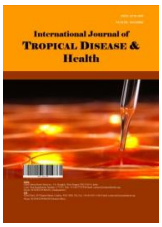

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Prevalence of Helminthiasis and Worm Load among Pre-school Children in Rural Areas of Enugu State

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Authors' contributions

This work was carried out in collaboration among all authors. Authors NCU conceptualized the study. NCU, NNU, and CNO designed the study. All authors contributed to data collection and analysis, writing of the manuscript, and final manuscript review. All authors read and approved the final manuscript.

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ABSTRACT

Background: Globally, many people suffer from parasitic infections of the intestines with up to 24% of the world population are affected. These infections are particularly prevalent in low-and middle-income countries and exist mainly among economically and socially disadvantaged populations. This study sought to establish the current prevalence of STHs among preschool children in rural areas of Enugu State.
Materials and Methods: This was a cross-sectional descriptive study carried out at Obinofia Ndi-Uno and Obe, rural communities of Enugu State, Nigeria. A pre-tested semi-structured interviewer-administered questionnaire and Laboratory kits for stool analysis were used. Data were analyzed using the IBM SPSS statistics version 22.
Results: A total of 589 preschool children (294 from Obinofia Ndi-Uno and 295 from Obe) were studied. Ova of helminths were seen in the stool of 47 preschool children giving a prevalence of 8%

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with ascariasis being the predominant infection.
Discussion: The prevalence of worm infection in this study was low compared to some studies in Nigeria, Africa, and other parts of the world.

Keywords: Prevalence; pre-school children; rural; ascaris lumbricoides; helminthiasis.

1. INTRODUCTION

Worldwide, billions of people suffer from parasitic infections of the intestines with the World Health Organization (WHO) estimating that 24% of the world population are affected [1]. These infections are particularly prevalent in low-and middle-income countries with most infections occurring in the Americas, China and East Asia, and Sub-Saharan Africa. Soil-transmitted helminths (STHs) are now included among the world's neglected tropical diseases (NTDs) as they exist mainly among economically and socially disadvantaged populations [2]. STHs are transmitted by ova present in the feces of man. The main species that infect man includes Ascaris lumbricoides, the hookworms, and Trichuris trichuria [3,4].

The high prevalence of soil-based helminthiasis in low-and middle-income countries can be attributed to several factors such as poverty, poor access to water, inadequate environmental sanitation, ignorance, and insufficient access to good health services [5,6]. This is because the main transmission routes for these parasitic infections include contamination of soil and food, as well as fecal contamination of drinking water. Other factors that are prevalent in endemic areas include malnutrition, poor management of waste products, and overcrowding [7,8,9].

Although STHs can affect people of all ages, the high-risk groups include pregnant women, and preschool and school-aged children [10]. Children under five years are particularly predisposed to heavy infections due to their immature immune systems and habitual play in faecally contaminated soil. Among these young children, the frequency of infection increases with age. WHO estimates that over 267 million preschool and 568 million school children live in places where STHs are strongly transmitted and will need treatment [1]. Although pre-school children, compared to school-age children, are less likely to harbor heavy infections, their worm burdens are housed in smaller bodies, and therefore they are at a higher risk of anemia and malnutrition. Chronic infection of children with these helminths is associated with subpar performance in school, poor growth, anemia, weight loss, delayed puberty, rectal prolapse, dysentery, and absence from schools [11].

Several studies have been carried out to determine the prevalence of helminthiasis in Nigeria [12,13]. However, large prevalence studies in rural areas are still lacking. This study sought to seek the current prevalence and worm load in rural areas of Enugu state with children in these locations being particularly vulnerable.

2. OBJECTIVES

To determine the prevalence of helminthiasis and worm load in pre-school children in rural areas of Enugu State.

3. MATERIALS AND METHODS

3.1 Study Area

Children living in rural areas of Enugu state were studied. Enugu rural areas consist of 14 local government areas (LGAs) – Aninri, Awgu, Ezeagu, Igbo-etiti, Igboeze north, Igboeze south, Isi uzo, Nkanu east, Nkanu west, Nsukka, Oji river, Udenu, Udi, and Uzo uwani. The map of Enugu is shown in Fig. 1.

3.2 Type of Study

This was a descriptive cross-sectional study of eligible preschool children (2-5 years) in rural areas of Enugu State, Nigeria.

3.3 Inclusion Criteria

Children aged 2 – 5 years in selected study areas whom informed consent have been gotten from their guardians were included.

3.3 Exclusion Criteria

Children that were too sick to participate were excluded.

3.4 Sample Size Calculation and Procedure

The minimum sample size to be used for the study was determined by a statistical formula[14] which is sample size (n) = $(Z_{1-\alpha/2})^2 p(1-p)/d^2$ where n = minimum sample size

p = observed proportion from a different study,0.273 (From a different study. [13])
$Z_{1-\alpha/2}$ = Standard normal deviate, 1.96
d = desired precision, 0.05

Therefore, n = $(1.96)^2(0.273)\ (0.727)/\ (0.05)^2$ = 304.

The sample size was increased to 600 to increase the power of the study.

Data was collected over 3 months. A multistage sampling system was used. First, all the L.G.As in Enugu state were grouped into rural and urban L.G.As. Then, the rural L.G.As were listed alphabetically, and two L.G.As (Ezeagu and Nkanu West) were selected through simple random sampling using the ballot method. Next, all the towns in each of the two L.G.As were listed and one town(Obinofia ndi-uno from Ezeagu and Obe from Nkanu West) selected from each L.G.A selected using a simple random technique. Finally, a list of all the nursery schools in the two selected towns and five schools was selected from each town using a simple random technique. Sixty children were selected from each of the 10 selected schools using a simple random technique. Parents of selected children were given consent forms, and the study and its requirements were explained to them in the local Igbo language and English.

3.5 Survey Instruments

These include:

1. Questionnaires (pre-tested in other schools): interviewer-administered to the selected children's caregivers that signed informed consent forms to obtain data on demographic, socio-economic characteristics of the pre-school children. The interview was done during their routine PTA meetings and those who could not attend were interviewed at their homes.

2. Laboratory kit: This included clean Universal bottles for collection of stool samples and Kato-Katz technique kit for stool analysis.

3.6 Data Management and Analysis

All data entry and statistical analysis were performed using IBM Statistical Package for Social Sciences (SPSS) version 22. First, data were checked for wrongly filled information and whether it was normally distributed using frequency counts. Then, the results displayed in frequency Tables and charts as appropriate. Quantitative variables like age were summed up using mean and standard deviation while categorical variables such as sex were summed up using proportions and percentages.

3.7 Estimation of the Intensity of STH Infections and Worm Load

The worm lord and intensity of STH infections were indirectly estimated by counting the numbers of helminth eggs excreted in feces; mean egg concentration in feces was computed, which was generally representative of the worm load. As a result, thresholds in egg concentration were set to define 'light', 'moderate' or 'heavy' infections of each of the three STH species in line with WHO guideline [15].

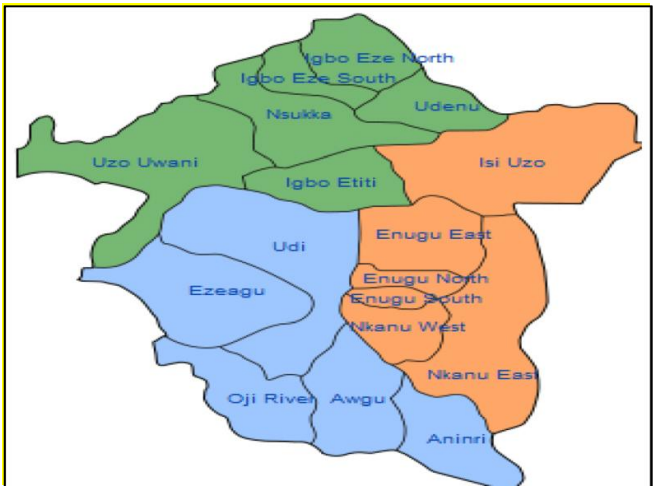

Fig. 1. A map of Enugu showing the 17 local government areas [19]

4. RESULTS

A total of 589 pupils (294 from Obinafio ndi-uno and 295 from Obe) were studied although 600 were selected (300 from each group). Questionnaires were also administered to their caregivers to ascertain socio-demographic characteristics. The mean age of pre-school children was 3.7 years with a standard deviation of 1.03 years. The socio-demographic characteristics of the caregivers are summarized in Table 2.

Ova of helminths were seen in the stool of 47 pre-school children giving a prevalence of 8% with ascariasis being the predominant infection. The prevalence of the other worms is summarized in Table 3. Bivariate analysis showed no association between socio-demographic characteristics of caregivers and prevalence of helminthiasis.

30 of the infected children (64%) of those infected had light infections and 17 (36%) had moderate infection. None of the study participants had heavy infections.

Table 1. Threshold of intensity of infection[15]

STH species	Light	Moderate	Severe
Ascaris Lumbricoides	1-4,999	5,000-49,999	≥50,000
Trichuris Trichuria	1-999	1,000-9,999	≥10,000
Hookworms	1-1,999	2,000-3,999	≥4,000

Table 2. Socio-demographic characteristics of the caregivers of the preschool children

Socio-demographic characteristics	Frequency (%) n=589
Sex	
Male	256 (43.5%)
Female	333 (56.5%)
Tribe	
Igbo	589 (100%)
Others	0 (0%)
Occupation of caregiver	
Farmer	177 (30%)
Artisan	120 (20.4%)
Trader	122 (20.7%)
Civil servant	54 (9.2%)
Others	116 (19.7%)
Educational level of caregiver	
No formal education	16 (2.7%)
Primary	242 (41.1%)
Secondary	271 (46%)
Tertiary	60 (10.2%)

Table 3. Prevalence of Helminthiasis

Soil transmitted Helminth type	Frequency (%), n=589
No STH in stool	542(92%)
Ascaris lumbricoides	28 (4.8%)
Others (Hookworm, Strongyloides Stercolaris)	19 (3.2%)

Table 4. Worm load of the preschool children in the study

Worm load	Frequency, n=589
Light	30
Moderate	17
Heavy	0
No worm seen	542

5. DISCUSSION

This study was done to estimate the prevalence of STHs in the rural part of Enugu state and contribute to the worldwide and local efforts against STHs. It provides the prevalence of these helminths in the rural areas of Enugu state. The findings will be beneficial in the assessment of Neglected Tropical Diseases (NTDs) in Nigeria which usually target pre-school and school children.

The study noted a prevalence rate of 8% for soil-transmitted helminths among pre-school children. This is lower than the prevalence rates noted in some studies in other parts of the country in similar age groups [12,13,16,17]. Ascaris lumbricoides was the most prevalent worm seen in the study with a prevalence of 4.8%.

The low prevalence noticed in this study could be attributed to the recent intensified effort by the government and agencies toward delivery of antihelminthic drugs to children through large-scale interventions, including Maternal, child, and Newborn weeks, and medical missions in different forms.

The ova of soil-based helminths are shed intermittently and not always present in the stool of infected individuals. This is why it is usually recommended that 3 samples are collected from individuals and examined as this can increase the sensitivity of the stool analysis to 99% [18]. However, there was not enough time nor resources to achieve and the true prevalence of helminthiasis is likely going to be higher. Ova of hookworm are particularly sensitive to degeneration which may also explain the low prevalence of that helminth.

STH prevalent studies should be carried out from, time to time, in our rural communities especially among preschool and school-aged populations, and the results from such studies used as a tool for enlightenment program to create awareness among the stakeholders in the community (including the parents, teachers and the policymakers) on ravaging effect of worm infestation, ages infested, need for regular deworming and general nutrition of the children. Where the prevalence is low, they will be encouraged to keep up with the best practices that made it possible.

The study is not without limitations. It was not possible to collect more than one stool sample per participant as already noted earlier. This may have impacted the prevalence of this study as it is low when compared to similar studies already done and the study may have underestimated the true prevalence.

6. CONCLUSION

This study suggests that the prevalence of soil-based helminthiasis in rural areas of Enugu state is low. This may be due to the efforts of the government and other organizations to control STHs in these areas.

AVAILABILITY OF DATA AND MATERIALS

All data used for research is available at the Department of Community Medicine, University of Nigeria library and they are available on request.

ETHICAL APPROVAL AND CONSENT

The study protocol was approved by the Health Research Ethics committee of the University of Nigeria Teaching Hospital, Ituku/Ozalla, Enugu State, Nigeria before the study was started. Approval was also sought and obtained from the Enugu State Ministry of Education and Parent Teacher Association (PTA) of each selected school. The children and their parents were informed about the purpose of the study, the procedures to be undertaken, and the results. Written informed consent was obtained from parents while assent was obtained by the children. Children found to be infected with STHs were treated with suitable anti-helminthics.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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