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PREVALENCE AND RISK FACTORS OF PARASITIC INFECTIONS AMONG CHILDREN IN KAMRANGIRCHAR SLUM, DHAKA, BANGLADESH

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ABSTRACT: A cross-sectional survey was conducted to determine the prevalence of intestinal parasitic infections and identify the risk factors among 80 children, aged 0–15 years, who lived in a slum. A sample size of eighty (80) participants was used for the investigation. A structured questionnaire and anthropometric tools were used to identify epidemiological data and risk factors. Stool samples were collected from the children and were subjected to laboratory analysis using the formol-ether concentration technique. The result revealed a high prevalence of intestinal parasitic infections, with an overall prevalence of 80%. Helminths presented a more significant prevalence than protozoans. *Ascaris lumbricoides* (40%) was the most prevalent parasite, followed by *Trichuris trichiura* (30.00%), *Giardia duodenalis* (20.00%), *Hymenolepis nana* (12.50%), *Entamoeba histolytica* (10.00%), *Taenia sp. Ancylostoma duodenale* (7.50%) and *Escherichia coli* (2.50%). The probability of parasitic infection was higher in boys than girls (*p*-value= 0.1569, 95% CI 0.72-6.7). The highest infection rate (94.12%) was detected in children in the age group 8-11years, and the least infection rate (33.33%) was detected in the age group 0-3years; additionally, statistical analysis revealed a statistically significant difference between intestinal parasite infections concerning age groups (*p*- value= 0.0043). 100% prevalence was recorded during the summer season, while 60% prevalence was found in autumn (*p* value= 0.0003). The study findings showed that illiteracy, poor hygiene practices, drinking water source, house and latrine type, and deworming treatment were the factors associated with intestinal parasitic infections. Increased hygiene practices, poverty reduction, and deworming promotions are essential to reduce intestinal parasitic infections among slum children. Mass-scale awareness camping could be effective as well.

Keywords*:* Intestinal parasitic infection, children, formol-ether concentration, risk factors.

INTRODUCTION

Parasites belong to several distinct taxonomic groups, primarily protozoa, helminths, and arthropods that depend on a host for housing, feeding, and

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reproduction. Protozoa and helminths thrive inside the host body, like the gastrointestinal tract, lung, liver, heart, etc., whereas ectoparasites (lice, fleas, ticks, mites) live on the host's external body surface. In some contexts, parasitic infections are specifically confined to endoparasitic infections by protozoa and helminths. Globally, children of all age groups are reported to be infected with parasites. However, young children and toddlers are the most vulnerable group due to their poor personal hygiene awareness, environmental contamination, behavioral patterns, and socioeconomic conditions (Khanum *et al.* 2008). Personal hygiene practice and early prevention can mitigate the environmental contamination of parasites in humans and animals (Ibraximova *et al.* 2025).

Various studies reported that the prevalence of helminth and protozoan parasites is closely associated with social, economic, geographical, and community practices (WHO 2006). Lack of pure drinking water, deficient housing, low literacy, and large family size were considered risk factors influencing parasitic diseases (Cappello 2004, Östan *et al.* 2007, and Harhay *et al.* 2010). Several hygiene practices, such as children's hand washing, nail trimming, and drinking water from river sources, have been associated with parasitic infections (Mulatu *et al.* 2015; Zemene and Shiferaw 2018). A significantly higher ($p < 0{\cdot}001$) prevalence among slum dwellers in Dhaka city has been reported for parasitic diseases in comparison to that of socioeconomically privileged residents (Sultana *et al.* 2012).

Morbidity and mortality in pediatric populations in tropical countries are related to parasitic infection (Al-Ballaa *et al.* 1993). Furthermore, the infant mortality and morbidity rates are higher in children who reside in slums, shanty towns, and squatter settlements, and these children are very prone to parasitic diseases (Vaid and Mammen 2007, Ellis *et al.* 2007). According to WHO, 3.5 billion people worldwide are infested with parasites, and 450 million people suffer from illness, the majority of whom are children (WHO 2007). However, the prevalence of gastrointestinal parasitic infection in children varies in different geographic locations (Hussain *et al.* 1997, Menan *et al.* 1997). Several studies have shown that the gastrointestinal parasitic infection in children sometimes causes chronic illnesses due to high parasite load, which is associated with impaired cognitive progress and physical development in school-aged children (King 2010, Bethony *et al.* 2006, Hotez *et al* 2006, Jukes *et al.* 2002, Cappello 2004).

Soil-transmitted helminths, including *Ascaris lumbricoides*, *Trichuris trichiura,* and hookworms are the most prevalent gastrointestinal parasites found to infect humans (Bethony *et al.* 2006). *Ascaris lumbricoides,* the largest intestinal helminth inhabiting humans, is estimated to infect approximately 800 million to 1.2 billion people worldwide (McHugh 2021, Hadush and Pal 2016).

The predominant cestode is *Hymenolepis nana,* which is known to infect people globally (PIllai and Kain 2003). Additionally, protozoan parasite, *Giardia duodenalis* formerly known as *Giardia lamblia*, which causes giardiasis, has one of the highest prevalences, currently infecting about 200 million people (Minenoa and Avery, 2003).

The present study was designed to identify demographic variables that influence the prevalence of intestinal parasites among slum children. The outcomes of this work will contribute to improving the efficacy of endorsing health initiatives and encouraging other public health policymakers to develop more effective strategies to combat intestinal parasitic diseases in Bangladesh.

MATERIAL AND METHODS

Study design: The present study was conducted in Kamrangir Chor Slum, a marginalized region of Dhaka city. 80 fecal samples were collected from March 2019 to February 2020, comprising individuals aged 0-15 years, of which 52 were boys and 28 were girls. The children were categorized into four age groups: 0-3 years; 4-7 years; 8-11 years; and 12-15 years. In addition, the demographic and socio-economic conditions of the households involved in the study were recorded using a questionnaire. The majority of the mothers showed a high level of cooperation. A serial number was assigned to each respondent.

Sample collection and preservation: Stool samples were collected in tightly sealed containers containing 10% buffered formalin in the morning between 9 A.M. and 12 P.M. and transported to the Parasitology laboratory of the Department of Zoology, University of Dhaka, within one or two hours. The samples were marked according to age and sex. Comprehensive aseptic protocols, including the use of gloves, apron, footwear, etc., were maintained to ensure biosafety and prevent parasite transmission.

Laboratory screening: The fecal samples were tested using the Formol-Ether Concentration Technique (Cheesbrough 1987) in the Parasitology Laboratory, Department of Zoology, University of Dhaka. Protozoa (egg, cyst, and trophozoite) and helminths (egg and larvae) were observed, and morphological identification was carried out with the help of a compound microscope under 10X and confirmed under 40X magnification (Chatterjee 1980, Schmidt and Roberts 1989, Soulsby 1982, and Wallach and Boever 1983).

Data processing and analysis: The relationship between the prevalence (%) of the parasite and various socio-demographic factors, such as age groups, sexes, and months, was calculated in this study. Data obtained from the samples were statistically analyzed using descriptive statistics, and P-values less than 0.05 were considered statistically significant. The odds ratio (OR) and corresponding 95% confidence interval (CI) were estimated using logistic regression analysis to determine the association.

RESULTS AND DISCUSSION

The present study included 80 children as study participants. Among them, 28 girls (35.0%) and 52 boys (65.0%) (Table 1). The minimum recorded age was 1 year, while 15 years was the maximum. The mean age of the subjects was 7.5 years. The age group (0–3 years) had the smallest population, whereas the age group (8–11years) comprised the largest population of children.

It was calculated that the overall prevalence was 80%. The children with the least to highest parasite infection ranged in age group from 8–11 years (94.12%), 4–7 years (77.78%), 12–15 years (72.73%), and 0–3 years (33.33%) (Table 2). Chi-square test (*p*-value = 0.0043, p < .05) revealed statistically significant variation in the prevalence of infection across different age groups.

Eight different species of helminth and protozoan parasites were diagnosed. During the study, the prevalence of parasites was calculated, and the range of prevalence was 2.00% - 40.00%. When comparing the prevalence of infections, helminths showed a more significant prevalence (97.5%) than protozoa (32.5%). The highest prevalence was found in *A. lumbricoides* (40.00%), followed by *T. trichiura* (30.00%), *G. duodenalis* (20.00%), *H. nana* (12.50%), *E. histolytica* (10.00%), *Taenia sp.,* and *A. duodenale* (7.50%), and the lowest prevalence was recorded in *E. coli* (2.50%). (Fig.1).

Seasonal difference in the prevalence of identified parasites was recorded, revealing a peak infection rate during the summer season (100%) while a decreased rate of 60% prevalence was noted during autumn. Statistically significant variation between parasitic infection and season (x^2= 18.79, *p*= 0.0003) was observed (Fig. 2). This finding suggests that the summer season offers all the possible appropriate environmental conditions conducive to parasitic development and transmission.

Socioeconomic and demographic risk factors of the study population are presented in Table 5. 44 male children were reported to have parasitic infections. The probability of parasitic infection was greater in boys than girls (p = 0.1569, 95% CI 0.72-6.7) (Table 3). No statistically significant variation was found between parasitic infection and sex. The prevalence of intestinal parasitic infection was not significantly associated with nail-trimming and hand-washing habits (p > 0.05). However, the source of drinking water was significantly associated with the prevalence (*p*= 0.0069) (Table 3), where 75% prevalence was recorded among those who used tap water for drinking and only 25% among those who used tube well water. Additional data analyses demonstrated that intestinal parasitic infection was independent of the type of latrine, housing condition, and maternal educational status (P>0.005). Nonetheless, a statistically significant relation was seen in the context of deworming treatment (P=0.0002, 95% CI 0.01-0.18) (Table 3).

Table 1. Percentage of boys and girls examined for the study

Total	Boy		Girl	
No. of children examined	No. of children examined	Percentage (%)	No. of children examined	Percentage (%)
80	52	65.00	28	35.00

Table 2. Prevalence of parasites in different age groups and sexes in children of Kamrangi Char slum area

Age group (Year)	Boy		Girl		Total	
	Total sample	Positive (%)	Total sample	Positive (%)	Total sample	Positive (%)
0-3	4	2(50.00)	2	0(0)	6	2(33.33)
4-7	12	10(83.33)	6	4(66.67)	18	14(77.78)
8-11	22	22(100)	12	10(83.33)	34	32(94.12)
12-15	14	10(71.42)	8	6(75.00)	22	16(72.73)
Total	52	44(84.61)	28	20(71.42)	80	64(80)

[x^2=13.18, p- value = 0.0043, p < .05]

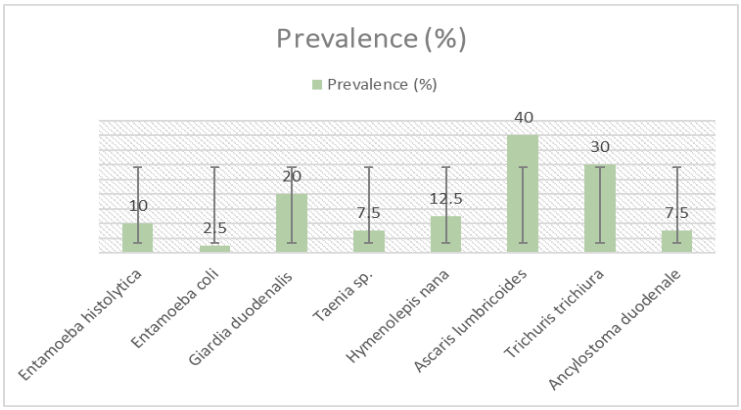

Fig. 1 Prevalence of parasites examined by formol-ether concentration method

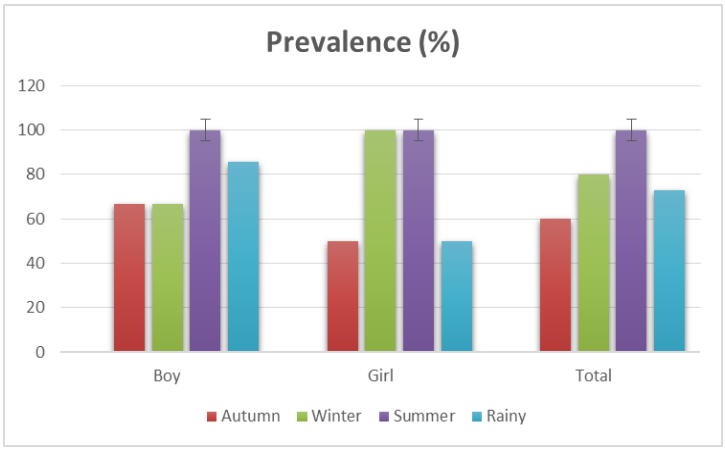

Fig.2 Seasonal prevalence (%) of parasites in different sexes

Table 3. Univariate analysis of children's intestinal parasite infections and possible risk factors among slum children

Risk factors	Total positive (n=64)	Total negative (n=16)	*p*-value	OR (95% CI)
Practice of fingernail trim				
Regularly	40 (62.50%)	14(87.50%)	0.0749	0.24(.05-1.14)
Irregularly	24 (37.50%)	2(12.50%)		
Water Source				
Tap water	48 (75%)	6 (37.50%)	0.0069*	5 (1.57-15.94)
Tube well	16 (25%)	10 (62.50%)		
Washing hands after defecation				
Yes	46 (71.88%)	12 (75.00%)	0.7892	0.85(0.24-2.9)
No	18 (28.13%)	4 (25.00%)		
Type of latrine				
Sanitary	34 (53.13%)	12 (75.00%)	0.2485	
Kaccha pit latrine	20 (31.25%)	2 (12.50%)		
Open space	10 (10.63%)	2 (12.50%)		
Type of house				
Semi Pucca	8 (12.5%)	2 (12.50%)	0.8021	
Kacha	7 (10.94%)	1 (6.25%)		
Tinshed	48 (75%)	14 (87.50%)		
Maternal education				
Illiterate	14 (21.88%)	2 (12.50%)	0.7029	
Can sign only	36 (56.25%)	10 (62.50%)		
Primary	14 (21.88%)	4 (25.00%)		
Having deworming treatment				
Yes	3 (4.88%)	9 (56.25%)	0.0001*	0.04(0.01-0.1)
No	61 (95.31%)	7 (43.75%)		

Note * = $p < 0.05$ is statistically significant

This study has assessed that the current overall prevalence of GI parasites among the population of children (aged 0–15 years) in a selected slum was 80%. We attempted to determine the prevalence and factors associated with GI parasites among slum children as well. The prevalence validates the findings of different studies that were done previously in different areas of Bangladesh (Fatema *et al.* 2020; Hosna *et al.* 2018). However, it is much higher than the findings of other studies (Rashid *et al.* 2011; Khanum *et al.* 2014, Raut *et al.* 2021). The possible reason for the variation in prevalence rate might be the difference in place and method used. Furthermore, this elevated prevalence might be aligned with the living conditions or might reflect the local geographic characteristics of the study area.

In the current study, helminth parasites showed a higher prevalence than the protozoan. *A. lumbricoides* was the dominant parasite among the eight species, showing 40% prevalence, followed by *T. trichiura* (30%). Similar studies done by Manir *et al.* 2017 and Seid *et al.* 2015 agreed with our result. *Giardia*

lamblia showed the highest prevalence among the protozoan parasites. These findings are consistent with another prior study conducted in Bangladesh by Khanum *et al.* 2014.

In this study, males were more prone to be infected twice as often as female children, which could be due to higher exposure of male children to the contaminated environment. But the highest prevalence was documented in the case of the 8–11-year age group for both male and female children when compared to other age groups. This result aligns with the previous findings (Boonjaraspinyo *et al.* 2013, Banhos *et al.* 2017). However, the current result shows a strong conflict with several earlier studies (Mama *et al.* 2015, Gelaw *et al.* 2013, Daryani *et al.* 2017). The variation in prevalence rate may be attributed to the study subject, as our study only concentrated on children up to 15 years of age.

The high prevalence of parasitic illnesses in Bangladesh can be linked to various factors such as inadequate hygiene practices, low living standards, limited health education, lack of awareness, poverty, and unfavorable socio-economic conditions (Adedoyin 1990). Prior researchers have demonstrated that intestinal parasites are a significant health issue in our nation, and current findings further substantiate this claim.

Maternal education level in our study community was notably low, with only primary education completed. The highest prevalence was 56.25%, which was recorded for those whose mothers were able to sign their names. This significant prevalence observed suggests a notable impact of maternal education on the occurrence of parasitic diseases. Additionally, previous studies have also shown that the level of education has a strong influence on the prevalence of parasites (Songserm *et al.* 2012).

Poor fingernail hygiene is also associated with low socioeconomic status, as there may be limited access to hygiene materials like clean water and soap. Children who did not keep their fingernails trimmed were more likely to be infected by intestinal parasites, as supported by a study (Al-Mekhlafi 2017). In our study, 62.50% prevalence was seen in children who regularly trim their fingernails. This study disagreed with research done by Erko *et al.* 1995.

The hygiene practices within a family are linked to the occurrence of parasitic infection. The practice of hand-washing can be seen as an initial obstacle to combat parasitic infection as it can disrupt the transfer of worms (Silva *et al.* 2011, Harhay *et al.* 2010). In our study, 71.88% prevalence was reported in the case of the children who washed their hands after defecation, whereas 75% of children were found to be negative. Although no statistically significant relation was found between hand washing habits and prevalence, it can be said that the absence of such hygiene practices might be a risk factor for intestinal parasitic infection.

The type of latrine and the structure of the household were evaluated in our study. These factors might be associated with the economic condition and contaminated food and water sources nearby, which could potentially influence the continuation of the parasite life cycle. However, no statistically significant variation was seen between parasitic infection and latrine and household type ($P>0.005$).

According to WHO (2002), deworming drugs can decrease parasite transmission by lowering the egg production of parasites. Keiser *et al.* (2008) reported a 78-88% cue rate for different helminth parasites. In the present study, it was observed and noted that only 4.88% of children harbored parasites despite having taken deworming drugs, while 95.31% prevalence was found who had not received deworming drugs. Additionally, deworming and parasitic infection have a statistically significant association.

CONCLUSION

A high prevalence of intestinal parasites, particularly helminths, was found in the study area. Variations in protozoan and helminth infection were observed by age group, sex, and season. The outcome revealed some demographic and socioeconomic risk factors, which can be statistically significant or not. Therefore, all stakeholders should be aware of parasitic diseases and raise awareness about parasite control, personal hygiene practices, and proper medication.

LITERATURE CITED

ADEDOYIN, M.A., AWOGUN, I.A., and JUERGENSEN, T. 1990. Prevalence of intestinal parasitoses in relationship to diarrhea among children in Ilorin. *West African Journal of Medicine* **9**: 83-88.

AL-BALLAA, S.R., AL-SEKEIT, M., AL-BALLA, S.R., AL-RASHED, R.S., AL-HEDAITHY, M.A. and AL-MAZROU, A.M. 1993. Prevalence of pathogenic intestinal parasites among preschool children in Al-Medina district, Saudi Arabia. *Annals of Saudi Medicine* **13**(3): 259-263.

AL-MEKHLAFI, H.M. 2017. Giardia duodenalis infection among rural communities in Yemen: A community-based assessment of the prevalence and associated risk factors. *Asian Pacific journal of tropical medicine* **10**(10): 987-995.

BANHOS, E.F., DA ROCHA, J.A.M., PIMENTEL, M.L., BATISTA, E.T.M. and SILVA, L.M. 2017. Prevalence and risk factors for intestinal parasite infections in schoolchildren, in the city of Santarém, Pará State, Brazil. *ABCS Health Sciences* **42**(3): 137-142.

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.

BOONJARASPINYO, S., BOONMARS, T., KAEWSAMUT, B., EKOBOL, N., LAUMMAUNWAI, P., AUKKANIMART, R., WONKCHALEE and N., JUASOOK, A. 2013. A cross-sectional study on intestinal parasitic infections in rural communities, northeast Thailand. *Parasites, Hosts and Diseases* **51**(6): 727-733.

CAPPELLO, M. 2004. Global health impact of soil-transmitted nematodes. *The Pediatric infectious disease journal* **23**(7): 663-664.

CHATTERJEE, K.D. 1980. Parasitology (Protozoology and Helminthology) in relation to clinical medicine. 12th Ed. Chatterjee Medical Publisher, Calcutta, 186 pp.

CHESSBROUGH, M. 1987. Medical Laboratory Manual for Tropical Countries. Vol I: Parasitology. 2nd Edn. Tropical Health Technology and Butterworth, London, 603 pp.

DARYANI, A., HOSSEINI-TESHNIZI, S., HOSSEINI, S.A., AHMADPOUR, E., SARVI, S., AMOUEI, A., MIZANI, A., GHOLAMI, S. and SHARIF, M. 2017. Intestinal parasitic infections in Iranian preschool and school children: A systematic review and meta-analysis. *Acta tropica* **169**: 69-83.

ELLIS, M.K., RASO, G., LI, Y.S., RONG, Z., CHEN, H.G. and MCMANUS, D.P. 2007. Familial aggregation of human susceptibility to co-and multiple helminth infections in a population from the Poyang Lake region, China. *International journal for parasitology* **37**(10): 1153-1161.

ERKO, B., MEDHIN, G. and BIRRIE, H. 1995. Intestinal parasitic infections in bahir dar and risk factors for transmission. *Tropical medicine* **37**(2): 73-78.

FATEMA, D.S.M., AHMED, B.N. and KHALEQUE, A. 2020. Prevalence of intestinal parasite in children and their mothers of a slum in Dhaka City. *Sch Int J Obstet Gynecol* **3**: 106-109.

GELAW, A., ANAGAW, B., NIGUSSIE, B., SILESH, B., YIRGA, A., ALEM, M., ENDRIS, M. and GELAW, B. 2013. Prevalence of intestinal parasitic infections and risk factors among schoolchildren at the University of Gondar Community School, Northwest Ethiopia: a cross-sectional study. *BMC public health* **13**: 1-7.

HADUSH, A. and PAL, M. 2016. Ascariasis: Public health importance and its status in Ethiopia. *Air Water Borne Diseases* **5**(1): 126.

HARHAY, M.O., HORTON, J. and OLLIARO, P.L. 2010. Epidemiology and control of human gastrointestinal parasites in children. *Expert review of anti-infective therapy* **8**(2): 219-234.

HOSNA, A., NAHAR, A. and KHANUM, H. 2018. Occurrence of intestinal parasites among the slum children. *Bioresearch Communications-(BRC)* **4**(1): 470-475.

HOTEZ, P.J., BUNDY, D.A., BEEGLE, K., BROOKER, S., DRAKE, L., DE SILVA, N., MONTRESOR, A., ENGELS, D., JUKES, M., CHITSULO, L. and CHOW, J. 2006. Helminth infections: soil-transmitted helminth infections and schistosomiasis. In: Disease Control Priorities in Developing Countries. 2nd edition. Washington DC, New York: The international bank for reconstruction and development/ World Bank: Oxford University Press.

HUSSAIN, S.M., RAZA, M.I. and NAEEM, S. 1997. Prevalence of intestinal parasites in Northern areas of Pakistan (Baltistan Division-Skardu). *Biomedica* **13**(2): 60-64.

IBRAXIMOVA, H.R., NURLLAYEV, R.R., BAZAROV, M.Y. and RAJABOVA, M.Q. 2025. Basics of preventing parasitic infections among children. *Multidisciplinary Journal of Science and Technology* **5**(2): 306-310.

JUKES M.C., NOKES C.A., ALCOCK K.J., KHAMIA C., NGOROSHO N., MBISE A., LORRI W.,YONA E., MWANRI L., BADDELEY A. D., HALL A., and BUNDY D. A. P. 2002. Heavy schistosomiasis associated with poor short-term memory and slower reaction times in Tanzanian schoolchildren. *Tropical Medicine & International Health* **7**(2): 104-117

KEISER, J. and UTZINGER, J. 2008. Efficacy of current drugs against soil-transmitted helminth infections: systematic review and meta-analysis. *Jama* **299**(16): 1937-1948.

KHANUM, H., AHMED, S. UDDIN, M. H., RAHMAN, A. B. M. M., DEY, R. R. and FARHANA, R. 2008. Prevalence of intestinal parasites and anaemia among the slum male children in Dhaka City. *Dhaka Univ. J. Biol. Sci* 17(2): 137-145.

KHANUM, H., RAHMAN, F. and ZAMAN, R.F. 2014. Occurrence of intestinal parasites among the teachers, students and staffs of Dhaka University. *Journal of the Asiatic Society of Bangladesh, Science* **39**(2): 239-246.

KING CH. 2010. Parasites and poverty: the case of schistosomiasis. Acta Tropica **113**(2): 95-104.

MAMA, M. and ALEMU, G. 2015. Prevalence and factors associated with intestinal parasitic infections among food handlers of Southern Ethiopia: cross sectional study. *BMC publichealth* **16**: 1-7. https://doi.org/10.1186/s12889-016-2790-x

MANIR, N., UMAR, L.M. and ABDUHADI, B.J. 2017. Survey on prevalence of intestinal parasitesassociated with some primary school aged children in Dutsinma Area, Katsina State, Nigeria. *MOJ Biol Med 2*(2): 00044.

MCHUGH, M. 2021. Ligand-gated ion channels: Putative target sites for anthelmintic therapy in muscle and intestine cells of parasitic nematodes (Doctoral dissertation, Iowa State University).

MENAN, E.I., NEBAVI, N.G., ADJETEY, T.A., ASSAVO, N.N., KIKI-BARRO, P.C. and KONE, M. 1997. Profile of intestinal helminthiases in school aged children in the city of Abidjan. *Bulletin de la Societe de Pathologie Exotique (1990)* **90**(1): 51-54.

MINENO, T. and AVERY, M.A. 2003. Giardiasis: Recent Progress in Chemotherapy and Drug Development (Hot Topic: Anti-Infective Agents Executive Editors: Mitchell A. Avery/Vassil St.) Georgiev. *Current pharmaceutical design* **9**(11): 841-855.

MULATU, G., ZEYNUDIN, A., ZEMENE, E., DEBALKE, S. and BEYENE, G. 2015. Intestinal parasitic infections among children under five years of age presenting with diarrhoeal diseases to two public health facilities in Hawassa, South Ethiopia. *Infectious diseases of poverty* **4**(1): 49.

ÖSTAN, İ., KILIMCIOĞLU, A.A., GIRGINKARDEŞLER, N., ÖZYURT, B.C., LIMONCU, M.E. and OK, Ü.Z. 2007. Health inequities: lower socio-economic conditions and higher incidences of intestinal parasites. *BMC public health* **7**: 1-8.

PILLAI, D. R. and KAIN, K. C. 2003. "Common intestinal parasites", Current Treatment Options in Infectious Diseases. *Journal of Tropical Medicine* **5**: 207-217.

RASHID, A.M., RASHID, A.S. and RAHMAN, A. 2011. Prevalence of intestinal parasitoses in urban and rural children of a developing country. *Asian Pacific Journal of Tropical Biomedicine 1*(2): 268-S270

RAUT, S., BHATTARAI, S., KHANAL, R., KHATIWADA, S. and KASARLA, R.R. 2021. Burden of intestinal parasitic infections among children from five schools in Bhairahawa, Nepal: a comparative cross-sectional study. *Journal of Universal College of Medical Sciences* **9**(02): 30-35.

SCHMIDT, G.D., and ROBERTS. L.S. 1989. Foundations of Parasitology. The C.V. Mushy Company, Louis Toronto, London. pp. 670.

SEID, M., DEJENIE, T. and TOMASS, Z. 2015. Prevalence of intestinal helminths and associated risk factors in rural schoolchildren in Were-Abaye sub-district, Tigray region, northern Ethiopia. *Acta Parasitologica Globalis* **6**(1): 29.

SILVA, J.C., FURTADO, L.F.V., FERRO, T.C., DE CARVALHO BEZERRA, K., BORGES, E.P. and MELO, A.C.F.L. 2011. Parasitism due to Ascaris lumbricoides and its epidemiological characteristics among children in the State of Maranhão. *Revista da Sociedade Brasileira de Medicina Tropical* **44**(1).

SONGSERM, N., PROMTHET, S., WIANGNON, S. and SITHITHAWORN, P. 2012. Prevalence and co infection of intestinal parasites among Thai rural residents at high-risk of developing cholangiocarcinoma: a cross-sectional study in a prospective cohort study. *Asian Pac J Cancer Prev* **13**(12): 6175-6179.

SOULSBY, E.J.L. 1982. Helminths, Arthopods and Protozoa of Domesticated Animals . Bailliere and Tindal, London. 766-771pp.

SULTANA, Y., GILBERT, G.L., AHMED, B.N. and LEE, R. 2012. Seroepidemiology of Strongyloides stercoralis in Dhaka, Bangladesh. *Parasitology* **139**(11): 1513-1520.

VAID, A., MAMMEN, A., PRIMROSE, B. and KANG, G. 2007. Infant mortality in an urban slum. *The Indian Journal of Pediatrics* **75**(5): 449-453

WALLACH, J.D. and BOEVER, W.J. 1983. Diseases of exotic animals: medical and surgical management. Saunders, Philadelphia. 212-1159 pp

WHO (WORLD HEALTH ORGANIZATION). 2002. The World Health Report. Reducing risk, promoting healthy life. World Health Organization, Geneva. pp. 7-247.

WHO. Winning the fight against neglected tropical diseases. 2006.

World Health Organization, 2007. Partners for Parasite Control: Geographical Distribution and Useful Facts Andstats. WHO, Geneva, Available at http://www.who.int/wormcontrol/statistics/geographical/en/index.html

ZEMENE, T. and SHIFERAW, M.B. 2018. Prevalence of intestinal parasitic infections in children under the age of 5 years attending the Debre Birhan referral hospital, North Shoa, Ethiopia. *BMC research notes* **11**: 1-6.

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