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# EPIDEMIOLOGY OF ENTEROBIASIS AMONG UNDERGRADUATE STUDENTS OF IGNATIUS AJURU UNIVERSITY OF EDUCATION, RUMUOLUMENI, PORT HARCOURT, RIVERS STATE, NIGERIA

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**Abstract**
This research on the epidemiology of enterobiasis among undergraduate students of Ignatius Ajuru University of Education (IAUE), Rumuolumeni, Port Harcourt, Rivers state, Nigeria was conducted over eight weeks from June to August 2022. Faecal samples were collected from a total of 46 undergraduate students (14 males and 32 females) and examined in the biology laboratory at Ignatius Ajuru University of Education, using the formol ether sedimentation and zinc sulphate floatation methods for parasite detection. 23.9% samples were positive for *Enterobius vermicularis*, while 35(76.1%) were not found with the parasite. The result also showed that 9(28.1%) females were infected more than males 2(14.3%). Chi-square statistics showed that the relationship between sex and infection is not significant ($p>0.05$). The four hostels sampled showed the following infection rates which are outlined in descending order as follows: Hostel E - 37.5%(6/16), Hostel D - 14.3%(2/14), Hostel G - 20%(2/10) with Stella Hostel showing the least infection rate of 10%(1/6). The relationship between hostels and infection is statistically non-significant ($p=0.458$). Finally, the risk factor assessment shows that 35(76.1%) wash their hands before eating any type of food, 36(78.3%) wash their hands after using toilet facilities, 20(43.5%) suck their fingers sometimes, 20(43.5%) trim their fingernails with their teeth, 38(82.6%) bath at least 2 times daily while only 21(45.6%) wash their beddings every week. This study has provided insight into the Enterobiasis infection rate among undergraduate students in the institution. It is therefore recommended that school authorities should make provision for intensive periodic deworming exercises and also create awareness of the health implications of this enterobiasis (pinworm) infection to promote sound public health.

**Keywords:** Epidemiology, Enterobiasis, Undergraduate, University, Rivers State, Nigeria

## Introduction

Enterobiasis is a nematode infection caused by the pinworm *Enterobius vermicularis.* Its principal mode of transmission is direct contact between the infected and uninfected person (Fan et al., 2021), It is one of the most common human parasitic helminths and about 200 million people worldwide are infected with children aged 5-10 years old accounting for over 30% of cases (Fan et al., 2021). Regardless of one's particular socioeconomic level, race, or culture, pinworm infection can be facilitated by certain factors such as poor personal or group hygiene, and overcrowding in preschools, schools, orphanages, and family groupings (Kim et al., 2013). These conditions favour pinworm eggs transmission from person to person, directly via the anus-to-mouth route and finger contamination or indirectly by contaminated objects, e.g., toys, classroom tables, chairs, or the ground (Bukhart & Bukhart, 2015). Since personal hygiene and exposure are important transmission factors, preschool-aged children (PSC) who live in crowded environments such as kindergartens are the most common group susceptible to pinworm infection (Bukhart & Bukhart, 2015). Available evidence has shown that enterobiasis which is often underrated and thought to be restricted to the temperate regions could cause more significant


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morbidity, particularly in the tropics, than previously thought. For example, the pinworm may occasionally cause severe ectopic diseases (extra-intestinal enterobiasis) and other complications in various parts of the body, including enuresis (Culha & Duran, 2006) and urinary tract infections (Siochou et al., 2008).

Enterobius is capable of invading the gastric mucosa with resultant ulcers/haemorrhages, secondary infections and sub-mucosal abscesses, necrosis and nerve injury, which may lead to nervous symptoms, and enuresis (Otu-Bassey et al., 2015). Enterobiasis can cause discomfort such as; scratching around the anus is the major symptom of this disease, unease, anxiety, sleeplessness and stomachache are also seen.

Adult males measure 2 to 5 mm, and females measure 8 to 13 mm. The cecum of the large intestine is the major site for pinworms to live and the gravid female migrates at night to lay up to 15,000 eggs. Ingested eggs hatch in the duodenum, and larvae mature during their migration to the large intestine. In the absence of host autoinfection, infestation usually lasts only four to six weeks. In general, female worms release their eggs on the skin near the anus, and some eggs may detach from the perianal region and lodge on clothing, bedding, and other surfaces such as the ground or tables and chairs (Bukhart & Bukhart, 2015), therefore, children may acquire infection through ingestion of eggs-contaminated foods or inhalation of infective eggs in the dust or retrograde migration of hatched larvae from the anus to the intestines. This infection is more common in temperate than in tropical districts, although recent studies indicated that a prevalence of over 20% is not uncommon in many parts of the world (Kim et al., 2013). Although pinworm infection may be asymptomatic in most patients, some of them may suffer perianal pruritus, insomnia, restlessness, and irritability, particularly in children (Altun et al., 2017). It should be stressed that pinworms may cause serious morbidities such as appendicitis and eosinophilic enterocolitis, and sometimes ectopic infections can result in pelvic inflammatory disease or urinary tract infections in females (Tsai et al., 2018).

The appropriate diagnostic choice is to employ a cellophane tape test or scotch tape method for screening instead of stool examinations since eggs can be detected in only about 5% of faecal samples; in other words, the prevalence of pinworm infection is generally underestimated due to the difficulty of detecting pinworm eggs by stool examinations (Kubiak et al., 2017; Ichiho et al., 2013). Although effective treatment has been established for decades, the control of pinworm infection remains a challenge due to reinfection, incomplete treatment, and its characteristic of easy transmission (Song et al., 2013).The infinitesimal eggs can reach your mouth by polluted water, drink or your fingers. There are effective antihelminth drugs for pinworm infection. The treatment requires a dose of mebendazole. Moreover, albendazole or pyrantel pamoate is an effective drug line. The treatments also require treating proximity families (Karuna & Mahendra, 2018). Increasing personal hygiene such as washing hands before eating or after toilets and cleaning the bedroom, bed, and clothes is preventive control to reduce the risk of recurrence (Fan et al., 2021). Once gulped, the eggs bring forth into the intestine and develop into mature worms inside in fourteen days. Indicator cleanliness is the utmost tactual resource of inhibition. The deceased person's family associates and wardens must preserve. Uncertainty pinworm infections continue to happen; the basis of the contamination must be required and preserved. Friends, school-mates, nearby friends outdoors the household and family associates must measure conceivable foundations of infections (Wang et al., 2010). Respectively diseased person must obtain the suggested two-dose treatments.

In many parts of the world, the prevalence of *E. vermicularis* infections varies between 0.21 and 54.86%. Schoolchildren who live in crowded environments and have poor personal hygiene are the most commonly infected group (Liao et al., 2017). Although various studies have been conducted on the distribution and prevalence of *E. vermicularis* infections in Nigeria, epidemiological information on *E. vermicularis* infections is lacking for several remote regions, especially Nigeria. In the Hostels of most Nigerian schools, there are poor environmental sanitation and a lack of adequate sanitary facilities, which are factors that can contribute to the


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survival and breeding of the parasite. Poor personal hygiene such as not always washing their hands before eating, after visiting the toilet and cleaning the room among these students is also alarming, leading to an increased infectious rate. Due to the recent rapid development and improvements in hygiene, the prevalence of three species of soil-transmitted helminthiases (Ascariasis, Trichuriasis, and Hookworm disease) have decreased to a low level, but the prevalence of *E. vermicularis* infection is still high.

Several studies have been carried out in different parts of the world by different researchers on the prevalence of Enterobiasis and some of their findings have been reported as follows: Karuna & Mahendra (2018), on the Pinworm *(Enterobius vermicularis*) infection among primary level Government School Children of Chhampi, Lalitpur District, Nepal, records that Overall 11(10.28%) enterobiasis prevalence was reported in children including 10.91% male and 9.26% female. Age group 5-7 years was found to be highly infected (4.67%) and there was the absence of enterobiasis among the age group 11-13 years. Otu-Bassey et al., (2011) in their research conducted in Calabar Nigeria on the post-treatment effects of enterobiasis on the occurrence of enuresis among children, report that the overall prevalence of Enterobius infection, anal itching, and enuresis before albendazole therapy were 6.8%, 42.9%, and 35.6% respectively. Although many studies have been done to explore the risk factors for parasitic diseases, less medical attention has been paid concerning *E. vermicularis* infection within the study area. Therefore, the present study was carried out to determine the status of Enterobiasis among undergraduate students in Ignatius Ajuru University of Education, Rumuolumeni, Port Harcourt, Rivers state, Nigeria.

**Materials and Methods**

The study was carried out in Ignatius Ajuru University of Education, Rumuolumeni campus in Obio/Akpor Local Government Area of Rivers State Nigeria. The school (IAUE) was previously known as Rivers State College of Education (C.O.E) from June 1971-October 2009. However, it became autonomous in 2010 as a full-fledged University of Education. The University is located in the Rivers State capital, Port Harcourt metropolis and has three campuses, Rumuolumeni campus, Ndele campus and St John's campus. Geographically, Ignatius Ajuru University of Education (IAUE) Rumuolumeni campus is located at 4.8057$^{o}$ N, 6.9317$^{o}$ E. The Rumuolumeni community plays host to some multinational oil companies. The faecal samples were collected from students in the Rumuolumeni campus of the University. The school's population is currently on the high side with lesser hostel space, this makes students cluster in the hostels especially during examination periods hence increasing the users of the restroom, which is a factor to trigger the transmission rate of some infectious diseases, making it a good source of sentinel survey of the disease. Faecal samples were collected from the undergraduate students who were given properly labelled universal sample bottles after which it was taken to the biology laboratory Ignatius Ajuru University of Education Rumuolumeni for parasitological examination.The collected stool samples were processed and examined using concentration techniques for stool examination as described by Cheesbrough (2006). All faecal samples were initially examined microscopically for colour, odour (offensive or inoffensive), consistency (formed, semi-formed, or watery), and presence of blood, pus and mucus and then microscopically.

Sedimentation method: For this method, the formol ether concentration technique, after Cheesbrough (2006) was used. About 2g of faecal sample was collected with a spatula and introduced into an empty sample bottle, after thorough stirring, with the use of a pipette, 10mls of normal saline was added into the sample bottle and stirred with a glass rod to obtain a faecal suspension. The solution was filtered into a clean and empty sample bottle with a sieve. Another 10 ml of normal saline was added to the filtered sample and stirred till a suspension was obtained. The suspension was filtered for the second time into an empty test tube. 3ml of normal saline was added to the already filtered sample and allowed to stand for about 15 seconds. 3ml of ether was added to the solution and mixed gently. The solution was then centrifuged at 3000 rpm for 5 minutes. The supernatant (top layers of the centrifuged specimen) was carefully decanted after stirring with a glass rod, and the sediment was left. Another 3ml of normal saline only was added to the sediments, stirred with a glass rod, and centrifuged


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again for the second time at 2000 rpm for 3 minutes. The supernatant was carefully decanted like the first time. 1 ml of normal saline was added to the sampled sediment and introduced into a preservation bottle. The final phase involved the examination of the prepared specimen; with a pipette, the specimen was collected and put on a microscope slide. A drop of lugol's iodine was added, covered with a cover slip then viewed under the microscope using the 4x, 10x and 40x objective lenses.

Floatation method: For this method, the Zinc Sulphate floatation technique, after Cheesbrough (2006) was also used. Before the laboratory experiment commenced, the Zinc Sulphate solution was first prepared thus: using the electric weighing scale, 165 grams of Zinc Sulphate salt was measured after which 500 ml of distilled water was added to the salt and mixed thoroughly until homogeneity was achieved. The test tube was filled to one-quarter with Zinc Sulphate solution. An estimated 2 grams of the faecal specimen was introduced into the test tube using a spatula and emulsified until a solution is obtained. The test tube was filled with the Zinc Sulphate solution and mixed well. 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 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 to give time for the cysts and eggs to float. After the expected time, the cover glass was carefully lifted from the test tube by a straight pull upwards. The cover slip was placed down on a microscope slide and viewed under the 4x, 10x and 40x objective lenses.

Determination of risk factors associated with Enterobiasis**:** The consent of the participants (students) was obtained verbally before administering the questionnaire. The questionnaires were well structured, and the contents were verified by professionals to reflect the risk factors such as hand and bedding washing, frequency of bathing, hygiene practices, and other questions associated with the research work. However, for confidentiality's sake, personal identifiers (i.e names, addresses, phone numbers etc.) of participants were not collected.

The *Enterobius vermicularis* parasite was identified on structural and morphometric criteria, (egg and adult) after Cheesbrough, (2006). Data obtained from this research were analysed using simple percentages and summarized into tables and bar graphs. Also, Chi-square statistics in the IBM Statistical Package for Social Sciences (SPSS) was used to test the relationship between variables and a p-value less than 0.05 was considered significant.

**Results**

**Overall prevalence:** The result obtained from this study shows that out of a total of 46 students examined, overall 11(23.9%) undergraduate students were positive for *Enterobius vermicularis* while 35(76.1%) were negative for the parasite under study (Fig. 1.).

**Sex-related prevalence:** The study examined 14 male and 32 female students of the university. The results show that out of the 14 males sampled, 2(14.3%) were found to with *Enterobius vermicularis* parasites while out of the 32 females examined, 9(28.1%) were found to with *Enterobius vermicularis* infection. The relationship between sex and infection was statistically not significant ($p>0.05$) as shown in Table 1.

**Location (Hostel) related prevalence:** Study samples were collected from students in four hostels in the university and examined. The results are reported as follows: from hostel E, 16 samples were collected out of which 6(37.5%) were positive for *Enterobius vermicularis*. From hostel D, 14 samples were collected out of which 2(14.3%) were positive for *Enterobius vermicularis*. From hostel G, 10 samples were collected out of which 2(20%) were positive for *Enterobius vermicularis.* From Stella hostel 6 samples were collected out of


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which 1(10%) was positive for *Enterobius vermicularis.* The relationship between hostels and infection was not significant (p>0.05) (Table 1.).

**Risk factor assessment:** Responses obtained from the questionnaires administered to the respondents show that 35(76.1%) wash their hands before eating any type of food, 36(78.3%) wash their hands after using toilet facilities, 20(43.5%) suck their fingers sometimes, 45(97.8%) trim their fingernails with their teeth, 38(82.6%) bath at least 2 times daily while 21(45.6%) wash their beddings every week (Table 2.).

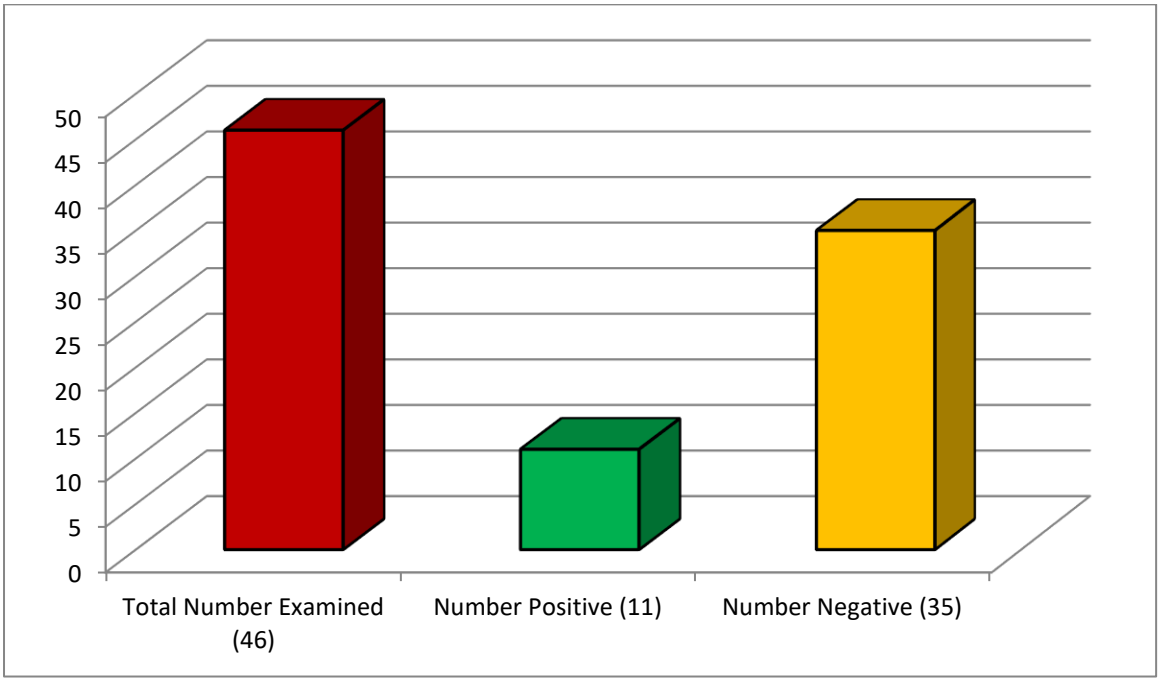


**Fig. 1: Graphical representation of the overall prevalence of *Enterobius vermicularis* infection among undergraduate students in the study area.**

**Table 1. Overall, Sex and Hostel Related Prevalence of *Enterobius vermicularis* infection**

| Parameters | Total No. Examined | No. positive (%) | No. Negative (%) | $\chi^2$ | df | P |
|---|---|---|---|---|---|---|
| **Overall Prevalence** | | | | | | |
| Sample size | 46 | 11 (23.9) | 35 (76.1) | | | |
| Sex Related Prevalence | | | | | | |
| Male | 14 | 2 (14.3) | 12 (85.7) | 1.025 | 1 | 0.311 |
| Female | 32 | 9 (28.1) | 23 (71.9) | | | |
| Hostel (location) Related Prevalence | | | | | | |
| Hostel E (F) | 16 | 6 (37.5) | 10 (62.5) | | | |
| Hostel D (M) | 14 | 2 (14.3) | 12 (85.7) | 2.539 | 3 | 0.458 |
| Hostel G (F) | 10 | 2 (20) | 8 (80) | | | |
| Stella Hostel (F) | 6 | 1 (10) | 5 (90) | | | |


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Key: d.f = degree of freedom, $\chi^2$ = Chi-square, F = female, M = male, p = probability value, % = percentage, No. = Number

**Table 2. Analysis of risk factors of Enterobiasis in the study area (n=46)**

| Variable | No. Examined | No. of +ve respondents (%) | No. of –ve respondents (%) |
|---|---|---|---|
| I wash my hands before eating any type of food | 46 | 35 (76.1) | 11 (23.9) |
| I wash my hands after using the toilet facilities | 46 | 36 (78.3) | 10 (21.7) |
| I suck my fingers sometimes | 46 | 20 (43.5) | 26 (56.5) |
| I trim my fingernails with my teeth | 46 | 45 (97.8) | 1 (2.2) |
| I bath at least 2 times daily | 46 | 38 (82.6) | 8 (17.4) |
| I wash my bedding every week | 46 | 21 (45.6) | 25 (54.4) |

Key: n = sample size investigated, +ve = positive, -ve = negative

**Discussion**

The result obtained from this study shows an overall prevalence of 23.9%(11/46) for *Enterobius vermicularis* while 76.1%(35/46) were negative for the parasite under study. This result is higher than the result of Khazaal et al., (2020) who reported a prevalence of 7.80% in their study titled; Prevalence of *Enterobius vermicularis* among pre-school age and school-age children in Thi-Qar province Southern Iraq, Hussein et al. (2019) who recorded 13.10% prevalence rate of enterobiasis among children in Hivi pediatric hospital. Also, a researcher who reported an overall prevalence of 6.8% in their study carried out in Calabar Nigeria. Some other authors recorded a very prevalence; Dafalla et al. (2017) recorded a prevalence of 0.28% in the United Arab Emirates and Siddig et al., (2017) reported a prevalence of 1.20% in Sudan. However, this result is lower than the results of Al-Waaly et al. (2020) who reported a higher prevalence rate of 41.93% among children in Al-Diwaniyah City, and Hussein and Meerkhan (2019) who recorded a prevalence rate of 25.67% in Duhok city in Iraq.

The study examined 14 male and 32 female students at the university. The results show that out of the 14 males sampled, 14.3%(2/14) were found to with *Enterobius vermicularis* parasites while out of the 32 females examined, 28.1%(9/32) were found positive for *Enterobius vermicularis* infection. There was no significant relationship between sex and Enterobius infection the female showing more infection rate agrees with Al-Taei, (2019) in Babylon province, and Meskin et al. (2019) in Iran. However it disagrees with the research by Al-Waaly et al. (2020) in Al-Diwaniyah City; Chen et al.(2018) conducted in Taiwan, and Fan et al. (2021) in the Marshall Islands. This result may be because more females were sampled and the geographical location of the various studies. It could also be because the males practised better hygiene than the females. Study samples were collected from students in four hostels in the university and examined. The results are reported as follows: from hostel E, 16 samples were collected out of which 6(37.5%) were positive for *Enterobius vermicularis*. From Hostel D, 14 samples were collected out of which 2(14.3%) were positive. From hostel G, 10 samples were collected out of which 2(20%) were found with *Enterobius vermicularis.* From Stella hostel 6 samples were examined out of which 1(10%) was positive. The relationship between hostels and infection was however statistically non-significant. The disparity in the results could be due to the different levels of hygiene practised by residents of the hostels and the different sanitary conditions of the various hostels. The responses obtained from the respondents in the questionnaire for risk factor evaluation show that 35(76.1%) wash their hands before eating any type of food, 36(78.3%) wash their hands after using toilet facilities, 20(43.5%) suck their fingers sometimes, 45(97.8%) trim their fingernails with their teeth, 38(82.6%) bath at least 2 times daily while


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21(45.6%) wash their beddings every week. These varying levels of hygiene and sanitation could be responsible for the sustenance of the parasite *Enterobius vermicularis* in the study area.

**Conclusion**

The findings from this study conducted at this time have shown that the prevalence rate of the pinworm (*Enterobius vermicularis*) was not too high among students in the Ignatius Ajuru University of Education Rumuolumeni campus Port Harcourt, Rivers State Nigeria. It was also established that males were more infected than females and that the parasite is found in residents of all the hostels sampled while also revealing relatively poor hygiene practices among the sampled subjects.

**Recommendation**

Sequel to the findings from this research, it is recommended that effective educational programmes and mass deworming exercises of students in Ignatius Ajuru University of Education Rumuolumeni Port Harcourt, Rivers State, Nigeria should be carried out regularly.

**Conflict of interest**

The authors declare that there is no conflict of interest whatsoever.

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