Original Article

Assessment of demographic, health and nutrition related factors to a school performance among school children in *Arb-Gebeya* Town, *Tach-Gaynt* Woreda, South Gondar, Ethiopia

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Abstract

Background: Intestinal parasite and malnutrition are prevalent among children in general and school aged children in particular, in the Ethiopian context. There is limited information how these factors are associated with school performance.

Objective: This study assessed the effect of intestinal parasitic infection and nutritional status on academic performance of school children.

Methods: A school-based cross-sectional survey was conducted among randomly selected 601 school childrenattending grades 5th-8th. Data was collected using standardized, closed ended and coded questionnaire. Physical health assessment, parasitological laboratory examinations and anthropometric measurements were the means used to assess the presence of parasitic infections and nutritional status. Grade scores were used to evaluate school performance. Graduate nurses and laboratory technicians were involved in the data collection. EPO INFO version 6.04 and SPSS version 13.0 were used for data management and analysis, respectively.

Results: Out of the 601 students, who had stool examination, 216 (35.9%) had at least one parasite. Of those, the dominant parasite was *E-histolytica*, 80 (13.3%), followed by *ascariasis*, 50 (8.3%). The prevalence of underweight (BMI value below the 5th percentile) in the area was 30(5%) in all age groups.The mean of the students' grade is 62.25% (SD±9.25). Three hundred twenty-eight (54.6%) of the students had scored below the mean. The rate of absenteeism in the group below five days was 540 (74.9%) students who had parasitic infection were less likely to achieve higher academic performance than those who had not (AOR=0.58, 95% CI: 0.41-0.83). Nutritional status as measured by BMI did not shows an association with academic performance.

Conclusion: Even though the prevalence of intestinal parasites in the area seemed low, it affected school performance in the *Arb-Gebeya* school. However, nutritional status did not affect academic performance according to this study. [*Ethiop. J. Health Dev.* 2013;27(2):104-110]

Introduction

Academic underachievement continues to be serious concern for educators, parents, and students alike recently, the issue of underachievement for of school children is more frustrating than it has ever been (1). There are many reasons for children is to under-perform in school, that include medical problems, below average intelligence, specific learning disability, attention deficit hyperactivity disorder, emotional problems, a poor socio-cultural home environment, psychiatric disorders, and environmental causes (2).

Helminthic infections are public health important causes of morbidity and mortality. An estimated 1,471 million cases of infection with *Ascarislumbricoides*, 1,200 million cases of infection with *hookworm*, 1,049 million cases of infection with *Trichuristrichiura*, and from 200–300 million cases of *schistosomiasis* occurred worldwide (3). Larger proportion of these infections among school aged children.

School age children in developing countries bear the greatest health burden due to helminthic infections. According to a World Bank report, morbidity due to helminthic infections accounts for an estimated 20% of the disability-adjusted life years lost because of to infectious diseases in children less than 14 years old. Among the well-described morbidities associated with helminthic infection in children are under-nutrition, anaemia, and failure to achieve innate potential for growth (3, 4).

The health risks associated with helminthic infection predominates among Ethiopian school aged children. The overall prevalence, among school children for at least one helminthic infection, was 92.7% (n=150) of which prevailing parasites were *Ascarislumbricoides*, 76% (5). In another study, from a total of 698 students, who participated in the study, 43.6% of them were positive for various intensities (6). *Shistosomamansoni*, was the commonest 24.9% followed by A*scarislumbricoides*, *(*18.3%) and *Trichuristrichiura* (4.4%) (6). A 27.2% overall prevalence of intestinal helminthes was found among school children with increased infection of *Hymenolepis* nana and *hookworm* (7).The type and prevalence of intestinal worms very much depends on the

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ecological context. *S. mansoni* was found to dominate in areas with lake ecology, prevalence of 85% among school kids near Lake Tana, and 67% in stream ecology in Zarima area (North Gondar) (9). There are other studies that indicated the ecological consistency (9-11). The local distribution of the parasites among children in Ethiopia generally is high

Intestinal parasites have been indicated to affect school grades. Jamaican children who were treated for moderate *whipworm* infections raised their test scores, which had lagged by 15%, from the level of uninfected children. School food programs had also a positive effect on attendance and academic performance (12). A clear illustration of the detrimental effects of helminthic infection on this was also provided in another Jamaican school children aged 9-12 years (13). Treatment of *T. trichiuia* infection was followed by significant improvements in the tests of auditory short-term memory and scanning and retrieval of long-term memory. Nine weeks after treatment, previously infected children performed as well as uninfected children had similar performance. Absenteeism was more frequent among infected than uninfected children: the heavier the intensity of the infection the greater the absenteeism, to the extent that some children attended school for only half as much time as their uninfected peers (13). School absenteeism because of parasites is a factor for poor grades.

A country like Ethiopia, with only half of its school age children in classrooms, cannot afford to disregard the responsibility of providing universal education. Good primary education is a necessity for development. Accordingly, in Ethiopia, basic education is viewed as individual's constitutional right and an essential necessity. The Ethiopian Education Sector Development Program is a vehicle to achieve this top priority (14). The national net enrollment ratio for primary education (Grade 1-8) increased from 22.5% in 1994/5 to 79.1% in 2006/7. This is in the Amhara Region the increase was from 17% in 1994/5 to 83.4% in 2006/7 (15).

The effect of health and nutritional problems on academic performance is not yet fully described in Ethiopia, with respect to the top agenda of quality universal education. The purpose of this study was to examine associated factors on educational performance among school children.

Methods

Study Area and Period

The study was carried out in South Gondar Zone of *Tach-Gayint Woreda,* in *Arb-Gebeya* Town from February 20 to March10, 2007. The town is found 760 KM northwest of Addis Ababa. *Arb-Gebeya* has one high school and one junior secondary school. There was no private school in the town at the time of the study. The study was conducted in the junior secondary school which had a total of 3,055 students.

Study Design and Population

A school-based cross-sectional survey with internal comparison was carried out among a 5^{th}-8^{th} school source population of 1955. Students in these grades were assumed to provide independently a reasonable response with regard to answering research questions.

Sample Size Determination

EPI INFO version 6.04 was used to estimate the sample size using a single proportion equation with assumptions of proportion of students with academic performance as 50%, 95% of certainty with standard Z score of 1.96, and precision of estimate as 4%. Calculated sample size was 601. The benefit of increasing the sample size was sought by using the proportion of 50% and lowering the precision of estimates.

Sampling Procedure:

A single stage sampling method was used to draw the study subjects. The list of students' roster as a sampling frame was used to stratify grades by 5^{th} -8^{th}. The size of each grade was first determined. Then, probability to proportionate size was used to select randomly the stipulate samples size from each grade.

Data Collection

Data collection employed a pre-tested structured questionnaire, reviewing records, anthropometrics measurements, medical history or physical examination and parasitological examination. The questionnaire was initially prepared in English and then translated into Amharic and back translated into English to check and correct any inconsistencies or distortions of words or concepts. Two nurses, two experienced laboratory technicians and a health officer (supervisor) were involved in data collection. Two-day training was given to introduce the data collection instruments, data collection techniques, and data quality issues prior to the fieldwork. The training involved discussions, role play and pre-testing of the instruments.

Parasitological Examination

Students were asked to bring about two grams of fresh stool specimens with a plastic stool container. Examination for parasites' ova in the stool was done by two laboratory technicians of the health center of *Arb-Gebeya*. A direct saline suspension (wet mount) technique was used to identify parasites (ova, cysts, and larvae).

Measurement of Weight

Body weight was recorded using a beam balance with non-detachable weighing scale (Detecto Standard Weight Scale, Model 429). Students were weighed with light clothing and without shoes. Their weight was measured in kilograms with two digit numbers and with two decimal numbers (16).

Height Measurement
Height was measured in centimeters with 3 digit numbers using a calibrated wall-mounted Stadio-meter and a modified tape measure. Measurement was taken without shoes in a standing position. The student stood back against a flat wall with heels, buttocks, shoulders and head touching the wall (16-19).

Data Management and Analysis
Data entry and cleaning was done using EPI INFO version 6.04, while the analysis was carried out using SPSS 13.0 version. Ten percent (10%) of the questionnaires were double entered in order to ensure the quality of data entry. BMI-for-age of the students was calculated according to the Quenelle's Index nutritional evaluation tools used for adults that were adapted to adolescents by CDC, 2000 (16-19). BMI index between 5^{th} and 85^{th} percentile was considered as normal BMI, while BMI less than 5^{th} was taken to underweight and above 85^{Th} percentile as obese. A summary of academic performance index was generated by dividing the sum of all grades of the first semester of the academic year 2006\07 (1999 EC) by the number of participation students. The academic performance was then dichotomized in reference to the overall grade average.

Tables and frequencies were used to present the data. The association between dependent and independent variables was determined using crude odds ratio (COR) and adjusted odds ratio (AOR) with 95% confidence interval in a bivariate and multivariate logistic regression analysis. Variables with $p<0.1$ in a bivariate analysis were considered for the multivariate analysis. Co-linearity was assessed using correlation matrix among independent variables. We did not find any sign of co-linearity variables. Statistical significance was assessed using the 95% CI of ORs and a significance level at p-value of < 0.05.

Data Quality Assurance
This was ensured through proper training of data collectors and supervisors. Pre-testing of the questionnaire was carried out in a similar setting to verify the utility of the questionnaire. The study team members met daily to check the daily progress and data completeness and consistency. Securing the consent of the school head as a guardian of the school children and getting permission from local authorities were managed to enhance data quality assurance.

Ethical Considerations
Ethical approval was obtained from the Ethical Committee of the School of Public Health, Addis Ababa University. Permission for data collection was obtained from the woreda education and health departments. The school head was informed about the purpose of the study and who consented verbally on behalf of the students. The study had no harm to the students not to their families: Therefore the involvement of parents was not a prerequisite for this study. The freedom of pupils to participate or not in the study was explained and tried out prior to the actual interviewing. The students' privacy during the interview, stool collection, and anthropometric measurements was maintained. Data obtained from them were anonymous to maintain confidentiality. Free treatment for those who had intestinal parasitic infection, scabies and other illnesses were provided with the cooperation of the World Health Center and Health Department.

Results

Socio-demographic Characteristics of Study Participants
A total of 601 (100%) response was obtained. Out of all participants, 363 (60.4%) were males. The majority of the students were between 10-14 years of age: 440 (73.2%), 150 (25%) were 15-19 years and 11 (1.8%) were 20 years of age. Five hundred forty eight (91.2%) of the participants were Orthodox Christians, and 50 (8.3%) were Muslims. All students were from the Amhara ethnic group. Just over fifty percent (53.4%) of the students were from the neighboring areas, while the rest were from the Town. Two hundred ten (34.9%) walked for more than 30 minutes to reach the school (Table 1).

Table 1: **Demographic characteristics and academic status of students of *Arb-Gebeya* Town school children, March, 2007**

Socio-demographic variables	Frequency (n=601)	%
Grade		
5^{th} grade	164	27.3
6^{th} grade	97	16.1
7^{th} grade	160	26.6
8^{th} grade	180	30.0
Sex		
Male	363	60.4
Female	238	39.6
Age category		
10-14 years	440	73.2
15-19 years	150	25.0
≥20 years	11	1.8
Religion		
Orthodox	548	91.2
Muslim	50	8.3
Others	3	0.5
Residence		
Urban	280	46.6
Rural	321	53.4
Time resumed to travel to school		
≤30 minutes	391	65.1
>30 minutes	210	34.9
Absenteeism from the school		
≤5 days	540	74.9
>5 days	151	25.1
Class repeated last academic year		
Yes	59	9.8
No	542	90.2
Grade Score		
Below mean	328	54.6
Above mean	273	45.4

Intestinal Parasitic Infection among Respondents

Out of 601 students, who had stool examination, 216 (35.9%) had at least one intestinal parasite. Of those, the dominant parasite was E-histolytica, 80 (13.3%), followed by ascariasis, 50 (8.3%). The presence of double infection was 8 (1.3%) (Table 2).

Table 2: **Parasitological examination and laboratory results of students of Arb-Gebeya Town, school children, March 2007**

Socio-demographic variables	Frequency (n=601)	%
Presence of Parasites		
Yes	216	35.9
No	385	64.1
Types of parasites		
Giardia	47	7.8
Ascaris	50	8.3
Amobiasis	80	13.3
Teaniasis	10	1.66
Strongyloides	6	0.99
Entrobiasis	8	1.33
Double infection	8	1.33

Academic Performance of the Respondents

Five hundred forty (74.9%) of the students were absent for ≤ 5 days of absenteeism from their schools within the past semester prior this study period (Table 1).Those who repeated last academic year were 59 (9.8%). The students' first semester average grade (score) was a minimum of 34.1% and a maximum of 90.1%. The mean (SD) of the students' grade was 62.25% (9.53%). Students, who had below mean score, were 340 (56.6%) and 261 (43.4%) had above the mean score.

***Nutritional Status of the Respondents*:**

According to the Quetelet's index, the mean and (SD) of the BMI-for-age was calculated as 16.49 (2.08). The prevalence of under-weight (BMI value below the 5th percentile) in the area was 30 (5%) in all age group, 481 (80%) of them had normal weights (BMI between the 5th and 85thpercentile), 60 (10%) of them were at risk-of-overweight (BMI between 85th and 95th percentile) and 30 (5%) of them were overweight (BMI above the 95th percentile) (Table 3).

Table 3: **Distribution of BMI based on age and sex of the students among *Arb-Gebeya*Town school children, March, 2007. (n=601)**

Age (years) and	Under weight		Normal weight		Over weight		Obese		Total	
in %	M	F	M	F	M	F	M	F	M	F
10-14	17	12	217	167	4	14	2	7	240	200
(%)	7.1	6	90.4	83.5	1.7	7.0	0.8	3.5	100	100
15-19	-	1	77	18	28	8	9	9	114	36
(%)	-	2.8	67.5	50	24.6	22.2	7.9	25	100	100
>=20	-	-	2	-	4	2	3	-	9	2
(%)	-	-	22.2	-	44.4	100	33.3	-	100	100
Total	17	13	296	185	36	24	14	16	363	238
(%)	4.7	5.5	81.5	77.7	9.9	10.1	3.9	6.7	100	100

5th percentile (BMI=13.78)
85th percentile (BMI=18.87)
95th percentile (BMI=20.44)
Mean ±SD BMI: 16.49(±2.08)
Median BMI: 16.15

Factors Affecting School Performance

In a bivariate analysis, male students, students living in urban settings, students with ≤ 5 family size, the proportion of students who were absent for≤5 days, students without eye discharge, walking distance of home from school measured by <30 minutes, and absence of eye discharges had higher academic performance than their counter parts. The presence of a specific parasite and nutritional status as measured by BMI did not show any association with academic performance (Table 4).

Adjustment of the confounding variables that we considered in this study was done using a binary multivariate logistics analysis. Only sex, the presence of eye discharges, and intestinal parasites remained to significantly impact school performance. Males performed 2.39 times better than females in academic performances [AOR (95% CI): 2.39 (1.67-3.42)]. Students, who had a complaint of purulent eye discharge, performed less than those who hadn't any purulent eye discharge [AOR (95%CI): 0.60 (0.39-0.92)]. Students who had Intestinal parasitic infestation, were less likely to achieve higher academic performance than those who did not [AOR 95%CI): 0.58 (0.41-0.83)]. Even though, the presence of intestinal parasites was significantly associated with academic performance, none of individual parasite species was associated with performance. There was not an interaction between intestinal parasite and nutrition as measured by BMI, absentees and intestinal parasite.

Table 4: **The association of demographic, health and nutrition related factors to academic performance (average score) of schoolchildren in Arb-Gebeya Town 2007 (n=601)**

Variables	Number of students per average grade score			
	Above average	Below average	COR* (95% CI)	AOR* (95% CI)
Sex				
Male	182	181	2(1.44,2.84)*	2.39(1.67, 3.42)*
Female	79	159	1.00	1.00
Residence				
Urban	139	141	1.61(1.16,2.23)*	1.30 (0.86,1.97)
Rural	122	199	1.00	1.00
Family size				
≤5	169	192	1.42(1.02,1.97)*	1.36 (0.96,1.94)
>5	92	148	1.00	1.00
Walking distance				
≤30 minutes	187	204	1.69(1.19,2.38)*	1.44 (0.94,2.21)
>30 minutes	74	136	1.00	1.00
Absenteeism				
≤5days	207	243	1.53(1.05-2.24)*	1.44 (0.97.16)
>6 days	54	97	1.00	1.00
Eye discharge:				
Yes	45	86	0.62(0.41,0.92)*	0.60 (0.39,0.92)*
No	216	254	1.00	1.00
Intestinal parasites				
Yes	78	138	0.62(0.44,0.88)*	0.58 (0.41,0.82)*
No	183	202	1.00	1.00
Nutritional status, BMI				
Normal	217	264	1.42 (0.94, 2.15)	1.24 (0.80,1.92)
Not normal	44	76	1.00	

COR*:Crude Odds ratio; AOR*: Adjusted Odds ratio; * significant association

Discussion

The overall intestinal parasitic infection rate of *Arb-Gebeya* Town School children was 35.9%, The result found in this study was less than that in other studies: 83.8% in Lake *Langano* (11); 68.4% prevalence in *Jimma* (20); 43.6% prevalence in South Wello, Ethiopia (6); 69.4% in Wolayta (21); 89.4% in Wondo-Genet (22); 68.29% prevalence in Baguio City, Philippines (3). The current prevalence, however, was greater than that was in Babile school children, 27.2% (7).

The prevalence of poly-parasitism (more than one parasite) in the study was 8 (1.33%). This was too low a prevalence when compared with the study in *Langano*, South Ethiopia. The survey in *Langano* showed a prevalence of poly-parasitism varying between 23.5% and 67% (11). The presence of multiple intestinal infectionof the current study was comparable with that of Gondar, 10.9% (23). The low prevalence of Intestinal parasitic infection in our study could be due to the activities of de-worming program in the woreda that had been given since the beginning of 2006 and throughout the year, including school students. In addition, the small sample size and the wet mount or direct saline suspension technique could be responsible for high probability of missing of ova of parasites which implies low probability of detecting parasites compared to other studies that used concentration methods. We can assume a crude estimate of the prevalence could be as much as 56% if the concentration method was used (24, 25).

The presence of intestinal parasites together affected school performance. A cumulative burden of parasitism meaningfully affected school performance due to their synergistic action. This finding was consistent with a study conducted in the Philippines that the presence of parasites affects academic performance among the public elementary school children in Baguio City, Philippines during the school year 1983-1984 (26). Of the 369 children studied, 68.29% harbored parasites. Children free of parasitic infections obtained higher grades than the infected group. This difference was of statistical significance. The teachers in charge of the treated group noted that a significant improvement in school performance following treatment (26). Another study in Jamaica had also found similar results. In one school of Jamaican children who were treated for moderate *whipworm* infections had test scores, that lagged by 15%, up to the level of uninfected children (12). Another study in Jamaican children aged between 9-12 years showed that treatment of *T. trichiura* infection showed significant improvements in the result of tests of the auditory, short term memory and scanning and retrieval of long-term memory. Nine weeks after treatment, previously infected children performed as well as uninfected children (13).

The nutritional status as evaluated by BMI in *Arb-Gebeya* Town school children was similar with the results that were found in Nigerian primary and

secondary school students (27). Male students performed better than female in the study area. Ethiopia has strong cultural practices that make a difference in the roles and responsibilities shared between males and females in a family. Females have multiple family duties that include at least water and fuel wood collection, food preparation and serving to family members, and child caring. Hence, female students perform these duties each day after and before school. Hence, they do not have adequate time to work on their school assignments, read more, and undertake personal hygiene. This cultural practice is assumed to affect the school performance and increased parasitism of female students in general.

Other studies indicated a positive association between nutritional status and school performance that is contrary our findings (27). Malnutrition as measured by food sufficiency and micronutrient intakes indicated a strong association with school performance in general and the cognitive ability of students in a systematic review (28). After controlling confounding factors, lower nutritional status was known to retard school performance (29). There are strong arguments that nutrition alone is not responsible for low academic performance. So there is no resolving the social causes of malnutrition without by the focusing on poverty alleviation and improving other socio-economic characteristics (30, 31). The link between nutrition and school performance is consistent in some actively engaged school programs. School nutrition programs measured through the availability of school nutrition interventions has been indicated to impact school performance in Kenya, India, Egypt, Zimbabwe, and Gambia (32).

Establishing an association of factors related to intestinal infection and nutrition with school performance is not an easy task due to the complex and multiple path ways of the relation. Fore instance, a study in Babile town indicated stunted school children had higher rate of intestinal parasites (7), which implies their action could be worse to affect school performance.

Hence, we need to interpret the relationship between malnutrition and school performance in the context of Ethiopia, where at least some 40% of the people struggle with absolute poverty. Given this condition, the loss of the relationship between nutrition and school performance in our study might be due to either small sample size we had or the prevailing temporal variation of students' nutritional status. The difference in the measurement of the dependent variable is another area of difference among the studies.

The effort to address the growing need of describing determinants of school performance is the strength of this study. However, the results of the study need to be evaluated carefully because of the limitations that are related with the use of wet mount or direct saline suspension and inadequate sample size that could have an under-estimated prevalence of parasites and possible associations.

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