ORIGINAL ARTICLE

INTESTINAL PARASITIC INFECTIONS IN ASSOCIATION WITH CUTANEOUS FUNGAL INFECTION AND NUTRITIONAL STATUS AMONG TSEDA SCHOOL CHILDREN, NORTHWEST ETHIOPIA

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ABSTRACT

Background: *Intestinal parasitic infections are the major cause and contributory factors for malnutrition. In Ethiopia, there is no report on the prevalence of intestinal parasitic infections in association with cutaneous fungal infections and nutritional status among school children.*

Objective: *To assess the magnitude and association of intestinal parasitic infections with cutaneous fungal infections and nutritional status among school children*

Methods: *A cross sectional study was conducted among the school children of Tseda town, northwest Ethiopia. A total of 870 eligible students enrolled and their sociodemographic and anthropometric variables were collected using a structured questionnaire. Clinical investigation was done for fungal infections. Stool specimen was collected and examined microscopically, following formol-ether concentration technique. Three anthropometric indices height for age, weight for age, and weight for height were expressed as differences from the mean in standard deviation units or Z-scores.*

Result: *Out of 870 students, 43.0% were male and 57.0% female. The overall prevalence of intestinal parasitoses was 72.8%. Single and multiple infections were seen in 35.1% and 37.7% children, respectively. The most common parasites identified were Ascaris lumbricoides (49.9%), Schistosomia mansoni (29.5%), and Hookworm (15.3%). Cutaneous fungal infection was observed in 12.1% of the children. Tinea capitis was the predominate fungus (6.2%). Children who had cutaneous fungal infections were more likely to have one or more intestinal parasites than those who did not (P<0.01). The proportion of children with underweight, stunting and wasting was 11.4%, 10.9%, and 2.9%, respectively.*

Conclusion: *The results of this study showed that intestinal parasitoses and cutaneous fungal infections were high among school children in the area. It also appeared that intestinal parasitic infections were associated with cutaneous fungal infections. Moderate childhood malnutrition was also common. Our result called for appropriate intervention measures to reduce childhood morbidity from parasitic and fungal infections, and malnutrition.*

Key words*: Intestinal parasitoses, nutritional status, cutaneous fungal infections, school children.*

INTRODUCTION

Intestinal parasitic infections are among the major health problems in Africa. Studies on estimated disease burdens show that globally, 39 million DALYs (disability-adjusted life years) are lost due to intestinal parasitic infections (1)**.** The high prevalence of these infections is closely correlated to poverty, poor environmental hygiene, and impoverished health service (2). Besides causing debilitating morbidity, intestinal parasitic infections are causes of important health problems, such as malnutrition and anemia among school children hence compromising their physical development, school attendance, and ability to learn (3-6)**.** Socioeconomic and health conditions, education and beliefs related to traditional health practices, as well as the presence of domestic animals in the home, and the contamination of water have all been reported as factors associated with the presence of these parasitic infections (7,8).

School children also suffer from the interactions be-

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tween infection and malnutrition since their immune system is relatively immature, their nutritional needs high, and their exposure to multiple infectious agents are frequent(9). Intestinal parasitic infections, malnutrition, and fungal infectious are common in school children (10-12). Intestinal parasitic infections are the major ones in predisposing to skin fungal diseases and vise versa.

However, in relation to this effect, no research findings have been reported so far. But it might be obvious that intestinal parasitic infections induce or produce factor(s) which can alter the susceptibility of their hosts to fungal diseases or enhance fungus ability to penetrate and develop within human tissues (13). Such interaction has been well studied in fungi and bacteria co-infection since interactions between bacteria and fungi can have dramatic effects on the survival, colonization, and pathogenesis of these organisms (14). Likewise, thus, one can speculate that parasitic and fungal infections could have such synergetic or antagonistic interactions.

The interactions between parasitic infections and fungi in natural settings might be complicated by a number of factors, including host responses, environmental parameters, and species composition of each organism. It is also obvious that the connections between nutrition, infections, and immunity are very important in determining the morbidity and mortality situations of an individual. Malnutrition undermines host resistance, and intestinal parasites impose an impact on nutrition and the host's immune resistance (9, 15).

Such a synergetic effect of being causal or contributory could be a great opportunity to have less resistance for fungal manifestations, particularly for those opportunist fungi which can be easily controlled by a strong host immune response (9, 13). Like in other developing countries, intestinal parasitic infection, malnutrition, and fungal infections are the major health problem in Ethiopia.

In particular, there is no report on the prevalence of cutaneous fungal infections and their association with intestinal parasitoses in the country. An assessment of the coprevalence as an initial step will make the study of parasitic-fungal interactions and their role in disease more complete. Therefore, the aim of this study was to assess the magnitude and association of intestinal parasitic infections with cutaneous fungal infections and nutritional status among school children in Tseda town, northwest Ethiopia.

MATERIALS AND METHODS

Study design, area and population*:* A cross sectional study was conducted in Tseda town from December 2005 to March 2006. Tseda is located 23 km South of Gondar city on the way to Bahir Dar. The town is located at an altitude of 2000m above sea level, and its daily temperature changes from 25 to 30^{o}C. The land is cultivated and mostly open grassland. The means of income for the town dwellers is mainly subsistence farming. Tseda has two schools: Tseda Basic Elementary School (Grades 1-4) and Tseda General Primary School (Grades 1-8).

Sampling and sample size determination: The sample size was determined with the help of Epi-info version 6 (16) and using the following assumptions: student population in the school, previous prevalence of parasites (40%) in the area, 95% confidence interval, 3% of marginal error, and 15% of non-response rate. Based on this assumption, out of a total of 2966 student population in the school, 875 students were taken as sample. To select the sample children, the students were first stratified according to their educational levels (grade 1 to grade 8). A quota was then allocated for each grade and each classroom. Finally, the sample children were selected using systematic random sampling techniques by using class rosters as the sample frame. For anthropometric data quality study we cross-checked students' age from their school records which had already been given by their parents to the school. During the sample size calculation, we used 15% non-response rate since most of the students, in the lower grades, in particular didn't know the exact sociodemographic data and morbidity indicators.

Specimen collection and examination*:* A questionnaire was administered for the collection of sociodemographic information together with self-reported morbidity indicators. A senior internist examined the children for the presence of fungal infections. About one gram of stool was collected from each student and preserved a in 10% formalin and transported to the main laboratory of the University of Gondar teaching Hospital. Each stool specimen was then processed and examined using the formol-ether concentration technique for the presence of protozoan cysts, helminths eggs, or larvae, following standard procedures (17).

For the anthropometric survey, height and weight of all participants were measured following the WHO recommended procedures (18, 19) using a portable weight balance and height scale. Weight was measured with the child dressed in light clothing to the nearest 0.1 kg on an electronic digital scale. Height was measured to the nearest 0.1 cm using a standard wooden board fitted with a measuring height scale, a fixed foot-plate, and a movable headboard. Quality control was checked by using standardized measuring devices that were available in the University of Gondar teaching hospital and the interpretation of the results by using the standard growth curve of WHO (18, 19).

Data analysis: Three anthropometric indices, height for age, weight for age, and weight for height were expressed as differences from the median in standard deviation units or Z-scores calculated with a software EPI-INFO version 6 (16). Interpretation of the anthropometric indices was done following the Gorstein *et al*. (20) guideline. Weight-for height (WHZ), height-for-age (HAZ), and weight-for-age (WAZ) ratios were used to level malnourished children as wasting, stunted, and underweight growth, respectively. Wasting, stunting, and underweight were defined as Z score values of less than -2nSD (Standard Deviation) which was below what was expected on the basis of the international growth reference scale (20). Parasitic data was managed and analyzed using SPSS Windows version 13. Descriptive and inferential (chi-square) statistical tests were used. Odds ratio was used as the measure of strength for the associations of parasitic infections (the dependent variable) and cutaneous fungal infections (independent variable) and P-value less than 0.05 was considered statistically significant.

Ethical consideration: Ethical clearance was obtained from the Ethical Committee of the University of Gondar. Although the specimen taken from the study subjects were not invasive for collecting stool sample and physical examination, written permission from the school administrations and the approval of the teachers from each section were obtained. After a proper examination of the samples, the positive study participants were treated.

RESULTS

A total of 870 students were included from the two schools of Tseda town to participate in the study. Their mean age was 11.84 years (ranging 5 to 24 years). Among these, 374 (43%) were male and 496 (57%) female. Four hundred twenty six (49.0%) of the total participants were from Tseda Basic Elementary School, and 444 (51.0%) were from Tseda General Primary School (Table 1).

Table 1 - Distribution of intestinal parasites based on their grade and sex, Tseda, Northwest Ethiopia.

Type of parasite	Schools	Male	Female	Total No. (%)	Overall prevalence
		+ve No.(%)	+ve No. (%)		
A. lumbricoides	Basic elementary*	84 (19.7)	143 (33.6)	227 (53.3)	434(49.9)
	General elementary**	68 (15.3)	139 (31.3)	207 (46.6)	
Hookworm	Basic elementary	37 (8.7)	47 (11.0)	84 (19.7)	133(15.3)
	General elementary	20 (4.5)	29 (6.5)	49 (11.0)	
S. mansoni	Basic elementary	56 (13.2)	58 (13.6)	114 (26.8)	257(29.5)
	General elementary	63 (14.2)	80 (18.0)	143 (32.2)	
Giardia lamblia	Basic elementary	26 (6.1)	40 (9.4)	66 (15.5)	99(11.4)
	General elementary	20 (4.5)	13 (2.9)	33 (7.4)	
T. trichiura	Basic elementary	12 (2.8)	11(2.6)	23 (5.4)	28(3.2)
	General elementary	2 (0.4)	3 (0.7)	5 (1.1)	
S. stercoralis	Basic elementary	12 (2.8)	13 (3.0)	25 (5.8)	36(4.1)
	General elementary	8 (1.8)	3 (0.7)	11 (2.5)	
E. vermicularis	Basic elementary	0	5 (1.2)	5 (1.2)	14(1.6)
	General elementary	4(0.9)	5 (1.1)	9 (2.0)	
H. nana	Basic elementary	19 (4.5)	20 (4.7)	39 (9.2)	52(6.0)
	General elementary	8 (1.8)	5 (1.1)	13 (2.9)	
Taenia sp.	Basic elementary	-	1 (0.2)	(0.2)	1(0.1)
	General elementary	-	-	-	
	Over all prevalence	261(30.0)	372(42.8)	633(72.8)	

**(Grade 1-4) N= 426 (49.0%)*
***(Grade 1-8) N= 444 (51.0%) (Sample taken from Grade 5-8)*

A microscopic stool examination done by the formol ether method for intestinal parasites showed an overall prevalence of 72.8 % (Table 1). Females were more infected (42.8%) than males (30%). A comparison of intestinal parasitic infection of the two schools showed a high rate of parasitic infection in the basic elementary school than in the general elementary school (Figure 1). Among the intestinal parasites, *Ascaris lumbricoides* was the predominant (49.9%), followed by *Schistosomia mansoni* (29.5%), Hookworm (15.3%), *Giardia* cyst (11.4%), *Hymenolepis nana* (6.0%), while others accounted for less than 5% prevalence (Table 1). The overall prevalence of infection with one parasite was 305 (35.1%). Infection with double, triple, quadruple, and five types of intestinal parasites was seen in 251(28.9%), 65 (7.5%), 11 (1.3%), and 1 (0.1%) of the children, respectively (Figure 1). *Ascaris lumbricoides* and Hookworm species were the most common combination observed in this study.

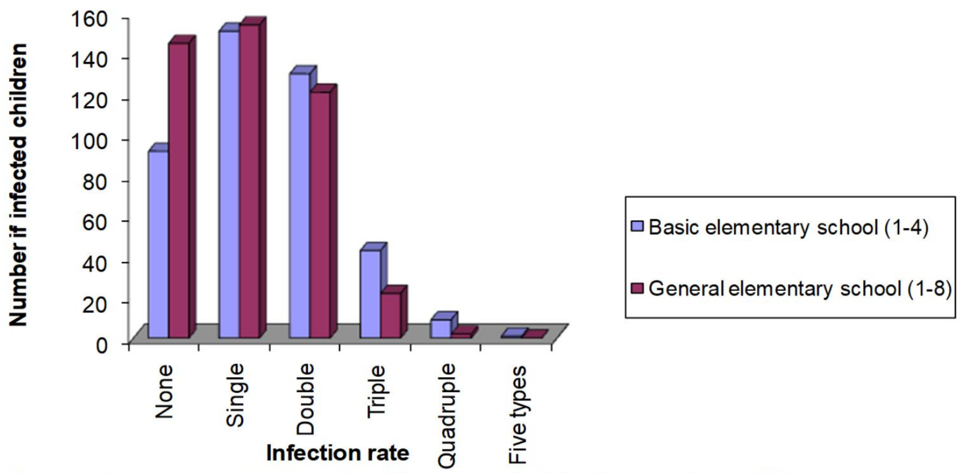

Figure-1. Prevalence of single and multiple parasitic infection in school children

There was an association between intestinal parasitic infections and age as well as the grade level of the children. A decreased trend in parasitic infection was clearly observed as age increased. Prevalence decreases from 79.6% among children aged 5-9 years to 58.3% among students aged 20 years and above (P<0.05). There was also a decreasing trend with increasing grade level (P <0.05). Shoe wearing habit was also protective for intestinal parasitic infections (P<0.05). Sex didn't show statistically significant difference (P>0.05). There was no statistically significant difference in the infection rate between students having different types of toilet facility (P>0.05) (Table 2).

A self-reported morbidity of children was also assessed, but none of the indictors showed a statistically significant association with the overall parasitic prevalence (P>0.05) (Table 3). However, the presence of nausea was significantly associated with *T.trichiura* infection (X^2=8.9, P=0.003), and headache with the *A. lumbricoides* and *Taenia* infections (X^2= 4.2, P= 0.041).

The overall cutaneous fungal infections were 105 (12.1%); out of these 54 (6.2%) of the children were predominately infected with *Tinea capitis* followed by *T. corporis* (OR=1.94, CI, 1.11-3.42, P= 0.01) (Table 4). The rate of intestinal parasitic infections and fungal infections of the children was strongly associated, particularly where children with one or more intestinal parasitic infections were more likely to have cutaneous fungal infections than children without (X^2= 46, P< 0.001).

The study had also evaluated the nutritional status of the school children. The mean WAZ, HAZ, and WHZ were -1.08$\pm$ 0.82, -0.95$\pm$1.04, and -0.63$\pm$1.03, respectively. The prevalence of children with underweight (WAZ<-2SD), stunting (HAZ< -2SD), and wasting (WHZ<-2SD), respectively, were 11.4%, 10.9 %, and 2.9%. Underweight was significantly associated with sex of the children in that boys had significantly higher underweight rates than girls (P=0.04) (Table 5). The prevalence of *S.mansoni* infection was 16.0% in wasted children, 84.1% in normally nourished children, and the difference was statistically significant (P<0.05). The overall prevalence rate of intestinal parasitic infection was not different among school children with or without stunting, wasting, and underweight (P>0.05) (Table 5).

Table 2 - Risk factors and intestinal parasites of school children in Tseda, Northwest Ethiopia.

Variables		Intestinal parasites			X2	P-value
		No No. (%)	Yes No. (%)	Total No. (%)		
Age	5-9	41(79.6)	160 (20.4)	201 (100)	9.12	0.03
	10-14	144(27.8)	374(72.2)	518 (100)		
	15-19	47(33.8)	92(66.2)	139 (100)		
	20-24	2(41.7)	7(58.3)	12 (100)		
Sex	Male	113 (30.4)	261(69.6)	374 (100)	2.92	0.09
	Female	124 (25.0)	372 (75.0)	496 (100)		
Family occupation	Farmer	167(27.2)	446(72.8)	613(100)	6.78	0.08
	Merchant	33(21.4)	121(78.6)	154 (100)		
	Employee	23(37.7)	38(62.3)	61(100)		
	Others	14(33.3)	28(66.7)	42(100)		
Grade	1-4	92(21.6)	334 78.4)	426 (100)	13.4	< 0.001
	5-8	145(32.7)	299 (67.3)	444 (100)		
Hygienic practices (Hand wash habit)	before meal	46 (31.3)	101 (68.7)	147 (100)	1.9	0.59
	after meal	1(16.7)	5 (83.3)	6 (100)		
	before & after meal	188 (26.4)	523 (73.6)	711 (100)		
	Sometimes	2 (33.3)	4 (66.7)	6 (100)		
Hand wash after latrine	No	100(29.2)	242 (70.8)	342 (100)	0.41	0.81
	Yes	137(25.9)	391(74.1)	528(100)		
Type of latrine	Pit latrine	102(27.2)	273(72.8)	375 (100)	1.14	0.29
	Latrine with water	2 (40.0)	3 (60.0)	5 (100)		
	Open field	133 (27.1)	357(72.9)	490 (100)		
Finger hygiene (regular nail cutting habit)	Always	87 (26.6)	240 (73.4)	327(100)	028	0.87
	Sometimes	144(27.8)	374 (72.2)	518(100)		
	No	6(24.0)	19 (76)	25(100)		
Shoe wearing habit	No	61 (21.3)	226 (78.7)	287 (100)	7.75	0.005
	Yes	176 (30.2)	407(69.8)	583 (100)		

Table 3 - Self reported morbidity and intestinal parasites of school children in Tseda, Northwest Ethiopia

Variables		Intestinal parasites			X^2	P-value
		No No. (%)	Yes No. (%)	Total No. (%)		
Abdominal pain	No	107(29.2)	260(70.8)	367(100)	1.28	0.26
	Yes	129(25.7)	373 (74.3)	502 (100)		
Loss of appetite	No	202(27.2)	541(72.8)	743(100)	0.00	0.96
	Yes	34 (27.0)	92(73.0)	126(100)		
Presence of diarrhea	No	208(26.8)	568(73.2)	776(100)	0.69	0.41
	Yes	29(30.9)	65(69.1)	94(100)		
Presence of nausea	No	182(27.2)	487(72.8)	669(100)	0.00	0.96
	Yes	55(27.4)	146(72.6)	201(100)		
Headache	No	194(27.6)	508(72.4)	702(100)	0.28	0.59
	Yes	43(25.6)	125(74.4)	168(100)		
Physically looks sick	No	200(27.0)	541(73.0)	741(100)	0.16	0.69
	Yes	37(28.7)	92(71.3)	129(100)		

Table 4- Association of intestinal parasitoses and cutaneous fungal infection among school children in Tseda, North west Ethiopia

		Frequency No. (%)	Intestinal parasitic infections			X2	P-value
			No (%)	Yes (%)	Total		
Cutaneous fungal infections	Negative	765(87.3)	219 (28.6)	546 (71)	765(100)	6.14	0.01*
	Positive	105(12.1)	18(17.1)	87(82.9)	105(100)		
	Species						
	T.capitis	54(6.2)	8(14.8)	46(85.2)	54(100)	8.28	0.041
	T.corporis	21(2.4)	2(9.5)	19(90.5)	21(100)		
	Others	30(3.4)	8 (3.4)	22 (73.3)	30(100)		

**OR= 1.94, CI 1.11-3.42*

Table 5. The nutritional status and association with intestinal parasite infected and non-infected among children

	Nutritional status						P-value	Z score	Intestinal parasites			X^2	P-value
	Boys		Girls		Total				Non infected No. (%)	Infected No. (%)	Total No. (%)		
	Mean ±SD	Prev.	Mean ±SD	Prev.	Mean ±SD	Preva.							
WHZ	*-0.78 ±1.05*	*12 (9.9)*	*-0.52 ± 0.78*	*13 (8.4)*	*-0.63 ±1.03*	*25 (9.1)*	*0.04*	≤-2SD	2 (8.0)	23 (92.8)	25 (100)	2.49	0.11
								>-2SD	53 (21.3)	196 (78.7)	249 (100)		
WAZ	*-1.07 ± 0.86*	*18 (14.9)*	*-1.09 ± 0.78*	*15 (9.7)*	*-1.08 ± 0.82*	*33 (12.0)*	*0.82*	≤-2SD	23 (23.2)	76 (76..8)	99 (100)	0.63	0.43
								>-2SD	182 (27.0)	492 (73.0)	672(100)		
HAZ	*-0.81 ±1.16*	*17 (14.1)*	*-1.05 ± 0.93*	*16 (10.3)*	*-0.95 ±1.04*	*33 (12.0)*	*0.06*	≤-2SD	20 (21.1)	75 (78.9)	95 (100)	1.77	0.18
								>-2SD	187 (27.5)	493 (72.5)	680 (100)		

*WHZ= weight for height Z-score **(Wasting)**, WAZ= weight for age Z-score (**Underweight**), HAZ= height for age Z-score **(Stunting)**.*

DISCUSSION

The present study revealed a prevalence of 72.8% of intestinal parasitic infections and clearly demonstrated a high prevalence of infection among school children in Tseda town. The three most prevalent species were *A. lumbricoides (*49.9%), *S. mansoni (*29.5%), and Hookworm (15.3%). A more or less similar pattern of distribution was reported from school children in Dembia, where 41.3%, 35.8% and 22.8% of the school children were found infected with *A. lumbricoides*, *S. mansoni*, and Hookworm, respectively (22). This similarity may illustrate the general trend of the problem among school children in many elementary schools of the region since there is a close similarity in environment and living standards. It is known that *A. lumbricoides,* Hookworm, and *Schistosoma mansoni* seriously impair the mental and physical development of children, causing iron deficiency anemia in both adults and children (17, 23, 24). These no doubt warrant the public health importance of these infections**.**

The 49.9% prevalence of *A. lumbricoides* observed in this study is more or less in agreement with a 40% prevalence reported elsewhere in Ethiopia previously (25). However, it is very high compared to a study on elementary schools southeast of Lake Langano which reported a prevalence of 6.2% (26). The possible reason may be that ascariasis shows a low prevalence in the lowlands and dry areas of the country (27). Like other similar studies done in Babile town, eastern Ethiopia (1) a shoe wearing habit was protective for parasitic infections (P< 0.05). Most of the time this is true for hookworm infection since the transmission is due to larvae penetration of the bare feet, despite the lack of a statistical difference among children with and without shoe wearing habits in hookworm infection (P>0.05).

We found out a significant variation in the prevalence of *T. trichiura* (2.7%) and *A. lumbricoides* (41.2%). The possible explanation may be that, although the geographic range of *T. trichiura* is similar to that of *A. lumbricoides*, the eggs of *T. trichiura* don't survive dry conditions or intense cold, while the eggs of *A. lumbricoides* can remain viable and infective more often than the eggs of any other helminths species (28).

An association was observed between intestinal parasitic infection and the age of the children where the prevalence decreased from 79.6% among children aged 5-9 to 58.3% among students aged 20 years and above. This may be because of increased consciousness about hygiene and information on the prevention of infection. In addition, we detected that intestinal parasite prevalence decreases as the level of school grade increases. The same tendency was also reported in street dwellers in Gondar city (29). This finding ensures that educational status is an important factor in determining the prevalence of intestinal parasitic infections.

The cutaneous fungal infections assessment showed that 12.1% of the children had the infections. *T. capitis* (6.2%) and *T. corporis* (2.4%) were the most common cutaneous fungal infections which were incomparable to the 20.2% prevalence of *T. capitis* among school children in Gondar town (30). However, in most parts of Africa, *T. capitis* was the predominate cutaneous fungal infection, followed by *T.corporis* (31) which is in line with the current study despite the low prevalence. Generally, *T. capitis* has been reported as a common finding in school children in other developing countries (12, 32-34), but the prevalence varies from place to place since it is highly affected by socio-economic standards, hygienic habits and practices, nutritional status, the presence of individuals with asymptomatic infection, host resistance, and other factors.

In addition, children who had one or more intestinal parasites also had cutaneous fungal infections. This might give a clue to the fact that children who have poor hygienic conditions and malnutrition could be exposed not only to parasitic infections but also to fungal infections which either have a thorough predisposing or contributory effects of the parasite, or coincidence or both as a result of unhygienic practices. To date, there has been no explanation about parasites being predisposing factors for fungal infections and vice versa. However, when we think about the overall impact of parasites on the nutrition and the immunity of an infected individual, we see that they can expose not only to fungal infection but also to other diseases. In particular, the double pressure of parasites on the immunity as well as the nutritional status of the host, the host could easily be susceptible to many of the opportunistic fungal infections.

In this study, we have also evaluated the association of parasitic infections and self-reported morbidity indictors. Only *A.lumbricoides* and *Taenia species*, and *T.trichiura* were significantly associated with headache and nausea, respectively. However, the absence of significant association of most intestinal parasitic infections with morbidity indicators, such as abdominal pain, loss of appetite, presence of diarrhea, and sick looking appearance seem to highly contradict the area which had a higher prevalence of 72.8% and a polyparasitism of 37.7% and 49.9%, 15.3%, and 29.5% of prevalence for *A. lumbricodes*, Hookworm, and *S.mansoni* infections, respectively. Unlike the findings of this study and in line with the above explanation, a study (35) in Cote'd Ivore reported that some parasitic infections and the total number of parasites were significantly associated with self-reported morbidity indicators.

Nevertheless, the association of the morbidity indicators and the intestinal parasitic infections may be helpful for a rapid screening of the high risk population as a means of cost effective interventions for mass administration of drugs like albendazole or mebendazole. However, care must be taken in the interpretation of the association between a particular parasitic infection and any of the self-reported morbidity indicators, because polyparasitism was common in the area.

School-age children typically have the a higher intensity of intestinal parasitic infections than any other age groups. As a result a chronic infection negatively affects children's nutrition which in turn affects all aspects of children's health, cognitive development, learning, and educational access and achievement (15). Three commonly used under nutrition indicators, i.e., underweight, stunting, and wasting were used in this study to evaluate the nutritional status of the school children. The prevalence of underweight, stunting and wasting was 11.4%, 10.9%, 2.9%, respectively, which was much smaller than that reported in Gondar town (36) but with the range values of the global malnutrition survey. Malnutrition is a considerable health problem in developing countries with prevalence ranges of 4-46%, with 1-10% severely malnourished (36).

In this study boys had significantly higher underweight rates than girls (P=0.04). This is in line with a report from a Brazilian school children where girls demonstrated a better level of development and nutrition compared with boys (37). However, reports opposite to the above findings showed that nutrient intake and anthropometric indicators were better in boys than in girls (38, 39). Generally reports in different areas showed a discrepancies in finding in relation to the inter-variations between the sexes. This might be variations in socio-economic standards, environmental factors, diseases and confiding risk factor burden, and many other factors.

In this study, in agreement with a previous study done in Ethiopia (36, 40), anthropometric scores were also found to be independent of the overall rate of intestinal parasitic infections (p>0.05). However, a study done elsewhere has shown a higher prevalence of overall intestinal parasitic infection in stunted children compared to those normally nourished children (11). Conversely, the relationship of malnutrition and intestinal parasitic infection has been well-established, and different reports showed a close association between intestinal parasitism and malnutrition, but observed that factors other than parasitism, such as social class and hygiene were more important (41, 42).

CONCLUSION AND RECOMMENDATIONS

Single and multiple intestinal parasitic infections were highly prevalent in this setting, and some socio-demographic factors were implicated as important risk factor for infections. Cutaneous fungal infections were also prevalent in these school children. Moderate malnutrition, prevalence of underweight and stunting were also common. It also appears that intestinal parasitic infections were associated with cutaneous fungal infections. Steps should be taken to control three of these important health problems through functional school-health programmes that provide regular deworming, skin, hair, and nail examinations of school children and seeking treatment so as to limit the spread of intestinal and fungal infections.

Generally, incorporation of health education in the school curricula and provision of clean water and installation of improved sanitation facilities will address the problem and can contribute to efforts for achieving poverty alleviation. This survey has also provided baseline data about anthropometric status and fungal infections in association of this health problem to intestinal parasitic infections.

ACKNOWLEDGMENT

The study was financially supported by the University of Gondar, Research and Publications Office (RPO). We thank Tseda General and Elementary School officials and study participants without whom this study could not have been completed.

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