

Research article

Intestinal Helminthes Parasite among Public and Private School Children of Nepal

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ABSTRACT

Background and Objectives: Gastrointestinal infections impose a great and often silent burden of morbidity and mortality on poor populations in developing countries. School age children are one of the groups at high-risk for intestinal parasitic infections. The objective of this study was to compare the prevalence rate of intestinal helminthes parasites among private and public school children of Devdaha Municipality of Rupandehi district and to determine the association of prevalence with different risk factors.

Material and methods: The study was carried out during June to July 2019. A total of 150 (75 from public and 75 from private school) stool samples were collected in clean, dry and screw capped plastic vials and were studied for the presence of intestinal helminthes parasites using direct smear method.

Results: Overall parasitic prevalence rate was 18.66% (28/150). Prevalence rate was considerably higher in public school children (22.66%; 17/75) compared with private school (14.66%; 11/75) ($P>0.05$). The prevalence of helminthes parasitic infections was statistically independent with age and gender of the students ($P>0.05$). The current finding was maximum for single parasitic infection in both public (88.23%) and private (90.90%) school. Total four genera of parasites were identified. Among them, *Ascaris lumbricoides* was most common followed by *Trichuris trichiura*, Hookworms and *Taenia* sp.

Conclusion: Transmissions of infections were generally due to poor sanitary habits, use of contaminated drinking water and improper disposal management. This study suggests the need of health education program in schools along with regular screening of intestinal parasites and periodic administration of anti-parasitic drugs for the effective management of the intestinal parasitic infections among school children in Nepal.

INTRODUCTION

Gastrointestinal infections impose a great and often silent burden of morbidity and mortality on poor populations in developing

countries [1]. Intestinal helminthic infections are the most common human parasitic infections. Globally 1.5 billion people are infected with soil-transmitted helminthes, above 267 million preschool children and

over 568 million school-age children live in intestinal helminthes prevalent area [2]. Intestinal parasitic infections (IPIs) are one of the biggest socioeconomic and medical problems. Research carried out in different countries has shown that the socioeconomic situation of the individuals is an important cause in the prevalence of intestinal parasites [3]. Children are affected by IPIs far more than adults due to their higher nutritional requirements and less developed immune systems. School age children are one of the groups at high-risk for intestinal parasitic infections. The adverse effects of intestinal parasites among children are diverse and alarming [4].

Soil-transmitted helminthes (STH) are among the most prevalent pathogenic organisms on the planet. It is estimated that almost one sixth of the global population is infected with STH; the highest rates among school-aged children who are frequently infected with two or more species simultaneously [1, 5]. There are approximately 60,000 deaths per year, mainly in children, in the developing world due to STH infection, a large percentage of which is caused by *A. lumbricoides* [3-5]. According to the estimates made by the World Health Organization (WHO), the most important soil-transmitted helminthes (STHs) include the *A. lumbricoides* roundworm which annually infects over 1.2 million of the global population and the *Trichuris trichiura* whipworm which infects 795 million people [6]. Insufficient drinking water, overcrowded population and poor personal hygiene with weak nutritional status have been identified as the risk factors for IPIs among children [7, 8].

In Nepal, over 70% of morbidity and mortality are associated with infectious

diseases and is also reflected in the “top ten diseases” of Nepal [9]. Overall helminthic infections only rank fourth in the top ten lists of diseases in Nepal [10]. Although people of all ages may be infected by these organisms, children are more often infected due to compromise in sanitary habits [11]. Therefore, the objective of this study was to compare the prevalence rate of intestinal helminthes parasites among private and public school children of Devdaha Municipality and to determine the association of prevalence with different risk factors such as species of parasites, intensity of parasitic infection, age and sex of the school children. The findings of this study might help in encouraging policy makers to design and implement effective strategies to control and prevent intestinal parasitic infections in the study area.

MATERIAL AND METHODS

Study Area: The study area is Devdaha municipality of Rupandehi district. The district lies on the southern and western part of Nepal. On the east it shares border with Nawalparasi District, on the west with kapilvastu district on North with Palpa district and on South with India. The elevation of the district lies between 100m to 1229m from sea level. The total area of district is 1360 km² with 16.1% in Churia Range and rest in the Terai region. Devdaha is a municipality in Rupandehi District of Nepal, the ancient capital of Koliya Kingdom, located 7 km east from Lumbini. It is identified as the maternal home of Queen Mayadevi, Prajapati Gautami and Princess Yosodhara. In Sanskrit Language Deva means God and Daha means a Pond hence the literal meanings of Devdaha is “Pond of a God”. Prince Siddhartha himself is believed to have bathed in this holy pond during his visit here in Devdaha.

Stool collection and processing: Systematic Random Sampling technique was applied in selection of students for the sample and data collection from the public and private school of the selected area. A total of 150 stool samples, 75 from public schools children and 75 from private school children were collected. Collection of samples was carried out at the first hour of a day when schools were in session. The children were taught in brief about the importance of the examination of stool and way of collecting stool samples with the help of their teachers and parents. Each student was told to collect about 2 gm. of fresh stool. Each of the specimens was checked for its labeling. The collected stool samples were preserved in 2.5% potassium-dichromate solution and brought to Aryans pathology at Devdaha, Khaireni of Rupandehi district and then processed to find cysts, trophozoites, eggs and larva of intestinal helminthesparasites by direct smear method [12].

Direct smear examination was done for the detection and identification of helminthes eggs or larva by wet preparation i.e. unstained smear preparation and stained smear preparation [12]. For unstained smear preparation of sample, a drop of normal saline was taken in a clean glass 1-2 drops of stool sample was mixed over it making its consistency thin and clear then observed under microscope [12]. For stained smear preparation of sample, a drop of 5 times diluted Logol's iodine solution was taken on a glass slide and mixed 1-2 drops of stool sample with it. The preparation was then observed under microscope [12].

Methods of Observation: Both stained and unstained preparations were first examined under the low power 10x of microscope. Observation was started from one end of the

slide to another. When the parasites eggs were seen then the objects were centered and focused under 40x for the clear vision and also for detailed diagnosis. Micrometry was done for the conformation of egg of helminth parasites.

Calibration of eggs, cysts and larva: Calibrating process was done by using ocular and stage micrometer. The length, breadth and diameter of parasites eggs, cysts and larva were measured with the calibration factors.

Calibration factor (CF) for 10X= 10.37 micrometer

Calibration factor (CF) for 40X= 2.588 micrometer

Identification of the Eggs, Cysts and Larva: The identification and confirmation of eggs, cysts and larva were made by comparing the structure, color, size of eggs, cysts & larva from published books, literature and journals [13].

Data management and analysis: The collected data from the field survey and laboratory reports were statistically analyzed with the help of excel 2007. Chi square test was performed for the analysis of data and $p < 0.05$ was considered for the statistically significance difference. The obtained data were also presented in the tabulated and bar diagram forms according to the model of collected data and information by using Microsoft Excel2007.

RESULTS

Out of 150 stool samples examined, (75 from private school and 75 from public school) overall prevalence was 18.66% where as in case of public school 22.66% and in case of

Table 1: General prevalence of intestinal helminthes parasites

Types of school	+ve cases n (%)	-ve cases n(%)	X ²	P-value
Public	17(22.66)	58(77.34)	1.58	0.208646
Private	11(14.66)	64(85.34)		

Table 2: Age group-wise prevalence

Types of Schools	Age	+ve cases n (%)	-ve cases n (%)	X ²	p-value
Public	(3-7)	9(25)	27(75)	0.36	0.834724
	(8-12)	6(22.22)	21(77.78)		
	(13-16)	2(16.66)	10(83.34)		
Private	(3-7)	7(18.42)	31(81.58)	0.88	0.641932
	(8-12)	3(10.34)	26(89.66)		
	(13-16)	1(12.5)	7(87.5)		
Total		28(18.66)	122(81.34)		

Table 3: Gender-wise prevalence

Types of Schools	Gender	+ve cases n (%)	-ve cases n (%)	X ²	p-value
Public	Boys	9(25.72)	26(74.28)	0.34	0.555404
	Girls	8(20)	32(80)		
Private	Boys	6(14.28)	36(85.72)	0.01	0.916212
	Girls	5(15.15)	28(84.85)		
Total		28(18.66)	122(81.34)		

private school 14.66%, was found positive for the intestinal helminthes parasites. There was no significant difference (P>0.05) between the helminthes parasite among the children in public and privateschools (Table 1).

From both public and private school the distribution of intestinal helminthes parasite were maximum in 3-7 year’s age group of children compared to 8-12 age group and 13-16 age group as shown in table. Statistically, the difference in prevalence of parasites with

age group in public school and in private school was found to be insignificant (P>0.05) (Table 2). No significant difference (P > 0.05) in positive rate among boys and girls was observed in both public school (boys: 25.72%; girls: 20%) and private school (boys: 14.28%; girls: 15.15%) (Table 3).

Prevalence of individual intestinal helminthes parasites: Out of 150 stool samples examined, four intestinal parasites were identified with list of *A. lumbricoides*,

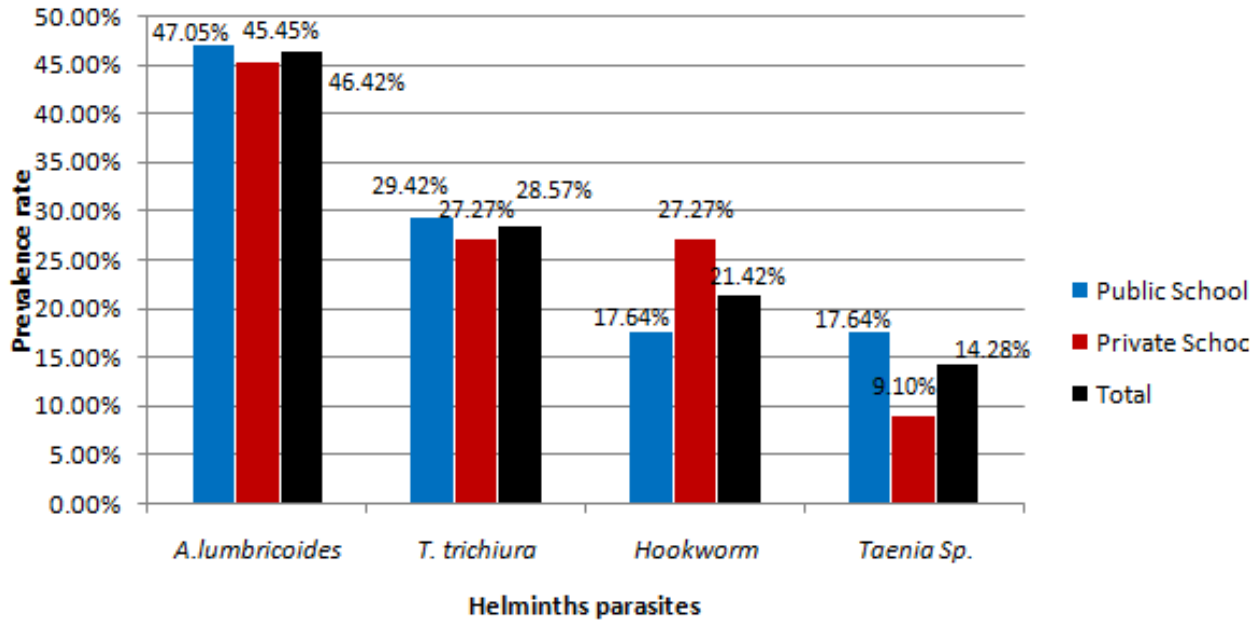


Figure 1: Prevalence of individual intestinal parasites detected in stool samples of public and private school children

Table 4: Intensity of single infection

S.N.	Parasites	Types of school			
		Public school		Private school	
		+ve cases	% of +ve cases	+ve cases	% of +ve cases
		1.	<i>A. lumbricoides</i>	6	40%
2.	<i>T. trichiura</i>	4	26.66%	3	30%
3.	Hookworm	2	13.33%	2	20%
4.	<i>Taenia Sp.</i>	3	20%	1	10%
	Total	N=15		N=10	

Table 5: Intensity of double infection

S.N.	Parasites	Types of school			
		Public school		Private school	
		+ve cases	% of +ve cases	+ve cases	% of +ve cases
1.	<i>A. lumbricoides</i> + Hookworm	1	50%	1	100%
2.	<i>T. trichiura</i> + <i>A. lumbricoides</i>	1	50%	-	
3.	Hookworm + <i>Taenia Sp.</i>	-		-	
4.	<i>Taenia Sp.</i> + <i>A. lumbricoides</i>	-		-	
	Total	N=2		N=1	

Hookworms, *T. trichiura* and *Taenia sp.* The children of public school have maximum

distribution of parasites in comparison to private school (Figure 1).

Intensity of parasitic infection: Altogether, 88.23% (15/17) children of public school and 90.90% (10/11) of private school were found to be infected with single parasitic infection (Table 4) where as 11.77% (2/17) of public school and 9.10% (1/11) of private school reported double parasitic infection (Table 5) with high prevalence of *A. lumbricoides* as most common single parasitic infection.

DISCUSSION

The present study reveals that out of 150 children of Devdaha municipality 28(18.67%) were infected by different kinds of intestinal parasites like *Ascaris lumbricoides*, Hookworm, *Trichuris trichura*, and *Taenia* Sp. which showed agreement with previously published reports [14-18]. However, this result was somehow lower than the work carried out among the children under 16-year age of Kathmandu [19], school children of Kalaiya, Bara [20], school children of Ithari, Sunsari [21] and rural area school children of Lokhim, Khotang [22]. In current findings, among 75 children of public school 17 (22.66%) were found to be infected and among 75 children of private school 11 (14.66%) were infected. Although, there was no significant difference between the gastrointestinal parasites among the children in public and private schools, our finding is in agreement with other reports [10, 23] of Nepal showing a higher prevalence of IPs in public schools than in private schools. In context of Nepal, most of the public school children belong to the family having a relatively low economic status, where they could not provide proper care and good personal hygiene to their children compared to economically strong family [23].

In addition, the prevalence of parasitic infections was statistically independent with age and gender of the students. The high

susceptibility of parasitic infection among small aged (3-7 years) children reported in this study is in agreement with previous reports [23-25]. This might be attributed to the strengthening of immune status and rise in the consciousness on hygienic behavior and environmental sanitation among school children with the increase in age [25]. On contrary to our report, higher infection rate among children aged 10-14 years have been reported by different studies done in Nepal [14, 26] attributing it to lack of parental control regarding dietary habits and increased outdoor activities [27]. No significant difference in prevalence of gastrointestinal parasitic infection among boys and girls student in the present study resembles with the study conducted among school children at Thimi [28], and Manamaiju [10] of Kathmandu valley. Both boys and girls have equal chance of being infected with parasitic disease as the infection in children is determined by family income, quality of sewage disposal, nutritional status and behavioral characteristics [10].

The prevalence of *A. lumbricoides* was found to be higher in both private and public schools with the overall prevalence rate of 46.42% followed by *T. trichura*, Hookworm and *Taenia* Sp. with the prevalence rate of 28.57%, 21.42% and 14.28% respectively. In both schools, *A. lumbricoides* was most common parasite and similar results were revealed from the previous studies done in Nepal [14, 29] and elsewhere in the world [17, 24]. This might be due to over dispersion of *Ascaris* egg in the environment as about 200000-250000 eggs are laid by single female worm and as well poor hygiene habits supporting its chances [30].

The current finding was maximum for single parasitic infection in both public school (88.23%) as well as private school (90.90%)

whereas rate of double parasitic infection was found to be 11.77% and 9.10% in public and private school respectively. The current finding is in line of agreement with the several previous studies carried out among school children at Manamaiju, Kathmandu[10], Bahir Dar, Ethiopia [31] and Tilili town, northwest Ethiopia [32]. In this study, two samples of public school were found to have double parasitic infection where *A. lumbricoides* + Hookworm (50%) and *T. trichura*+ *A.lumbricoides* (50%) were noted. Similarly, only one sample of private school was found to have double parasitic infection where *A. lumbricoides* + Hookworm (100%) were noted. The varying differences between single and double infections may be due to differences in concentrations of parasites and sanitation conditions of the communities [33].

CONCLUSION

The study indicates overall prevalence of intestinal helminthes parasite among the school children of public and private school was 18.66%. Altogether 4 species of parasites were encountered with most common helminthes parasite *A. lumbricoides*. This shows that intestinal parasitic infection is still prevalent as major health problem among school children. Transmissions of infections were generally due to poor sanitary habits, use of contaminated drinking water, improper disposal management and somewhat lack of knowledge regarding parasitic infections. These findings strongly indicate a need for a comprehensive program to combat intestinal parasites associated with morbidity and mortality in Nepal. Therefore, the public health interventions and control program including treatment of infected individuals, education on personal and environmental hygiene, school-based awareness program, installation

of mass water filter and chlorination of drinking water in schools, focusing children on periodic administration of anti-parasitic drug, development of the health care facilities and other are required to minimize the risk of intestinal parasitic infections in the study area.

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REFERENCES

1. Saboya, M. I., Catala, L., Nicholls, R. S. and Ault, S. K. 2013. Update on the mapping of prevalence and intensity of infection for soil-transmitted helminth infections in Latin America and the Caribbean: a call for action. PLOS Neglected Tropical Diseases, 7(9): e2419.
2. Soil-Transmitted Helminth Infections. Available from: <https://www.who.int/news-room/fact-sheets/detail/soil-transmitted-helminth-infections>. [Last accessed on 2019 Jan 11].
3. Ashtiani, M.T.H., Monajemzadeh, M., Saghi, B., Shams, S., Mortazavi, S.H., Khaki, S., Mohseni, N., Kashi, L. and Nikmanesh, B. [2011]. Prevalence of intestinal parasites among children referred to Children's Medical Center during 18 years (1991-2008), Tehran, Iran. Annals of Tropical Medicine & Parasitology, 105(7): 507-513.
4. Tadesse, G. 2005. The prevalence of intestinal helminthic infections and associated risk factors among school children in Babile town, eastern Ethiopia. Ethiopian Journal of Health Development, 19(2): 140-147.
5. Ashbolt, N. J. 2004. Microbial contamination of drinking water and disease outcomes in developing regions. Toxicology, 198(1-3): 229-238.

6. Bethony, J., Brooker, S., Albonico, M., Geiger, S. M., Loukas, A., Diemert, D. and Hotez, P. J. 2006. Soil-transmitted helminth infections: ascariasis, trichuriasis, and hookworm. *The Lancet*, **367**(9521): 1521-1532.
7. Alum, A., Rubino, J. R. and Ijaz, M. K. 2010. The global war against intestinal parasites—should we use a holistic approach?. *International Journal of Infectious Diseases*, **14**(9): e732-e738.
8. Tiwari, B. R., Chaudhary, R., Adhikari, N., Jayaswal, S. K., Poudel, T. P. and Rijal, K. R. 2013. Prevalence of intestinal parasitic infections among school children of Dadeldhura District, Nepal. *Journal of Health and Allied Sciences*, **3**(1): 14-16.
9. Rai, S. K., Gurung, R., Saiju, R., Bajracharya, L., Rai, N., Gurung, K. and Shrestha, A. 2008. Intestinal parasitosis among subjects undergoing cataract surgery at the eye camps in rural hilly areas of Nepal. *Nepal Medical College Journal*, **10**(2): 100-103.
10. Gurung, B., Subedi, J. R. and Chhetri, B. 2019. Prevalence of Intestinal Parasites among Public and Private School Children below 10 years' at Tarakeswor-10 Manamaiju, Kathmandu, Nepal. *National Journal of Health Sciences*, **4**: 97-102.
11. Wiwanitkit, V. and Ampavasiri, A. 2003. Intestinal Parasitic Infestations Among Children in an Orphanage in Pathum Thani Province. *Journal of Medical Association of Thailand*, **86**(2): S263-S270.
12. Chatterji KD. *Parasitology (Protozoology and Helminthology) in Relation to Clinical Medicine*. 11th ed. India: Medical Publishers 2001; p. 236.
13. World Health Report. *Conquering suffering enriching*. Geneva, Switzerland: World Health Organization 2000.
14. Khanal, L. K., Choudhury, D. R., Rai, S. K., Sapkota, J., Barakoti, A., Amatya, R. and Hada, S. 2011. Prevalence of intestinal worm infestations among school children in Kathmandu, Nepal. *Nepal Medical College Journal*, **13**(4): 272-274.
15. Shrestha, A., KC, N. and Sharma, R. 2012. Prevalence of Intestinal Parasitosis among school children in Baglung district of Western Nepal. *Kathmandu University Medical Journal*, **37**(1):3-6.
16. Sah, R.B., Baral, R., Shah, U. and Jha, N. 2016. A study of prevalence of intestinal helminthic infections and associated risk factors among the school children of Biratnagar sub-metropolitan, Eastern region of Nepal. *International Journal of Current Research in Medical Science*, **4**(2): 8-15.
17. Belachew, E.B., Torko, D.B. and Wallie, Y.M. 2017. Prevalence of intestinal helminthic parasitic infections and associated risk factor among students in Tepi Town, South West Ethiopia. *Science Journal of Public Health*, **5**(3):192-197.
18. Emmanuel, M., Austin, A. and Peace, M. 2017. Prevalence of gastro-intestinal parasitic infection among school children in port Harcourt city local government area, Nigeria. *Journal of Bacteriology and parasitology*, **8**: 5.
19. Dhital, S., Pant, N.D., Neupane, S., Khatriwada, S., Gaire, B., Sherchand, J.B. and Shrestha, P. 2016. Prevalence of enteropathogens in children under 15 years of age with special reference to parasites in Kathmandu, Nepal; a cross sectional study. *Springer Plus*, **5**(1): 1813.
20. Regmi, P., Rai, K.R., Mukhiya, R.K., Tamang, Y., Gurung, P. and Mandal, P.K. 2014. Prevalence of intestinal parasites and associated risk factors among school children of Kalaiya in Bara District, Nepal. *JSM Microbiology*, **2**(1): 1009.
21. Sah, R.B., Bhattarai, S., Yadav, S., Baral, R., Jha, N. and Pokharel, P.K. 2013. A study of intestinal parasites and associated risk factors among the school children of Itahari District, Eastern region of Nepal. *Tropical Parasitology*, **3**(2): 140-144.
22. Saud, B. 2017. Prevalence of intestinal parasitic infection among rural area school children of Lokhim VDC, Nepal. *Journal of Microbiology and experimentation*, **4**(1): 001012.
23. Shrestha, J., Bhattachan, B., Rai, G., Park, E. Y. and Rai, S. K. 2019. Intestinal parasitic infections among public and private schoolchildren of Kathmandu, Nepal: prevalence and associated risk factors. *BMC research notes*, **12**(1): 192.
24. Esiet, U.L.P. and Edet, I. 2017. Comparative prevalence of intestinal parasites among children in public and private schools in Calabar South, Calabar, Cross River State, Nigeria. *American journal of research communication*, **5**(1): 80-97.
25. Shakya, B., Shrestha, S., Madhikarmi, N.L. and Adhikari, R. 2010. Intestinal parasitic

- infection among school children. Journal of Nepal Health Research Council, **10**(20): 20-3.
26. Rai, D.R, Rai S.K., Sharma, B.K., Ghimire, P. and Bhatta, D.R. 2005. Factors associated with intestinal parasitic infection among school children in a rural area of Kathmandu Valley, Nepal. Nepal Medical College Journal, **7**(1): 43-46.
 27. Pradhan, P., Bhandary, S., Shakya, P. R., Acharya, T. and Shrestha, A. 2014. Prevalence of intestinal parasitic infections among public school children in a rural village of Kathmandu Valley. Nepal Medical College Journal, **16**(1): 50-53.
 28. Shrestha, S. K., Rai, S. K., Vitrakoti, R. and Pokharel, P. 2009. Parasitic infection in school children in Thimi area, Kathmandu valley. Journal of Nepal Association for Medical Laboratory Sciences, **10**(1): 31-33.
 29. Khadka, K.S., Kaphle, H.P., Gurung, K. and sigdel, M. 2013. Study of Intestinal Parasitosis among school going children in Pokhara, Nepal. Journal of Health Allied Sciecne, **3**(1): 47-50.
 30. Shrestha, A., Rai, S. K., Basnyat, S. R., Rai, C. K. and Shakya, B. 2007. Soil transmitted helminthiasis in Kathmandu, Nepal. Nepal Medical College Journal, **9**(3): 166-169.
 31. Hailegebriel, T. 2017. Prevalence of intestinal parasitic infections and associated risk factors among students at Dona Berber primary school, Bahir Dar, Ethiopia. BMC infectious diseases, **17**(1): 362.
 32. Abera, A. and Nibret, E. 2014. Prevalence of gastro-intestinal helminthic infections and associated risk factors among schoolchildren in Tilili town, northwest Ethiopia. Asian Pacific Journal of Tropical Medicine, **7**(7): 525-530.
 33. Forson, A. O., Arthur, I., Olu-Taiwo, M., Glover, K. K., Pappoe-Ashong, P. J. and Ayeh-Kumi, P. F. 2017. Intestinal parasitic infections and risk factors: a cross-sectional survey of some school children in a suburb in Accra, Ghana. BMC research notes, **10**(1): 1-5.