Original Research Article

Soil-Transmitted Helminthiasis among Pupils in Semi-Urban Communities inAnambra State, Nigeria

ABSTRACT

Aim: This study was aimedat determining the prevalence of soil-transmitted helminth (STH) infections among pupils in semi-urban communities in Aguata LGA, Anambra State, Nigeria.

Study design: The study was a cross-sectional, school-based study.

Place and duration of study: The study was carried out in three communities namely Ekwulobia, Isuofia and Igboukwu in Aguata Local Government Area (LGA) of Anambra State, southeast Nigeria. The laboratory analysis were carried out at the laboratory of the Department of Parasitology and Entomology Nnamdi Azikiwe University, Awka,between September – December 2023.

Methodology: A total of three hundred and twenty-six (326) randomly selected pupils, aged 3-14 years attending public primary schools in Aguata LGA were sampled for STH infections. Stool samples were collected and examined for soil transmitted helminth parasites using the Kato-Katz technique.

Results: Of the 326 pupils examined 24.2% (79) were positive for at least onesoil-transmitted helminth parasites*. Ascarislumbricoides* was the most prevalent18.7% (61), followed by *Trichuris trichiura*2.7%(9) and Hookworms0.9%(3). Co-infections of *A. lumbricoides* and *T. trichuira* 5 (1.5%) and *A. lumbricoides* and Hookworm 0.3% (1) were also observed. Pupils of the age group 3-6yearsshowed the highest prevalence29.5% (21). Males had a higher prevalence 25.6%(37) than females23.0% (42).

Conclusion: Soil-transmitted helminth infections still pose a public health challenge among pupils in Anambra State. Annual deworming programmes should be sustained and be complemented with continuous health enlightenment programmes as well as improved sanitation.

Keywords: (Soil transmitted helminth; Prevalence; Aguata; Ascaris lumbricoides, Trichuris trichuira; Hookworm)

1. INTRODUCTION

Soil-transmitted helminths (STHs) are intestinal parasites of humans transmitted through faecally contaminated soil[1]. The burden of soil-transmitted helminth infections has remained a public health problem worldwide [2]. Nigeria has a long history of STH endemicity with prevalence ranging from low-to-high worm burden recorded in all the states of the country [3]. The main species that infect people are the *Ascarislumbricoides* (roundworm), *Trichuris trichiura* (whipworm), *Ancylostoma duodenale*/*Necator americanus* (hookworm) and *Strongyloides stercoralis* (threadworm) [4].

Transmission of soil-transmitted helminthiasis is by the ingestion of the eggs of *Ascaris lumbricoides* and *Trichuris trichiura* or by active penetration of the skin by hookworm larvae. These infections affect the poorest and most deprived communities with poor access to clean water, sanitation and hygiene in tropical and subtropical areas [2].

Most conditions of STH have a light worm burden and usually have no discernible symptoms. Heavy infections, however, cause a range of health problems, including abdominal pain, diarrhoea, blood and protein loss, rectal prolapse, physical and mental retardation [5]. School age children are the most vulnerable group and they harbour the greatest number of intestinal worms [6]. School children are known to play with contaminated soil and eat without washing their hands after play, walk barefoot, eat raw, unpeeled and/or unwashed vegetables and fruits, and defecate indiscrimately, and these are known to facilitate the transmission of helminth infections [7]. Millions of school age children worldwide are infected with soil-transmitted helminths. As a result, they experience stunting and diminished physical fitness as well as impaired memory and cognition. These adverse health consequences combine to impair childhood educational performance and reduce school attendance thereby limiting their ability to access and benefit fully from the education system [8].

Soil-transmitted helminth (STH) infections are among the most common infections worldwide with an estimated 1.5 billion infected people or 24% of the world's population. Infections are widely distributed in the tropical and subtropical regions, with the highest prevalence reported in sub-Saharan Africa, China, South America and Asia [2]. Over 260 million preschool-age children, 654 million school-age children, live in areas where these parasites are intensively transmitted, and need treatment and preventive interventions [2].

The endemicity of soil-transmitted helminth infections and their risk factors has been documented in Anambra State [9],[10],[11] but most communities are yet to be studied**.**Soil-transmitted helminth is still a public health problem in Anambra State with prevalence above 20%[9]. Majority of communities in Aguata LGA are farming communities, where children and adults are fully exposed to risks of helminth infection. Most communities are warm and moist for most of the year, creating a good environment for parasites to develop all year round.

Anambra State, Nigeria, had implemented mass administration of medicines(MAMs) to combat soil-transmitted helminthiasis (STH) [11].Despite the implementation of annual Drug Administration, poor environment as well as poor hygiene behaviour of individuals, could lead to occurrence of reinfection rapidly after treatment. Therefore, there is a need for periodic studies to determine the current status ofsoil-transmitted helminth infections and foreffective management and control of soil-transmitted infections in the population.

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out in three communities namely Ekwulobia, Isuofia and Igboukwu in Aguata Local Government Area (LGA) of Anambra State. Aguata LGA lies between latitude 6.0086° N and longitude 7.1009° E. The Loal Government Area has two distinct seasons; rainy (April–October) and dry seasons (November-March). The area's relative humidity is between 60%-80% and temperature between 25°C – 30°C. In 2006, Aguata LGA had a population of 369,972, with 187,262 males and 182 710 females [12]. The major occupation of inhabitants is crop farming and trading, with some of them combining both.

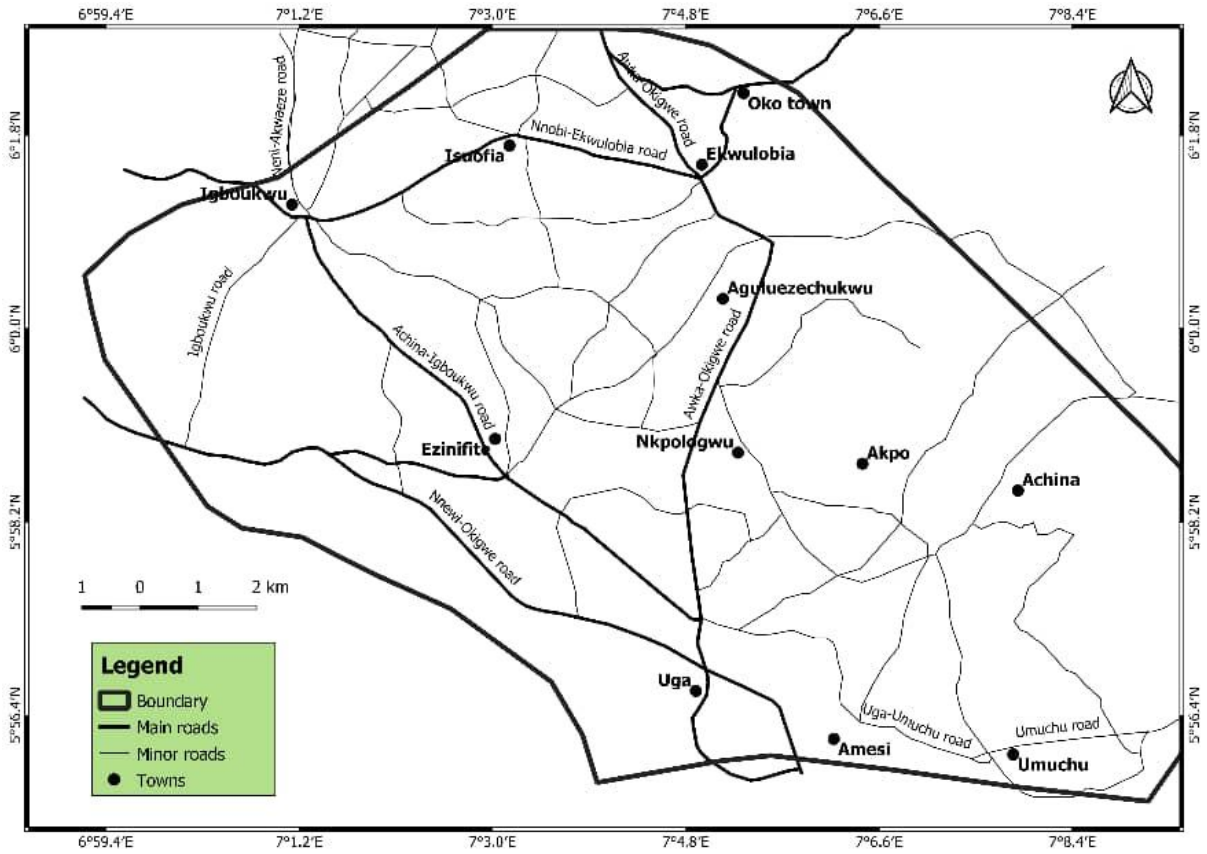

Fig 1. Map of Aguata

2.2 Study Design

The study was a cross sectional study. This study involved laboratory examination of faecal samples using Kato-Katz technique. Sample collection was a one-time collection carried out between September 2023 – December 2023. Participants were drawn from primary schools in Aguata LGA through random sampling technique.

2.3 Study Population

The study population consisted of pupils aged between 3 years to 12 years old, attending primary schools in Ekwulobia, Isuofia and Igboukwu communities in Aguata LGA.

2.4 Sample Size Determination

Samplesize was estimated using the sample size estimation formula by [13].

$$n = \frac{N}{1 + N\,(e)^2}$$

Where n = sample size, N = total number of study population (1431). e = probability level (*P* = 0.05). The estimated sample size was 318.

However, a total of 326 children were randomly recruited for the study from six randomly selected schools in the study area, two (2) from each town. Parents/guardians of these selected pupils were properly educated on the importance of this research before they signed consent forms. Those pupils whose parents or guardians consented were recruited for the study and were given study identification numbers.

2.5 Ethical Approval

Approval was obtained from the Ethics committee of the Anambra State Ministry of Health to conduct the research (MH/AWK/M/321/463). Approval was sought from the Education Secretary of Aguata LGA, Anambra State. Permission for access to the schools to carry out the study was obtained from the Education Secretary Catholic diocese of Ekwulobia, and the Heads of schools. In addition, Informed consent of the participants and their parents was obtained. The identity of all pupils selected for the study was protected as no names were used, instead identification numbers were assigned to each study participant.

2.6 Collection of stool Sample

Stool sample was collected from each participant using a sterile, leak-proof, and transparent wide-mouthed universal sampling container, pre-labelled with the participant's identification number. Samples from the participants were stored in an ice bag stacked with ice cubes for preservation. The collected samples were transported on the same day to the Laboratory unit of the Department of Parasitology and Entomology, Nnamdi Azikiwe University, Awka for Parasitological analysis.

2.7Parasitological Examination of Stool Samples for Soil Transmitted Helminths

Stool samples were prepared and examined following the Kato-Katz technique [14]. One gram of stool sample was placed on a piece of paper. Nylon screen was pressed on top of the stool to sieve

the stool, with a spatula the sieved stool was collected. The Kato-Katz template was then placed in the middle of a clean glass slide. The hole of the template was filled using the stool on the spatula. The template was removed vertically (avoiding any horizontal movement). Cellophane strips pre-soaked in glycerol-Methylene blue solution was placed on top of the stool. A second, clean glass slide was used to press against the cellophane spreading the stool evenly between the microscope slide and the cellophane strip. The slides were then carefully removed and placed on the bench with the cellophane upwards. All the slides were examined under the microscope within 30 minutes after they were prepared. The presence of STH parasites eggs in any of the stool samples was noted as positive.

2.8 Statistical Analysis

Data obtained were analysed using Statistical Package for Social Sciences (SPSS) version 23. Level of significance between variables were analysed using Chi square at p-value of 0.05% (95%) level of significance.

3.0 RESULTS

Prevalence of Soil-Transmitted Helminth Infections among Pupils in Aguata, Anambra State.

Out of the 326 stool samples of pupils examined in three communities in Aguata L.G.A, Anambra State24.2% (79) were positive with at least one soil-transmitted helminth parasite. *Ascaris lumbricoides* had the highest prevalence18.7%(61) followed by *Trichuris trichiura*2.7%(9) and hookworm 0.9% (3) as shown in Table 1.

On the prevalence by community, the highest prevalence was observed in Igboukwu 29.7% (33) followed by Isuofia 26.3% (29) and Ekwulobia16.1%(17) as shown in Table 1. There was no significant difference at (*P*= .28). The result also showed co-infection observed between *Ascaris lumbricoides* and *Trichuris trichiura* 1.5% (5) followed by *Ascaris lumbricoides* and hookworm 0.3% (1). This is shown in Table 4.

Prevalence of Soil-Transmitted Helminth Infections by age among pupils in Aguata, Anambra State

The result on prevalence by age showed that the age group 3-6years old had the highest prevalence 29.5% (21) followed by pupils aged 7-10 years24.0% (49) and 11-14 years had the least17.6%(9). The rate of helminth infections decreased with increase in age. As shown in Table 2, there was no significant difference (*P*=.77).

Prevalence of Soil-Transmitted Helminth Infections by sex among pupils in Aguata, Anambra State

The result also showed that males had a higher prevalence 25.6% (37) than females23.0%(42). It was observed that *A.lumbricoides* and *T.trichiura* occurred more in females with 78.5%(33) and14.2% (6) prevalence respectively, than in males,while Hookworm occurred more in males 5.4% (2). But this was not significantly different as shown in Table 3 (*P*=.77).

Table 1: Prevalence of soil-transmitted helminth infections among pupils in Aguata L.G.A, Anambra State.

Community	No Examined (%)	No Positive (%)	*A. Lumbricoides* (%)	*T. trichiura*(%)	Hookworm(%)
Igboukwu	111 (34.0)	33 (29.7)	26 (78.7)	3 (9.0)	2 (6.0)
Ekwulobia	105 (32.2)	17 (16.1)	13 (76.4)	2 (11.7)	1 (5.8)
Isuofia	110 (33.7)	29 (26.3)	22 (75.8)	4 (13.7)	0 (0.00)
TOTAL	**326**	**79 (24.2)**	**61 (18.7)**	**9 (2.7)**	**3 (0.9)**

x^2= 5.79*P*= .05

Table 2: Prevalence of soil-transmitted helminth infections among pupils by age among pupils in Aguata, Anambra State.

Age group	No Examined (%)	No Positive(%)	*A. lumbricoides* (%)	*T.trichuira* (%)	Hookworm (%)
3-6yrs	71 (21.7)	21 (29.5)	15 (71.4)	3 (14.2)	0.00
7-10yrs	204 (62.5)	49 (24.0)	38 (77.5)	5(10.2)	3 (6.1)
11-14yrs	51 (15.6)	9 (17.6)	8 (88.8)	1 (11.1)	0.00

x^2=2.31 *P*= .31

Table 3: Prevalence of soil-transmitted helminth infections among pupils by gender in Aguata, Anambra State.

Gender	Examined(%)	Positive(%)	(%)	*trichuira*(%)	Hookworm(%)
Males	144 (44.2)	37 (25.6)	28 (75.6)	3 (8.1)	2 (5.4)
Females	182 (55.8)	42 (23.0)	33 (78.5)	6 (14.2)	1 (2.3)

x^2=0.3 *P*=.05

Table 4: Prevalence of soil-transmitted helminth co-infections among pupils by Community in Aguata, Anambra State.

Community	No examined(%)	No positive(%)	*A. lumbricoides + T. trichiura*(%)	*A. lumbricoides + hookworm*(%)
Igboukwu	111 (34.0)	2 (1.8)	2	0
Ekwulobia	105 (32.2)	1 (0.9)	0	1
Isuofia	110 (33.7)	3 (2.7)	3	0
Total	326	6 (1.84)	5 (1.53)	1 (0.31)

4.0 DISCUSSION

This study showed an overall prevalence of 24.2% (Table 1) for soil-transmitted helminth infections among pupils in Aguata Local Government Area, Anambra State. By this, Aguata LGA may be categorised as moderately endemic to Soil-transmitted helminth infections [15]. The prevalence is lower than 56.2% reported by [16] in Uga Aguata, 48.08% recorded by [17]in Ozubulu, 42.0% recorded by [18] in Nnewi, 29.1% recorded by [19] in Ifite Ogwari Anambra State, and 30.3% recorded by [20] in Imo State. However, the result of this study is higher than 0.7% reported by [21]in Ekwulobia, Aguata LGA and9.86% by [22] in Awka South LGA, Anambra State. The prevalence recorded is relatively comparable to findings by [23] with prevalence of 28.2% in Umunze, [24] with prevalence of 21.7% in rural communities in Anambra¸ [10] with a prevalence of 21.7% in Nimo, Anambra State and 25.6% recorded by [25] in Enugu State. These differences may be due to the difference in the sample size, study time, annual deworming programmes, predisposing factors, and differences in the endemicity of parasites in the study areas.

The three Soil-transmitted helminths documented in this study were, *Ascarislumbricoides*, *Trichuris trichiura* and hookworm (Table 1). *A*. *lumbricoides* was the most predominant among the soil-transmitted helminths (18.7%). This corroborates with the findings by [24] who also recorded a higher prevalence of *A.lumbricoides* infection compared to other infections in rural communities in Anambra State, [26] in rural communities in Enugu State, [27] in Edo State, Nigeria and [28] in rural Kenya.

A few pupils had mixed infections of *Ascaris lumbricoides* and hookworm 0.31%, and *Ascaris lumbricoides* and *Trichuris trichiura* 1.53%. This confirms recent reports by [11] in Anaocha LGA, Anambra State, but in contrast with [26] who reported 24.3% coinfection rates;*Ascaris lumbricoides* and hookworm as the most coinfection recorded. However, [29] recorded no coinfection among pupils in Nnewi. These variations may be due to the season at the time of study, and frequency of annual deworming programmes. Co-infections of *Ascaris lumbricoides* and *Trichuris trichiura* were more common (Table 4). This could be dueto similar fecal-oral route of infection for both parasites.

Male pupils had a higher prevalence (25.6%) than the females (23.0%) (Table 3), although there was no significant difference. The high prevalence of infection among males compared to females in this

study could be attributed to habits like playing football barefooted by boys on wet soil, which can promote penetration of the skin by filariform larvae. The above result is in line with [17] in Ozubulu who reported male pupils had 2.9% when compared to females (1.1%) and [20] who reported male pupils had 38.4% compared to females 21.1% in Imo State, The low prevalence of Hookworm recorded among pupils in this study is similar to studies by [30], but in contrast with studies by [22] which reported hookworm as the most prevalent STH in Umunze, Anambra State, and also recorded the prevalence of Hookworm higher in males (49.1%) than females (37.3%). The prevalence of Hookworm was higher in males (5.4%) than in females (2.3%) which is like the report by [30].

Rate of prevalence of infection was high among pupils in the age group 3-6 years, while pupils in the age group 11-14 years had low prevalence rate (Table 2), this is similar to reports by [25]. This could be due to the fact that the younger age category (3-6 years) engages more in high level of soil activities while playing outdoors. Also, this group maintains poor personal hygiene as this plays a role in helminth infections. The older age group have more immunity than the younger age groups and are more likely to have better knowledge and practice of personal hygiene. This finding is in contrast to studies by [31] who reported highest prevalence (17.65%) in age group 13-16years, and 9.8% in age group 5-8 years among pupils in Ekwulummili community, Anambra State.

5.0 CONCLUSION

This study has determined the Prevalence of soil-transmitted helminth infections among pupils in Aguata LGA, which showed the prevalence of 24.2%. Therefore, Aguata LGA is moderately endemic to soil transmitted helminths according to WHO and is of public health concern. Intervention programmes such as annual deworming programmes should be sustained, monitored,and be complemented with continuous health enlightenment programmes as well as improved sanitation.

REFERENCES

1. Dahal SA, Francis OE, Francis EJ, Wamtas IF. Soil-transmitted helminths and associated risk factorsamong elementary school pupils in Dadin Kowa, Jos. Nigerian Medical Journal. 2019;60(4): 181–185.

2. World Health Organisation. Soil-transmitted helminths infections. 2023. https://www.who.int/news-room/fact-sheets/detail/soil-transmitted-helminth-infections%20Accessed%2010/03/2023
3. Ohiolei JA, Isaac C, Omorodion OA. A review of soil-transmitted helminthiasis in Nigeria. Asian Pacific Journal of Tropical Diseases.2017;7:930–937.
4. Centre for Disease Control and Prevention. Helminths, Soil-Transmitted. 2023. https://wwwnc.cdc.gov/travel/yellowbook/2024/infections diseases/helminths-soil-transmitted
5. Pukuma MS, Thadawus D, Augustine LM. Soil transmitted helminths among school aged children in Hong local Government Area of Adamawa state, Nigeria. Animal Research. 2022;19(1):4318 – 4323.
6. Hailegebriel T, Nibret E, Munshea A. Prevalence of soil-transmitted helminth infection among school-aged children of Ethiopia: A systematic review and meta-analysis. Infectious Diseases:Research and Treatment. 2020;13:1–14.
7. World Health Organisation. Soil-transmitted helminthiases: Eliminating soil-transmitted helminthiases as a public health problem in children: Progress Report, 2001-2010. 2012.
8. Hotez PJ, Brindley PJ, Bethony JM, King CH, Pearce EJ, Jacobson J. Helminth infections: The Neglected Tropical Disease. *The Journal of Clinical Investigation*, 2008;118:1311-1321.
9. Federal Ministry of Health (FMOH): National protocol for epidemiological mapping and baseline survey of schistosomiasis and soil transmitted helminths in Nigeria. Pp 14. 2013.
10. Onyido A, Okoye M, Irikannu KC, Okafor E, Ugha C, Umeanaeto PU, Egbuche CM, Iwueze MO, Ezeani A. Intestinal helminth infections among primary school pupils in Nimo Community, Njikoka Local Government Area, Anambra State, Southeastern Nigeria. Journal of Advanced Research in Biology & Pharmacy Research. 2016;1(4)44-48.
11. Aribodor OB, Jacob EC, Azugo NO, Ngenegbo UC, Obika I, Obikwelu EM, Nebe OJ. Status of soil-transmitted helminthiasis among adolescents in Anaocha Local Government Area, Anambra State, Nigeria: prevalence, associated factors, and future directions after a decade of ongoing mass administration of medicines. Medrxiv. 2023. https://doi.org/10.1101/2023.09.15.23295620
12. National Population Commission (NPC). Nigeria National Census: Population Distribution by sex, State, LGAs and Senatorial District. 2006.

13. Yamane, T. Statistics: An Introductory Analysis. 2nd Edition, Harper and Row, New York, USA. 1967.
14. World Health Organization. Training manual on diagnosis of intestinal parasites Geneva: World Health Organization;2004.
15. World Health Organization. Guideline: Preventive chemotherapy to control soil-transmitted helminth infections in at-risk population groups. World Health Organization, Geneva, Switzerland;2017. https://www.who.int/intestinalworms/resources/97892415501166.
16. Umeh C, Mbanugo JI, Ezeugoigwe N. Prevalence of intestinal helminthes parasites in stools of nursery and primary school pupils in Uga, Anambra State, Nigeria. Sky Journal of Microbiology Research. 2015;3(1):006-010
17. Ezeagwuna D, Okwelogul I,Ekejindu I, Ogbuagu C. The prevalence and socio-economic factors of intestinal helminth infections among school pupils in Ozubulu, Anambra State, Nigeria. The Internet Journal of Epidemiology, 2009; 9(1):1-5.
18. Ukibe SN, Ukibe NR, Obi-Okaro AR, Iwueze MO. Prevalence and pattern of soil transmitted helminths (Sths) among primary school children at Nnewi, Nnewi- North Local Government Area, Anambra State, Nigeria. Annual Research & Review in Biology. 2018;28(1):1-6.
19. Ahanonu GE, Aribodor DN, Okwelogu IS, Ekezie CC, Okafor NM, Okafor DC, Echeta OC. Soil-transmitted helminthiasis in Ifite-*Ogwari*: A farming rural community in Anambra State, Nigeria. South Asian Journal of Parasitology. 2023;6(2):73-82.
20. Odinaka KK, Nwolisa EC, Mbanefo F, Iheakaram AC, Okolo S. Prevalence and pattern of soil-transmitted helminthic infection among primary school children in a rural community in Imo State, Nigeria. Journal of Tropical Medicine. 2015.
21. Aribodor OB, Ekwunife CA, Sam-Wobo SO, Aribodor DN. Risk factors and socio-demographic determinants of intestinal helminthiasis amongst children in schools that implemented the homegrown school feeding programme in Ekwulobia, Anambra State. International Journal of Translational medical Research and Public Health.2018;2(1):1-10.
22. Nzeukwu CI, Ihejie PO, Irikannu KC, Umeanaeto PU, Nzeukwu AC, Elosiuba NV, Onwuachusi GL, Obiefule IE. Prevalence and risk factors for soil transmitted helminth infections among pupils in Awka South LGA, Anambra State, Nigeria=short communication.The Bioscientist. 2022;10(2): 156-166.

23. Okafor NM, Aribodor DN, Ekezie CC, Ahanonu GE, Okafor NP, Ihemanma CA, Obiefoka SO. Prevalence of Soil-Transmitted Helminth Infection in Umunze, Anambra State, Nigeria. South Asian Journal of Parasitology. 2023;6(3),103–112.
24. Aribodor DN, Obikwelu MC, Ekwunife C, Egbuche I, Ezugbo-Nwobi O, Etaga H. Preliminary investigation on soil-transmitted helminth infections in rural communities in Anambra State, Nigeria. Journal of Life Sciences. 2012;6:448-451.
25. Aniwada EC, Uleanya ND, Igbokwe LN, Onwasigwe C. Soil transmitted helminths: Prevalence, perception and determinants among primary school children in rural Enugu State Nigeria. International Journal of Tropical Diseases and Health. 2016;15(1):1-12.
26. Okoro JC, Ezeogu J, Ogbonna IF. Prevalence, and risk factors of soil transmitted helminth infections amongst children in a tertiary institution in South-east, Nigeria. Open Journal of Gastroenterology. 2023;13:267-277.
27. Isaac C, Turay PN, Inegbenosun CU, Ezekiel SA, Adamu HO, Ohiolei JA. Prevalence of soil-transmitted helminths in primary school playgrounds in Edo State, Southern Nigeria. Helminthologia. 2019;56(4): 282–295.
28. Steinbaum L, Njenga SM, Kihara J, Boehm AB, Davis J, Null C, Pickering AJ. Soil-transmitted helminth eggs are present in soil at multiple locations within households in rural Kenya. Public Library of Science One. 2016;11:1–10.
29. Mmekowulu JC, Ekwunife CA, Okwelogu IS, Ekelozie IS. Status of Geohelminth infections-nine years after mass administration of medicine in primary schools in Nnewi, Anambra State. International Annals of Medicine. 2017;1(7):1-5.
30. Bishop HG, Azeez Z, Momoh SJ, Abdullahi B, Ujah AO, Barwa J, Babalola AR. Risk factor and effects of hookworm infections on anthropometric indices of school children in Samaru, Zaria, Nigeria. Science World Journal. 2022;17(2)291-294.
31. Onyido AE, Anumba JU, Ezechukwu GC, Chibuzor U, Umeanaeto PU, Iwueze MO. Intestinal helminth infection among primary school pupils in Ekwulumili community, Nnewi South Local Government Area, Anambra State. Nigerian Journal of Parasitology. 2017;38(2):185-188.