

KNOWLEDGE BASED ASSESSMENT OF INTESTINAL PARASITIC INFECTIONS AMONG STUDENTS ATTENDING BOARDING SCHOOLS IN EBONYI STATE, NIGERIA

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ABSTRACT

There is an apparent lack of information on the risk and clinical symptoms of Intestinal Parasitic Infections (IPIs) among students attending boarding secondary schools in Ebonyi State, Nigeria. This questionnaire-based survey attempts to assess some behavioural habits, possible risk factor(s) as well as clinical symptoms experienced by these students. 256 questionnaires were filled by (52.7% males and 47.3% females) from four boarding schools between June and July 2015. Results showed that on hand-washing practice after defecation, while there was much more students who washed their hands with soap and water (79.7%) than with water only (10.2%), only a few do not wash their hands (2.7%). Also, students wash (86.3%), do not wash (1.2%) or sometimes wash (11.3%) their hands before meals. There were students who do (16.4%), do not (53.5%) or sometimes do (22.3%) bite off on their fingernails using their teeth. Records were taken of those who walk (11.3%), do not walk (68.0%) or sometimes walk (18.0%) on bare feet. A greater number of students use water cisterns (41.0%) than pit toilets (36.7%), and pit toilets (36.7%) than bushes (19.5%). Borehole constituted the most ready source of drinking water for students (75.8%). Parents are predominantly farmers, traders, teachers and civil servants. Clinical symptoms were more occasional than frequent. The hygiene behavioural practices are commendable. Thus there is possibly a low risk of IPIs among these students. However, promotion of healthy hygienic practices should be further encouraged.

Keywords: Intestinal parasitic infections, Risk, Clinical symptoms, Boarding schools, Ebonyi State

INTRODUCTION

Intestinal parasitic infections (IPIs) are easily transmitted in an atmosphere of close human contacts. Students in boarding institutions, particularly those living under crowded conditions, are highly vulnerable to acquiring these infections (Al-Madani and Mahfouz, 1995; Gamboa *et al.*, 2011; Sagnuankiat *et al.*, 2014). The risk of infection is further compounded by the hygiene practices of some of these students. The habits of fingernail biting, walking on bare feet, eating with unwashed hands and defecating without washing the hands after toilet use are some of the bad habits that raises

the risk of infection (Dambhare *et al.*, 2010; Tamirat and Getye, 2014; Al-Delaimy *et al.*, 2014).

IPIs are common in developing countries particularly in areas where basic facilities such as pipe-borne water, proper faecal waste disposal systems and adequate healthcare services are lacking (Agi, 1995; Al-Delaimy *et al.*, 2014). Places with poor sanitary habits and improper personal and environmental hygiene are more often inhabited by low income earners and thus are worse hit by IPIs (Wordemann *et al.*, 2006; Juarez and Rajal, 2013). IPIs results in a wide-spectrum of clinical symptoms ranging from apparently

symptomless to life-threatening conditions (Ichhpujani and Bhatia, 2002; Polimeno *et al.*, 2010; Muennig *et al.*, 2015). Common manifestations include abdominal pains, diarrhoea, anal itching and weight loss (Ichhpujani and Bhatia, 2002). These may occur occasionally or frequently depending on a number of factors such as infection burden, duration and risk of repeated exposures.

A number of studies conducted in different parts of Ebonyi, southeastern Nigeria revealed a high prevalence of IPIs among school children (Anim and Akamnonu, 2009; Ugbogu and Asogu, 2013). This is largely a consequence of ignorance of the routes and risks of IPIs. We strongly believe that if school-age children are adequately informed about IPIs, habits that predispose them to acquiring IPIs will be dropped easily. Seeking information from the students as to their level of awareness on the causes and the clinical symptoms associated with IPIs is pivotal to the disease management (Workneh *et al.*, 2014) because it will expose the ignorance level as well as bring to light the amount and areas where enlightenment needs to be strengthened so as to impact positively on behavioural habits and thereby reduce the incidence of infection. Thus inline with Idowu and Rowland (2006) and Canete *et al.* (2012), questionnaires were employed as information gathering tool to achieving the aforementioned set objectives.

MATERIALS AND METHODS

Study Area: The survey was carried out in Ebonyi Central and South, two of the three senatorial zones of Ebonyi State. Ebonyi State is located in the South Eastern part of Nigeria. It lies between longitude 7⁰35'N and latitude 6⁰45'E. There are two distinct seasons; rainy season from April to October and dry season from November to March. A good number of Ebonyians are civil servants, students, drivers, manual labourers and artisans, but are predominantly traders and farmers. They produce crops such as rice, yam, potatoes, maize and cassava in large quantities. The rural dwellers especially, rely on rivers and streams for water (Nworie *et al.*, 2014). Several of the

people make use of pit toilets and bushes as means of faecal waste disposal, a practice which inadvertently promote IPIs transmission. The State has a rich presence of academic institutions which include Universities, Colleges of Education and Agriculture, and boarding secondary schools.

Study Population and Sample Estimation:

The present questionnaire based survey was conducted among students attending boarding secondary schools between June and July, 2015. Four boarding schools were selected for this survey; an exclusively boys' and an exclusively girls' boarding secondary schools from each of the two [Ebonyi Central (Ezza High School and Ezza Girls) and South (Eghugbo Technical College and Sir Francis Ibiham Grammar School)] senatorial zones. These schools are well known and the enrolment of children by their parents is relatively encouraging. Using the Creative Research Systems Survey Software (Version 11.0) with a Confidence Limit (CL) and Confidence Interval (CI) of 95% and 5.5 respectively, a population estimate of 2,800 students resulted in a sample size of 285 students out of which only 256 respondents were processed. The other 29 were voided due to a range of errors.

Data Collection: Verbal consents were granted by the schools' heads. Data were gathered by the use of questionnaires. The questionnaires were designed to address four major aspects: environmental, socio-economic, sanitary behavioural risk factors of IPIs and some of their clinical symptoms. The socio-economic factors were age, sex and parents' (father and mother) occupations. The sanitary behavioural aspect covered questions on hand washing after defecation (yes/no, and if yes, with soap and water, or with water only), and before meals (yes/no/sometimes), walking on barefoot (no/yes/sometimes) and biting of fingernails (no/yes/sometimes). Environmental risks were on the type of faecal waste disposal system (pit toilet, water cistern, bush) and source of drinking water (borehole, stream, well, river, storage tank, any other source). The students were to give a 'frequently' or 'occasionally'

answer to each of the clinical symptoms (diarrhoea, anal itch, flatulence, abdominal pains, foul-smelling stools) presented in the questionnaires.

Statistical Analysis: The odd ratio (OR) analysis was performed using Medcalc Statistical Software (version 15.6) to assess the relative exposure of students in the use of the different faecal waste disposal systems (pit toilet, water cistern and bush). ORs were statistically significant if $p < 0.001$ at 95% confidence interval. The Social Science Statistical Software was used in chi-square analysis of sanitary behavioural data and between occasional and frequent occurrences of clinical symptoms. Chi-square analysis was significant if $p < 0.01$. Frequency distributions of the responses of subjects on various aspects of the survey were carried out. Categorical variables were tabulated as numbers and percentages in parenthesis.

RESULTS

A total of 256 students [males 135(52.7%); females 121(47.3%)] responded to the questionnaires. These respondents were within the age bracket of 11 – 19 years. Data on personal hygiene of the students, according to their age groups are presented in Tables 1 – 4. Significant differences between students (males and females) who washed their hands after defecation with water only, and with water and soap ($\chi^2 = 11.7$, $p = 0.000615$, $p < 0.01$) and students who walked, did not walk and sometimes walked on bare feet ($\chi^2 = 13.2$, $p = 0.001395$, $p < 0.01$) were observed. There were no significant differences between students who washed, failed to wash and sometimes washed their hands before meals ($\chi^2 = 4.3$, $p = 0.116745$, $p > 0.01$); and those who used, did not use and sometimes used their teeth to bite off their fingernails ($\chi^2 = 4.0$, $p = 0.136924$, $p > 0.01$).

Water cistern (WC) was used by 105(41.0%) students, pit latrine by 94(36.7%) and bush by 50(19.5%). Some other students used a combination of these faecal waste disposal methods.

The number of students using WCs were higher than those using pit latrines (OR = 3.56, CI (95%) = 1.98 to 6.39, $p < 0.001$); and pit latrines than bushes (OR = 3.44, CI (95%) = 1.68 to 7.06, $p < 0.001$) (Table 5).

Borehole constituted the most ready source of drinking water for a majority (194, 75.8%) of students. This was distantly followed by storage tanks (19, 7.4%), streams (17, 6.6%), wells (3, 1.2%), river (2, 0.8%), rainfall (1, 0.4%) and tap (1, 0.4%). There were other students who listed a combination of some of these water sources.

Parents are predominantly traders (22.7% fathers, 48.0% mothers), farmers (12.5% fathers, 8.6% mothers), teachers (9.0% fathers, 10.2% mothers), civil servants (16.0% fathers, 10.9% mothers), artisans (9.0% fathers, 3.5% mothers) and health workers (3.1% fathers, 9.4% mothers).

Data on the clinical symptoms of IPIs among students revealed that more students were occasionally than frequently down with the symptoms of IPIs ($\chi^2 = 4.5$, $p = 0.340138$, $p > 0.01$) (Table 6).

DISCUSSION

The present questionnaire survey assessed a number of risk factors and clinical symptoms of IPIs among students attending boarding secondary schools in Ebonyi State, Nigeria. The hygienic behaviour of any individual has a significant correlation with the risk of infection (Dambhare *et al.*, 2010; Tamirat and Getye, 2014; Al-Delaimy *et al.*, 2014). The route of transmission of IPIs is largely faeco-oral. The majority of students in this study wash their hands after defecation (89.9%) and before meals (86.3%). This could be a result of good education on hand washing, presence of washing facilities around points of defecation and food service. Additionally, a greater number of these students after defecation wash their hands with soap and water (79.7%) and consequently they are at much lesser risk of IPIs than those who used only water (10.2%).

Table 1: Knowledge based assessment of hand washing behaviour after defecation among students attending boarding schools in Ebonyi State, Nigeria

Age Group (Years)	Wash hands after defecation		
	Water only	Yes (%) Soap and Water	No (%) None
11 – 12	4(1.6)	21(8.2)	0(0.0)
13 – 14	7(2.7)	62(24.2)	2(0.8)
15 – 16	10(3.9)	87(34.0)	4(1.6)
17>	5(2.0)	34(13.3)	1(0.4)
Total	26(10.2)	204(79.7)	7(2.7)

Table 2: Knowledge based assessment of hand washing behaviour before meals among students attending boarding schools in Ebonyi State, Nigeria

Age Group (Years)	Wash hands before meals		
	Yes (%)	No (%)	Sometimes (%)
11 – 12	20(7.8)	1(0.4)	4(1.6)
13 – 14	71(27.7)	1(0.4)	4(1.6)
15 – 16	95(37.1)	0(0.0)	14(5.5)
17>	35(13.7)	1(0.4)	7(2.7)
Total	221(86.3)	3(1.2)	29(11.3)

Table 3: Knowledge based assessment of the behavioural practice of walking on bare feet among students attending boarding schools in Ebonyi State, Nigeria

Age Group (Years)	Walk on bare feet		
	Yes (%)	No (%)	Sometimes (%)
11 – 12	4(1.6)	17(6.6)	4(1.6)
13 – 14	11(4.3)	53(20.7)	8(3.1)
15 – 16	8(3.1)	80(31.3)	20(7.8)
17>	6(2.3)	24(9.4)	14(5.5)
Total	29(11.3)	174(68.0)	46(18.0)

Table 4: Knowledge based assessment of fingernails biting behaviour among students attending boarding schools in Ebonyi State, Nigeria

Age Group (Years)	Biting of fingernails		
	Yes (%)	No (%)	Sometimes (%)
11 – 12	3(1.2)	16(6.3)	5(2.0)
13 – 14	12(4.7)	41(16.0)	14(5.5)
15 – 16	17(6.6)	60(23.4)	25(9.8)
17>	10(3.9)	20(7.8)	13(5.1)
Total	42(16.4)	137(53.5)	57(22.3)

Table 5: Knowledge based assessment of faecal matter disposal methods among students attending boarding schools in Ebonyi State, Nigeria

Age range	Pit latrine	Water cistern	Bush
11 – 12	12	6	6
13 – 14	28	34	12
15 – 16	43	49	14
17>	11	16	18
Total	94	105	50

Table 6: Knowledge based assessment of rates of clinical symptoms among students attending boarding schools in Ebonyi State, Nigeria

Clinical symptoms	Males (%)		Females (%)		Total (%)	
	Occ	Fre	Occ	Fre	Occ	Fre
Diarrhoea	34(13.3)	9(3.5)	39(15.2)	1(0.4)	73(28.5)	10(3.9)
Anal itch	43(16.8)	3(1.2)	37(14.5)	5(2.0)	80(31.3)	8(3.1)
Flatulence	56(21.9)	16(6.3)	46(18.0)	3(1.2)	102(39.8)	19(7.4)
Abdominal pain	72(28.1)	9(3.5)	72(28.1)	5(2.0)	144(56.3)	14(5.5)
Foul-smelling stool	53(20.7)	9(3.5)	46(18.0)	8(3.1)	99(38.7)	17(6.6)

Key: Occ = occasionally, Fre = frequently

A study carried out among school children in the eastern region of Nepal reportedly showed that children who washed their hands after defecation using soap and water had a significantly lower prevalence of infection (24%) when compared to those using only water (63.2%) (Sah *et al.*, 2013). Students who failed to wash their hands are very much vulnerable to the disease. Failure to wash hands after defecation may result from an eagerness to play with friends, laziness, lack or distance of washing facilities from defecation points among other reasons.

Intestinal parasites like hookworms and *Strongyloides* are capable of penetrating intact human skin like the soles of the feet which are in constant contact with soil (Ichhpujani and Bhatia, 2002). Hence, the need to always put on foot wares. About 86.0% of students admittedly use shoes regularly. The good practice by a majority of students to always be on foot wares would help in reducing the risk of parasitic infection. The comparatively low prevalence of *Ascaris lumbricoides*, hookworm and *Schistosoma mansoni* recorded in some school children have been presumably attributed among other factors to the regular wearing of shoes (Gelaw *et al.*, 2013).

Although many of the students have formed the habit of biting (16.4%) or sometimes biting (22.3%) off their fingernail, those who do not (53.5%) were much more. The biting of infected fingernails, undoubtedly, results in auto-infection of individuals. The provision of nail clippers for these students will greatly discourage the use of their teeth thus reducing possible incidences of re-infection (Mahmud *et al.*, 2015).

The choice of faecal waste disposal method is critical in assessing the risk of IPIs (Agi, 1995; Al-Delaimy *et al.*, 2014).

This study revealed that WCs was the most used faecal waste disposal method than other methods. The steady decline in the number of students using WC (105, 41.0%), pit toilet (94, 36.7%) and the bush (50, 19.5%) suggest a reduction trend in the risk of acquiring IPIs through waste disposal systems. Communities where individuals use bushes following lack of or refusal to use toilet facilities, rank high in IPIs (Agi, 1995; Abate *et al.*, 2013). Similarly, in a cross sectional study on primary school children in Addis Ababa, children who used traditional type of toilet had the highest prevalence of IPIs as well as those whose toilets were farther from their vicinity (Ashenafi and Mohammed, 2014). To this end, while advocating for a total elimination of the practice of defecating in bushes, we recommend the constructed of good numbers of water closet toilets which are easily accessible and having adequate washing facilities in place of pit latrines.

Choice and source of drinking water has strong correlation with risk of IPIs (Agi, 1995; Al-Delaimy *et al.*, 2014; Ashenafi and Mohammed, 2014). The intermittent visits of some of the students to their homes after each day's academic activity may account for some of the various responses recorded (stream, well and river) as these may be the only source of water.

The occupational engagements of parents is an index of their economic status which may constitute a risk of acquiring these infections (Wordemann *et al.*, 2006; Juarez and Rajal, 2013; Sah *et al.*, 2013). Parents of students were mostly traders, farmers, teachers and civil servants. Some are artisans and health workers. In a study among children in Jos, Nigeria, significantly higher infection rates were recorded among children whose female parents

or care givers were petty traders, artisans and farmers compared to those whose parents were civil servants and health workers (Jombo *et al.*, 2011). In another study, infection rate was highest among children of farmers (60.94%) and was least among children of civil servants (30.17%) (Ogbuagu *et al.*, 2009).

The use of questionnaires in assessing the clinical symptoms of IPIs is a rapid assessment technique (RAT) in evaluating the prevalence, magnitude and burden of the disease in a population. Questionnaires have been used in collecting information on symptoms of IPIs in previous studies (Niyyati *et al.*, 2009; Escobedo *et al.*, 2008). There is no gainsaying that the population where IPIs are markedly present will experience frequent manifestations of the disease symptoms than the population where the infections are barely seen. For all five clinical symptoms assessed from the students' testimonial, it was shown that there was the likelihood of students going down with the symptoms of IPIs occasionally than frequently. This result thus suggests a possible low prevalence of the disease among boarding students in contrast to previous parasitological survey of the general population across age groups elsewhere (Anim and Akamnonu, 2009; Ugbogu and Asogu, 2013). We advise that a screening exercise be conducted among these students in order to ascertain the prevalence of IPIs. Also, enlightenment campaigns on personal and environmental hygiene should be a regular phenomenon.

REFERENCES

- ABATE, A., KIBRET, B., BEKALU, E., ABERA, S., TEKLU, T., YALEW, A., ENDRIS, M., WORKU, L. and TEKESTE, Z. (2013). Cross-sectional study on the prevalence of intestinal parasites and associated risk factors in Teda Health Centre, Northwest Ethiopia. *ISRN Parasitology*, 5: 1 – 5.
- AGI, P. I. (1995). Pattern of infection of intestinal parasites in Sagbama Community of the Niger Delta, Nigeria. *West African Journal of Medicine*, 14(1): 39 – 42.
- AL-DELAIFY, A. K., AL-MEKHLAFI, H. M. NASR, N. A. SADY, H., ATROOSH, W. M., NASHIRY, M., ANUAR, T. S. MOKTAR, N., LIM, Y. A. and MAHMUD, R. (2014). Epidemiology of intestinal polyparasitism among Orang Asli school children in rural Malaysia. *PLoS Neglected Tropical Diseases*, 8(8):
- AL-MADANI, A. A. and MAHFOUZ, A. A. (1995). Prevalence of intestinal parasitic infections among Asian female house keepers in Abha District, Saudi Arabia. *South East Asian Journal of Tropical Medicine and Public Health*, 26(1): 135 – 137.
- ANIM O. C. and AKAMNONU, N. J. (2009). Intestinal helminth infection among primary school children in Ntezi area of Ebonyi State, Nigeria. *African Journal of Infections Diseases*, 7: 1
- ASHENAFI, A. and MOHAMMED, S. (2014). Assessment of the prevalence of intestinal parasitosis and associated risk factors among primary school children in Chench town, Southern Ethiopia. *BMC Public Health*, 14: 166.
- CANETE, R., DIAZ, M. M., GARCIA, R. A., MARTINEZ, P. M. L. and PONCE, F. M. (2012). Intestinal parasites in children from a day care centre in Matanzas city, Cuba. *PLoS ONE*, 7: 12. doi: 10.1371/journal.pone.0051394
- DAMBHARE, D. G., BHARAMBE, M. S. and GARG, B. S. (2010). Intestinal parasites prevalence and related factors among school children in the rural area of Central India. *Journal of Communicable Diseases*, 42(4): 281 – 286.
- ESCOBEDO, A. A., CANETE, R. and NUNEZ, F. A. (2008). Prevalence, risk factors and clinical features associated with intestinal parasitic infections in children from San Juan y Martinez, Pinar del Rio, Cuba. *West Indian Medical Journal*, 57(4): 377 – 382.
- GAMBOA, M. I., NAVONE, G. T. ORDEN, A. B., TORRES, M. F., CASTRO, L. E. and OYHENART, E. E. (2011). Socio-

- environmental conditions, intestinal parasitic infections and nutritional status in children from a suburban neighbourhood of La Plata, Argentina. *Acta Tropica*, 18(3): 184 – 189.
- GELAW, A., ANAGAW, B., NIGUSSI, B., SILESH, B., YIRGA, A., ALEM, M., ENDRIS, M. and GELAW, B. (2013). Prevalence of intestinal parasitic infections and risk factors among school children at the University of Gondar Community School, Northwest Ethiopia: a cross-sectional study. *BMC Public Health*, 13: 304.
- ICHHPUJANI, R. L. and BHATIA, R. (2002). *Medical Parasitology*. Jaypee Brothers Medical Publishers, Calcutta, India.
- IDOWU, O. A. and ROWLAND, S. A. (2006). Oral fecal parasites and personal hygiene of food handlers in Abeokuta, Nigeria. *African Health Science*, 6(3): 160 – 164.
- JOMBO, G. T. A., DAMEN, J. G. AMECHI, I. ETUKUDO, N. S. and DABIT, O. (2011). Intestinal parasitosis among undernourished children of an urban settlement in West Africa: pattern and types. *International Infections Diseases*, 1: 3 – 6.
- JUAREZ, M. M. and RAJAL, V. B. (2013). Intestinal parasites in Argentina: major causal agents found in the population and in the environment. *Review of Argentina Microbiology*, 45(3): 191 – 204.
- MAHMUD, M. A., SPIGT, M., BEZABIH, A. M., PARON, I. L., DINANT, G. and VELASCO, R. B. (2015). Efficacy of hand washing with soap and nail clipping on intestinal parasitic infections in school-aged children: a factorial cluster randomized controlled trial. *PLoS Medicine*, 12(6).
- MUENNIG, P., PALLIN, D., SELL, R. L. and CHAN, M. S. (2015). The cost effectiveness of strategies for the treatment of intestinal parasites in immigrants. *New England Journal of Medicine*, 340(10): 773 – 779.
- NIYYATI, M., REZAEIAN, M, ZAHABION, F., HAJARZADEH, R. and KIA, E. B. (2009). A survey on intestinal parasitic infections in patients referred to a hospital in Tehran. *Pakistan journal of Medical Sciences*, 25: 87 – 90.
- NWORIE, O., NWALI, U. N., NNAMDI, O. A., INNOCENT, O. C., SOMADINA, O. C. and SHEDRACK, E. O. (2014). The prevalence and distribution of human onchocerciasis in two senatorial districts in Ebonyi State, Nigeria. *American Journal of Infectious Diseases and Microbiology*, 2(2): 39 – 44.
- OGBUAGU, C. N., ENEANYA, C. I., CHUKWUMA, C., OGBUAGU, E. N. and OGUOMA, V. M. (2009). High prevalent of intestinal parasites in a Nigeria Tertiary Health Institution. *The Internet Journal of Parasitic Diseases*, 4: 2.
- POLIMENO, L., LOIACONO, M., PESETTI, B., MASTRODONATO, M., AZZARONE, A., ANNOSCIA GATTI, F., AMORUSO, A. and VENTURA, M. T. (2010). Anisakiasis, an underestimated infection: effect on intestinal permeability of *Anisakis simplex* sensitized patients. *Foodborne and Pathological Diseases*, 7(7): 809 – 814.
- SAGNUANKIAT, S., WANICHSUWAN, M., BHUNNACHET, E., JUNGARAT, N., PANRAKSA, K, KOMALAMISRA, C., MAIPANICH, W., YOONUAN, T., PUBAMPEN, S., ADISAKWATTANA, P. and WATTHANAKULPANICH, D. (2014). Health status of immigrant children and environmental survey of child day care centers in Samut Sakhon Province, Thailand. *Journal of Immigrant and Minority Health* [Epub ahead of print].
- SAH, R. B. BHATTARAI, S., YADAR, S., JHA, N. and POKHAREL, P. K. (2013). A study of prevalence of intestinal parasites and associated risk factors among the school children of Itahari, Eastern Region of Nepal. *Tropical Parasitology*, 3(2): 140 – 144.
- TAMIRAT, J. and GETYE, M. (2014). Prevalence and predictors of intestinal parasites among food handlers in Yebu town, Southern Ethiopia. *PLoS One*, 9(10):
- UGBOGU, O. C. and ASOGU, G. O. (2013). Prevalence of Intestinal parasites amongst school children in Unwana

- Community Afikpo, Ebonyi State, Nigeria, *Nigerian Journal of Parasitology*, 34(2): 69 – 71.
- WORDEMANN, M., POLMAN, K., MENOCA, H. L. T., DIAZ, R. J., MADURGA, A. M., NUNEZ, F. F. A., CORDOVI, P. R. A. ESPINOSA, A. R., DURBAN, L. P., GORBEA, M. B., RIVERO, L. R. and GRYSSELS B. (2006). Prevalence and risk factors of intestinal parasites in Cuban Children. *Tropical Medicine and International Health*, 11(12): 1813 – 1820.
- WORKNEH, T., ESMAEL, A. and AYICHILUHM, M. (2014). Prevalence of intestinal parasitic infections and associated factors among Debre Elias Primary School children, East Gojjan Zone, Amhara Region, North West Ethiopia. *Journal of Bacteriology and Parasitology*, 5: 181.