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GEOHELMINTH INFECTIONS AND WASH PRACTICES AMONG PRIMARY SCHOOL PUPILS IN MGBAKWU, AWKA NORTH LGA, ANAMBRA STATE NIGERIA.

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ABSTRACT

Geohelminth (also called STH) infections are major public health problems that require continuous measurement of the prevalence and control practices for its effective elimination. This study aimed to determine the status of Geohelminth infections and WASH practices in Mgbakwu, Anambra State. With cross-sectional design, data were collected using standard parasitological techniques for stool examination, and FMoH checklist for WASH indicators. Chi-Square, Paired-T, Wilcoxon Signed Ranks and Correlation tests were done at 5% significant level. Overall prevalence of infection was 38.1%. Two STHs encountered: *Ascaris lumbricoides* and Hookworms had 33.7% and 8.9% prevalences respectively ($p < 0.05$). Males had 31.8% prevalence and females 42.3% ($p > 0.05$). Pupils (5-9) years had 42.8% prevalence while those (10-14) years had 32.8% ($p > 0.05$). School based prevalence was highest, 43.8% in APS and least, 28.6% in GLNS ($p > 0.05$). Overall WASH score was 62.9% ($p < 0.05$), ranging from 20.0% to 100% among schools. Correlation between WASH scores and STH prevalence was -0.26 ($p > 0.05$). In conclusion, STH infection predominantly with *A. lumbricoides*, and poor WASH quality were observed in this study. Therefore, health education and other control measures are recommended for effective elimination of STH in the study area.

Keywords: Geohelminths, *Ascaris lumbricoides.* Hookworm, Prevalence, WASH, Mgbakwu

INTRODUCTION

Geohelminths also called Soil Transmitted Helminths (STH) are group of intestinal parasites that are transmitted through contaminated soil, food, water, edibles, fingers and objects. They are called geohelminths to emphasize that their life cycle and development are strictly dependent on soil environment. Examples of geohelminth parasites are: *Ascaris lumbricoides or* (roundworms), *Trichuris trichiura* or (whip worms), *Strongyloides stercoralis*, and the two hookworm species (*Ancylostoma duodenale* and *Necator americanus*) which are the old world and new world hookworms respectively (CDC, 2022). The modes of transmission of the STHs vary depending on the parasite species in question. *Ascaris lumbricoides,* and *Trichuris* t*richiura* are transmitted by faecal - oral route through ingestion of infective eggs of the parasites passed in human faeces and spread in the soil especially where there are poor hygienic practices (WHO, 2022). Transmission of Hookworms and *Strongyloides stercoralis* is by skin penetration of the infective larval stage.

In a given population where STH infections occur, pre-school and school-aged children are known to harbour the highest intensity of infection (Yaro *et al.,* 2020). Common signs and symptoms of STH infections includes: malnutrition, intestinal obstruction, abdominal discomfort, chronic dysentery, rectal prolapse, respiratory complications, poor weight gain, and anaemia (Ibrahim *et al.,* 2022; Bethony *et al.,* 2006). In addition to their deleterious health effects, infection with some of the STH can impair cognition in children, lead to absenteeism from school, and days lost from work in adult populations (Hotez *et al*., 2020). It can also result in low productivity that hinders economic development (GBD, 2017).

STH infections have been reported recently in Anambra State with the following prevalences: 21.7% (Onyido *et al*., 2016), 7.7% (Egbuche *et al.,* 2017), 9.86% (Nzeukwu *et al.*, 2022) and 28.2% (Okafor *et al.,* 2023) among others. STH infections is spread through multiple factors, and this makes control and possible elimination of STH infections difficult. One of the global strategies for the control of STH infection is the use of Water, Sanitation and Hygiene (WASH) facilities. FMoH (2022) has emphasized the role of WASH facilities in preventing the spread of STH infections. Where there is efficient water supply, improved sanitation infrastructure and adequate promotion of hygiene, it is believed that the spread of diseases will be reduced especially STH. Nevertheless, Saheed *et al*. (2014) opined that water which is essential for sustainable development is not safe, sufficiently affordable in adequate quantities to meet basic health needs in most communities of the world. In Southwestern Nigeria, Olukanni (2013) assessed WASH practices in public secondary schools and observed a lot of inadequacies in different components. Offiong *et al.,* (2024) evaluated how WASH programme is implemented in secondary schools in Cross-River State and reported that safe drinking water in secondary schools is available and accessible on a low extent. In another study, Otto *et al.* (2022) assessed WASH practices among students from selected public and private secondary schools and observed that the students have adequate knowledge, but poor practices on WASH. Aside schools, Rawlings and Seghosime (2022) carried out a community-based evaluation of WASH in Edo State and observed that households have poor access to adequate WASH facilities / services. In general, the overall status of the WASH sector in Nigeria is poor, where only

9% of the Nigerian population has access to complete basic Water, Sanitation and Hygiene services (FMoH, 2022).

Despite being given attention, the magnitude of the burden of geohelminthiasis is still grossly underestimated. STH infections have chronic and asymptomatic nature that go largely unnoticed particularly at an early stage. Even though progresses have been made in the last decade to promote and provide WASH facilities to people throughout the world, millions of people still lack improved source of water, live without any form of sanitation and practice open defecation. In some places where WASH facilities are provided, there is no evidence of assessment to monitor and evaluate the impact. For effective control, attempts to measure the morbidity of infections from STH must be a continuous programme in different communities and regions of the world, especially where the diseases are endemic. There is no published data on the prevalence of geohelminths infections and WASH facility assessment in Mgbakwu, Awka North Anambra State, Nigeria. That actually forms the basis for the choice of this study area. Thus, this study was carried out to provide baseline information / data on the prevalence of geohelminth infections and status of WASH facilities in Mgbakwu, Awka North LGA, Anambra State, Nigeria. This study also focused on primary school pupils as the target population, so that WHO 2030 global targets for elimination of STH morbidity in pre-school and school age children would be achieved and maintained. Therefore, the aim of this study was to determine the status of Geohelminth infections and WASH practices among primary school pupils in Mgbakwu, Awka North LGA, Anambra State.

MATERIALS AND METHODS

Study area

This study was conducted in Mgbakwu, Awka North L.G.A in Anambra State. Mgbakwu is a rural community with the following seven villages: Amaezike, Amaeze, Amankpu, Uruaku, Uruotulu na Uruonaga, Amede, and Achallaumana. Mgbakwu has Latitude of 6.2712o N and Longitude of 7.0577^{o} E. The following Towns / Communities are situated near Mgbakwu: Isu-Aniocha, Urum, Ebenebe and Okpuno. Mgbakwu has a community Health Center and several primary and secondary schools alongside a tertiary institution called Anambra State Polytechnic, Mgbakwu. There is a stream with fishing, washing and swimming activities. Occupants are farmers, traders, masons, Okada riders, commercial bus drivers, Keke drivers and Civil Servants.

Study Design

The study was a cross-sectional survey of geohelminth parasites and WASH facility assessment in seven selected primary schools located in Mgbakwu. The study covered a period of eight months (May 2023 to December 2023). The study entailed collection and examination of faecal specimen for detecting diagnostic stages of STH and assessment of WASH facilities in the schools.

Study Population and Sample size determination

The study population were school aged children who were enrolled in public and private primary schools in Mgbakwu during the 2022/2023 academic year. Minimum sample size for this study was calculated using the formula of sample size calculation for cross sectional studies or survey as described by Charan and Biswas (2013).

$$\text{Sample size} = \frac{Z_{1-\alpha/2}{}^{2}\,p(1-p)}{d^{2}}$$

Where Z = value for selected alpha level of 0.025 in each tail = 1.96
p = prevalence = 0.148 (which is the average prevalence of STH infection from the most recent reports in Anambra State (Okafor *et al.,* 2023; Nzeukwu *et al.,* 2022).
q = 1- P = 0.852
d = acceptable margin of error for proportion being estimated = 0.05

The calculation done is as follows:

$$\text{Sample size} = \frac{1.96 \times 1.96 \times 0.148 \times 0.852}{0.05 \times 0.05} = 193$$

Thus, the required minimum sample size for this study was 193.

Selection of schools and study participants
Seven (7) schools and three hundred (300) pupils were randomly selected from nine (9) private and four (4) public schools in the study area. First was selection of schools and this was done by assigning number codes (written on paper) to schools belonging to each category. Considering the low population of pupils in most of the schools, seven papers (three from public school category and four from private school category, representing seven schools) were picked at random to select the schools that participated in this study.

For each of the selected schools, a proportionate sample size was determined from the overall school population. In each of the schools, approximately equal number of male and female pupils, were drawn from each class (primary 1 to primary 6). Selection of the study participants was done using random sampling method after going through the class register.

Ethical Consideration
A letter of introduction and identification was obtained from the Head of Parasitology and Entomology Department of Nnamdi Azikiwe University Awka. With the letter of introduction and letter of attestation, Ethical approval to conduct the study was sought for and obtained from Health Research Ethics Committee of Chukwuemeka Odumegwu Ojukwu University Teaching Hospital (COOUTH) Amaku, Awka (COOUTH/CMAC/ETH.C/VOL 1/FN: 04/294) and Anambra State Ministry of Health (MH/AWK/M/321/466).

Advocacy Visit
Advocacy visits was made to the selected schools. Sensitization program was done before the study and the parents or guardians of the study participants were involved. They were assured of absolute confidentiality of information that they would provide. Oral Informed consent of the pupils was obtained from their parents or guardians.

Faecal Sample Collection
Sterile universal containers with tight lids and an applicator stick were given to each participant for use in getting his or her stool sample. The universal containers were labelled with the appropriate pupil's identification numbers before issuing it to each pupil. The parents/guardians of the pupils were instructed on how to collect the early morning stool of their wards safely to avoid contamination with urine. The stool samples from the participants were stored in an ice bag stacked with ice cubes for preservation. Samples were immediately transported to the laboratory of the Department of Parasitology and Entomology, Nnamdi Azikiwe University, Awka for proper examination.

Parasitological examination of the stool specimens.

Each stool specimen was examined both macroscopically and microscopically. Macroscopic examination was done to detect the presence of mucus, blood, worm segment and adult worms in the stool specimen. Microscopic examination was done for the presence of parasite eggs or ova. Stool microscopy was done using Direct saline wet mount and Formol Ether Concentration Techniques according to Cheesbrough (2009).

Assessment of WASH (Water, Sanitation and Hygiene) indicators

WASH resources in the selected schools was assessed using a modified FMoH Recommended Checklist for improved WASH intervention in schools (FMoH, 2013). The status and condition of the WASH resources was carefully observed during field visitations and was scored 1 or 0 point as appropriate. For each WASH resource component (water component, sanitation component and hygiene component), a cumulative test score was computed.

Statistical Analysis

The data obtained was analyzed at 5 % level of significance using the SPSS software, Version 25. 0. Chi-Square (χ^2) Test was used to compare prevalence of STH infection between or among different categories of the following variables: species of STH detected, gender of the pupils, Age of the pupils, and schools of the pupils. T-test was used to compare the overall WASH score with the standard. Wilcoxon Signed Ranks Test was used to compare the WASH scores of each school with the standard. Correlation was used to evaluate the impact of WASH on the prevalence of STH infection in the selected schools.

RESULTS

Prevalence of Soil Transmitted Helminth Parasite Infection in the study area

Out of the 300 pupils selected for this study, a total of two hundred and seventy (270) pupils in seven selected primary schools brought their stool samples for examination. This gave a compliance level of 90.0%. No mucus, blood, worm segment or adult worm was observed when the stool specimens were examined macroscopically. The number of positive cases recorded using microscopy to detect STH eggs / ova was 103, giving an overall prevalence of 38.1%. Table 1 shows the prevalence of soil transmitted helminth infections, stratified by parasite species, gender of the pupil, age group, and school attended by the pupil. Two species of soil transmitted helminths observed in the study were *A. lumbricoides* with a prevalence of 33.7 % and Hookworm with a prevalence of 8.9%, 12 (4.4 %) participants had mixed infection with both parasites. There was significant difference in the prevalence of the two parasites causing Soil Transmitted Helminth infection in the study area (p = 0.000). Gender based prevalence showed that males had 31.8% prevalence while females had 42.3% prevalence. However, the difference in prevalence based on gender is not statistically significant (p = 0.081). Between the two age groups of the primary school pupils, those that are within (5 – 9) years had higher, 42.8% prevalence than those within (10 -14) years that recorded a prevalence of 32.8%. Nevertheless, there was no significant difference in the prevalence of STH infection by age group (p = 0.093). Prevalence based on individual school is highest, 43.8% in APS and least, 28.6 % in GLPS. However the difference in prevalence based on individual school is not statistically significant (p = 0.808).

Table 1: Prevalence of STH in the study area.

Variable	Category	Number examined	Number infected	Prevalence rate
Species of STH detected	*A. lumbricoides*	270	91	33.7%
	Hookworm	270	24	8.9%
Gender of the pupils	Male	107	34	31.8%
	Female	163	69	42.3%
Age group of the pupils	5 – 9 years	145	62	42.8%
	10 – 14 years	125	41	32.8%
School	CPS	57	22	38.6%
	APS	48	21	43.8%
	UPS	43	16	37.2%
	CKPS	36	13	36.1%
	FGPS	23	8	34.8%
	GLPS	35	10	28.6%
	URPS	28	13	46.4%

Assessment of WASH Facilities in the selected primary schools

Table 2 shows the WASH resource scores of the selected schools in the study area. The overall WASH score of 9.4 out of 15 available point (62.9%) was significantly lower than the standard score ($p = 0.019$). CPS recorded a WASH score of 3 out of 15 available points (20.0%) which was significantly low when compared to the standard WASH score ($p = 0.001$). APS recorded a WASH score of 4 out of 15 available points (26.7%) which was significantly low when compared to the standard WASH score ($p = 0.001$). UPS recorded a WASH score of 15 out of 15 available points (100.0%). CKPS recorded a WASH score of 12 out of 15 available points (80.0%) and it was not statistically different from the standard WASH score ($p = 0.083$). FGPS recorded a WASH score of 4 out of 15 available points (26.7%) which was significantly low when compared to the standard WASH score ($p = 0.001$). GLPS recorded a WASH score of 15 out of 15 available points (100.0%). URPS recorded a WASH score of 13 out of 15 available points (86.7%) and it was not statistically different from the standard WASH score ($p = 0.157$).

Table 2: Assessment of WASH Facilities in the selected primary schools

SCHOOL	Water component						Sanitation component						Hygiene component						Grand Total	
	Water source	Condition of water source	Distance of water source	Frequency of water supply	Number of water sources	**TOTAL**	Presence of toilet	Condition of toilet	Type of toilet in use	Presence of soap in toilet	Presence of tissue for use after defecation	**TOTAL**	Presence of bush	Presence of garbage can	Provision of hand wash facilities	Presence of authorized food vendor	Usage of common cup	**TOTAL**	**TOTAL**	**%**
CPS	0	0	0	0	0	**0**	1	0	0	0	0	**1**	0	1	0	1	0	**2**	**3**	**20.0**
APS	0	0	0	0	0	**0**	1	0	0	0	0	**1**	0	1	1	0	1	**3**	**4**	**26.7**
UPS	1	1	1	1	1	**5**	1	1	1	1	1	**5**	1	1	1	1	1	**5**	**15**	**100.0**
CKPS	1	1	1	1	1	**5**	1	0	0	1	1	**3**	0	1	1	1	1	**4**	**12**	**80.0**
FGPS	0	0	0	0	0	**0**	1	0	0	1	1	**3**	0	1	0	0	0	**1**	**4**	**26.7**
GLPS	1	1	1	1	1	**5**	1	1	1	1	1	**5**	1	1	1	1	1	**5**	**15**	**100.0**
URPS	0	1	1	1	1	**4**	1	1	0	1	1	**4**	1	1	1	1	1	**5**	**13**	**86.7**
Total	3	4	4	4	4	**19**	7	3	2	5	5	**22**	3	7	5	5	5	**25**	**66**	
Mean						**2.7**						**3.1**						**3.6**	**9.4**	**62.9**

Impact of WASH on STH Prevalence in the study area

The impact of WASH on STH prevalence in the study area is shown in Figure 1. From the school ranking, the WASH score increased from 20.0% to 100%. Following the same ranking of schools from WASH score, the prevalence of STH infection among the schools fluctuated as follows: 38.6%, 43.8%, 34.8%, 36.1%, 46.4%, 37.2%, to 28.6%. There was a weak negative correlation (r = -0.26) between WASH quality and the prevalence of STH infection among the selected schools. However, the observed correlation was not statistically significant (p = 0.101).

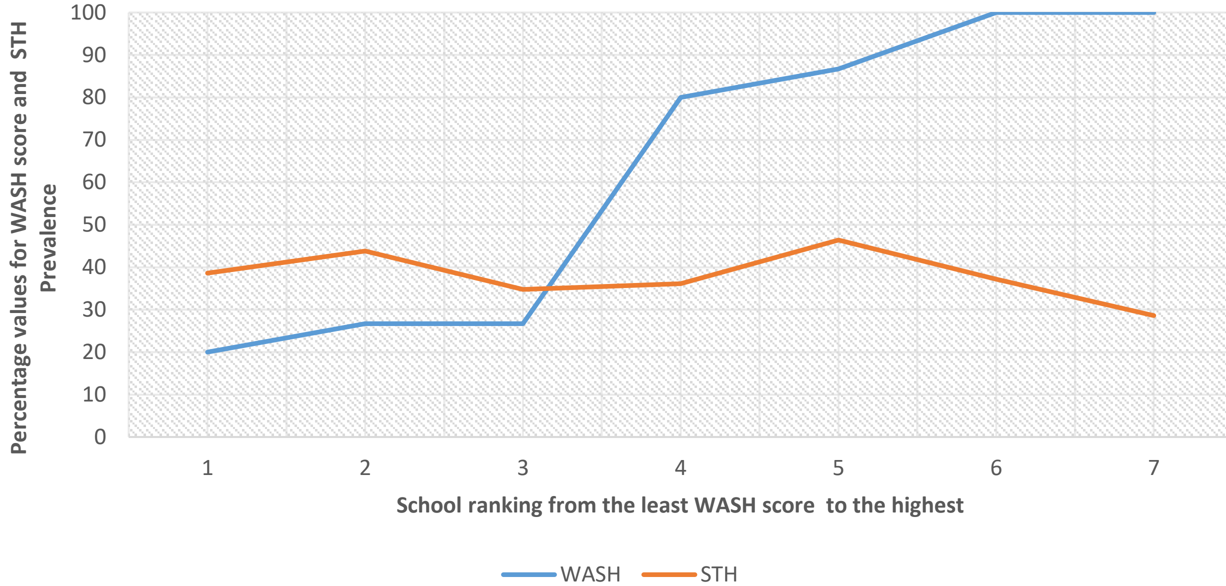

Figure 1: Impact of WASH on STH prevalence

DISCUSSION

Soil Transmitted Helminth infection is a public health problem in Mgbakwu, Awka North Local Government Area of Anambra State. This is evident by the presence of infected pupils identified in this research work, with an overall prevalence of 38.1% recorded. Compared to recent studies in different parts of Anambra State, lower prevalence rate of 21.7% (Onyido *et al*., 2016), 7.7% (Egbuche *et al*., 2017), 9.86% (Nzeukwu *et al.*, 2022) and 28.2 % (Okafor *et al.*, 2023) were reported. Nevertheless, this prevalence of 38.1% classifies the study area as a 'low risk area' for preventive chemotherapy, and put them under the category of places recommended by (WHO, 2023) for preventive chemotherapy (deworming) with annual instead of biannual administration of single-dose albendazole (400 mg) or mebendazole (500 mg). For this level of prevalence to be observed, it is possible that the pupils were dewormed in a Mass Drug Administration campaign, or just by their parents prior to this study. Continued presence of infected pupils, and up to the prevalence rate recorded may be attributed to presence of infected and untreated adults, infected and untreated children, poor hygiene level of the pupils and their guardians, as well as open or indiscriminate defecation. This is the same view Yap *et al.* (2013) has when he attributed high and continuous prevalence of STH infection in communities to rapid re-infection.

Only two species of soil transmitted helminths were observed in this study: *A. lumbricoides* with a prevalence of 33.7 % and Hookworm with a prevalence of 8.9%. There was significantly higher number of pupils infected with *A. lumbricoides.* This is in accordance with the earlier findings of Egbuche *et al.* (2017), Nzeukwu *et al.,* (2022), and Okoro *et al.* (2023) who reported *A. lumbricoides* as the most occurring species of STH infecting primary school pupils. This shows that the most common route of infection with STH in the study area is faecal-oral route. *A. lumbricoides* eggs easily attaches or adheres to surfaces of fruits, vegetables, objects and body of houseflies (Nwangwu *et al*., 2013; Adenusi *et al*., 2015), where one can easily come in contact with them. This infective stage, eggs of A. *lumbricoides* are resistant to harsh environmental conditions and can survive for a long time without deterioration or loss of viability.

Even though there was no significant difference in the prevalence of STH infection based on gender, females were found to be more infected than males. This may be attributed to the fact that pupils within the age range (5 – 14 years) studied display the same level of poor hygiene regardless of their gender. Similarly, Ezeagwuna *et al.* (2009) reported higher prevalence in females than in males. From this study, both male and female school aged children (5 – 14 years) showed equal level of susceptibility to STH infection.

Even when the age group is stratified, no significant difference was observed in the prevalence of STH infection among the pupils. However, children aged 5 to 9 years old recorded higher prevalence of STH infection than those aged 10 to 14 years old. This is similar to the finding of Okoro *et al*., (2023), who reported that the prevalence of soil-transmitted helminthic infection amongst subjects' 5 - 9 years was higher and least in children older than 15 years, though not statistically significant. This could simply be due to chance occurrence as pupils belonging to the two age groups have similar level of hygiene and behavior both at home and in the school.

The difference in prevalence of STH infection based on school is also not statistically significant. Ibrahim *et al.* (2022) noted that unhygienic class environment is among important factors associated with STH infection. Though the pupils attend different schools, the level of sanitation at the different school seems the same, such that infection and reinfection of the pupils is possible in all of them. Also, the pupils live in the same community, Mgbakwu such that the presence of infected persons within the schools and the condition of school environment are not the only sources of infection.

WASH facilities are one of the recent strategies mapped out in the control of STH infections. The overall WASH score of 62.9% recorded in this study was significantly lower than the standard score. Only two out of the seven selected schools recorded a WASH score of 100% and it is not good enough to achieve effective control of STH infections in the study area. Among the five schools with less than 100% WASH score, two schools recorded significantly low scores. This shows that the quality of Water, Sanitation and Hygiene facilities in primary schools within the study area is poor and as such, the pupils are not protected from contracting STH infection as recorded in this study. Poor water, sanitation and hygiene (WASH) practices have been proposed as a likely explanation to STH infection and reinfection (Ziegelbauer *et al.,* 2012). The usage of WASH facilities in the study area may not be frequent and efficient. No wonder the difference in the prevalence of STH infection among schools is not statistically significant. Also, the negative correlation between WASH score and prevalence of STH infection among the children in this study is weak and not statistically significant. This points to the fact that adequate health education is needed to sensitize the pupils and their teachers on the importance of WASH facilities and the correct ways to use them.

CONCLUSION

In conclusion, Soil Transmitted Helminth infection is a public health problem in Mgbakwu, Awka North Local Government Area of Anambra State, affecting children aged 5 – 14 years. Only two species of soil transmitted helminths: *A. lumbricoides and* Hookworm were observed in this study. *Ascaris lumbricoides* is the most predominant, STH in the study area. Mixed infection of the two species of STH was equally observed. It is worthy to note that the state and usage of WASH facilities in the study area is very poor and might have contributed to the level of STH prevalence recorded in this study.

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