

Nutritional status and its association with academic performance among 5-8 grade students in Debre markos second cycle primary school, Amhara Regional State, Ethiopia

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Abstract

Background: A number of factors can interfere on the academic performance of children, especially in early schools. Among these factors, nutritional status and socio-demographic factors are the major contributors. Adequate nutrition for their body growth, development of organs and their functions, body resistance, mental or neurological and cognitive status may be required in early school age period.

Objective: To assess nutritional status and its association with academic performance among 5-8 grade students of second cycle primary school in Debre Markos town. .

Methods: Institution based cross-sectional study design was conducted among 308 second cycle primary school students among grade 5-8 in Debre Markos town. To assess nutrition related factors, AnthroPlus software was used. Educational performance of children was assessed by using first semester examination marks obtained for the overall subject average. Data were entered using EPI data version 4.2 and analysis was done by SPSS version 24. Binary and multi-variable analysis were done with binary logistic regression model for statistical analysis.

Results: A total of 308 study participants were included in the study with response rate of 98% in the selected second cycle primary government schools, which were found on four kebeles of Debre Markos Town. According to World Health Organization (WHO) AnthroPlus software, the prevalence of stunting, wasting, underweight, overweight and obesity were 98(35.9%), 8(2.5%), 13(4.9%), 10(3.2%) and 2(0.6%), respectively. With regard to factors associated with academic performance, being malnourished with stunting [AOR (95%CI) =6.51(3.7-11.6)] was significantly associated factor with academic performance of the study participants.

Conclusion: Poor nutritional status on an academic performance is still a public health problem. Malnutrition in the form of stunting was significantly associated with academic performance of the students. Hence, urgent action is needed to tackle nutrition related problems in its all forms to reduce poor academic performance.

Key words: Nutritional status, academic performance, primary school children, Debre Markos

Introduction

There are an estimated 1.8 billion adolescents in the world, with 90% residing in low- and middle-income countries(Christian 2018). Primary school age is characterized by dynamic physical growth, mental development and high vulnerability stage (Srivastava 2012). Children's physical and mental activities are influenced widely by malnutrition (Candler 2017). Adequate nutrition for their body growth, development of organs and their functions, body resistance, mental or neurological and cognitive status could be required in early school age period (Jaacks 2015). Physical growth and cognitive development in children were faster during the early years of life, and about 50% of the adult intellectual capacity has been attended before 13 years (World Health Organization/WHO 2015).

The significant impact of nutritional status is not only for survival of children but also it is a core factor for an excellent academic performance among the students in lower grades (Viner 2012). Therefore,

nutrition is considered to be the typical pillar for development and growth in children's life in many dimensions (Maehara 2019).

Numerous factors can interfere on the academic performance of children, especially in early schools (Candler 2017; Getaneh 2019). Health and physical consequences of prolonged states of malnourishment among children could bring delay in their physical growth and motor development; lower intellectual /intelligent/ quotient (IQ), greater bad behavioral problems and deficient social skills; and susceptibility to contracting diseases (Olaf 2012). The burden of nutritional deficiency, suboptimal linear growth and under nutrition, socio-demographic factors are major public health problems associated with poor academic performance (Haddad 2015; Christian 2018).

Nutritional deficiencies in school age children are a public health concern especially in resource limited countries (De Onis et al. 2012). Malnutrition among school age children in developing nations, especially in Africa, has been linked with morbidity, hygienic

practices, dietary intakes and family socioeconomic status (Getaneh 2019; Mesfin et al. 2015). Poor feeding practices are associated with stunting and impaired brain development (Degarege et al. 2015). Academic performance could be difficult in the presence of hunger (Mwaniki and Makokha 2013; Haddad 2015), because hungry stomachs, lethargic bodies and thin blood vessels cannot be able to feed the brain. Hence, under nutrition could result academic performance difficult in children from poor socio economic status (Candler 2017). Chronic under nutrition is considered to be causes of children to have low ability to learn at school and poor scholastic achievement (Candler 2017; Herrador et al. 2014).

Child parental education, maternal nutritional knowledge, age, gender and father's occupation (Alredaisy and Ibrahim 2011), parasitic infection (Wolde 2015; Karimi 2016), and family size (Wolde 2015; Yeasmin and Islam 2016) are considered as important risk factors of stunting and wasting among school age children although the factors varies from country to country. The adverse effect of poor family income and the variability of academic score among students from lower and higher socio-economic status on academic performance of students is supported by various studies (Kingsberry et al. 2014).

Stunting reflects the cumulative effect of problems in socioeconomic status and recurrent infections. It results from long-term nutritional deprivation, inadequate childcare and poor environmental and socio-cultural conditions, poor educational achievement and reduced capital and social progress (Getaneh et al. 2019). For these reasons, wide variations in the prevalence of stunting have been observed in different countries. The magnitude of stunting among SAC ranges from 20 to 80% in the world (Yeasmin and Islam 2016). On the other hand, wasting indicates acute under nutrition, usually due to inadequate food intake or a high incidence of infectious diseases (Mushtaq et al 2011; Getaneh et al. 2019). It was most prominent among people in South-East Asia and Africa, whereas it was generally below 10% in Latin America (Rakes 2008).

Ethiopia is one of the developing countries who had signed on the world education forum statement (Forum for World Education/FEW 2019) promising basic education for all citizens and to overcome the basic immediate and underlying causes for better academic performance, particularly on youngest adolescents. However, child malnutrition rate in Ethiopia remains the highest and the most critical public health problem. Nationally, 29% of children (are underweight, 10% are wasted and 44% are stunted, half of which are severely stunted (CSA

2016). The EDHS survey which was conducted in Amhara, Benishangul-Gumuz and Afar regions, and Dire Dawa city administration showed stunting of 41-46%, 23%, 18%, and 14%, respectively and had a huge impact on academic performance of school age children (Ethiopian Central Statistical Agency/ECSA 2016).

A study conducted in Haik Town Primary Schools of South Wollo Zone, North Eastern Ethiopia showed the prevalence of stunting among school age children to be 11.3% with Z-scores below-2SD and 83.7% of students were categorized under 16.5-18.5 body mass index. The study further indicated the significant associated of mixed food consumption with stunting (Menber 2017).

Identifying the level of association of nutritional status and other factors with academic achievement could help to save future population in general and maximize academic performance of school children in particular. The reason for conducting this study was to contribute to the goals of increasing the enrolment of children in second cycle primary education with the aim of achieving the Sustainable Development Goal (SDG) of universal primary education. Moreover, lack of data on the health of school age children, growing interest of governments and development agencies in the link between health and education, and the need for a national school health policy for Ethiopia were the other motives for conducting this study. Studies addressing under nutrition have been mostly restricted to under-five children, rather than focusing school-going children to assess the magnitude of the problem. Therefore, this study aimed to assess the nutritional status and its association with academic performance among 5-8 grade students in the study area.

Materials and Methods

An institution based cross-sectional study design was conducted among second cycle primary school students from grade 5 to 8 in Debre Markos town from February to August 2019. All second cycle primary school students from Debre Markos Town, whose grade is 5-8 were taken as source population and all second cycle primary school students who were from grade 5-8 of the selected school were the study population. By using a single population proportion formula on CI 95%, P (46.1%) (Getaneh et al. 2019), margin of error (5%), correction factor formula, 10% nonresponse rate, a sample size of 308 was computed. Four schools were selected randomly by lottery method from 15 primary schools of the town. Then, participants were selected from each grade level proportionally to size using systematic random sampling technique by taking student's registration list as a sampling frame. Those students who were

critically sick during the study period were excluded from the study. Academic performance (low score or high score) was the assessed dependent variable while nutritional status, socio-demographic characteristics and environmental factors were the valued independent variables.

For this study, academic performance is a school-level summary measure based on the total subject score of a student on the semester school achievement test; high score means a score above the score of the rest students' after checking the distribution status whereas low score is a score below score of the rest students' after checking the distribution status. Students are said to be absenteeism when have not attended at school during school hours for more than five days in the last academic semester. Nutritional status is the term which describes whether an individual is normal, stunted, and underweight or wasted in terms of anthropometric measurement.

- Stunted is Z-score of Height-for-age (HAZ) using a cut-off value of < -2 standard deviation from the median value of the reference.
- Under weight is Z-score of Weight-for-age (WAZ) using a cut-off value of < -2 standard deviation from the median value of the references.
- Overweight Z-score of WHZ using the Z - score of a cut-off value $+2$ to $+3$ standard deviation from the median value of the references.
- Obesity Z-score of WHZ using the Z - score of a cut-off value ≥ 3 standard deviation from the median value of the references.
- Wasted is Z-score of weight for height (WHZ) using a cut-off value of < -2 standard deviation from the median value of the references.
- Normal is Z-score of HAZ, WAZ and WHZ using the Z - score of a cut-off value ± 1 standard deviation from the median value of the references (WHO 2000).

Anthropometric assessment was done by eleven trained nurses who were trained on anthropometric measurements. Weight of students was measured using beam balance and was measured to the nearest 0.1 kg, and height of students was measured to the nearest 0.1cm on standing position without shoes. An object, with two kg weight was used after every students; to check for accuracy of the scale and frequent calibrating of the scale was done. Just after the first semester final examination period, anthropometric measurements such as height and weight of students were taken in the classroom according to the standard procedures using standard equipment. WHO (2000) references were used to define nutritional indices. Z-scores of Height-for-age (HAZ), Weight-for-age (WAZ) and weight -for-

height (WHZ) were used to define stunting, underweight and wasted, respectively using a cut-off value of < -2 standard deviation from the median value of the references.

Assessment of educational performance: The students' educational achievement was assessed by using their end-term examination marks which was based on the curriculum designed by the Ministry of Education in Ethiopia. The successful development of literacy and numeracy skills (essential skills) during the primary school years were crucial for educational success in second cycle primary school and in enabling every individual to realize his or her social and vocational potential (Brhane and Regassa 2014). The average marks obtained from overall subjects' average were considered for their performance assessment. To examine nutritional status on academic achievement, subject total mark was divided into two categories as lower and higher based on a cut-off points and the median was taken because of the nature of the data distribution. As the distribution was not normally distributed and hence the median was considered.

Anthro-plus software was used to calculate the Z-score of weight-for-age, height-for-age and weight-for-height of the students and educational performance of students was assessed using first semester examination marks obtained for the overall subject average.

Data were checked, cleaned, and entered into Epi-Info version 4.2 and transferred to SPSS version 20 software for further analysis. Anthropometric data of weight and height were converted to HAZ, and BMI for age Z scores (BAZ) using the WHO AnthroPlus version 1.4.1. Descriptive statistical data were summarized using texts, tables and figures. Bivariable logistic regression model was fitted to identify factors associated with stunting and wasting. Variables with < 0.2 p-values in the bivariate analysis were fitted into the multivariable logistic regression analysis. Both crude (COR) and adjusted odds ratios (AOR) with the corresponding 95% confidence interval (CI) were calculated to show the strength of associations. In the multivariable analysis, variables with < 0.05 p-values were considered statistically significant.

Ethical clearance was obtained from the ethical clearance committee of Debre Markos University, College of Health Sciences. Permission was obtained from Debre Markos Town Administrative officials, Educational offices and the directors of each school. The importance of the study and the whole information was briefly described for the parents and the study participants before conducting the interview.

Results

Socio-Demographic Characteristics of the respondents: A total of 308 study respondents were included in the study with response rate of 98% in the selected primary government schools, which were

found in four kebeles of Debre Markos Town. Among the study participants, 49% were males and 51% were females. About 44% and 72% of the participants have radio and Television in their household, respectively. With regard to farm land ownership, about 31% of the parents have farm lands (Table 1).

Table 1: Socio-demographic characteristics of study participants from primary governmental school in Debre Markos Town, Amhara Regional State, Ethiopia, 2019

Variables	Category	N (%)
Age group	<12	120 (39.0)
	12-14	179 (58.1)
	>14	9 (2.9)
Educational status of the parent (mother)	No formal education	67 (21.8)
	primary(1-8)	108 (35.1)
	secondary(9-10)	52 (16.9)
	Diploma	30 (9.7)
	degree and above	51 (16.6)
Marital status of the parent(mother)	Married	187 (60.1)
	Widowed	44 (14.3)
	Divorced	33 (10.7)
	Separated	44 (14.3)
Occupation of the parent(mother)	House wife	40 (13.0)
	Farmer	73 (23.7)
	Student	25 (8.1)
	Government employee	88 (28.5)
	Private employee	66 (21.4)
	Others	14 (4.5)
	Orthodox	297 (96.4)
	Muslim	4 (1.3)
Religion	Protestant	5 (1.6)
	Others	2 (0.6)
Residence	1 urban	271 (88.0)
	2 rural	37 (12.0)

Other variables related to academic performance:

Majority of the study participants (91%) had eaten breakfast before going to school and slightly more than half of the study participants (65%) were ever punished by their teachers for their wrong activity related to their education. Moreover, 71% of the study participants had a habit of studying at night time and 21% faced shortage of educational materials (Table 2).

Table 2: Personal and environmental factors of the study participants in Debre Markos, primary governmental school, East Gojjam Zone, North West Ethiopia, 2019.

Variables	Category	N (%)
Vegetable in the household	Yes	136 (44.2)
	No	170 (55.8)
Feeling happy going to school	Yes	294 (95.5)
	No	14 (4.5)
Ever faced for workload in HH	Yes	61 (19.8)
	No	247 (80.2)
	Total	308 (100)
Comfort of HH for study	Yes	261 (84.7)
	No	47 (15.3)
Preference place for study	In my house	176 (57.1)
	School library	35 (11.4)
	In the street	97 (31.5)
	Total	308 (100)
Type of light used for study	Electricity	287 (93.2)
	Lump	12 (3.9)
	Kerosene	9 (2.9)

Nutritional Status of the study participants: The nutritional status of the study participants was measured by using WHO AnthroPlus software measurement techniques and the results of the study participants have been put by referring the world health organization cut points (Table 3).

Table 3: Nutritional Status of the study participants in Debre Markos primary governmental school, East Gojjam Zone, North West Ethiopia, 2019.

Variables	category	N%
WAZ	Wasted (<-2 SD)	8 (2.5)
	Normal (-2 up to +1 SD)	300 (97.5)
HAZ	Stunted (<-2 SD)	98 (35.9)
	Normal (-2 up to +1 SD)	210 (68.1)
BAZ	Underweight(<-2 SD)	15 (4.9)
	Normal(-2 up to +1 SD)	281 (91.2)
	Overweight(+2 up to +3 SD)	10 (3.2)
	Obese(>+3 SD)	2 (0.6)

Prevalence of malnutrition: Based on anthropometric measurement of WAZ, HAZ and BAZ through World Health Organization (WHO) AnthroPlus software, the prevalence of stunting, wasting, underweight, overweight and obesity were 31.8%, 2.6%, 4.9%, 3.2% and 0.6%, respectively.

Factors associated with academic performance of the study participants: Factors with a p-value of <0.2 in the binary logistic regression analyses were entered into the multiple variable logistic regression analysis to control potential confounders. These were, residence [COR (95%CI) =2.16(1.05-4.4)], watching television [COR (95%CI) =1.97(1.18-3.27)], number of siblings in the household [COR (95% CI) =1.99 (1.25-3.18)], and type of light used for the study [COR (95%CI) = 2.3(0.6-7.8)] (Table 4). With regard to factors associated with academic performance in multiple logistic regression, being malnourished with stunting [AOR (95%CI) =6.51(3.7-11.6)] was the only significantly associated factor with academic

performance of the study participants when it was further analyzed with multiple logistic regression and those who were being stunted were 6.51 times more likely to score lower grade result as compared to their counter parts (Table 5).

Table 4: P-value and CI of factors associated with academic performance of the study participants in Debre Markos primary governmental school, East Gojjam Zone, North West Ethiopia, 2019.

	P-value	95% CI
Residence	0.035	2.156 (1.054, 4.412)
Respondents siblings	0.004	1.99 (1.250, 3.182)
Watching TV	0.009	1.971 (1.187, 3.273)
Light use to study	0.178	2.316 (0.682, 7.863)

Table 5: effect of stunting on academic performance of the study participants in Debre Markos primary governmental school, East Gojjam Zone, North West Ethiopia, 2019.

Variables	Higher grade	Lower grade	COR (95%CI)	AOR (95%CI)	P value
Stunting (zHAZ)					
-2 up to +1	112	21		1	1
<-2	63	77	6.51(3.7-11.56)	6.51(3.7-11.6)	<0.001*

The sign * shows significance of the variable

Discussion

This study was conducted to assess the nutritional status and its association with academic performance of the study participants. Based on anthropometric measurement of WAZ, HAZ and BAZ through World Health Organization (WHO) AnthroPlus software, the prevalence of stunting, wasting, underweight, overweight and obesity were 31.8%, 2.5%, 4.7%, 3.2% and 0.6%, respectively. An anthropometric assessment conducted in Addis Ababa among second cycle primary school children revealed that the prevalence of wasting for students using National Center for Health Statistics reference data, the stunting and overweight for the students were 9.8% and 3.3%, respectively (Degarege et al. 2015), in which stunting was significantly lower and overweight was comparable with the present study. The current study also showed that prevalence in nutritional status is relatively lower as compared to the study findings from Amhara region (Asmare et al. 2018). Moreover, prevalence in underweight and wasting are also lower in the present study finding as compared to previous findings from the same study area, Debre Markos (Asmare 2018). The reasons for this discrepancy may be due to inadequate sample size and/or chances of randomly selected schools. The finding of this study further showed lower prevalence in wasting and underweight as compared with the report from Zambia, which was 3.9% and 14.5%, respectively (al GMe 2009). In addition, prevalence of stunting among school-age children in the present study is highest when compared with the findings of the studies in Sri Lanka (26.6%), in Brazil (14.9%) (Sarma 2013), and

Kenya (24%) (Mwaniki 2013); while the wasting prevalence of this study (2.5%) is lowest when compared to 8.5% in Sri Lanka, 9.7% in Brazil (Sarma 2013), and 9.7% in Kenya (Mwaniki 2013). The difference may be attributed to factors associated with socio-demographic and socioeconomic status, study areas and sampling techniques. Prevalence of academic performance scores, considering the median of the study participants, was 56.2% and 43.8% with lower and higher scores, respectively. For the data without normal distribution, the median is better to be considered since it has not been affected by outliers. According to the present study, there was significant negative association between HAZ and academic performance of students. It was supported with the study which was carried out among Egyptian rural community school children showing that the students who were well nourished performed superior to those who were under nourished; in intellectual tests (Karimi et al. 2016). The result from the present study was similar with another study finding from Debre Markos town in which WAZ and BAZ had no effect with the academic performance of the students in preschool (Asmare et al. 2018). With regard to associations of nutritional status with academic performance, HAZ had association with academic performance of the students. Those malnourished students with stunting were 6.51 times more likely to score lower grade results than their counter parts. The reason for this may be due to malnourishment at early ages and/or born from malnourished mothers (Kingsberry et al. 2014). However, the present study did not show significant association between WHZ and child academic performance.

Conclusion

According to the present study, malnutrition with stunting was the only factor which have negative significant association with academic performance of the students. To overcome this problem, the following recommendations are forwarded for the government and other concerned bodies. Especial attention should be given for adolescent nutritional education, particularly for preschool children. Nutritional course as a school curriculum should be applied in both primary and secondary schools to interrupt intergenerational cycle of malnutrition. Urgent action is needed to tackle malnutrition in its all forms to reduce poor academic performance. Further researches should be done on the relationship of nutritional status and academic performance of second cycle primary school children with the help of more sophisticated measurement of their academic performance.

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