scores less than $-3SD$ show severe underweight, severe stunting and severe wasting, respectively. The values between $\geq -3SD$ to $< -2SD$ is to indicate moderate status; children with Z-scores values between $\geq -2SD$ to $+1SD$ were classified as normal. Z-scores values greater than $> +1SD$ were indicative for overweight and tall stature whereas, BAZ values greater than $+2SD$ is indicative for obesity (de Onis et al. 2007).

Dietary diversity and nutrient composition analysis: Number of food-groups consumed preceding 24 hours to the survey was assessed. The foods consumed in the preceding 24-hour recall were grouped in 8 food-groups according to the Food and Nutrition Technical Assistance (FANTA) (Anne and Paula 2006). Based on the total number of food-groups, dietary diversity was measured qualitatively.

Chemists (AOAC) (Sullivan and Carpenter 1993). From the schools, foods consumed were collected and their nutrient composition was determined. Respective AOAC official methods were followed to determine moisture, protein, crude fat, crude fiber, ash contents

whereas, carbohydrate content was determined by difference from the weight of dry matter.

Determination of mineral contents, iron and zinc were determined by using flame atomic absorption spectrophotometer after preparing series of working standard solutions by diluting metal stock solution with deionized water to set calibration curve as indicated by Osborne and Voogt (1978). Determination of energy intake was computed using factors 4, 4, and 9 for available carbohydrates, proteins and total fat, respectively. The dietary diversity score was compared with FANTA individual dietary diversity score reference cut-off. Data was analyzed using SPSS version 20. Proximate results were presented as Mean $\pm$ standard deviation. An independent sample t-test was used to compare means of the feeding and non-feeding groups and statistical significance was assigned for p-values less than 0.05. This study was carried out after getting permission from the institutional review board of Addis Ababa University, College of Natural and Computational Sciences, Center of Food Science and Nutrition. Permission was obtained from each sub city's education office and heads of the selected schools.

Consent was obtained from the children's parents or caregivers prior to conducting the study. Information sheet and consent form were prepared before conducting data collection to obtain informed consent.

Results

Nutritional status of school children who were involved in the school feeding program and those who were not involved in the program are given in Table 1. Severe wasting was similar in both feeding and non-feeding groups. In contrast, stunting was higher among school children involved in school feeding compared with those not involved in the program. Nutrient content of the meals provided to the school children are also presented in Table 2. Meal code TK contained the least amount of protein per 100 g food whereas meal coded G8 contained very low fat and iron. In general, all meals contained low amount of zinc. Figure 2 shows energy contributed by individual macronutrients of the meals. Dietary diversity scores among the school meals are given in Table 3. About 84% of the school meals have less than 4 dietary diversity score. There is only one school meal with dietary diversity score greater than five.

Table 1: Anthropometric measurement of school children who were and were not involved in school feeding program

Degree of malnutrition	Wasting (P=0.494)				Types of malnutrition Stunting (P=0.123)				Underweight (P=0.441)			
	Feeding -0.861 $\pm$ 0.872		Non Feeding -1.007 $\pm$ 0.956		Feeding -1.20 $\pm$ 1.040		Non Feeding -1.026 $\pm$ 1.068		Feeding -0.662 $\pm$ 0.877		Non Feeding -0.617 $\pm$ 0.947	
	N	%	N	%	N	%	N	%	N	%	N	%
Sever	3	2.1	3	2.1	6	4.3	3	2.1	-	-	-	-
Moderate	7	5.0	11	7.9	27	19.3	20	14.4	2	5	4	10.5
Normal	127	90.7	122	87.1	105	75	112	80.6	36	90	34	89.5
Over nutrition	3	2.1	4	2.9	2	1.4	4	2.9	2	5	-	-
Total	140	100	140	100	140	100	140	100	40	100	38	100

Table 2: Nutrient composition of the school meal (Mean $\pm$ SD)

Meal code	Protein g/100g	Fat g/100g	Carbohydrate g/100g	Iron mg/100gm	Zinc mg/100gm
AF	8.68 $\pm$ 0.6	2.3 $\pm$ 0.1	11.01 $\pm$ 2.7	0.95 $\pm$ 0.04	0.53 $\pm$ 0.07
DM	9.72 $\pm$ 0.8	6.5 $\pm$ 0.6	23.66 $\pm$ 2.9	2.89 $\pm$ 0.20	0.70 $\pm$ 0.45
EB	11.87 $\pm$ 0.9	5.9 $\pm$ 0.5	20.44 $\pm$ 1.8	8.78 $\pm$ 0.26	1.07 $\pm$ 0.09
EF	10.4 $\pm$ 1.1	5.2 $\pm$ 0.3	11.87 $\pm$ 1.5	7.04 $\pm$ 0.31	0.85 $\pm$ 0.07
GS	13.7 $\pm$ 0.6	0.35 $\pm$ 0.08	10.61 $\pm$ 1.8	0.85 $\pm$ 0.02	0.43 $\pm$ 0.07
JK	4.75 $\pm$ 0.4	9.77 $\pm$ 0.7	21.29 $\pm$ 2.7	0.63 $\pm$ 0.16	0.42 $\pm$ 0.09
KM	12.3 $\pm$ 0.8	5.3 $\pm$ 0.2	13.36 $\pm$ 0.9	3.73 $\pm$ 0.58	0.56 $\pm$ 0.03
LS	8.8 $\pm$ 0.4	10.6 $\pm$ 0.7	17.65 $\pm$ 3.0	7.08 $\pm$ 1.19	0.77 $\pm$ 0.14
TK	11 $\pm$ 0.46	3.05 $\pm$ 0.3	24.34 $\pm$ 1.7	1.08 $\pm$ 0.004	0.36 $\pm$ 0.08
WE	11.3 $\pm$ 0.96	7.89 $\pm$ 0.6	34.79 $\pm$ 1.8	3.61 $\pm$ 0.24	1.27 $\pm$ 0.19

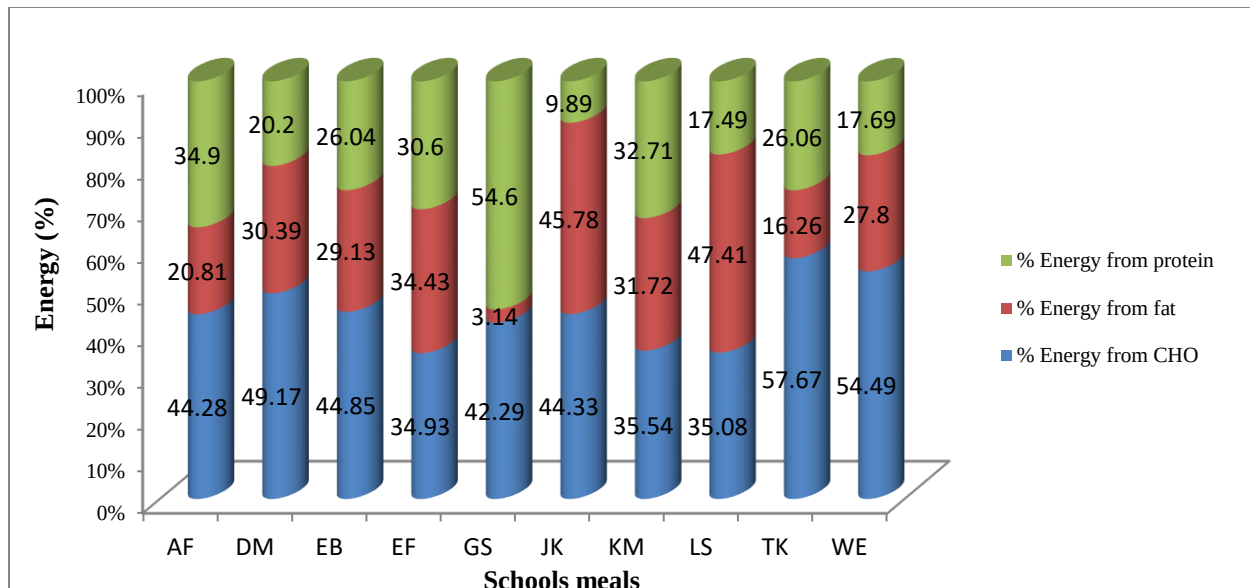


Figure 1: Energy composition of the school meals

Table 3: Dietary diversity status

IDDS (P=0.524)	Student's Category			
	Feeding		Non Feeding	
	Number	Percent	Number	Percent
Food group <4	117	83.6	120	85.7
Food group from 4-5	22	15.7	20	14.3
Food group >5	1	0.7	-	-

Discussion

Weight-for-age is a composite index of weight-for-height and height-for-age and thus does not distinguish between acute malnutrition (wasting) and chronic malnutrition (stunting). Children can be underweight for their age because they are stunted, wasted, or both. Weight-for-age is an overall indicator of a population's nutritional health. The results show that 24% of all children are underweight (below -2 SD), and 7% are severely underweight (below -3 SD). The percentage of underweight children decreases with increasing mother's education and household wealth.

From the total study population, 6.4% were wasted (2.1% severely and 4.3 % moderately wasted). Prevalence of underweight was 8.1% which was moderate. According to EDHS (2016), overall, 10% of children in Ethiopia are wasted, and 3% are severely wasted (below -3 SD). Regional variations exist, with Somali (23%) and Afar (18%) having the highest percentages of wasted children. , , Stunting was 20% (3.2% severely, 16.8% moderately stunted). According to EDHS (2016), stunting is greater among children in rural areas (40%) than urban areas (25%). There are some regional variations; stunting ranges from as high as 46% in Amhara region to the lowest (15%) in Addis Ababa.

According to WHO (2007), in older children, that is, above 10 years, weight-for-age is not a good indicator as it cannot distinguish between height and body mass in an age period where many children are experiencing pubertal growth spurt and may appear as having excess weight (by weight-for-age) when in fact they are just tall. BMI-for-age is the recommended indicator for assessing thinness, overweight and obesity in children 10-19 years.

When the data was analyzed independently for the two groups' nutritional status, prevalence of wasting among the feeding group was found to be 7.1% (2.1% severe thinness and 5% were moderately) and 2.1% were overweight and they had a low prevalence of wasting than those who were not in the feeding program. This result might show the contribution of the feeding program as intervention to reduce prevalence of acute malnutrition.

The prevalence of underweight was 5% moderately, and 5% were overweight for the feeding group. The prevalence of stunting for the feeding group was found to be 23.6% (4.3% severely and 19.3% moderately). The prevalence of stunting recorded in the present study were less than the prevalence of stunting (25.2%) found from previous study in Gondar town (Amare et al. 2013).

The prevalence of wasting for children who were not involved in the non-feeding program was 10% (2.1% severely and 7.9% moderately) which is greater than the prevalence of wasting (8.9%) and 2.9% were overweight found in Gondar town school children (Amare et al. 2013). The prevalence of underweight was found to be 10.5% moderately for the non-feeding group which was less than the prevalence of underweight (15.1%) found in school children of Gondar town. According to EDHS (2016), Children in rural areas are more likely than those in urban areas to be underweight. The highest percentages of underweight children are observed in Afar (36%) and Benishangul-Gumuz (34%). The prevalence of stunting for the non-feeding was 16.5% (2.1% severely and 14.4% moderately). The prevalence of wasting and underweight were lower in the feeding group but the prevalence of stunting among the group was higher than the prevalence of stunting in the non-feeding group but the difference was not statistically significant.

Prevalence of malnutrition of this study which mainly focus on children living in urban areas as a whole were found to be less than the prevalence of malnutrition found in the school children of Fogera district, northwest Ethiopia (Mekonnen et al. 2013) which can be an indicator that the prevalence of malnutrition among rural areas are higher than in urban areas even though the problem in both cases has its own public health significance.

Nutrition plays a key role in the control of linear growth through a variety of mechanisms. Energy and protein restriction reduces insulin like growth factor-1(IGF-I) plasma concentration, which is an anabolic hormone that plays an active role in the maintenance of muscle mass and strength. It has been shown as a sensitive marker of nutritional status. The association between nutritional status and the IGF-I system has been observed in humans: IGF-I is reduced during protein-energy malnutrition. IGF-1 modulates growth hormone (GH) secretion and GH/IGF-1 signaling is essential for normal growth in children (Maggio et al. 2013). The energy was found to be very low in terms of fulfilling one third of the daily requirements assuming that most of the children have three meals per day. Macronutrients especially protein are essential component for school children because they are growing and they need it for their development. In this study, 10 to 55% comes from the protein of the meals which fulfills the requirement. The Majority of the analyzed school meals have shown to contain inadequate level of fat. Majority of the school meals contain less amount of carbohydrate, the meal from DM, TK and WE contain relatively better amount of

carbohydrate which is still below the adequacy level indicated by Yasmin et al. (2014). The brain is dependent on circulating blood glucose since glucose is the brain's primary fuel. Carbohydrate consumption appears to improve cognitive and physical performance. Therefore, taking inadequate amount of this nutrient may cause the children to be weak in concentration and it could influence their mood and have its own negative impact in the learning and teaching process (D'Anci et al. 2009).

Deficiencies of some micronutrients, such as iron and zinc, result in anorexia. These nutrient deficiencies also may contribute to growth retardation indirectly by reducing the intake of other growth-limiting factors, such as energy and protein. Mild to moderate zinc deficiency and severe iron deficiency may affect growth. Deficiency of these micronutrients are associated with immune function and risk of morbidity, which in turn affects growth. Therefore, micronutrient deficiencies may have an indirect effect on growth by increasing the prevalence or severity of morbidity and anorexia (Rivera et al. 2003). Majority of the school meals contain inadequate level of iron and zinc which is a potential indicator for poor dietary diversity of the school meal. Children who are in the feeding program diversify better than those who are not in the feeding program. This indicates the contribution of the school feeding program for diet diversity by increasing the number of food groups, and hence good micronutrient even though the micronutrient of the school meals by itself is not sufficient.

Conclusions and Recommendations

The results show that 24% of all school children are underweight, 6.4% were wasted and stunting was found to be 20%. The prevalence of acute malnutrition was found to be low and chronic malnutrition was medium in terms of public health significance. In this study, acute malnutrition was low among children who are involved in the feeding program. The nutritional status of the school children involved in the feeding program was not statistically different from those who were not involved in the program. The school meal served for the children in the feeding program had adequate amount of protein but less effective in providing other macronutrients (fat and carbohydrate), micronutrients (Iron and Zinc) and energy dense food for the school children. Children who are involved in the feeding group had better dietary diversity profile. The available school feeding program is not sufficient enough to address most of the school children who are in need of feeding. School feeding program should be considered as a basic and an important way of improving the quality of life of school children and should be consistent enough in order to deliver

nutrition and energy dense food. Fulfilling the need of school children nutrition is the basic requirement for having healthy and productive citizens for the country. Therefore, it will be better if feeding program can be widened and implemented along with the school curriculum for primary schools at the national level till citizens will be able to insure individual-household food security.

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