The Bioscientist Vol. 10 (3): 326-336, June 2022
Available online at *http://www.bioscientistjournal.com*



OPEN ACCESS

Full Length Research Paper

INTESTINAL HELMINTH INFECTIONS IN PUPILS OF A RURAL COMMUNITY IN NIGERIA

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ABSTRACT

Helminth parasites are endemic in rural communities in Nigeria that lack adequate water and sanitary facilities, so this study was focused on intestinal helminth infections and associated risks amongst pupils at Ebenebe in Anambra State Nigeria. This cross-sectional study was approved by Ministry of Basic Education Awka (Ref: MOBE/SCHD/1583/T9/8) while ethical permit (Ref: ASUBEB/ADM/14/VOL.III/232 of 21/11/2019) was granted by Anambra State Universal Basic Education Board. The 110 pupils enrolled in Umuji, Obuno, Umuoye, and Umuogbuefi public primary schools at Ebenebefor 2018/2019 school year constituted study population, while sample size of eighty (twenty pupils from each school) were systematically chosen. Pupils' schools, age, gender, parents' main occupation and toilet-use were obtained through visits, observations and oral interviews. Direct faecal smears and formalin-ether concentration techniques were used for stool samples analysis while parasitological keys were used for helminth parasites identifications. Data were summarized with bar charts using Microsoft Excel13Chart wizard, and standard error bars indicated significant differences (p<0.05) among variables. Overall prevalence of intestinal helminth infection was 45% (boys 44.2% and girls 45.9%). Species-specific prevalence of infection was *Ascaris lumbricoides*(36.2%), Hookworm (6.3%), and *Trichuris trichiura*(2.5%). Observed inadequate toilet facility and safe water supply are potential risks for intestinal parasitism in Ebenebe. Provision of these facilities, periodic deworming and good hygiene practices will help to control infection and re-infection of intestinal parasites in Ebenebe.

Keywords: *Ascaris lumbricoides*, Hookworm, *Trichuris trichiura*, pupils, rural Ebenebe

INTRODUCTION

Parasitic helminth infection is a major health problem in rural areas of developing countries where infants experience the highest worm burden (Ojurongbe *et al*., 2014). Species of helminths incriminated worldwide include *A. lumbricoides, T. trichiura*, hookworm (*Ancylostoma duodenale* and *Necator americanus*) and *Strongyloides stercolaris* (Ngenegbo and Iwuagwu, 2019; Nasiru *et al.,* 2017). These infections are most prevalent in regions of the world that lack adequate water and sanitation facilities (Tefera *et al.,* 2015).Prevalence of infections between 14.4% and 71.1% was reported from Nigeria (Nwaneri and Omuemu, 2012) but this may depend on location and methodology employed. Risk factors for intestinal helminthosis include open defecation (Ngenegbo *et al*., 2019) indiscriminate dumping of animal feces, overcrowding, geophagy, failure to put-on protective foot wears (Metuh and Ikpeze, 2009), and other human behaviors which permit soil and water contamination with feces (Nasiru *et al.,* 2017; Chukwuma *et al.,* 2009). Infection may be direct or indirect through secondary sources such as food, water, vegetables, and fruits (Ikpeze and Chima, 2017).

Outcome of most intestinal helminth infections in children such as malnutrition, iron-deficiency anemia, impaired-physical and mental development would ultimately retard their educational advancement which will impact negatively on nation's economic growth and development (Albonico *et al*., 2006).According to WHO (2015), primary control strategy for intestinal helminth infection mainly depends on mass drug administration (MDA) in populations at risk, sustained by health education and provision of clean water and sanitary facilities. School-based deworming is the most commonly practiced strategy in developing countries, but it does not prevent re-infection. Strategic deworming is however useful in maintaining minimal intensity of intestinal helminth infection and thereby reducing associated morbidities among those infected (Montresor *et al*., 2012).In consideration of the negative impact of parasitic helminth infections in infants, the need to constantly generate baseline data that may help in control is timely (Wosu and Onyeabor, 2014). The present study focused on intestinal helminth infections amongst pupils in public primary schools in Ebenebe, Awka-North Local Government Area of Anambra State, Nigeria to identify and determine the prevalence and risk factors which will help step-up intervention programmes in the area.

MATERIALS AND METHODS

Study Area: Ebenebe (6°20'02"N and 7°07'45"E)inAwka North Local Government Area of Anambra State, Nigeria comprises eight villages namely: Obuno, Okpuno, Umuajana, Umuji, Umuogbuefi, Umuoye, Uwani and Umuaba (Figure 1) with an estimated population of 45,897 (NPC, 2006).

Ebenebe is in the tropical zone of Nigeria and experiences about 7 months of rainy season (April-October) and 5 months of dry season (November-March). Its temperature fluctuates between 28-32°C (June-December) and 32-34°C (January-April).Its climate and soil conditions are favorable for crop-farming, being one of the highest producers of agricultural

commodities in the state. The community has rudimentary open-air markets, with Oye Ebenebe being the largest. Six public primary schools in the area are the Ebenebe Community Primary School, Central School Umuoye, Irunese Primary School, Obuno Primary School, Umuogbuefi Primary School, and Umuji Primary School. Health facilities in the area include the Mobile Hospital, Dike Medical Center and Ebenebe Health Center but these are no longer functional. Some conditions that may expose pupils to soil-transmitted helminth (STH) infections and water-borne diseases include unsafe water supply, poor toilet facilities and walking bare-footed (Plate 1).

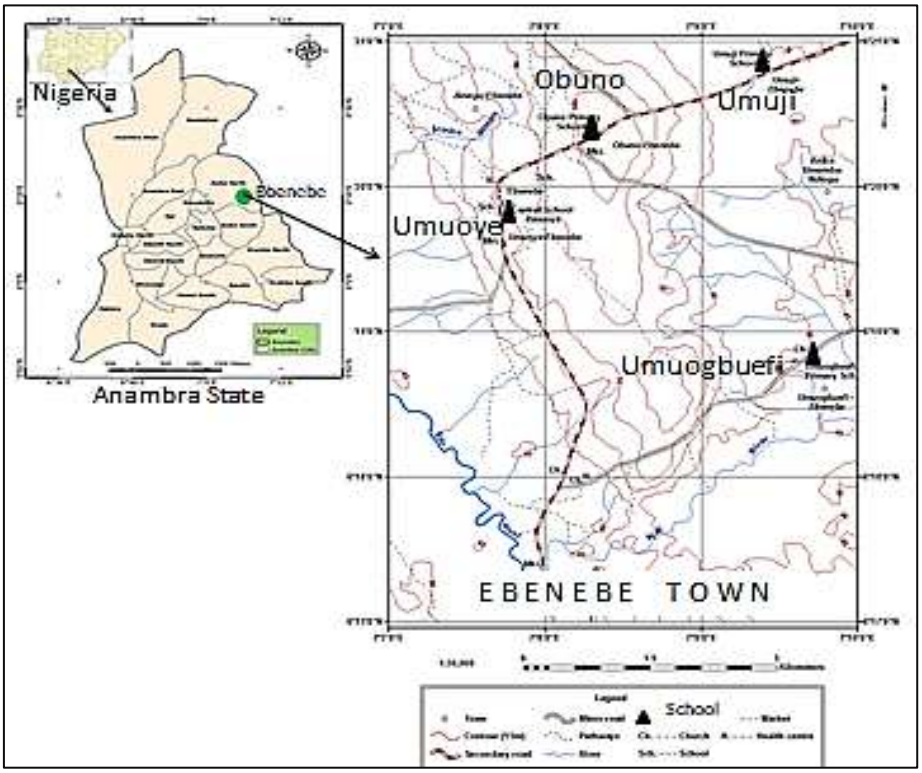


Figure 1: Ebenebe,Anambra State, Nigeria showing school locations studied



Plate 1: Predisposing factors for soil-transmitted and water-borne diseases in the study area. Dilapidated toilet facility in a primary school [A]. Community source of water supply [B], and some bare-footed pupils [C]

Ethical considerations

Approval for this study was granted by the Anambra State Ministry of Basic Education (Ref: MOBE/SCHD/1583/T9/8 of 9/10/2019) while Ethical Approval was obtained from Anambra State Universal Basic Education Board (Ref: ASUBEB/ADM/14/VOL.III/232of 21/11/2019). Sensitization on the purpose of the study was done at selected schools to solicit the cooperation of teachers, and informed consent of parents and guardians of pupils that participated in the study.

Study design

A cross-sectional study was carried out to identify intestinal helminth parasites in stool of pupils at Ebenebe, as well as determine prevalence and risk factors of the intestinal helminth infections between September 2019 and January 2020.

Study Population and Sample size

Study population included all the pupils (n=110) enrolled for 2018/2019 school year in Umuji, Obuno, Umuoye, and Umuogbuefi public primary schools at Ebenebe.

Sample size determination

Sample size formula (Rao and Scott, 1992), $n = \frac{N}{1+N(e^2)}$ where n is minimum sample size, N is study population, e is error term, 0.05 at 95% confidence interval was used to determine the number of pupils sampled. Therefore, $n = \frac{110}{1+(110\ x\ 0.05^2)} = \frac{110}{1+o.275} = \frac{110}{1.275} = 86$.

Eventually Eighty pupils that fully participated in the study comprised 20 each, from the four participating public primary schools (selected by ballot from the six schools) and were systematically chosen from respective school registers.

Pupils' demographics and toilet use

Information on participants' ages, gender, parents 'main occupations, and toilet-use was obtained through visits, direct observations and oral interviews. Participants were thereafter categorized for the study on the basis of their demographics. Age-groups considered were those ≤8, >8≤12, >12≤16 years. Parents' main occupation included farming (crops and livestock), trading (lock-up stores, open markets), artisanship (craftsmen), and public service (public and private employees) while pupils used pit latrines, water closet and open defecation.

Stool sample collection, analysis and identification of helminth eggs or larvae: Freshly passed morning stool samples from pupils were routinely collected and analyzed in our stand-by mobile laboratory using the direct faecal smears (saline and iodine wet mount preparations) and formalin-ether concentration technique (WHO, 1991). Identifications of parasite eggs\larvae were done using the Bench Aids for the Diagnosis of Intestinal Parasites (WHO, 1994).

Data analysis: Data on pupils were collated. Percentages and prevalence of infections were determined according to schools, gender, age groups, parasite species and risk factors (parents' main occupation and toilet facilities obtained through oral interviews). These were further analyzed in Microsoft Excel Wizard (version 13) that produced bar charts where standard error bars indicated significant differences (p<0.05) among the variables considered.

RESULTS AND DISCUSSIONS

Each of the four schools contributed 25% to the total number of pupils examined. About 53.7% of them were boys while 46.3% weregirls.Pupilsbetween8 and 12 years comprised 48.7%of those examined while children of farmers and those that practiced open defecation comprised about 46.2% and 28.8% respectively (Figure 2). Identified eggs are those of *Ascaris lumbricoides* with characteristic mamillations on its surface, *Trichuris trichiura*

with bipolar plugs and a single celled ovum, and hookworm ova with characteristic 4-cell stage (Plate 2).

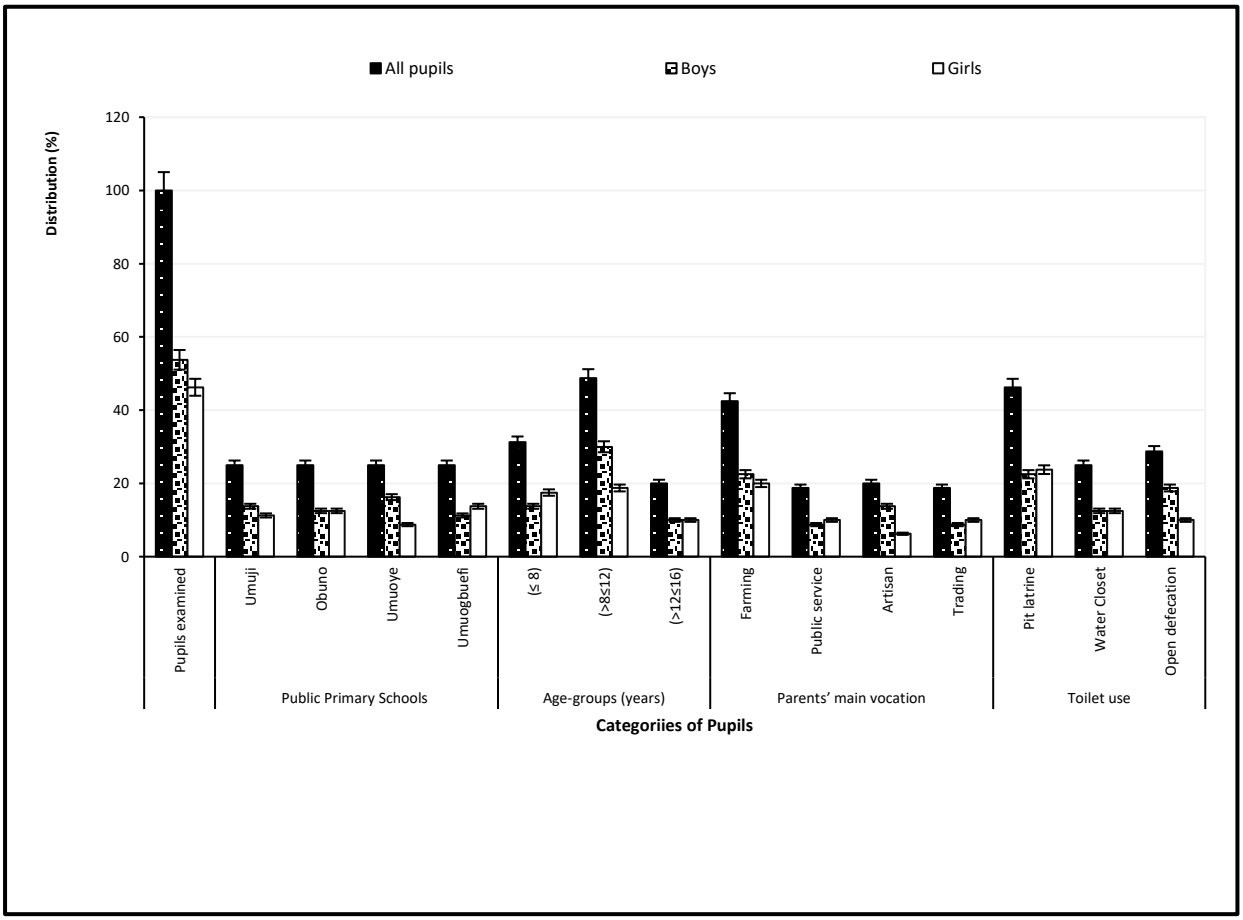


Figure 2: Percentage distribution of pupils in different categories studied



Plate 2: *Ascaris* egg with characteristic mamillations on its surface [A]. *Trichuris* egg in fresh stool with bipolar plugs and a single celled ovum [B]. Hookworm egg with characteristic 4-cell stage [C]

The Overall prevalence of helminth infections among the pupils was 45%, with significant differences in infection prevalence of *A. lumbricoides* (36.2%), *T. trichiura* (2.5%) and 6.3% for Hookworm (Figure 3).

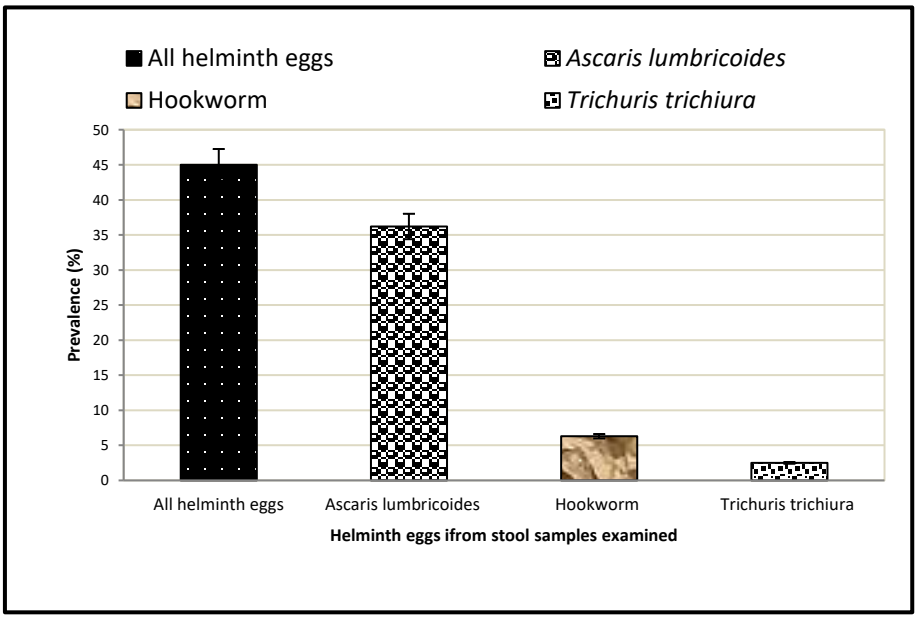


Figure 3: Overall prevalence of helminth eggs infection. Standard error bars indicate significant differences ($p<0.05$).

Similar trends were noticed in the bar charts of overall prevalence in the four schools, except that *T. Trichiura* infection was not observed among pupils of Obuno and Umuogbuefi schools (Figure 4).

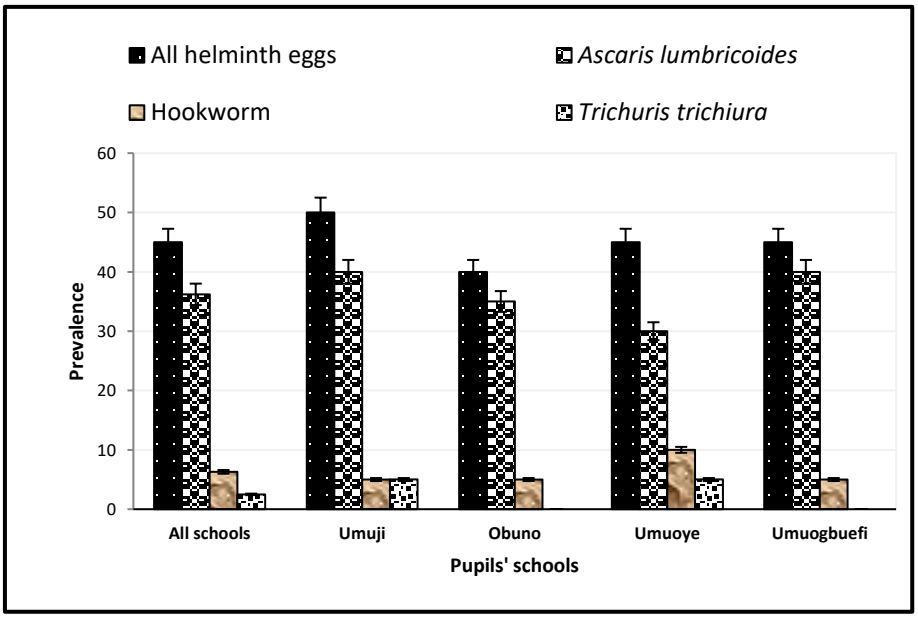


Figure 4: Prevalence of helminth parasites according to schools. Standard error bars indicate significant differences ($p<0.05$).

Trichuris trichiura infection was not observed among the boys (Figure 5) but there was no significant gender difference in *Ascaris* and hookworm infections, but previous similar study had reported higher prevalence of these two helminths in males

(Ukibe *et al*., 2018). Some of the reasons given by these authors (Ukibe *et al*., 2018)for the higher prevalence in males hinged on differences in gender roles. For example, Widjana and Sutisna (2000) reported that the higher prevalence in adult males was that they normally did not use footwears on farms, thus exposing skins to penetration by infective larvae of hookworms. The present study on pupils showed higher prevalence of hookworm in males but the difference was insignificant, though boys were observed to be playing around bare footed more than girls.

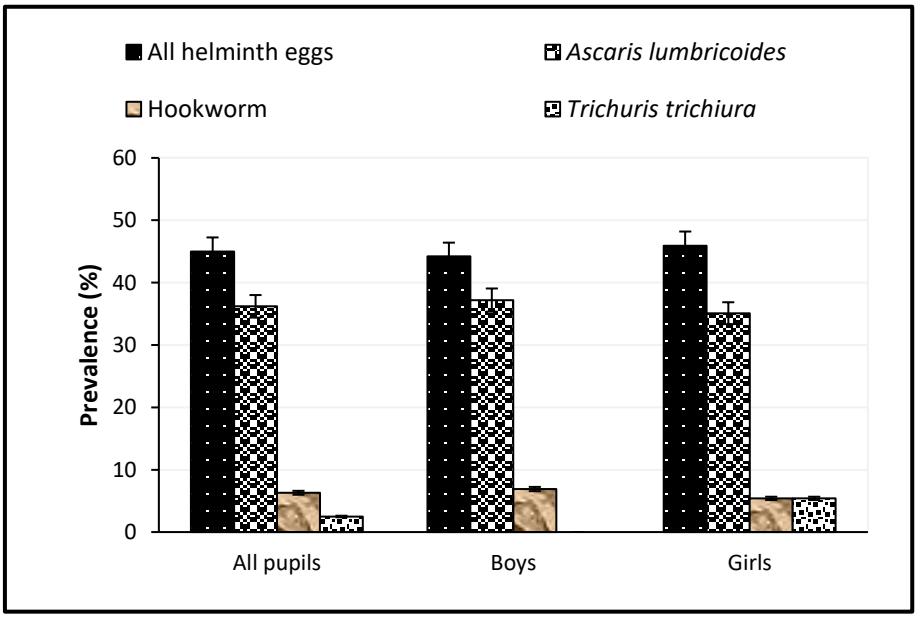


Figure 5: Prevalence of helminth parasites according to gender. Standard error bars indicate significant differences ($p<0.05$).

Intestinal helminths can be acquired at any age, but young children are more prone to acquire it as a result of their low immune system and lack of good sanitary habits. Anderson *et al.*, 2015; 2013) had stated that children can be infected with hookworms and other parasites as early as 6 months of age. In this study, infants <8year were mostly infected by *Ascaris* species (Figure 6) but there were significant differences in *Ascaris* infections between the three age-groups studied. Only age groups of >8 years had infection with hookworm and *Trichuris* infections, perhaps due to their more adventurist characteristics which could readily expose them to risks of infection. It was observed that those of younger age are usually given more parental attention and therefore may be prevented from playing with older ones. Parasites found in this study can have serious effects on pupils, such as stunting, diminished physical fitness, impaired memory and cognitive functions in the absence of intervention measures (Albonico *et al*., 2006). Furthermore, 45% prevalence of intestinal helminth in this study was above the WHO recommended 20% intervention threshold for introduction of annual mass deworming (Anderson *et al.*, 2015; 2013). If infected pupils continue with open defecation and poor sanitation habits, the prevalence of intestinal parasitism has the potential to remain high.

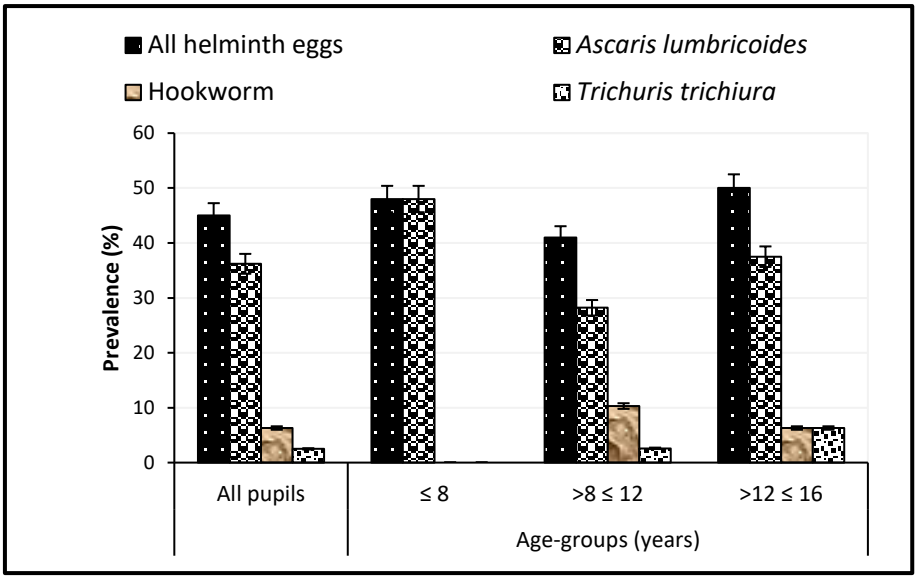


Figure 6: Prevalence of helminth parasites according to age-groups. Standard error bars indicate significant differences ($p<0.05$).

Main occupation of pupils' parents considered in relation to pupils' exposure to intestinal helminth infections were farming, public service, artisans, and trading (Figure 7). There were no significant differences in infection rates of hookworm and *Trichuris* species among children of these parents. Overall prevalence of *Ascaris* infection was significantly higher among children of artisans and public servants (40-44%) than among children of farmers and traders (32-34%). Kamalu *et al*.(2013) posited that parents' educational level may have a major influence on children's behaviour that may bring them closer to risks associated with soil transmitted helminthosis but are of the opinion that parents' educational levels may not entirely protect the adventurous children in areas endemic for soil-transmitted helminth infections.

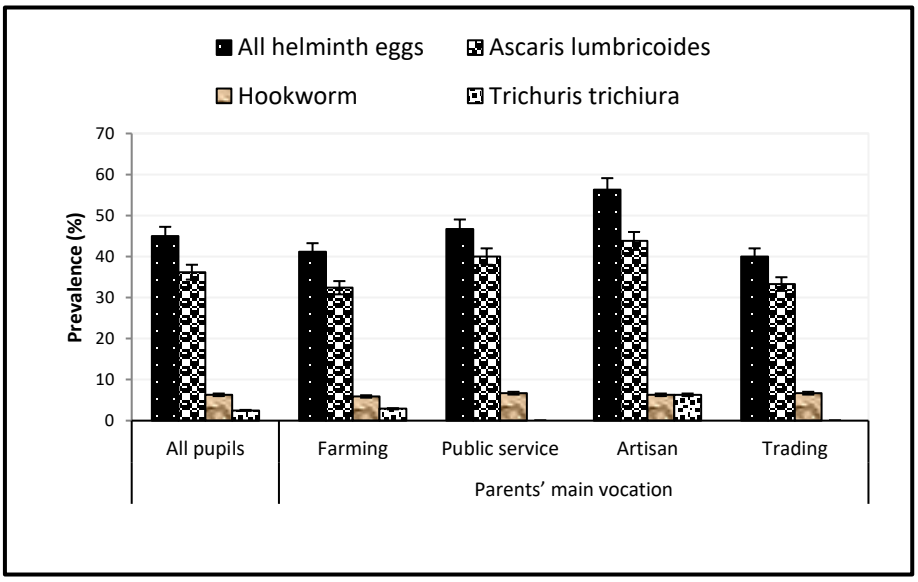


Figure 7: Prevalence of helminth parasites according to parents' main occupation. Standard error bars indicate significant differences ($p<0.05$).

Prevalence of helminth parasites according to toilet facilities available to pupils are shown in Table 8. There was no significant difference in prevalence of *Ascaris* infections between pupils that used any of the options, probably because provision of water closet without piped water in the schools or community could still subject pupils to the use of either pit latrine or open defecation. This situation is similar to what was obtainable in a similar study (Aniwada *et al*., 2016) in rural communities at nearby Enugu State. The higher prevalence of intestinal helminthes obtained in the area was likely due to lack of provision of good water supply in the schools and poor hygiene practice observed among pupils. It is well-known that personal hygiene is a major factor in the transmission of parasitic diseases (Asaolu and Ofoezie, 2003) as was also reported by Chioma *et al*. (2015).

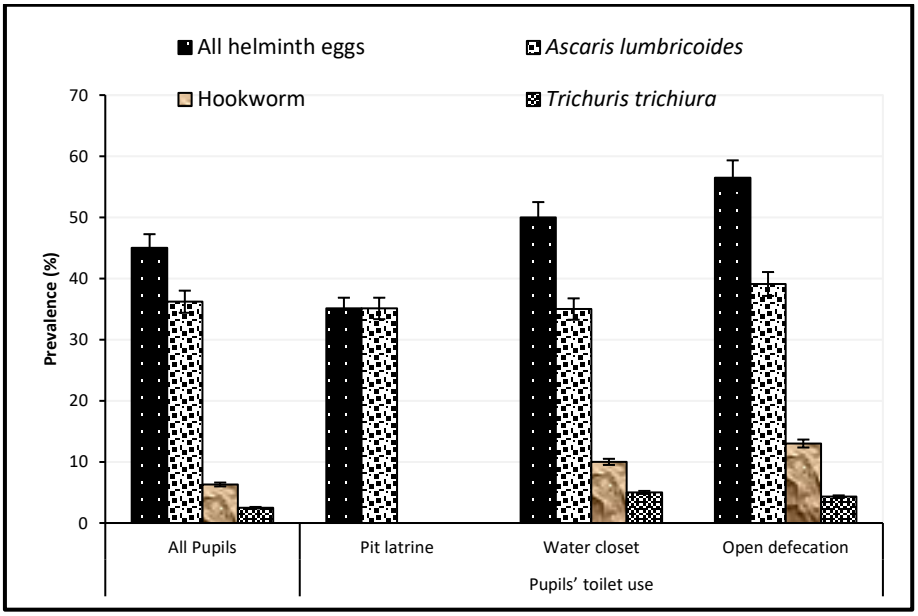


Figure 8: Prevalence of helminth parasites according to toilet use. Standard error bars indicate significant differences ($p<0.05$).

Conclusion

Ascaris lumbricoides, Hookworm, *Trichuris trichiura*, were the commonest intestinal helminths found among pupils in Ebenebe. Inadequate toilet facilities, lack of safe water supply, and poor sanitation are associated risks for intestinal parasitism in the study area. It is recommended that strategic school-based deworming and good hygiene practices will help to prevent infection and re-infection of intestinal helminth infections in the study area.

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