GEOHELMINTHS ASSOCIATED WITH PRIMARY SCHOOL CHILDREN IN EGBEMA, OGBA/EGBEMA/NDONI LOCAL GOVERNMENTAREA, RIVERS STATE, NIGERIA

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Abstract: This study investigated geohelminth infections among 280 primary school pupils in Egbema, Ogba/Egbema/Ndoni LGA, Rivers State, Nigeria. Faecal samples were analyzed at Ignatius Ajuru University using formol-ether and Zinc sulphate (ZnSO4) flotation techniques. Results showed a high prevalence of geohelminth infections, with 199 pupils (71.1%) testing positive. The most common species were Ascaris lumbricoides (16.4%), Enterobius vermicularis (16.1%), Strongyloides stercoralis (13.6%), Trichuris trichiura (12.1%), and hookworm (Ancylostoma duodenale, 12.8%). The total infection count was 491, with a Parasite Mean Intensity (PMI) of 2.5. Prevalence varied across schools, with CPS Okwuzi and CPS Ebocha recording the highest rates (74.3%), followed by CPS Mgbede (68.6%) and CPS Aggah (67.1%). However, chi-square tests found no significant differences. Age-wise, pupils aged 11–13 years had the highest prevalence (85.1%), followed by 8–10 years (67.7%) and 5–7 years (60.2%), with a statistically significant variation (p=0.005). Males exhibited a higher prevalence (75%) than females (64.4%), with chi-square results (p=0.059) indicating a significant gender difference. Risk factor analysis highlighted poor sanitation, unsafe water sources, inadequate hygiene, and lack of footwear. About 45.7% defecated in bushes or rivers, 30.7% relied on borehole water, and 41.4% did not wash hands after using the toilet. Additionally, 51.8% did not wash fruits, and 10.4% never wore footwear. These findings underscore the need for urgent public health interventions to improve sanitation, promote hygiene, and enhance access to safe drinking water in affected communities.

Keywords: parasites, aggah, ebocha, mgebede, okwuzi.

INTRODUCTION

Geohelminths and Their Global Burden

Geohelminths, commonly known as Soil-Transmitted Helminths (STHs), are parasitic nematodes that infect humans primarily through exposure to parasite eggs, such as *Ascaris lumbricoides* and *Trichuris trichiura*, or through direct contact with infective larvae, as seen in hookworms and *Strongyloides stercoralis*. These parasites thrive in the warm, moist soils of tropical and subtropical regions worldwide. STH infections are classified as Neglected Tropical Diseases (NTDs) due to their widespread prevalence and significant public health impact (Utzinger et al., 2012; Pullan et al., 2014). Recent estimates indicate that approximately 819 million people globally are infected with *A. lumbricoides*, 465 million with *T. trichiura*, and 439 million with hookworm. Although often underreported, *S. stercoralis* infections remain a concern, affecting nearly 100 million individuals worldwide. However, there are currently no disability-adjusted life year (DALY) estimates for *S. stercoralis* infections (Pullan et al., 2014).

Factors Contributing to Soil-Transmitted Helminth Infections

The high prevalence of STHs is closely associated with poverty, inadequate environmental hygiene, limited access to clean water and sanitation, poor awareness, and insufficient healthcare resources. Recognizing their impact, the World Health Organization (WHO) identified STHs among the NTDs targeted for elimination by 2020 (WHO, 2012). The 2012 London Declaration reinforced global efforts toward eliminating NTDs, particularly those that can

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be controlled through preventive chemotherapy. Albendazole and mebendazole remain the primary drugs for mass treatment in endemic regions. However, research has shown that STH prevalence often rebounds to pre-treatment levels within six months, primarily due to high rates of re-infection (WHO, 2015). This phenomenon is common in areas where open defecation, poor sanitation, and inadequate hygiene practices persist. To address this, WHO emphasizes that in addition to chemotherapy, sustainable improvements in water, sanitation, and hygiene (WASH) are essential to achieving long-term STH elimination.

Children in developing countries bear the highest burden of STH infections, with prevalence rates ranging between 50% and 80% (Oluwole et al., 2015). This is largely due to their increased exposure to contaminated soil and water through outdoor activities (Escobedo et al., 2008; Wagbasoma et al., 2012).

Environmental and Epidemiological Influences on STH Distribution

Epidemiological studies highlight the influence of environmental and climatic factors, such as humidity and rainfall, on STH transmission. The use of Geographic Information Systems (GIS) and remote sensing technology has provided spatially continuous estimates of climatic variables, revealing that the prevalence of *T. trichiura* and *A. lumbricoides* rarely exceeds 10% in regions where land surface temperatures rise above 38–40°C. Consequently, the highest prevalence of STH infections is observed in equatorial regions of developing countries, where warm, humid conditions promote parasite survival and transmission (Fenwick et al., 2008).

Localized transmission is also significantly affected by sanitation infrastructure, hygiene behaviors, and socioeconomic factors. Age-dependent infection patterns for *T. trichiura*, *A. lumbricoides*, and other nematodes show that peak prevalence typically occurs before the age of five. In areas with low transmission, prevalence remains stable throughout adulthood.

Global Health Impact of Soil-Transmitted Helminths

Helminths, which can be free-living or parasitic, are found in both aquatic and terrestrial environments. Among them, intestinal nematodes—or soil-transmitted helminths (STHs)—are the most prevalent globally, affecting an estimated 819 million individuals with *A. lumbricoides*, 464 million with *T. trichiura*, and 438 million with hookworm. These infections are most common in rural areas characterized by warm, humid climates and poor sanitation.

Of the 5.2 million disability-adjusted life years (DALYs) attributed to STHs, 62% result from hookworm infections, underscoring their significant burden on global public health (London School of Hygiene and Tropical Medicine, 2015). Addressing STH infections requires a multifaceted approach, integrating mass drug administration (MDA), improved sanitation, and enhanced public health education to break the cycle of transmission and reduce infection rates in endemic regions

Helminths: Classification, Transmission, and Global Impact

Helminths are invertebrates characterized by elongated, flat, or cylindrical bodies. They are broadly classified into **flatworms (Platyhelminths)**—which include flukes (trematodes) and tapeworms (cestodes)—and **roundworms (Nematodes)**. Further classification is based on their site of infection, such as **intestinal roundworms** or **lung flukes** (Tukahebwa et al., 2013).

Trematodes (Flukes)

Trematodes are leaf-shaped parasites ranging from a few millimetres to 8 cm in length. Most are **hermaphroditic**, capable of self- or cross-fertilization, except for **schistosomes (blood flukes),** which are the only bisexual trematodes. Schistosomes inhabit blood vessels, where male and female worms live together. Their complex life cycle involves multiple larval stages. Fluke eggs, excreted through feces, urine, or sputum, hatch in aquatic environments, releasing ciliated larvae that infect snail intermediate hosts. Within the snail, they develop into **cercariae**, which re-enter the aquatic environment and penetrate the definitive host, maturing into adults (Tukahebwa et al., 2013).

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Nematodes (Roundworms)

Nematodes have cylindrical bodies and are primarily **bisexual**, requiring copulation for fertilization. Parasitic nematodes lay eggs that contain developing embryos or fully formed larvae. Some species, such as **filariae** and *Trichinella spiralis*, release larvae directly into host tissues. Their life cycle progresses through **egg, larval, and adult stages** (Baron, 2015).

Modes of Helminth Transmission

Helminths infect humans through three primary modes:

1. **Direct Transmission:** Eggs transfer from the anus to the mouth without soil exposure, as seen in **Enterobius vermicularis** (pinworm) and **Trichuris trichiura** (whipworm).
2. **Modified Direct Transmission:** Eggs mature in soil before becoming infectious, as observed in **Ascaris lumbricoides**.
3. **Skin Penetration:** Infectious larvae actively penetrate the skin, as in **hookworms (*Ancylostoma duodenale* and *Necator americanus*)**.

Clinical Manifestations and Diagnosis

Enterobiasis (Pinworm Infection)

E. vermicularis is one of the most common helminthic infections in Western Europe. Female worms lay eggs in perianal folds, leading to **autoinfection** through contaminated hands. Transmission occurs via contact with contaminated surfaces or food. While many cases are **asymptomatic**, common symptoms include **pruritus ani** (itching around the anus). Severe infections may cause **abdominal pain, nausea, and vomiting**. Diagnosis involves the **pinworm paddle** or **tape test**, where adhesive tape is applied to the perianal region at night to capture eggs for microscopic examination (Gill et al., 2011).

Ascariasis (Roundworm Infection)

Infections with *Ascaris lumbricoides* often go unnoticed unless worms are visibly passed in the stool. However, heavy infections can cause **intestinal obstruction, volvulus, or perforation**, accounting for **5–35% of bowel obstructions in endemic regions**. Migrating worms may cause **biliary colic, cholangitis, liver abscess, pancreatitis, or appendicitis**, and in rare cases, worms may be expelled through sputum.

The most frequent clinical manifestation is **Ascaris pneumonitis**, characterized by **fever, cough, dyspnea, and urticaria**, resulting from larval migration through the lungs. **Loeffler's syndrome** describes the condition where larval migration causes eosinophilia and respiratory symptoms, typically resolving within ten days. Diagnosis involves detecting larvae and eosinophils in sputum, chest X-ray findings, and stool microscopy (Gupta et al., 2012).

Hookworm Infections (*Ancylostoma duodenale* and *Necator americanus*)

Although **not endemic in the UK**, hookworm infections are seen in travelers returning from tropical regions. While many patients remain asymptomatic, some experience **abdominal discomfort, flatulence, anorexia, nausea, vomiting, and diarrhea** (which may contain blood and mucus). Chronic infections can lead to **iron deficiency anemia, hypoalbuminemia, and even cardiac failure due to anemia**.

At the site of skin penetration, **"ground itch"** may develop, and in certain cases, **cutaneous larva migrans**, a serpiginous rash, can occur—most commonly associated with **dog or cat hookworms**. Diagnosis includes a **full blood count** (to detect eosinophilia) and **stool microscopy** to identify eggs (Tukahebwa et al., 2013).

Trichuriasis (Whipworm Infection)

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Trichuris trichiura infections are typically asymptomatic. However, heavy infestations may lead to **colitis, dysentery, and iron deficiency anemia**—especially in malnourished children, where it can contribute to **growth retardation**. In severe cases, **rectal prolapse** may occur, though it is rare (British National Formulary for Children, 2015).

Global Burden and Public Health Impact

Helminth infections, particularly **Soil-Transmitted Helminths (STHs)**, remain a significant public health concern. These infections occur through exposure to parasite eggs (*A. lumbricoides, T. trichiura*) or larvae (*A. duodenale, N. americanus, S. stercoralis*), thriving in warm, humid environments (Abe et al., 2019).

STHs are classified as **Neglected Tropical Diseases (NTDs)** due to their widespread prevalence (Pullan, 2014; Abe et al., 2019). Current estimates indicate that:

- **819 million people** are infected with *A. lumbricoides*,
- **465 million** with *T. trichiura*, and
- **439 million** with hookworms.

Although ***Strongyloides stercoralis*** infections are less prevalent, they still affect approximately **100 million people**, mainly in tropical and subtropical regions. However, no specific disability-adjusted life year (DALY) burden has been calculated for this infection (Rogers et al., 2005; Abe et al., 2019).

The high prevalence of STHs is linked to **poor sanitation, lack of clean water, poverty, and inadequate healthcare services** (Albonico et al., 2019). In children, factors such as **poor personal hygiene, unclean nails, lack of handwashing, and exposure to contaminated soil** significantly contribute to infection rates (McCarthy et al., 2016).

Prevention and Control Strategies

Preventing helminth infections requires a **multifaceted approach**, including:

- **Public health education** on hygiene practices such as handwashing, nail trimming, and proper sanitation,
- **Deworming programs** to reduce worm burden and break transmission cycles, and
- **Improving sanitation and clean water access** to prevent soil contamination with helminth eggs (Coordinating Office of the National Surface, 2015).

STH infections persist in areas where **poor waste disposal and hygiene practices** allow parasite eggs to spread. Adult worms residing in the intestine release thousands of eggs daily, contaminating the environment and perpetuating transmission in endemic regions (Ojha et al., 2014).

Addressing helminth infections requires **integrated control measures**, combining **mass drug administration (MDA), hygiene promotion, and environmental improvements** to achieve long-term disease reduction.

Helminth infections can occur through various environmental exposures. Eggs present on unwashed fruits and vegetables may be ingested if they are not properly cleaned, cooked, or peeled. Contaminated water sources also serve as a transmission route, particularly when children play in infected soil and subsequently touch their mouths without washing their hands (Campbell et al., 2016).

Hookworm eggs hatch in soil, releasing larvae that develop into an infective stage capable of penetrating human skin. The primary mode of transmission occurs when individuals walk barefoot on contaminated soil (Qian et al., 2016).

Direct human-to-human transmission does not occur, as fresh feces are not immediately infectious. Helminth eggs require a maturation period of several weeks in soil before becoming infective (CDC, 2020).

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Ascaris lumbricoides, Trichuris trichiura, and hookworm species do not replicate within human hosts; reinfection only occurs through repeated environmental exposure to infective stages. However, Strongyloides stercoralis is unique in its ability to reproduce within the human body, particularly in immunocompromised individuals, which may lead to a life-threatening condition known as hyperinfection syndrome (Genta, 2005).

Soil-transmitted helminths adversely impact nutritional health by depleting essential nutrients from the host. Hookworms, in particular, contribute to chronic intestinal blood loss, which can result in anemia due to iron and protein deficiencies (WHO, 2017). Roundworms may also interfere with vitamin A absorption, and helminth infections in general can suppress appetite, leading to reduced food intake and impaired physical fitness (Ali-SA et al., 2003).

Trichuris trichiura infections can manifest as diarrhea and dysentery, with symptom severity correlating with worm burden. Mild infections are frequently asymptomatic (Ali-IK et al., 2008). Trichuris trichiura, commonly known as whipworm, belongs to the Trichuridae family and is the causative agent of trichuriasis, a Neglected Tropical Disease. This parasite primarily resides in the large intestine and, while often asymptomatic, can cause abdominal discomfort, fatigue, and bloody diarrhea (Hayes et al., 2010; WHO, 2013).

In pediatric cases, Trichuris trichiura infections may impair cognitive and physical development and contribute to anemia due to blood loss. The primary mode of transmission occurs through the ingestion of contaminated food or water. Additionally, exposure to contaminated soil, unwashed vegetables, open defecation areas, or untreated human feces used as fertilizer can facilitate transmission (Hayes et al., 2010; CDC, 2013).

Helminth eggs present in feces can contaminate soil and water, posing a significant health risk, particularly to children who frequently engage in outdoor activities. Trichuris trichiura, residing in the large intestine, can reach lengths of up to four centimeters. Diagnosis of trichuriasis is typically confirmed through microscopic examination of stool samples for the presence of eggs. The disease is classified under soil-transmitted helminthiasis and is recognized as a Neglected Tropical Disease (CDC, 2011).

Preventive measures include thorough cooking of food, regular handwashing with soap before meals and after using the toilet, utilization of improved sanitation facilities, and ensuring access to clean drinking water (CDC, 2011; Ziegelbauer et al., 2012). Severe infections can lead to systemic complications such as fatigue, malnutrition, and impaired growth and development (Brooker et al., 2004). In extreme cases, helminth infections can cause intestinal obstruction, resulting in severe complications such as abdominal pain, constipation, anorexia, vomiting, fever, intestinal perforation, and, in rare cases, mortality (Kliegman et al., 2020).

Strongyloides stercoralis infections can cause dermatological and gastrointestinal conditions and have been associated with chronic malnutrition in children (Maizels et al., 2011). In immunocompromised individuals, this parasite can lead to severe hyperinfection or disseminated disease, which, if untreated, may be fatal (Finney et al., 2007). The parasite is primarily transmitted through fecal contamination of soil, particularly in areas with inadequate sanitation infrastructure (De-Silva et al., 2003).

Several soil-transmitted helminths, predominantly nematodes, are responsible for these infections. The most prevalent species include Ascaris lumbricoides (roundworm), Trichuris trichiura (whipworm), and hookworm species such as Ancylostoma duodenale and Necator americanus (Hotez et al., 2007). Strongyloides stercoralis, another nematode species, infects humans through direct skin contact with contaminated soil or via the gastrointestinal tract. Although many infections remain asymptomatic, some individuals may develop cutaneous, pulmonary, or gastrointestinal symptoms (Al-Hasan et al., 2007).

Strongyloidiasis, caused by Strongyloides stercoralis, affects an estimated 30 to 100 million people globally, though the actual burden of the disease is often underestimated. Infection severity varies, ranging from mild cases to chronic strongyloidiasis. In immunocompromised individuals, the uncontrolled proliferation of the parasite can lead to a fatal outcome, with disseminated disease exhibiting an 85% mortality rate (Keiser et al., 2012; Schar et al., 2013). Strongyloides species are naturally found in primates, dogs, and humans and are endemic to tropical and subtropical climates, although transmission also occurs in temperate regions with inadequate sanitation.

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In certain regions of Africa and Papua New Guinea, human infections are attributed to Strongyloides fuelleborni and Strongyloides fuelleborni kelleyei, parasites that primarily infect non-human primates. However, in Papua New Guinea, no animal host has been identified (Viney and Lok, 2007). Strongyloides stercoralis is distinct among human-infecting nematodes due to its ability to undergo a free-living reproductive cycle in the external environment, where larvae excreted in feces develop into adults capable of producing infective larvae. This heterogenic developmental pathway amplifies the number of infectious larvae present in contaminated environments (Schar et al., 2013).

Helminthiasis, including ascariasis, trichuriasis, and hookworm disease, remains widespread in low-income countries due to inadequate sanitation, poverty, and environmental conditions conducive to parasite transmission. More than a billion individuals worldwide are infected with at least one of these parasites, with the highest disease burden in sub-Saharan Africa, where poverty and limited access to sanitation facilities exacerbate transmission (De-Silva et al., 2003). These infections constitute a major public health challenge in affected regions.

The World Health Organization (WHO) estimates that approximately 1.5 billion individuals, constituting 24% of the global population, are infected with soil-transmitted helminths (STHs), with around 300 million cases leading to severe morbidity (WHO, 2007a). In 2010, it was estimated that 438.9 million individuals were infected with hookworm, 819 million with *Ascaris lumbricoides*, and 464.6 million with *Trichuris trichiura* (Hotez et al., 2003; NCDC, 2007; Rachel et al., 2007). Notably, *Ascaris lumbricoides* alone accounted for approximately 2,824 deaths, predominantly in Asia. By 2016, one-third of the estimated three billion people subsisting on less than two US dollars per day in developing countries were considered at risk of contracting at least one form of soil-transmitted helminth infection (Rachel et al., 2007; Ngonjo et al., 2007; Hotez et al., 2007).

In sub-Saharan Africa, an estimated 866 million individuals were affected by soil-transmitted helminth infections in 2012. The recorded prevalence rates for hookworm, *Ascaris lumbricoides*, and *Trichuris trichiura* were 13.6%, 13.6%, and 11.6%, respectively (WHO, 2007b). While these infections are more prevalent in rural communities, they also pose significant health risks to individuals residing in urban slums and peri-urban settlements. School-aged children are particularly vulnerable due to behaviors such as walking barefoot, engaging in outdoor activities in contaminated soil, and inadequate hygiene practices. Furthermore, limited access to clean water and healthcare services exacerbates their susceptibility to infection (NCDC, 2007; Asaolu et al., 2002; Miguel et al., 2004).

Soil-transmitted helminths are classified as Neglected Tropical Diseases (NTDs) and remain widespread across Africa, Asia, and Latin America, collectively affecting over 1.5 billion people (Miguel and Kremer, 2004). Among these, *Ascaris lumbricoides* is the most prevalent, infecting approximately 1.2 billion individuals, followed by *Trichuris trichiura*, with 795 million reported cases, and hookworm (*Ancylostoma duodenale* and *Necator americanus*), which affects nearly 740 million people worldwide. The high prevalence of STHs in tropical regions is closely associated with socioeconomic disparities and environmental conditions conducive to their transmission. WHO estimates indicate that approximately 568 million school-aged children reside in high-transmission regions, rendering them particularly susceptible to infection. The situation is further exacerbated by inadequate sanitation infrastructure in many developing nations, where only 33% of the population has access to improved sanitation facilities (WHO, 2007).

Chronic STH infections contribute to significant public health challenges, including school absenteeism, stunted growth, and cognitive impairments, which adversely affect learning capacity, memory retention, intelligence, and reaction time (WHO, 2007). Among school-aged children, these infections are strongly associated with malnutrition, intellectual disabilities, and diminished academic performance, ultimately hindering future economic productivity. Additionally, STH infections may increase vulnerability to other diseases, such as malaria, tuberculosis, and human immunodeficiency virus (HIV). These helminthic parasites derive nourishment and protection from their human hosts, resulting in compromised nutrient absorption, physical weakness, and heightened susceptibility to disease.

In light of these concerns, the present study aims to investigate the prevalence of geohelminth infections among students in public schools located in Okwuzi, Mgbede, Aggah, and Ebocha, within the Egbema region of the Ogba/Egbema/Ndoni Local Government Area of Rivers State.

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MATERIALS AND METHODS

Study area

This study was conducted in four primary schools in Egbema, Ogba/Egbema/Ndoni Local Government Area, Rivers State, Nigeria. The geographical coordinates of Ogba/Egbema/Ndoniare latitude:5.3383^0 N, longitude: 6.6533^0 E. the Local Government Area has an area mass of 1.621km^2 and a population of 275,000 (National Bureau of Statistics, 2010). The study area experiences periodic flooding and high rainfall between April and October annually and is naturally endowed with tropical rain forest and many mangrove swamps. The socioeconomic classes of the people comprise farming, fishing, civil servants, oil and gas industrial work, transportations, other contemporary Businesses while some others are become self-employed. Most of the farmers are still seen walking to their farmlands bare footed with their children. Ogba/Egbema/Ndoni is bordered by Imo state, Delta state, and Anambra State (Okoh et al., 2021).

The coordinates of each of the schools are given as follows: Community Primary School (CPS) Okwuzi (Lat 5.4755215, Long 6.7213034), Community Primary School (CPS) Mgbede (Lat. 5.4670024, Long. 6.7259852), Community Primary School (CPS) Aggah (Lat. 5.4749894, Long. 6.7373393) and Community Primary School (CPS) Ebocha (Lat. 5.4620911 and long. 6.6992367).

Collection of samples

Stool samples were collected from a total number of 280 pupils (70 from each school), and this comprise of 176 males and 104 females (the number of males varies slightly in three of the schools compared to the number of females). Each pupil was given a clean, dry, sterile, transparent universal plastic sample bottle with a stool collection kit as prescribed by (Daleet al., 2023). The stool sample in the specimen bottle was collected from the students, properly designated, and transported to the biology research laboratory, Ignatius Ajuru University of Education Rumuolumeni, Port Harcourt within 2 hours of collection for parasitological analysis. The collection was done over a period of 11weeks from the month of October to December 2023.

Parasitological examination of the samples

The stool samples were collected from the pupils and analysed macroscopically for the presence of the adult worms, egg, larva, and mucus and microscopically using the formol-ether sedimentation and zinc sulphate ($ZnSO_4$) flotation method.

Formol-ether sedimentation method:

3 grams of each faecal sample was carefully emulsified (in a stable suspension form) in a test tube containing 5ml of normal saline and then centrifuge at 3000 revolutions per minute (rpm) for 5 minutes, after which the supernatant was discarded. This process was repeated severally as to obtain a clear supernatant. 7ml of 10% formal saline was later added to the solution and thoroughly mixed before adding 3ml of ether. The mixture was then covered, shaken vigorously and centrifuge at 3000 revolutions per minutes (rpm) for 3 minutes. The supernatant was again discarded. A drop of Lugol's iodine was then added and covered with a cover slip. Parasitological examination was performed under a light microscope using 10x and 40x objectives lens for the presence of eggs, cysts, ova of helminths egg.

Zinc sulphate ($ZnSO_4$) floatation method

The test tube was filled to one quarter with Zinc Sulphate solution. An estimated 2 grams of faecal sample was introduced into the test tube using a spatula and emulsified until a solution was obtained. The test tube was filled with the Zinc Sulphate solution and was mixed properly. The faecal suspension was strained to remove large faecal particles. The suspension was returned to the tube and kept in a completely vertical position in a rack. With the use of a hand pipette more Zinc Sulphate solution was carefully added until the test tube was filled to the brim. A clean (grease-free) cover slip was gently placed on top of the test tube and care was taken not to trap air bubbles. The experiment was left to stand for between 30-45 minutes in order to give time for the cysts and eggs to float. After

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the expected time, the cover glass was carefully lifted from the test tube by a straight pull upwards. The cover slip was placed downward on a microscope slide and viewed under the 4x, 10x and 40x objective lenses.

Isolation and identification of geohelminths

To achieve this objective, the samples was examined for the presence of helminthic eggs, larva, segments due to the intermittent shedding of eggs and or larva and even the adult worms. Several samples were collected over the estimated period and analysed. Fresh faecal specimen of approximately large teaspoonful amounted or about 10ml of liquid stool sample was taken the laboratory within 2hours of being collected. Cross section examination of the specimen was examined for the colour, consistency, (formed/semi-formed/unformed/watery) presence of worm or segments, presence of pus or blood etc. Direct microscopy was made for a smooth thin preparation (with saline and iodine) and covered with a cover glass in unformed specimens, specimen which contain blood and mucus was not added with saline when making the smear but was covered with cover glass then examine the preparation under microscope to identify any larva, or helminthes eggs, it was carefully observed for their shape, size, bile staining, etc. example of *A. lumbricoides* are bile stained while those of other STHs are not. Fertilised eggs of *A. lumbricoides* are rounded. 45 to 75ɥm long and have a thick shell with an external mamillated layers, sometimes, the outer layer is somehow absent. The eggs of *Ancylostoma* and *Necator* cannot be differentiated microscopically the eggs are thin shelled, colourless measures 60 - 75× 20 - 25ɥm. (CDC, 2016). T. *trichura* eggs are 50 - 55× 20 - 25, thick shell barrel- shaped and have a pair of polar "plug" at each end (Cheebrough, 2009). S. *stercoralis* unsheathed larva measuring 200 - 250 ɥm ×16 ɥm are observed, they are typical rhabditiform, large bulbed oesophagus (Cheesbrough, 2009).

School/community-related prevalence

This objective was achieved via the stool samples which was collected from male and female students from the four primary schools in Okwuzi, Mgbede, Aggah, and Ebeocha which was examined using the formol-ether and Zinc sulphate ($ZnSO_4$) floatation methodsof parasites concentration. In the end the prevalence rates in relation to schools was calculated thus: the total number of positive samples was divided by the total number of samples examined and multiplied by 100.

Age-group related prevalence

This objective was achieved by visitation to the rivers and/streams close to the schools within the study area and some snails which are intermediate host was handpicked, properly designated and was brought to the biology laboratory for identification by the professionals in the field. Also, the distance of the water bodies (rivers/streams/pounds etc) from the school was also measured and recorded.

Risk factor analysis

To achieve these objective, well-structured questionnaires was developed and administered to the volunteer respondents after the project supervisor has verified it. The information inherent in the questionnaire was designed to reflect information such as age, sex, hygiene habits, sources of drinking water, types of toilet system, knowledge of geohelminths and related ones. However, for confidentiality's sake, personal identifiers such as names, phone numbers, house address etc was not taken

Identification of the geohelminth parasites.

Identification of the parasites from the samples was done using the morphology of the organism in the atlas of Medical Helminthology and Protozoology after Chiodini et al., (2001) and Medical Parasitology by Arora and Arora (2010).

RESULTS

Overall prevalence

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The graphical illustration in the adjoining page, presents the prevalence of geohelminth infection among a sample of 280 individuals (pupils). Out of the total examined, 199 individuals tested positive, representing 71.1% of the sample. In contrast, 81 individuals tested negative, accounting for 28.9% of the sample. This distribution indicates a high prevalence of the condition within the studied population, with more than two-thirds of the individuals affected. This data underscores the significance of addressing the condition in this population due to its substantial occurrence (Fig. 4.1).

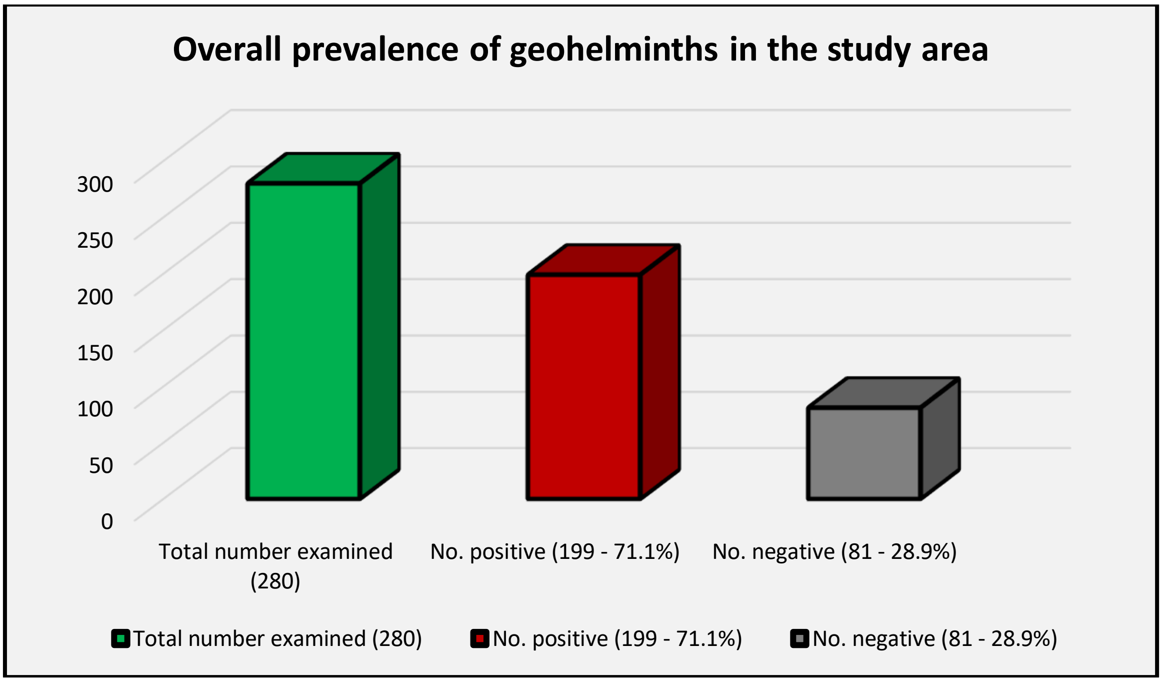

Fig. 4.1: Overall prevalence of geohelminths from the four public primary schools in the study area

Types/species of geohelminths

In the adjoining table, findings fromthe study presents data on various species of geohelminths encountered among the 280 examined subjects. The data reveals that *Ascaris lumbricoides* was the most frequently identified parasite, with 46 positive cases, representing 16.4% of those examined, and a frequency (Freq.) of 96, yielding a Parasite Mean Intensity (PMI) of 2.1. *Enterobius vermicularis* followed closely, with 45 positive cases (16.1%), a frequency of 85, and a PMI of 1.9. *Strongyloides stercoralis* was found in 38 subjects (13.6%) with a frequency of 72 and a PMI of 1.9. *Trichuris trichiura* was identified in 34 subjects (12.1%), showing a notably higher frequency of 184 and a PMI of 5.4, indicating a relatively higher infestation intensity. *Ancylostoma duodenale* was present in 36 cases (12.8%) with a frequency of 54 and a PMI of 1.5. Overall, the total number of positive cases across all species was 199, accounting for 71.1% of the examined population, with a cumulative frequency of 491 and an average PMI of 2.5. This comprehensive data highlights the prevalence and distribution of geohelminth infections in the studied cohort (Table 4.1).

Table 4.1: Types/species of geohelminths encountered in the study.

Types/species of parasites	No examined	No positive (%)	Freq.	PMI
A. lumbricoides	280	46 (16.4%)	96	2.1
E. vermicularis	280	45 (16.1%)	85	1.9
S. stercoralis	280	38 (13.6%)	72	1.9
T. trichiuria	280	34 (12.1%)	184	5.4
A. duodenale	280	36 (12.8%)	54	1.5
Total	**280**	**199 (71.1%)**	**491**	**2.5**

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School/community related prevalence

Table 4.2 illustrates the prevalence of geohelminth infections across four different schools/communities, with a total of 280 subjects examined. The data indicates that at CPS Okwuzi, 70 individuals were examined, and 52 tested positive (74.3%), while 18 tested negative (25.7%). Similarly, at CPS Mgbede, 70 individuals were examined, with 48 positive cases (68.6%) and 22 negative cases (31.4%). At CPS Aggah, 70 individuals were examined, showing 47 positive cases (67.1%) and 23 negative cases (32.9%). CPS Ebocha also had 70 individuals examined, with 52 testing positive (74.3%) and 18 testing negative (25.7%). Overall, out of the 280 individuals examined across all communities, 199 tested positive (71.1%) for geohelminth infections, while 81 tested negative (28.9%). The chi-square test results indicate that the differences in prevalence among the schools/communities are not statistically significant (p=0.695).

Table 4.2. School/community-related prevalence (X^2=1.441, d.f =3, P=0.695; statistically not significant)

School/community	Number examined	Number +ve (%)	Number -ve (%)
CPS Okwuzi	70	52 (74.3%)	18 (25.7%)
CPS Mgbede	70	48 (68.6%)	22 (31.4%)
CPS Aggah	70	47 (67.1%)	23 (32.9%)
CPS Ebocha	70	52 (74.3%)	18 (25.7%)
Total	**280**	**199 (71.1%)**	**81 (28.9%)**

Age-group related prevalence

The table that follows presents the prevalence of geohelminth infections across three age groups within a total sample of 280 individuals. For the 5-7 years age group, 93 subjects were examined, with 56 testing positive (60.2%) and 37 testing negative (39.8%). In the 8-10 years age group, also comprising 93 subjects, 63 were positive (67.7%) and 30 were negative (32.3%). The 11-13 years age group, consisting of 94 subjects, showed the highest prevalence, with 80 positive cases (85.1%) and 14 negative cases (14.9%). Across all age groups, the overall prevalence was 71.1%, with 199 positive cases and 28.9%, with 81 negative cases. The chi-square test results (p=0.005) indicate that the variations in prevalence among the different age groups are statistically significant, highlighting a notable correlation between age and the prevalence of geohelminth infections (Table 4.3).

Table 4.3: Age-grouprelated prevalence (X^2=14.838, d.f = 2, P= 0.005, statistically significant)

Age group	No. examined	No. positive (%)	No. negative (%)
5-7	93	56(60.2%)	37 (39.8%)
8-10	93	63 (67.7%)	30 (32.3%)
11-13	94	80 (85.1%)	14 (14.9%)
Total	280	199 (71.1%)	81 (28.9%)

Sex-related prevalence

The table that follows provides data on the prevalence of geohelminth infections based on sex among a sample of 280 individuals. Of the 176 males examined, 132 (75%) tested positive for geohelminth infections, while 44 (25%) tested negative. Among the 104 females examined, 67 (64.4%) were positive and 37 (35.6%) were negative. Overall, the total prevalence of geohelminth infections in the sample was 71.1%, with 199 individuals testing positive and 28.9% (81 individuals) testing negative. The chi-square test results (P=0.059) suggest that the difference in prevalence between males and females is statistically significant, indicating a potential correlation between sex and the likelihood of geohelminth infections (Table 4.4).

Table 4.4: Sex-related prevalencen=280(X^2= 3.557, d.f = 1, P= 0.059) (statistically significant)

Sex	Number examined	Number positive	Number negative
Male	176	132 (75%)	44 (25%)

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Female	104	67 (64.4%)	37 (35.6%)
Total	**280**	**199 (71.1%)**	**81 (28.9%)**

Risk factor analysis

The adjoining table assesses various risk factors for geohelminth infections among 280 individuals, examining their toilet systems, water sources, hygiene practices, and frequency of wearing footwear. The data reveals that 32.8% of the individuals use pit toilets, 21.4% use water closets, and 45.7% resort to bush or river for sanitation. Regarding water supply, 30.7% rely on borehole water, 24.3% use sachet water, 19.6% depend on rainfall water, and 25.4% source their water from rivers or streams. Handwashing practices after using the toilet show that only 23.6% always wash their hands, 41.4% do not, and 35% do so sometimes. When it comes to washing fruits before consumption, 25.4% always wash them, while 51.8% do not, and 22.8% only sometimes wash them. Footwear usage patterns indicate that 24.6% always wear footwear, 65% wear it sometimes, and 10.4% never wear footwear. These findings highlight significant variations in sanitation and hygiene practices, which are critical risk factors for geohelminth infections, suggesting areas for potential public health interventions (Table 4.5).

Table 4.5: Risk factors assessment (n=280)

Variables	Frequency	(%)
What type of toilet system do you use?		
Pit toilet	92	(32.8%)
Water closet	60	(21.4%)
Bush/river	128	(45.7%)
What is your source of water supply?		
Bore hole water	86	(30.7%)
Sachet water	68	(24.3%)
Rain fall water	55	(19.6%)
River/stream water	71	(25.4%)
Do you wash your hands after using the toilet?		
Yes	66	(23.6%)
No	116	(41.4%)
Sometimes	98	(35%)
Do you wash fruits always before eating them?		
Yes	71	(25.4%)
No	145	(51.8%)
Sometimes	64	(22.8%)
How often do you wear foot wears?		
Always	69	(24.6%)
Sometimes	182	(65%)
Never	29	(10.4%)

Discussion

The high prevalence of geohelminth infections revealed in this study, with 71.1% of stool samples testing positive, is a significant finding. This result aligns with, and in some cases surpasses, the findings of other researchers in similar fields, particularly within the context of sub-Saharan Africa. Uneke (2010) reported that the prevalence of soil-transmitted helminth (STH) infections among school-aged children in southeastern Nigeria was around 68.4%. This is slightly lower than the 71.1% observed in this study but still indicates a high prevalence. Uneke attributed this high prevalence to poor sanitation, lack of clean water, and inadequate health education, which are consistent with the factors identified in this study.

Similarly, Oyewole et al. (2007) found a prevalence rate of 64.8% among school children in riverine communities. Like our study, this high rate was linked to the environmental conditions that favor the survival and transmission of geohelminths, as well as socio-economic challenges. The slightly lower rate compared to our study could be due to

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differences in environmental and socio-economic conditions between the study areas. Adeoye et al. (2007) reported a prevalence of 57.3% among school children in Lagos. Although this figure is significantly lower than the 71.1% in our study, it still highlights a considerable burden of geohelminth infections. The lower prevalence in Lagos might be attributed to better urban sanitation and health education compared to the more rural or peri-urban settings of our study.

Furthermore, Brooker et al. (2006) conducted a comprehensive review of geohelminth infections across sub-Saharan Africa and found varying prevalence rates, generally ranging from 50% to 70% in school-aged children. The prevalence reported in our study is at the higher end of this range, indicating a particularly severe problem in the studied population. Brooker et al. emphasized the importance of integrated control strategies, including mass deworming, sanitation improvements, and health education. Additionally, Adegoke et al. (2018) found a prevalence rate of 63.5% among school children in Osogbo. Their study highlighted the impact of health education on reducing infection rates, suggesting that comprehensive educational programs can effectively lower the prevalence of geohelminth infections. This finding supports the need for robust health education interventions, as indicated by the high prevalence in our study.

The comparison with these studies reveals that the 71.1% prevalence observed in thisstudy is consistent with, and in some cases higher than, the prevalence rates reported in similar studies. The common factors contributing to these high rates include poor sanitation, inadequate clean water access, lack of health education, and socio-economic challenges. These studies collectively highlight the urgent need for comprehensive intervention strategies to address geohelminth infections. Given the high prevalence observed, immediate and coordinated efforts are necessary to mitigate the impact of geohelminth infections. Effective strategies should include mass deworming programs, improvements in sanitation and water quality, and comprehensive health education campaigns. Investing in infrastructure to provide clean water and adequate sanitation facilities is crucial. Furthermore, combining deworming with nutrition and general health initiatives can address the broader impacts of infections.

Conclusively, the 71.1% prevalence of geohelminth infections observed in this study underscores a severe public health issue that aligns with findings from other researchers in Nigeria and sub-Saharan Africa. Addressing this challenge requires a multifaceted approach, combining deworming, sanitation improvements, and health education to reduce the burden of these infections and improve the health and well-being of affected populations.

The data obtained from types/species of geohelminths presents a detailed picture of the prevalence and intensity of various intestinal parasites in the examined population. *Ascaris lumbricoides* was the most frequently identified parasite, with 46 positive cases, representing 16.4% of those examined. It had a frequency (Freq.) of 96, yielding a Parasite Mean Intensity (PMI) of 2.1. *Enterobius vermicularis* followed closely, with 45 positive cases (16.1%), a frequency of 85, and a PMI of 1.9. *Strongyloides stercoralis* was found in 38 subjects (13.6%) with a frequency of 72 and a PMI of 1.9. *Trichuris trichiura* was identified in 34 subjects (12.1%), showing a notably higher frequency of 184 and a PMI of 5.4, indicating a relatively higher infestation intensity. *Ancylostoma duodenale* was present in 36 cases (12.8%) with a frequency of 54 and a PMI of 1.5. Overall, the total number of positive cases across all species was 199, accounting for 71.1% of the examined population, with a cumulative frequency of 491 and an average PMI of 2.5.

The high prevalence of *Ascaris lumbricoides* is consistent with other studies highlighting its global significance, particularly in regions with inadequate sanitation. According to Brooker et al. (2006), *A. lumbricoides* infections can lead to severe health issues such as malnutrition, intestinal obstruction, and impaired cognitive development. The PMI of 2.1 suggests that infected individuals often harbor multiple worms, which can exacerbate these health problems. Similarly, a study by Nmorsi et al. (2009) in Nigeria supports these findings, emphasizing the importance of improved sanitation and public health measures to control the spread of *A. lumbricoides*.

Enterobius vermicularis, while slightly less prevalent, still represents a significant portion of the parasite burden. This parasite is known for causing perianal itching and discomfort, particularly in children. The PMI of 1.9 indicates a moderate intensity of infection, which aligns with findings from other endemic regions (Hotez et al., 2008). A study by Okpala (2014) in southeastern Nigeria also highlights the prevalence of *E. vermicularis* among schoolchildren, emphasizing the importance of regular screening and treatment in school settings.

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Strongyloides stercoralis, detected in 13.6% of the subjects, is particularly concerning due to its ability to cause autoinfection and chronic infections that can persist for decades. Bisoffi et al. (2013) emphasize the public health challenge posed by *S. stercoralis*, especially in tropical regions. The PMI of 1.9 reflects a moderate intensity but highlights the need for enhanced diagnostic and treatment approaches to manage this persistent threat. A study by Ugbomoiko et al. (2012) in Nigeria discusses the challenges of diagnosing and treating *S. stercoralis* in healthcare settings, underscoring the need for more resources and training.

Trichuris trichiura, with a frequency of 184 and a PMI of 5.4, indicates a high burden of infection. This parasite causes trichuriasis, leading to chronic gastrointestinal symptoms, anemia, and growth retardation in severe cases (Jia et al., 2012). The high PMI suggests that individuals often carry heavy worm burdens, necessitating robust public health interventions. A study by Ekpenyong and Eyo (2008) highlights the significant impact of *T. trichiura* on children's health in rural Nigeria, advocating for mass deworming programs to reduce its prevalence and intensity.

Ancylostoma duodenale, responsible for hookworm infections, was found in 12.8% of the cases with a PMI of 1.5. Hookworm infections are a major cause of iron deficiency anemia, especially in developing countries, as noted by Hotez et al. (2004). The moderate PMI indicates a need for regular deworming and nutritional support to mitigate the adverse effects of these infections (Humphries et al., 2013). A study by Adeoye et al. (2007) emphasizes the role of community health initiatives in reducing the prevalence of hookworm infections in Nigerian villages. Conclusively the data highlights a substantial burden of parasitic infections, with varying degrees of prevalence and intensity among different species. The findings underscore the need for sustained public health efforts, including improved sanitation, health education, and regular deworming programs, to reduce the impact of these infections.
The data presented highlights the prevalence of geohelminth infections across four communities: CPS Okwuzi, CPS Mgbede, CPS Aggah, and CPS Ebocha. Out of the 280 individuals examined across these communities, 199 tested positive for geohelminth infections, resulting in an overall prevalence rate of 71.1%, while 81 individuals tested negative (28.9%). At CPS Okwuzi, 70 individuals were examined, with 52 testing positive (74.3%) and 18 testing negative (25.7%). Similarly, CPS Mgbede had 70 individuals examined, with 48 positive cases (68.6%) and 22 negative cases (31.4%). CPS Aggah also had 70 individuals examined, with 47 positive cases (67.1%) and 23 negative cases (32.9%). CPS Ebocha had the same numbers as CPS Okwuzi, with 70 individuals examined, 52 testing positive (74.3%), and 18 testing negative (25.7%).

The high prevalence of geohelminth infections observed in this study is consistent with other research findings from rural and peri-urban settings in Nigeria, where soil-transmitted helminths are endemic due to poor sanitation and inadequate health education (Ekpenyong and Eyo, 2008; Oyewole et al., 2007). Geohelminths such as *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworms thrive in environments where sanitation is compromised, leading to widespread transmission through contaminated soil, water, and food (World Health Organization [WHO], 2020). The uniform high prevalence rates across CPS Okwuzi, CPS Mgbede, CPS Aggah, and CPS Ebocha suggest that similar environmental and socioeconomic conditions exist across these communities. Factors such as open defecation, lack of access to clean water, and inadequate hygiene practices are likely contributing to the high infection rates (Strunz et al., 2014).

The implications of such high prevalence rates are significant, particularly for school-aged children who are most vulnerable to the adverse effects of geohelminth infections. These infections can lead to malnutrition, anemia, stunted growth, and impaired cognitive development, thereby affecting the overall health and educational outcomes of the children (Brooker et al., 2008). Efforts should be intensified to improve sanitation facilities in these communities. Building latrines and ensuring proper waste disposal can reduce the contamination of soil and water sources (Speich et al., 2016). Community-based health education programs should be implemented to raise awareness about the transmission and prevention of geohelminth infections. Such programs can promote behavior change towards better hygiene practices (Adeniran et al., 2017). Implementing regular mass deworming programs in schools can significantly reduce the burden of these infections and improve children's health outcomes (WHO, 2020). Combining deworming with improvements in sanitation, nutrition, and health education can provide a comprehensive approach to controlling and eventually eliminating geohelminth infections in these communities (Hotez et al., 2008).The study underscores the urgent need for targeted public health interventions to address the high prevalence of geohelminth infections in the studied communities. The uniformity in infection rates across different schools highlights the necessity for a community-wide approach to improve sanitation, health education, and regular deworming programs.

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The study's findings provide valuable insights into the prevalence of geohelminth infections across different age groups among 280 examined pupils. Among 93 subjects in the 5-7 years age group, 56 tested positive (60.2%), while 37 tested negative (39.8%). In the 8-10 years age group, comprising 93 subjects as well, 63 were positive (67.7%), and 30 were negative (32.3%). The 11-13 years age group, consisting of 94 subjects, exhibited the highest prevalence, with 80 positive cases (85.1%) and 14 negative cases (14.9%). Overall, the prevalence across all age groups was 71.1%, with 199 positive cases and 28.9% (81 individuals) negative cases. The chi-square test results (p=0.005) suggest statistically significant variations in prevalence among the different age groups, highlighting a notable correlation between age and the prevalence of geohelminth infections.

These findings resonate with research conducted by Nigerian scholars. Uneke et al. (2007) reported similar age-related variations in geohelminth infection prevalence among school children in Southeast Nigeria. Their study observed higher infection rates among older children, which aligns with the findings of the current study. Additionally, Adeniran et al. (2017) investigated the impact of health education on knowledge and attitudes towards soil-transmitted helminthiasis among schoolchildren in Ibadan, Nigeria. While their focus was on intervention strategies, the study indirectly reinforces the importance of age-specific approaches to tackling geohelminth infections.

International studies also support the observed correlation between age and geohelminth infection prevalence. Brooker et al. (2006) conducted asystematic review that highlighted the vulnerability of school-aged children to soil-transmitted helminth infections, emphasizing the need for targeted interventions in this age group. Similarly, Hotez et al. (2008) underscored the significance of age-related behavioral factors, such as outdoor activities, in increasing the risk of helminth infections among children in various global contexts.

Environmental and socioeconomic factors play pivotal roles in geohelminth infection prevalence, as highlighted by Agi and Okafor (2005) in their study on the epidemiology of intestinal helminthiasis in riverine communities of Nigeria. These factors contribute to the higher prevalence rates observed in certain age groups, reflecting the complex interplay between human behavior, environmental conditions, and health outcomes.

The study's findings on geohelminth infections among the sampled population reveal significant gender differences in infection rates. Of the 176 males examined, 132 (75%) tested positive for geohelminth infections, while 44 (25%) tested negative. In comparison, among the 104 females examined, 67 (64.4%) were positive, and 37 (35.6%) were negative. The overall prevalence of geohelminth infections in the sample was 71.1%, with 199 individuals testing positive and 81 individuals (28.9%) testing negative. The chi-square test results (P=0.059) suggest that the difference in prevalence between males and females is statistically significant, indicating a potential correlation between sex and the likelihood of geohelminth infections.

This observed gender disparity aligns with findings from both local and international studies. Research conducted in Port Harcourt, Rivers State, Nigeria, by Uneke et al. (2007) and Ojurongbe et al. (2014) similarly reported higher infection rates among males compared to females. These studies suggest that males are more frequently engaged in outdoor activities and occupations that increase their exposure to contaminated soil and water, which are primary transmission routes for geohelminths. Such behavioral patterns are not unique to Nigeria; similar trends have been observed in other regions, including East Africa and Southeast Asia, where males are often more exposed to environmental risks due to agricultural and manual labor (Brooker et al., 2006; Hotez et al., 2008).

Environmental and socioeconomic factors also play a crucial role in the prevalence of geohelminth infections. Poor sanitation, inadequate access to clean water, and insufficient health education are common issues in many developing regions, exacerbating the spread of these infections. Agi and Okafor (2005) highlighted that in many Nigerian communities, open defecation and the use of contaminated water sources are prevalent, contributing significantly to the high rates of geohelminth infections. This is corroborated by global studies that emphasize the importance of improved sanitation and hygiene in controlling soil-transmitted helminth infections (Strunz et al., 2014).

The high overall prevalence rate of 71.1% in this study underscores the need for comprehensive public health interventions. Regular deworming programs have proven effective in reducing infection rates and improving the health and educational outcomes of children in endemic areas (WHO, 2020). However, for these programs to be

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sustainable and impactful, they must be coupled with efforts to improve sanitation infrastructure and provide clean water. This approach has been successful in various regions, as noted by Speich et al. (2016), who found that combining deworming with sanitation improvements led to significant reductions in infection rates.

Health education is another critical component of controlling geohelminth infections. Community-based programs that educate individuals about the transmission and prevention of these infections can promote better hygiene practices and reduce risk behaviors (Adeniran et al., 2017). These programs should be tailored to address the specific needs and behaviors of different demographic groups, particularly focusing on the higher-risk behaviors observed among males.

Conclusively, the study highlights a significant gender disparity in the prevalence of geohelminth infections, with males showing higher infection rates than females. This finding is consistent with both local and international research and underscores the need for targeted public health interventions. By addressing the environmental, socioeconomic, and behavioral factors contributing to these infections, health authorities can significantly reduce the burden of geohelminth infections and improve the overall health outcomes of the affected populations.

The findings from this objective presents a comprehensive analysis of various risk factors associated with geohelminth infections among a sample of 280 individuals. These risk factors include sanitation methods, water sources, hygiene practices, and the frequency of wearing footwear.

Sanitation practices

Sanitation practices play a pivotal role in the transmission of geohelminths. The data reveals that 32.8% of the surveyed individuals utilize pit toilets, 21.4% use water closets, and a significant 45.7% resort to using bushes or rivers for sanitation. The latter group is at a higher risk of geohelminth infections due to the direct exposure to contaminated soil and water, which are common transmission routes for these parasites (Bethony et al., 2006; Uneke, 2010).

Water sources

Water source is another critical factor influencing geohelminth infection risk. According to the findings, 30.7% of individuals rely on borehole water, which is generally safer but can still be contaminated if not properly maintained. Additionally, 24.3% use sachet water, 19.6% depend on rainfall water, and 25.4% source their water from rivers or streams. The latter group, sourcing water from rivers or streams, faces a higher infection risk due to the potential contamination of these water bodies with helminth eggs (Strunz et al., 2014; Okpala and Onyenwe, 2019).

Hygiene practices

Handwashing practices after using the toilet are crucial for preventing the spread of infections. The data shows that only 23.6% of individuals always wash their hands post-toilet use, while 41.4% do not, and 35% sometimes do. Inconsistent handwashing practices can significantly contribute to the transmission of geohelminths, as contaminated hands can transfer eggs to the mouth or other individuals (Curtis and Cairncross, 2003; Auta et al., 2013).

Similarly, fruit washing practices also impact infection rates. Only 25.4% of the individuals always wash fruits before consumption, 51.8% do not, and 22.8% sometimes do. Consuming unwashed fruits can lead to ingestion of helminth eggs present on the fruit surface (Hotez et al., 2008).

Footwear usage

The frequency of wearing footwear is another important factor, as geohelminths can penetrate the skin. The data indicates that 24.6% of individuals always wear footwear, 65% sometimes wear it, and 10.4% never wear footwear. Individuals who never or only sometimes wear footwear are at increased risk of infection, particularly with species like hookworm, which can penetrate bare skin (Hotez et al., 2008; Ajero et al., 2008). Conclusively, these findings underscore the importance of improving sanitation facilities, ensuring safe water sources, promoting consistent

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hygiene practices, and encouraging regular use of footwear to reduce the risk of geohelminth infections. Public health interventions should focus on these areas to mitigate infection rates and improve overall health outcomes in the affected populations.

Conclusion

This study of geohelminth infection among the studied population showed that significant number of the samples were infected with different types of geohelminths. The males were more infected than the females while all age brackets and schools/communities showed high rate of infection. The risk factor analysis revealed variations in sanitation, water sources, hygiene practices, and footwear usage. A substantial portion of the population uses inadequate sanitation facilities, such as bushes or rivers, increasing their risk of infection. Water sources also vary, with many individuals relying on potentially contaminated sources like rivers and streams. Hygiene practices, including inconsistent handwashing and fruit washing, further exacerbate the risk. Moreover, a large percentage of individuals do not consistently wear footwear, heightening their susceptibility to skin-penetrating helminths. These findings underscore the urgent need for comprehensive public health interventions to mitigate geohelminth infection rates.

Recommendations

To mitigate the risk of geohelminth infections especially in the study area, several comprehensive public health interventions are recommended. Firstly, improving sanitation facilities is crucial. This can be achieved by developing infrastructure to increase access to improved sanitation options, such as water closets and well-maintained pit latrines, and implementing educational programs to raise awareness about the risks associated with open defecation. Ensuring safe water sources is also essential. Providing safe and treated water through community boreholes or centralized treatment plants, alongside regular monitoring to ensure safety standards, can significantly reduce contamination risks. Promoting hygiene practices, particularly handwashing with soap after toilet use, is vital. This can be facilitated through handwashing campaigns and the installation of handwashing stations in public places and schools, as well as educating communities on the importance of washing fruits and vegetables before consumption. Encouraging consistent footwear usage is another critical intervention. Distributing footwear to vulnerable populations and educating them on the health benefits of wearing shoes can prevent skin-penetrating helminth infections. Finally, integrated public health interventions involving collaboration among government agencies, non-governmental organizations, and community leaders are necessary. Continuous monitoring and evaluation of these programs will ensure their effectiveness and sustainability, ultimately leading to a significant reduction in geohelminth infection prevalence and improved health outcomes for the affected populations.

REFERENCES

1. Adeniran, A. A. (2017). Impact of health education on the knowledge and attitudes towards Soil-Transmitted Helminthiasis among schoolchildren in Ibadan, Nigeria. *Journal of Community Health*, *42*(2), 262-268.
2. Adeoye, G. O., Akinsanya, A., and Adedokun, B. (2007). Epidemiology of intestinal helminthiasis among schoolchildren in Ilie, Osun State, Nigeria. *Nigerian Journal of Parasitology*, *28*(1), 21-24.
3. Agi, P. I., and Okafor, O. (2005). The Epidemiology of Intestinal Helminthiasis in Primary School Children in Riverine Communities of Nigeria. *Journal of Applied Sciences and Environmental Management*, *9*(1), 37-42.
4. Ajero, C. M. U., Ukaga, C. N., and Ebirim, C. (2008). Soil-transmitted helminthiasis among school children in rural communities of Ebonyi State, Nigeria. *Journal of Medicine and Medical Sciences*, *9*(3), 134-139.
5. Albonicco, M., Ramsan, K., Wright V., Jape, K., Haji, H. J., Taylor, M., Savioli, L. and Bickle, Q. (2002). Soil- transmitted nematode infection and Mebendazole treatment in Mafia Island school children. *Annals of tropical Medicine and Parasitology,96*,717-726.
6. Al-hasan, M. N., McCormi, M., and Ribes, J. A. (2007). Invasive enteric infection in hospitalised patients with underlying Strongyloidiasis.*American Journal of Clinical Pathology*. *128*, 622-627
7. Anwuri, N. and Elele, K. (2023). Incidence of intestinal parasites and associated risk factors among primary school pupils in Etche Local Government Area, Rivers state Nigeria. *IAU - Journal of Applied and Environmental Biology, (IAU-JAEB)1*(1), 40-49.

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8. Auta, A., Adewuyi, E. O., and Tor-Anyiin, A. (2013). Health services utilization for childhood illnesses in Nigeria: analysis of the 2011 Multiple Indicator Cluster Survey (MICS-4). *Journal of Public Health and Epidemiology*, *5*(12), 501-507.
9. Baron, S. (2015) Medical Microbiology, *4th Edition. The university of Texas Medical Branch at Galveston*.
10. 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.
11. Biegal, Y., Greenburg, Z. and Ostfeld I., (2000). Letting the patient off the Hook. *The New England Journal of Medicine,342*(22),1658-1661.
12. Bisoffi, Z., Buonfrate, D., Montresor, A., Requena-Mendez, A., Muñoz, J., Krolewiecki, A. J., and Albonico, M. (2013). *Strongyloides stercoralis*: a plea for action. *PLoS Neglected Tropical Diseases*, *7*(5), e2214.
13. Brooker, S. (2006). The co-distribution of *Plasmodium falciparum* and Hookworm among African school children…*Malaria Journal of intensive care medicine.* 5, 99.
14. Brooker, S. J. (2012). The global limits and population at risk of soil transmitted helminths infection in 2010. *Parasites and Vectors,5*, 81.
15. Brooker, S., Hotez, P. J., and Bundy, D. A. P. (2008). Hookworm-related anaemia among pregnant women: a systematic review. *PLoS Neglected Tropical Diseases*, *2*(9), e291.
16. Budke, C. M., Qian, W., Jiamin Q., Zinsstag, and Torgerson, P. R. (2004). Use of Disability Adjusted Life Years in the estimation of the disease burden of echinococcosis for a high endemic region of the Tebotan Plateau. *American Journal of Tropical Medicine and Hygiene*, *71*, 56-64.
17. CDC. (2011). Helminths impact worldwide. *Centre for Disease Control*
18. CDC. (2013). *Trichuriasis* impact worldwide. *Center for Disease Control*
19. Chitsulo, L., Enge, l. D, Montresor, A. and Savioli, L (2000). The global status of schistosomiasis and its control. *Acta Tropica Journal*, *77*(1), 41-51.
20. Concha, R., Harrington, W., Jr. and Rogers, A. I. (2005). Intestinal strongyloidiasis: Recognition, management, and determinants of outcome. *Journal of Clinical Gastroenterology*., *39*, 203–211.
21. Cox, F. E. G. (2002). *History of human parasitology*. Clinical Microbial. Review *15*, 595-612.
22. Crompton, D. W. and Nesheim, M. C. (2022). National Impact of intestinal helminthiasis during the human life cycle. *Annual Review of Nutrition22*, 35-59.
23. Crompton, D. W. T. and Savioli, (2007). Handbook of helminthiasis for public health, Boca Raton: CRC/Taylor and Francis. 362.
24. Curtis, V., and Cairncross, S. (2003). Effect of washing hands with soap on diarrhoea risk in the community: a systematic review. *The Lancet Infectious Diseases*, *3*(5), 275-281.
25. De-Silva, N. R. (2023). Soil transmitted helminths infections; Updating the global picture. *Trends in Parasitology*, *19*, 547-551.
26. Drake, L J. and Bundy, D. A. P. (2001). *Multiple helminth infection in children impact and control. Journal of parasitology122*, 573-581.
27. Drake, L. J., Jukes, M. C. H., Sternberg R. J. and Bundy, D. A. P. (2000). *Geohelminths* Infections (Ascariasis *Trichuriasis* and Hookworm: *Cognitive and developmental Impact. Seminar in paediatric infectious Diseases 11*, 245-251.
28. Ekpenyong, E. A., and Eyo, J. E. (2008). Prevalence of intestinal helminths infections among schooling children in tropical semi-urban communities. *Animal Research International*, *5*(1), 804-810.
29. Escobendo, A. A., Canete, R., and Nunezi, F. A. (2008). Prevalence, risk, and clinical features associated with intestinal parasitic infection in children from San Juan Martinez, Pinar de Rio, Cuba. *West Indian Medical Journal*, *57*, 378–382.
30. Fincham, J. E., Markus, M. B. and Adams, V. J. (2003). Could control of soil transmitted helminthic infection influence the HIV/AIDS Pandemic? *Acta Tropica86*, 315-333.
31. Fletcher, R. H. and Fletcher, S.W. (2005), Clinical epidemiology. *The essentials. 4th edition. Lippincott. Williams, and Wilkins. Philadelphia, Pennsylvania,* USA. 288.
32. Forester, J. E., Scott, M. E., Bundy, D. A. and Golden M. H. (1988). Clustering of *Ascaris lumbricoides* and *Trichuris trichura* infections within households …*Trans. R. Soc. Tropical Medicine andHygiene*. *82*, 282-288.
33. Guyatt, H. (2000). Do intestinal Nematodes affect productivity in Adulthood? *Parasitol Today*. *16*, 153-158.
34. Hayes, K. S., Bancroft, A. J., Goldrick, M., Portmouth, C., Roberts, I. S. and Greencis, R. K. (2010). Exploitation of the intestinal micro-flora by the parasitic nematode, *Trichuris muris*" *Science*, *328*(5984), 1391-1394.
35. Hotex, P. J. and Ferris, M. T. (2006). The anti-poverty vaccines. *Vaccine*. *24*, 5787-5799.

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36. Hotex, P. J., Ottesen E., Fenwick, A. and Molyneux, D. (2006). The neglected tropical disease; the ancient affliction of stigma and poverty and the prospects for their control and elimination. *Advanced Experiment in Medicine and Biology. 582*, 23-33.
37. Hotez, P. J., Bethony, J., Bottazzi, M. E., Brooker, S., and Buss, P. (2005). Hookworm: "The Great Infection of Mankind". *PLoS Medicine*, *2*(3), e67.
38. Hotez, P. J., Brindley, P. J., Bethony, J. M., King, C. H., Pearce, E. J., and Jacobson, J. (2008). Helminth infections: the great neglected tropical diseases. *The Journal of Clinical Investigation*, *118*(4), 1311-1321.
39. Hotez, P. J., et al. (2008). Control of neglected tropical diseases. *New England Journal of Medicine*, *357*, 1018-1027.
40. Humphries, D., Nguyen, S., and Boakye, D. (2013). The promise and pitfalls of mass drug administration to control intestinal helminth infections. *Current Opinion in Infectious Diseases*, *26*(5), 584-589.
41. Jia, T. W., Melville, S., Utzinger, J., King, C. H., and Zhou, X. N. (2012). Soil-transmitted helminth reinfection after drug treatment: a systematic review and meta-analysis. *PLoS Neglected Tropical Diseases*, *6*(5), e1621.
42. Keiser, P. B. and Nutman, T. B. (2004). *Strongyloides stercoralis* is the immunocompromised population. *clinical microbiology Reviews. 17*, 208-217.
43. Le-Hesran, J. Y., Akiana, J., Ndiaye, H. M., Dia, M., Senghor, P. and Konate, L. (2004). Severe malaria attack is associated with high prevalence of *Ascaris lumbricoides* infection among children in rural Senegal. *Transmissions of the royal society of tropical medicine and hygiene,98*(7), 377-399.
44. London school of hygiene and Tropical Medicine. Global Atlas of Helminths infections.
45. Miguel, E, A. and Kremer, M. (2003). Worms identifying impacts on education and health in the presence of treatment externalities. *Econometrica. 72*, 159-217
46. Naish, Y. S., Zhou, X. N. and Utzinger, J. P. (2004). Bayesian geostatistical Modelling of soil transmitted helminths infections in a south India fishing village. *Acta Trop.*, *19*, 177-187.
47. Nmorsi, O. P. G., Kwandu, U. N., and Ebi, E. E. (2009). Parasitic contamination of fruits and vegetables sold at markets in Aba, southeastern Nigeria. *African Journal of Biotechnology*, *8*(16), 3560-3564.
48. Ojurongbe, O., Akinboye, D. O., and Ogiogwa, I. J. (2014). Parasitological and nutritional status of children in semi-urban communities in Port Harcourt, Nigeria. *Journal of Infection and Public Health*, *7*(2), 91-97.
49. Okpala, H. O. (2014). Intestinal helminth infections among schoolchildren in rural and semi-urban communities in Enugu State, southeastern Nigeria. *Nigerian Journal of Parasitology*, *35*(1-2), 1-6.
50. Okpala, H. O., and Onyenwe, E. E. (2019). Geohelminth infection and its association with socio-demographic factors among primary school children in rural communities of Enugu State, Nigeria. *African Journal of Infectious Diseases*, *13*(2), 45-53.
51. Oluwole, A. S., Ekpo, U. F., Karagiannis-Voules, D., Abe, E.M., Olamiju, F.O., Isiyaku, S., Okoronkwu, O., Saka, Y., Nebe, O. J. and Braide, (2015). Bayesian Geostatistical Model-based estimate of soil transmitted helminths infections in Nigeria, including *annual deworming requirement. PLOS Neglected Trop. Disease.*
52. Ottesen, E. A. (2006). Lymphatic filariasis; treatment, control and elimination, *Advanced parasitology,61*, 395-441.
53. Oyewole, F., Ariyo, F., and Awolola, T. (2007). Helminthic reduction with albendazole among schoolchildren in riverine communities of Nigeria. *Parasites and Vectors*, *3*(1), 107.
54. Perera, M., Whitehead, M., Molyneux, D., Weerasooriya M. and Gunatilleke, G. (2007). Neglected patients in Neglected disease? *Qualitative study of lymphatic filariasis. PLOS Neglected Tropical Diseases. 1*, 128.
55. Pullan, R. L., Smith, J. L., Jasrasaria, R. and Brooker, S. J. (2014). Global numbers of infection and disease burden of soil transmitted helminth infections in 2010. *Parasites Vectors*, *7*, 37.
56. Savioli, L, Stansfield, S. and Bundy, D. A. P. (2002). Schistosomiasis and soil transmitted helminth infections; Forging control efforts. *Transactions of the Royal Society of tropical medicine and Hygiene* 96 (6), 577-579.
57. Schar, F., Inpankaew. T., Traub, R. J, Khieu, V., Dalsgaard, A., Chimnoi, W., Chhoun, C., Sok, D., Marti, H., Muth. S. and Odermatt, P (2014). The prevalence and diversity of intestinal parasitic infections in humans and domestic animals in rural Cambodian village. *Parasitological International. 63*, 597- 603.
58. Scott, M. E. (2008). *Ascaris lumbricoides*! A review of its Epidemiology and Relationship to other infections. *Annales Nestle 66*, 7-22.

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59. Speich, B., Croll, D., Fuerst, T., Utzinger, J., and Keiser, J. (2016). Effect of sanitation and water treatment on intestinal protozoa infection: A systematic review and meta-analysis. *The Lancet Infectious Diseases*, 16(1), 87-99.
60. Steinmann, P., Keiser, J., Bos, R., Tanner, M. and Utzinger, J. (2006). Schistosomiasis and Water resources developments: Systematic review. Meta-analysis and estimate of people at risk. *Lancet infectious Diseases 6*, 411- 425.
61. Stephson, L. S., Latham, M. C. and Ottensen, E. A. (2000). Malnutrition and parasitic helminth infections. *Parasitology,121*, 23 – 38.
62. Strunz, E. C., Addiss, D. G., Stocks, M. E., Ogden, S., Utzinger, J., and Freeman, M. C. (2014). Water, sanitation, hygiene, and soil-transmitted helminth infection: a systematic review and meta-analysis. *PLoS Medicine*, *11*(3), e1001620.
63. Tukahebwa, E. M., Magnussen, P. and Madsen, H. (2013). A very high infection intensity of *Schistosoma mansoni*in a Ugandan Lake Victoria Fishing Community is required for association with highly prevalent organ related morbidity. *PLoS Neglected Tropical Diseases*, *7*(7).
64. Ugbomoiko, U. S., Ofoezie, I. E., and Heukelbach, J. (2012). *Strongyloides stercoralis* in rural communities of southeastern Nigeria: a public health concern. *International Journal of Infectious Diseases*, *16*(3), e177-e182.
65. Uneke, C. J. (2010). Soil-transmitted helminth infections and schistosomiasis in school-age children in sub-Saharan Africa: efficacy of chemotherapeutic intervention since World Health Assembly Resolution 2001. *Tanzania Journal of Health Research*, *12*(1), 86-99.
66. Uneke, C. J., Eze, K. O., and Oyibo, P. G. (2007). Soil-transmitted helminth infection in school children in Southeast Nigeria: The public health implication. *Internet Journal of Third World Medicine*, *4*(1).
67. Utzinger, J., Becker, S. L., Knopp, S., Blum, J., Neumayr, A. L., Keiser, J. and Hatz, C. F. (2012). Neglected tropical diseases: Diagnosis, clinical management, treatment and control. *Swiss Medical Weekly*, *142*, 13727.
68. Wagbasoma, V. A. and Aisien, M. S. O. (2005). Helminthiasis in selected children seen at the University of Benin Teaching hospital, Benin City. *Nigeria Postgraduate Medical Journal*, *12*, 25–27.
69. WHO (2005). Preventive chemotherapy in Human Helminthiasis; coordinated use of anthelminthic drugs interventions; a manual for health professionals and programme managers, 2006. helminthiasis chemotherapy, *World Health Organization*
70. WHO (2012). A Roadmap for Implementation Acceleration work to overcome the Global impact of Neglected Tropical Diseases: *World Health Organization: Geneva, Switzerland*,
71. World Health Organization (2012). A Roadmap for Implementation: Accelerating Work to Overcome the Global Impact of Neglected Tropical Diseases. World Health Organization: Geneva, Switzerland.
72. World Health Organization (2015). Water Sanitation and Hygiene for Accelerating and Sustaining Progress on Neglected Tropical Diseases: A Global Strategy 2015–2020. World Health Organization: Geneva, Switzerland.
73. World Health Organization (WHO). (2020). *Soil-transmitted helminth infections*. WHO fact sheet.
74. Zie gelbauer, K., Spiech, B., Mausezahl. D., Boss., R., Keiser, J. and Utzinger, J (2012). Effect of sanitation on soil transmitted helminth infection; *systematic review and mata-analysis' PLOS medicine*, *9*(1).

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