

Under Nutritional Status of Pre-Primary School Children with and Without School Meals Program in Addis Ababa, Ethiopia

Dinksera Debebe Mekuria¹, Zewdie Aderaw Alemu^{2,3}, and Admas Abera Abaerei^{4*}

¹Federal Ministry of Health, Addis Ababa, Ethiopia

²Department of Public Health, College of Health Sciences, Debre Markos University, Ethiopia

³School of Public Health, College of Health Sciences, Addis Ababa University, Ethiopia

⁴School of Public Health, College of Health and Medical Sciences, Haramaya University, Ethiopia

Abstract

Background: Ethiopia has decided to incorporate the school feeding program in the second phase of the Growth and Transformation Plan. The country is committed to ending child undernutrition by 2030 as indicated in the 2015 SEQOTA declaration. The effect of school meals program on the prevention of under-nutrition is not well understood, and no studies have addressed the effect of school meals program on nutritional status among pre-primary school children in Addis Ababa. Thus, this study aimed to explore the association between a school meals program and a child's under-nutrition in the Kolfe Keranio sub-city of Addis Ababa, Ethiopia.

Methods: A comparative cross-sectional study was conducted among 518 pre-primary school children; 257 students were from schools with meal programs and 261 from those without. A simple random sampling technique was used to select the schools and study participants. Anthropometric measurements, socio-demographic information, and maternal, and child health characteristics were collected between February and March 2016. Data were double entered using EpiData and using STATA 13TM and Emergency Nutrition Assessment for SMART software and Emergency Nutrition Assessment for SMART software. Multivariate logistic regression models were employed to control for confounding factors in exploring the association between school meals and undernutrition. statistical significance was declared at a cut-off p-value of 0.05.

Results: Among the study participants, 7% (95% CI: 5, 11) and 5% (95% CI: 3, 8) prevalence of underweight was observed in children without the school meals program and with the school meals program, respectively. The prevalence of wasting was 4% (95% CI: 2, 7) and 5% (95% CI: 3, 8) with and without a school meals program. The children's gender, parents' marital status, maternal education, exclusive breastfeeding, child illness two weeks before the survey, household head gender, and dietary diversity were found to have a statistically significant association with child under-nutrition.

Conclusion: The magnitude of wasting among children in the school meals program was lower than those children without the program; while the magnitude of underweight was found to be higher, respectively. No statistically significant difference was observed in children's undernourishment between the two groups. Strengthening the existing school meals program is needed with emphasis on diversifying the types of meals provided for school children.

Keywords: *Pre-primary children; School Meals program; Under-nutrition; Underweight; Wasting*

How to cite: Mekuria, D.D., Alemu, Z.A. and Abaerei, A.A. 2021. Under Nutritional Status of Pre-Primary School Children with and Without School Meals Program in Addis Ababa, Ethiopia. *East African Journal of Health and Biomedical Sciences*, Volume 5 (1): 22-34

Introduction

Malnutrition remains one of the major public health burdens that affects millions of people worldwide. It is globally one of the most common risk factors for illness and death (FAO, 2014). Worldwide, about 805 million people, or one in nine, were suffering from chronic undernourishment from 2012-2014, and al-

most all (98%) of them are found in developing countries (FAO, IFAD, and WFP, 2014). About 8% of children worldwide suffer from wasting, 26% of them from stunting, and 16% of them from being underweight, while the prevalence is about 10%, 38%, and 23% for developing countries, respectively (United Nations Children's Fund and World Health Organiza-



tion, 2012). Sub-Saharan Africa has the highest prevalence of undernourishment, though there has been some improvement over the last two decades, with the prevalence of undernourishment declining from 32.7% to 24.8% (FAO, 2013).

According to the United Nations World Food Program (UNWFP), 66 million school-age children go hungry every day, with 23 million hungry children in Africa alone. Furthermore, 80% of these 66 million children are concentrated within just 20 countries. Additionally, 75 million school-age children (55% of them were girls) do not attend school, with 47% of them living in sub-Saharan Africa (Bundy *et al.*, 2009).

Ethiopian children and their mothers suffer disproportionately from the poor health and nutrition situation in the country. Malnutrition is the underlying cause of nearly 50% of child deaths, with some of the highest rates of stunting and underweight in the world (Boerma *et al.*, 2010). In school-aged children, undernutrition has been reported in the forms of stunting (11% to 42.7%) and underweight (7.2% to 59.7%) in different parts of Ethiopia (Reji *et al.*, 2011; Mekonnen *et al.*, 2013; Herrador *et al.*, 2014). In Addis Ababa, a 24% prevalence of stunting was reported (Zerfu and Mekasha, 2006).

Education has a positive economic implication; educational quality has a strong impact on individual earnings. Healthier and well-nourished children stay in school longer, learn more, and become more productive adults. Addressing nutrition and health among school-age children also brings intergenerational nutrition and health benefits and long-term economic gains (Bundy *et al.*, 2006).

The government of Ethiopia has identified poor health and nutrition as major constraints on the quality of learning and educational achievement of its children. Accordingly, a decision has been made to incorporate the “Ethiopian School feeding program” in the second phase of the Growth and Transformation Plan (GTP) (CSA, 2014).

Based on the government’s commitment, the Ethiopian School Meals Initiative (ESMI), which is a legally registered Ethiopian resident charity, was established to generate a sustainable school meals system in

schools. The ESMI is implementing a school milk project model in collaboration with the Swedish International Cooperation Agency (SIDA) starting from December 2014 to address the nutritional needs of the children to increase school attendance and improve school performance, and thereby reduce under nutrition of the children. The program provides fresh milk and bread for the students as breakfast and plans to add more varieties of food after three to four years. Around 100g of bread and 200ml of milk is provided once per day. It has been implemented in selected pilot cities Sebeta, Bahirdar, Hawasa, Mekelle, and Addis Ababa cities (Abera, 2019).

Studies conducted elsewhere have shown that these programs have positively impacted children’s nutritional status (Simeon, 1998; Lien *et al.*, 2009; Muthayya *et al.*, 2012; Nkhoma *et al.*, 2013; Ahmed and Salah, 2016). However, to the authors’ knowledge, no studies have assessed whether the nutritional status of school children has been improved by the school meals initiative in Addis Ababa. Exploring the association between nutritional status and school meals program is essential as it informs these sectors in designing an effective school meals program, which in turn improves the nutritional status and school performance of these children. Thus, this study is aimed at assessing the association between a school meals program and a child under nutrition in Addis Ababa, Ethiopia from February 15 to March 15, 2016.

Materials and Methods

Study area and period

The study was carried out in February-March 2016 in the Kolfe Keranio sub-city of Addis Ababa City Administration. KolfeKeranio sub-city is one of the newly established ten sub-cities of Addis Ababa. It is located in the western suburb of the city near the Gefersa Reservoir, between 8°57'00"N and 9°05'24"N and between 38°39'36"E and 38°43'12"E. It is 9.6 km from the center of the city and has an estimated total area of 6400 hectares. It borders the districts of Gullele, Addis Ketema, Lideta, and Nifas Silk-Lafto. In the sub-city, there are fifteen woredas. As of 2011, its population was 546,219. There are about ten government primary and pre-primary schools in the sub-city.

Source population

The source population was all pre-primary school children in KolfeKeranio sub-city during the data collection period.

Study population

Randomly selected children from selected school children in Kolfe keranio sub-city.

Inclusion criteria

All the students in pre-primary government schools during the study period were included.

Exclusion criteria

All the children who were enrolled in government schools with meals but those who did not use the school meals program for different reasons such as students with lactose intolerance were excluded.

Study design

School-based comparative cross-sectional study design was used to assess the association between the school meals program and a child's under-nutrition.

A quantitative study was used to collect data on nutritional status and other explanatory characteristics.

Sample size determination and sampling technique

The required sample size for the study was determined using two-population proportion formula (Pagano, 2018) considering the following assumption for nutritional status with $P_1=12\%$ and $P_2= 22\%$ (CSA, 2014) at 95% confidence level, 80% power, and 10% non-response rate.

$$= \frac{\left(Z_{\frac{\alpha}{2}} \sqrt{\left(1 + \frac{1}{r}\right) P(1 - P)} + Z_{\beta} \sqrt{P_1(1 - P_1) + \frac{P_2(1 - P_2)}{r}} \right)^2}{(P_1 - P_2)^2}$$

Where,

- $Z_{\frac{\alpha}{2}}$ is the confidence level, which is 95%(1.96)
- Z_{β} is the power of the study, which is 80%
- r is the ratio between two groups, one to one ratio
- P_1 (Proportion among school meals), for both nutritional status and absenteeism
- P_2 (Proportion of non-school meals), for both nutritional status and absenteeism

- P is the weighted pooled proportion for P_1 and P_2 . $P=(P_1+P_2)/2$
- Since there are no comparative studies similar to this study, the proportions among school meals program for each variable cannot be found hence 10% difference was used.

With the above assumptions, the final sample was computed to be 564. The two government schools with a meals program were included in the study and out of the eight government schools without a meals program, another two were randomly selected. The total number of students in each school was identified and samples were allocated proportionally to the number and participants were selected randomly using the student attendance sheet (Roster) as a sampling frame (Figure- 1).

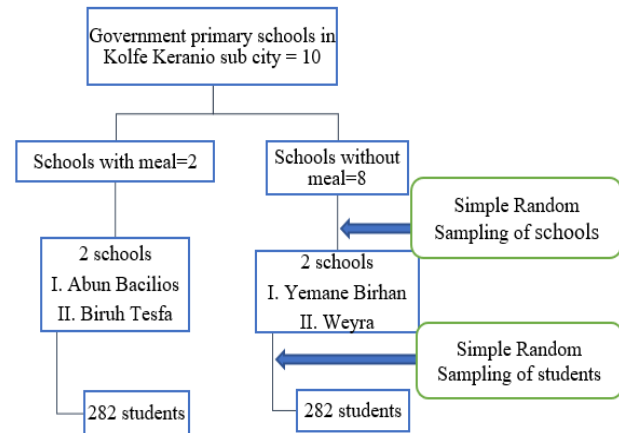


Figure 1: Schematic representation of sampling procedure of the study, Addis Ababa, Ethiopia, 2016.

Data collection techniques

Data were collected by five kindergarten teachers who had been trained for two days by the principal investigator on the purpose of the study, the method of data collection, and how to measure the height and weight of the students according to standard WHO procedures (CDC and WFP, 2005). A pre-test on the instruments of data collection was done on one pre-primary school which was not included in the study. Afterward, the weight and height of the preprimary school children were measured according to standard WHO procedures (CDC and WFP, 2005). Weight was measured to the nearest 0.1 kg on a battery-powered digital scale (SECA 881), and standing height was measured to the nearest 0.1 cm using a portable

adult/infant measuring unit (PE-AIM-101). A pre-tested structured questionnaire which was first prepared in English was translated into the local language, Amharic, and back into English to check for consistency.

Socio-economic and demographic characteristics and various maternal and child health variables were collected using a structured questionnaire. Quantitative dietary data was collected through a 24-hour dietary recall of the students' parents or legal guardians by going to capture detailed information about all types of food and beverages consumed by the children in the past 24 hours. Based on the food and agriculture organization/food and nutrition technical assistance (FAO/FANTA) household dietary diversity guidelines (Kennedy, Ballard, and Dop, 2011), the dietary data collected through the 24-hour diet recall were computed into 12 food groups (cereals, vitamin A-rich fruits and vegetables, other fruits, other vegetables, legumes and pulses, meat or fish, organ meat, oil, dairy, eggs, sugar, other sweets and beverages, and condiments). based on the food and agriculture organization/food and nutrition technical assistance (FAO/FANTA) household dietary diversity guidelines (Kennedy, Ballard, and Dop, 2011). The principal investigator was responsible for coordination and supervision of the overall data collection process.

Variables and Measurements

The outcome variable for this study was nutritional status (underweight and wasting), and the main predictor variable was the school meals program. Other covariates which were included were socio-demographic characteristics (age and sex of the child and parents, parents' educational status, income, employment status, head of the household, number of children in the house, or number of people living in the house); child health indicators (Illness during the last one month before the survey and immunization status); child feeding practices (history of exclusive breastfeeding, complementary feeding, frequency of current feeding, consumption of different types of food groups); and maternal characteristics (presence of ANC of the current child and age at first childbirth).

Operational definitions

Pre-primary school: Includes students in Kindergartens and "O" class program in a government primary school.

School meals: The provision of milk and bread to primary school children at least once during school hours.

Wasting: A student with low weight-for-height < -2 SD of the median value of the national center for health statistics (NCHS/WHO) international weight for-height reference. Sever wasting is < -3 SD.

Underweight: Refers to a student with low weight for age at < -2 SD of the median value of the NCHS/WHO international reference.

Data quality control

Firstly, the questionnaire was developed in English, then translated into Amharic, and translated back into English. It was pretested in two schools that were not included in the study. The training was provided for data collectors and supervisors. Measurements of weight and height were done using a calibrated digital scale and height measuring board in a standing position. Each subject was weighed with minimum clothing and the height was measured on a bare foot. The collected information was reviewed and errors were returned to data collectors for correction.

Statistical analysis

Wasting and underweight were the main outcomes of interest, defined as height-for-age z-score (HAZ), weight-for-height z-score (WHZ), and weight-for-age z-score (WAZ), respectively. Stunting was not considered as an outcome of interest for this study because it is a chronic condition and the school meals program was going on only for two years. The z-scores were calculated using the World Health Organization (WHO) 2007 reference (for children ≥ 5 years) computed by the emergency nutrition assessment for standardized monitoring and assessment of relief and transition (ENA for SMART) software.

Data were double entered using EPI data software and exported to STATA for analysis. They were checked for duplicates, missing data, or inconsistency. Explanatory analysis, graphical displays, and frequency tables were carried out for both independent and dependent variables to have an insight into the data. Afterward, a descriptive analysis was carried out to compare the schools with and without the school

meals program. Associations of the predictors with the outcome were assessed using a chi-square test for categorical variables and a t-test for continuous variables. Predictors associated with nutritional status among pre-school children and included in the final parsimonious model looking for potential confounders. Bivariate analysis was carried out to identify the variables to be included in the multiple logistic regression model. All the variables with a liberal P-value of ≤ 0.20 were considered in the multiple logistic regression. Any variable that did not improve the fit of the model was eliminated from the model using the forward likelihood ratio method. The results of the multivariable analysis were presented using the adjusted odds ratio with a 95% confidence interval and a p-value of < 0.05 was declared significant. Model fitness was checked using the Hosmer and Lemeshow test.

Ethical consideration

Ethical clearance was obtained from the Ethical Review committee of Debre Markos University and

at a 5% significance level and presented as proportions and mean \pm standard deviation. Then, stepwise logistic regression was used to select Gamby College of Medical Sciences. The purpose, risks, and benefits of the study were explained to the participants. Data were collected after full informed written consent has been obtained from parents or legal guardians.

Results

Socio-demographic characteristics of participants

Out of the 564 sampled population, a total of 518 participants responded to the questionnaire, which makes a response rate of 92%. Out of the total 518 study participants, 257(49.6%) of the children were in schools with a meals program while 261(50.4%) of the children were in schools without a meals program (Table 1). The mean age of the children in schools with meals program was 4.4 years and it was 4.5 years in schools without the program.

Table 1: Sociodemographic characteristics of respondents with and without school meals program in Kolfe Keranio sub-city, Addis Ababa, Ethiopia, 2016.

Variables	Classification	School-meals program		Total [n=518]	P value
		Yes [n=257]	No [n=261]		
Age (mean \pm SD)		4.4 \pm 0.3	4.5 \pm 0.3	4.4 \pm 0.3	<0.001
Gender	Male	134 (52.14%)	135 (51.72%)	269	0.925
	Female	123 (47.86%)	126 (48.28%)	249	
Parents marital status	Single	21 (8.17%)	31 (11.88%)	52	0.362
	Married	197 (76.65%)	190 (72.80%)	387	
	Others*	39 (15.18%)	40 (15.33%)	79	
Maternal education	No formal-education	90 (35.02%)	86 (32.95%)	176	0.322
	Primary	95 (36.96%)	92 (35.25%)	187	
	Secondary	68 (26.46%)	72 (27.59%)	140	
	Higher	4 (1.56%)	11 (4.21%)	15	
Maternal occupation	Housewife	139 (54.09%)	102 (39.08%)	241	<0.001
	Employed	21 (8.17%)	45 (17.24%)	66	
	Others	97 (37.74%)	114 (43.68%)	211	
Household-Income	≤ 1000	105 (40.86%)	96 (36.78%)	201	0.618
	1001-3000	134 (52.14%)	144 (55.17%)	278	
	>3000	18 (7%)	21 (8.05%)	39	
Household-head	Male	197 (76.65%)	190 (72.80%)	131	0.313
	Female	60 (23.35%)	71 (27.20%)	387	

Maternal and child health indicators

Overall, most of the mothers, 449 (86.7%), had ante-natal care (ANC) follow-up during pregnancy with the participant child, in which the proportions were similar in the two groups. A little more than half of the

children (52%) in schools without the program and 48% of the children in those with the program were exclusively breastfed. The immunization of children was similar in the two groups (Table 2).

Table 2: Maternal and Child health indicators of respondents with and without the school meals program in Kolfe Keranio Sub-City Addis Ababa, Ethiopia, 2016.

Variables	Classification	School-meals program		Total [n=518]	P value
		Yes [n=257]	No [n=261]		
ANC follow up	Yes	222 (86.38%)	227 (86.97%)	449	0.843
	No	35 (13.62%)	34 (13.03%)	69	
Place of delivery	Home	49 (19.07%)	24 (9.20%)	73	0.001
	Health facility	208 (80.93%)	237 (90.80%)	445	
Exclusive BF	Yes	230 (89.49%)	253 (96.93%)	483	0.001
	No	27 (10.51%)	8 (3.07%)	35	
Child Immunization	Yes	228 (88.72%)	232 (88.89%)	460	0.95
	No	29 (11.28%)	29 (11.11%)	58	
Child Illness in the last 2 weeks	Yes	130 (50.58%)	142 (54.41%)	272	0.384
	No	127 (49.42%)	119 (45.59%)	246	
Type of child illness in the last 2 weeks	Fever	20 (22.22%)	33 (29.20%)	53	0.134
	Diarrhea	28 (31.11%)	31 (27.43%)	59	
	Cough	32 (35.56%)	45 (39.82%)	77	
	Others	10 (11.11%)	4 (3.54%)	14	

Child feeding practices

In this study, 20 (7.78%) students from schools with meals and 14 (5.36%) from schools without meals reported having less than three meals per day in the last 24 hours (Table 3). The mean (SD) dietary diversity for the children with the school meals program was 6.1 (± 0.7) and 5.4 (± 0.7) for children without the

school meals program. There was a significant difference between the school meals program and no school meals program in dietary diversity ($P < 0.001$). When asked about latrines, 3.89% of school meal program respondents and 0.38 percent of non-school meal respondents reported having none. (Table 3).

Table 3: Child feeding practice of respondents with and without the school meals program in Kolfe Keranio sub-city of Addis Ababa, Ethiopia, 2016.

Variables	Classification	School-meals program		Total [n=518]	P value
		Yes [n=257]	No [n=261]		
Frequency-of-meals (per day)	< Three times	20 (7.78%)	14 (5.36%)	34	0.267
	Three and above	237 (92.22%)	247 (94.64%)	484	
Dietary diversity (mean \pm SD)		6.1 \pm 0.7	5.4 \pm 0.7	5.7 \pm 0.7	<0.001
Source of water	Tap water	249 (96.89%)	258 (98.85%)	507	0.121
	Others	8 (3.11%)	3 (1.15%)	11	
Latrine	Yes	247 (96.11%)	260 (99.62%)	507	0.006
	No	10 (3.89%)	1 (0.38%)	11	

Nutritional status of participants

This study showed that there was a high prevalence of under-nutrition (stunting 17%, underweight 6%, and

wasting 4.4%) among pre-primary school children in the study area. A higher prevalence of underweight was observed in the children with school meals

program (7%) than in those without school meals program (5%). (Figure-2). A slightly smaller prevalence

of wasting was reported among children with school meals (4%) compared to children without the program (5%).

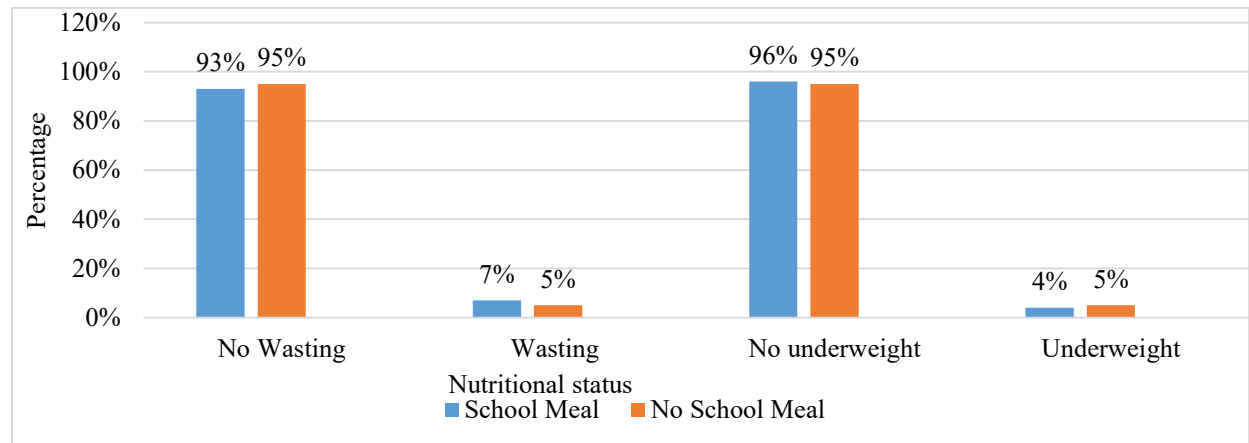


Figure 2: Under nutrition among children with and without school meals program in Addis Kolfe Keranio Sub-city Ababa, Ethiopia, 2016.

Association of school meals program with children underweight

In this study, the school meals program had no significant influence on the underweight (AOR= 1.94, 95% CI: 0.66-5.74). Lower odds of being underweight were associated with being female, having EBF, and being immunized. Female study subjects were 71% less likely to be underweight compared to male children (AOR= 0.29, 95% CI: 0.10-0.84). On the other hand,

those children who had exclusively breastfeeding were 93% less likely to be underweight compared to those who were not exclusively breastfed (AOR=0.07, 95% CI: 0.02-0.24). Children from separated, divorced, or widowed families were four times more likely to be underweight (AOR = 4.33, 95% CI: 1.49-12.57) than their counterparts (Table 4).

Table 4: Bivariate and Multi-variable logistic regression analysis of the association between factors and child underweight in Kolfe Keranio Sub City of Addis Ababa, Ethiopia, 2016.

Variables	Category	Underweight		COR (95% CI)	AOR (95% CI)
		Yes	No		
Age				0.32 (0.11-0.92)	
Gender	Male	23	246	1	1
	Female	8	241	0.35 (0.15-0.81)	0.29 (0.10-0.84)
Marital status	Married	14	373	1	1
	Single	3	49	1.63 (0.45-5.88)	2.20 (0.44-10.89)
	Others ¹	14	65	5.74 (2.61-12.6)	4.33 (1.49-12.57)*
EBF	No	11	24	1	1
	Yes	20	463	0.09 (0.04-0.22)	0.07 (0.02-0.24)*
Illness	Yes	28	244	1	1
	No	3	243	0.10 (0.03-0.36)	0.19 (0.04-0.91)*
School meals program	Yes	12	249	1	1
	No	19	238	1.65 (0.78-3.49)	1.94 (0.66-5.74)
Household-head	Male	14	373	1	1
	Female	17	114	3.97 (1.89-8.30)	3.58 (1.38-9.30)*
Dietary diversity				0.26 (0.16-0.42)	0.31 (0.17-0.58)

Association of school meals program with wasting

The findings of this study revealed that being in a school with a meal program had no significant influence on wasting (AOR= 0.56, 95% CI: 0.13-2.39). Higher odds of wasting were associated with female-headed households (AOR= 4.97, 95% CI: 1.37-18.08).

Children of mothers with primary educated are 89% less likely to be wasted (AOR = 0.11, 95% CI: 0.02-0.56) compared to no formal education. Good dietary diversity reduced childhood wasting by 88% (AOR= 0.12 95% CI: 0.04-0.32) (Table 5).

Table 5: Bivariate and Multi-variable logistic regression analysis of the association between factors and child wasting in Kolfe Keranio Sub City of Addis Ababa, Ethiopia, 2016.

Variables	Category	Child wasting		Odds Ratios (95% CI)	
		Yes	No	COR (95% CI)	AOR (95% CI)
Maternal-education	No formal education	17	159	1	1
	Primary	4	183	0.20 (0.07-0.62)	0.11 (0.02-0.56)*
	Secondary and above	2	138	0.13 (0.03-0.59)	0.36 (0.02-0.86)
School meals program	Yes	10	247	1	1
	No	13	248	1.29 (0.56-3.00)	0.56 (0.13-2.39)
Household-head	Male	7	380	1	1
	Female	16	115	7.55 (3.03-18.80)	4.97 (1.37-18.08)*
Income	≤1000	19	182	1	
	1000-3000	3	275	0.10 (0.03-0.36)	
	3001-5000	1	38	0.25 (0.03-1.94)	
Dietary diversity				0.09 (0.05-0.19)	0.12 (0.04-0.32)

Discussion

This study showed that there was a high prevalence of under-nutrition among pre-primary school children with and without school meals program in the Kolfe Keranio sub-city of Addis Ababa. This finding is in line with the 2014 national mini EDHS results of Addis Ababa The city Administration (CSA, 2014). However, the prevalence of under-nutrition was lower than the ones reported in other studies conducted in different parts of Ethiopia (Mekonnen *et al.* 2013; Degarege and Animut, 2015). The discrepancies could be a result of differences in the study methods, study period, and samples. Moreover, socio-economic variances between regions could describe the difference in the prevalence of under-nutrition across the different areas of Ethiopia.

The prevalence of underweight did not show a significant association between the children enrolled in schools with meals and those enrolled in schools without meals programs. This could be due to parents of the children in school with feeding programs who might have reduced the food portion and size at home

for their children knowing that the children would be fed at school. Another possible reason could be related to prior selection to include schools in the school feeding program might be based on the severity of nutritional problems in the area, which might undermine the contributions of the program in improving the nutritional status of the students. Hence, this finding implies that there should be baseline data to have a clear understanding of the contribution of the school feeding program.

This study revealed that there was no significant association between child under-nutrition index and school meals programs. This might be related to the short period since the school meals program was started. Another possible reason might be due to the absence of variation and diversity in the meals that is provided in the schools. Other forms of plant and animal proteins are absent in the program, which may give insignificant results. Moreover, the amount and frequency of food given in schools in which it is provided once per day and only consists of bread and milk. Daily bread has an energy value of about 250

kcal/100g and milk has 124cal/200ml, which is reasonable to say not enough diversity in food groups for breakfast, thus may not give significant results. Furthermore, the schools to be included in the program were selected based on the magnitude of the problem in the area.

In this study, male children were more likely to be underweight compared to females. The finding is in line with several studies in Ethiopia and elsewhere (Alemayehu, 2014; Prince and Laar, 2014; Asfaw *et al.*, 2015). This could be due to pre-primary boys being more physically active and moving to the external environment which increases exposure to infection which has an immense contribution to malnutrition. Inadequate dietary intake leads to weight loss, lowered immunity, mucosal damage, invasion by pathogens, and impaired growth and development in children. A sick person's nutrition is further aggravated by diarrhea, mal-absorption, loss of appetite, diversion of nutrients for the immune response, and urinary nitrogen loss, all of which lead to nutrient loss and further damage to defense mechanisms (Asfaw *et al.*, 2015). The odds of being underweight decrease with an increase in dietary diversity. This was consistent with a study conducted in Kenya, in which children who consumed foods from four or more food groups had a lower risk of being underweight compared to those who took foods from less than four food groups (Mwaniki and Makokha, 2013). The consumption of a varied diet is associated with an increased intake of energy-dense foods, which then leads to better nutritional status and health.

This study also showed that illness in the past two weeks of the survey was associated with child underweight. In a similar study conducted on children having diarrhea in the past two weeks before data collection, the children were more likely to be underweight than the children without the diarrheal disease (Asfaw *et al.*, 2015). Similarly, a study in Kenya showed the incidence of diarrhea, coughs/colds increased the risk of being underweight (Mwaniki and Makokha, 2013). This may be because children at this age are more prone to infection and contamination of toxic substances while playing on the ground, which might contain polluted soil and with other children,

thus increasing their exposure and susceptibility to illness. This tendency may contribute to faltering under-nutrition among children in these age groups.

The children from female-headed households were more likely to be wasted compared to the children who came from male-headed households. This might be due to in most African countries including Ethiopia, females become household heads when they are single mothers and the source of income will be only from the mother. In contrast, when the male is a household head both the mother and the father will contribute to the household income which in turn improve the nutrition provided to their child. Similarly, the current study revealed that children with better dietary diversity had a reduced risk of wasting. The consumption of a varied diet is associated with an increased intake of energy-dense foods, which then leads to a better nutritional status and health.

Future studies should explore the impact of the school meals program on chronic malnutrition, through longitudinal study design. The proportion of required nutritional intake of children in the school feeding programs and daily dietary intake at home was not established in this study.

Conclusion

This study found that there was no statistically significant association between school meals program and under-nutrition. Gender, parental marital status, maternal education, exclusive breastfeeding, child illness, household head, unprotected water source, and dietary diversity were significantly associated with under-nutrition. Strengthening the existing school meals program is needed with emphasis on diversifying the types of meals provided for the children. The government should support the program through funds to provide schools with a variety of foods and to provide children with freshly prepared balanced meals.

Acknowledgments

The authors are thankful to Addis Ababa Education Bureau, data collectors, Kolfekeranio sub-city, participating students, and their parents.

Competing interests

The authors declare that there is no conflict of interest

Funding statement

This study was not funded by any organization.

Authors' contribution

Dinksera Debebe conceived the idea of the study, managed data collection, analyses, and interpretation, and critically reviewed the manuscript. Zewde Aderaw assisted in proposal development, and data analysis, and assisted in the preparation and critically reviewed the manuscript. Admas Abera assisted with the design of the study, data analysis, and critical review of the manuscript. All authors approved the final manuscript.

References

- Arsenault, J.E., Mora-Plazas, M., Forero, Y., López-Arana, S., Marin, C., Baylin, A. and Villamor, E. (2009). Provision of a school snack is associated with vitamin B-12 status, linear growth, and morbidity in children from Bogota, Colombia. *The Journal of nutrition*, 139 (9):1744-1750.
- ABERA, E. (2019). Ethiopia: 'Feeding School Children Is Not Charity, It Is Our Duty and It Is Their Right': Frealem Shibabaw. <https://allafrica.com/stories/201911200614.html> access Jun 20/2021
- Ahmed, Y. M., and Salah, A. A. (2016). Epidemiology of Dengue Fever in Ethiopian Somali Region : Retrospective Health Facility Based Study. *Central Africa Journal of Public Health*,2(2):51-56. doi: 10.11648/j.cajph.20160202.12.
- Alemayehu,M.(2014).Nutritional Status and Associated Factors among Under-Five Children, Tigray, Northern Ethiopia. *International Journal of Nutrition and Food Sciences*, 3(6): 579. doi: 10.11648/j.ijnfs.20140306.24.
- Asfaw, M., Wondaferash, M., Taha, M., and Dube, L. (2015). Prevalence of undernutrition and associated factors among children aged between six to fifty nine months in Bule Hora district, South Ethiopia. *BMC Public Health*, 15 (1): 1-9. doi: 10.1186/s12889-015-1370-9.
- Boerma, J. T., Mathers, C., and Abou-Zahr, C. (2010). Who and global health monitoring: The way forward. *PLoS Medicine*, 7(11):1-3. doi: 10.1371/journal.pmed.1000373.
- Bundy, D., Burbano, C., Grosh, M. E., Gelli, A., Juke, M., and Lesley, D. (2009). Rethinking school feeding: social safety nets, child development, and the education sector. The International Bank for Reconstruction and Development / The World Bank, Washington DC, USA. ISBN: 978-0-8213-7974-5, eISBN: 978-0-8213-7975-2. DOI: 10.1596/978-0-8213-7974-55.
- CDC and WFP. (2005). A Manual: Measuring and Interpreting Malnutrition and Mortality. <https://www.unhcr.org/45f6abc92.pdf>
- Central Statistical Agency (CSA). (2014). Ethiopia Mini Demographic and Health Survey. <https://www.statsethiopia.gov.et/uploads/2019/06>.
- Degarege, D., Degarege, A. and Animut, A. (2015). Undernutrition and associated risk factors among school age children in Addis Ababa, Ethiopia Global health. *BMC Public Health*, 15 (1). doi: 10.1186/s12889-015-1714-5.
- FAO. (2004). The state of food insecurity in the world 2004. Monitoring progress towards the World Food Summit and Millennium Development Goals. <http://www.fao.org/3/y5650e/y5650e00.htm>.
- FAO. (2013). The State of Food Insecurity in the World 2013. The multiple dimensions of food security. <http://www.fao.org/3/i3434e/i3434e00.htm>.
- FAO, IFAD, and WFP. (2014). The State of Food Insecurity in the World: Strengthening the enabling environment for food security and nutrition. Rome.
- Herrador, Z., Sordo, L., Gadisa, E., Moreno, J., Nieto, J., Benito, A., Custodio, E. (2014).. Cross-sectional study of malnutrition and associated factors among school aged children in rural and urban settings of fogera and libo kemkem districts, ethiopia. *PLoS ONE*, 9(9):1-11. doi: 10.1371/journal.pone.0105880.
- Kennedy, G., Ballard, T., and Dop, M. C. (2011). Guidelines for measuring household and individual dietary diversity: Food and Agriculture Organization of the United Nations. <http://www.fao.org/3/i1983e/i1983e.pdf>.

- Lien, D. T. K., Nhung, B. T., Khan, N. C., Hop, L. T., Nga, N. T. Q., Hung, N. T., Biesebeke, R. (2009). Impact of milk consumption on performance and health of primary school children in rural Vietnam. *Asia Pacific journal of clinical nutrition*, 18 (3): 326-334.
- Mekonnen, H., Tadesse, T., and Kisi, T. (2013). Malnutrition and its correlates among rural primary school children of Fogera District, Northwest Ethiopia. *Journal of Nutritional Disorders and Therapy*, 12 (2013): 002. doi: 10.4172/2161-0509.1000S1-002.
- Muthayya, S., Thankachan, P., Hirve, S., Amalrajan, V., Thomas, T., Lubree, H., Yajnik, C. S. (2012). Iron fortification of whole wheat flour reduces iron deficiency and iron deficiency anemia and increases body iron stores in Indian school-aged children. *The Journal of nutrition*, 142 (11): 1997-2003. <https://doi.org/10.3945/jn.111.155135>.
- Nkhoma, O. W., Duffy, M. E., Cory-Slechta, D. A., Davidson, P. W., McSorley, E. M., Strain, J., and O'Brien, G. M. (2013). Early-stage primary school children attending a school in the Malawian School Feeding Program (SFP) have better reversal learning and lean muscle mass growth than those attending a non-SFP school. *The Journal of nutrition*, 143 (8): 1324-1330. doi: 10.3945/jn.112.171280.
- Pagano, M., and Gauvreau, K. (2018). Principles of biostatistics, 2nd Edition. Chapman and Hall/CRC Press. Boca Raton, Florida, USA.
- Prince, A. K. and Laar, A. (2014). Nutritional status of school-aged children in the Nkwanta south district-Volta region of Ghana. *European Scientific Journal*, 10 (30):310-327.
- Reji, P., Belay, G., Erko, B., Legesse, M., and Belay, M. (2011). Intestinal parasitic infections and malnutrition amongst first-cycle primary schoolchildren in Adama, Ethiopia. *African journal of primary health care and family medicine*, 3(1): 347-203. doi: 10.4102/phcfm.v3i1.198.
- Simeon, D. T. (1998). School feeding in Jamaica: A review of its evaluation. *American Journal of Clinical Nutrition*, 67(4): 790S-794S. doi: 10.1093/ajcn/67.4.790S.
- United Nations Children's Fund and World Health Organization, T. W. B. (2012). UNICEF-WHO-World Bank Joint Child Malnutrition Estimates. UNICEF, New York; WHO, Geneva; The World Bank, Washington, Dc.
- Zerfu, M., and Mekasha, A. (2006). Anthropometric assessment of school age children in Addis Ababa. *Ethiopian Medical Journal*, 44(4): 347-352.

