



## Prevalence and Socio-Demographic Determinants of Ascariasis among Primary School Pupils in Central Nigeria

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### Authors' contribution

This work was carried out in collaboration among all authors. Author HIM designed the study, collected samples, performed laboratory and statistical analyses and wrote the first draft of the manuscript. Authors SBB and IMM designed the study, manage literature searches, wrote the protocols and managed the analyses of the study. All authors read and approved the final manuscript.

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### ABSTRACT

**Aims:** This study was conducted to evaluate the prevalence and socio-demographic determinants of Ascariasis among primary school pupils in Central Nigeria.

**Study Design:** The study was a cross sectional study.

**Place and Duration of Study:** Keffi, Nasarawa State, between March and June 2019.

**Methodology:** 300 stool samples (100 from each of the 3 selected primary schools) were collected from the pupils and information about them were obtained by structured questionnaires. The ova or cyst of *Ascaris lumbricoides* were microscopically detected from the samples using formal-ether concentration technique. Data collected were analysed using Smith's Statistical Package (version 2.8, California, USA) and P value of  $\leq 0.05$  was considered statistically significant.

**Results:** Out of the 300 pupils screened, 49(16.3%) were positive for Ascariasis. Ahmadu Maikwato primary school had the highest prevalence (24.0%) of the infection followed by Nurudeen (19.0%) and Model Science (6.0%) primary schools. Age, gender, location and occupation of

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parents were not significantly associated with the parasitic infection ( $P>0.05$ ). However, the rate of the infection was higher among pupils aged  $\geq 16$  years (33.3%), males (19.4%), from rural areas (19.4%) and whose parents were farmers (21.9%).

**Conclusion:** This study confirms the presence of Ascariasis in the study population. Hence, improved personal and environmental hygiene together with health education and regular deworming of pupils are highly advocated as these will facilitate elimination of the infection in the year 2025 as advocated in the global strategic plan.

**Keywords:** *Ascaris lumbricoides*; ascariasis; prevalence; school-age-children; central; Nigeria.

## 1. INTRODUCTION

*Ascaris lumbricoides* (*A. lumbricoides*), the causative organism for Ascariasis, is one of the most common intestinal helminthic human parasite, infecting about 1.2 billion people worldwide and making it the most prevalent helminthiasis of humans [1,2]. The parasite belongs to genus *Ascaris* of the phylum nematode and causes infection that is common in children of tropical countries due to poor sanitation. This might be because the infection is usually acquired via faecal-oral transmission through ingestion of food, water, or soil contaminated with embryonated eggs of the parasite [1,3].

Infection caused by *A. lumbricoides* is mostly asymptomatic, especially when the number of present worms in the samples is tenuous [2]. However, chronic form of the infection is associated with vomiting worms, bloody sputum, cough, low-grade fever, passing worms in stool, short breath, skin rash, abdominal pain and wheezing. It may also manifest in form of growth retardation, pneumonitis, hepatobiliary and pancreatic injuries and intestinal obstruction [3-5].

Transmission of the parasite particularly among children is associated with them playing on the soil, unhygienic conditions, indiscriminate disposal of wastes and unavailability of portable water supplies particularly in rural settings [6,7]. Accordingly, the infection can be prevented by ensuring that soil is decontaminated and this can be achieved by providing adequate sanitary facilities in communities [3]. The use of untreated human feces as fertilizers should be avoided and public health education should be advocated particularly in rural areas [2].

The persistent burden of Ascariasis is mostly reported among school age children living in developing countries with the prevalence rate ranging between 20% and 50% [8,9]. This burden has negative impacts on nutritional status

of children, including decreased absorption of micronutrients, loss of appetite, weight loss, anemia leading to mental and physical disability, growth retardation [10] and consequently reducing their ability to learn [11].

From the foregoing, it is obvious that the negative effects of Ascariasis particular on school age children can never be over emphasized. Hence, this current study was conducted to evaluate the prevalence and socio-demographic determinants of Ascariasis among primary school pupils in Central Nigeria. The results from this study can be used for control and intervention strategies which may facilitate elimination of the infection in the year 2025 as advocated in the global strategic plan.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

The study was conducted in Keffi Local Government Area of Nasarawa State, Nigeria. Keffi is approximately 68km from Abuja, the Federal Capital Territory and 128km from Lafia, the capital of Nasarawa State. It is located geographically between latitude  $8^{\circ}3'N$  of the equator and longitude  $7^{\circ}50'E$  and situated on an altitude of 850m above sea level [12].

### 2.2 Study Population

The study population comprises of male and female pupils of an average age of 12 years in three (3) selected primary schools in Keffi (Ahmadu Maikwato, Nurudeen and Model Science primary schools) who agreed to participate in the study. Their socio-demographic information was obtained by the use of a designed questionnaire.

### 2.3 Sample Size Determination

The sample size for this study was determined using the formula by Naing et al. [13] for sample size calculation at 0.05 level of precision;

$$n = \frac{Z^2 pq}{d^2}$$

Where:

n = required sample size  
 Z = standard normal deviation at the required confidence interval (1.96) which corresponds to 95% confidence interval.

P = prevalence of Ascariasis from previous study (19.7%) (0.1) [14].

Q = 1 – p = 0.9

d = degree of precision expected (0.05)

$$n = \frac{(1.96)^2(0.1)(0.9)}{(0.05)^2} = \frac{3.8416 \times 0.09}{0.0025} = \frac{0.3457}{0.0025} = 138.3$$

$$n = 138$$

To minimize error, this was however rounded up to 300 samples.

## 2.4 Sample Collection and Transportation

Following the administration of the questionnaire, each pupil was given a 30 ml sterile wide mouth, screw-capped plastic container carrying their identification number and was instructed on how to collect the stool sample in private [15]. A total of 300 stool samples (100 from each of the three selected primary schools) were collected between 10:00 am and 12:00 pm. The samples were transported in a cold box to Medical Laboratory unit of Primary Health Care Kofar Pada, Keffi for analysis.

## 2.5 Parasitological Examination

Microscopic examination of each stool sample for detection of *A. lumbricoides* was performed using formal-ether concentration technique as described by Cheesbrough [15]. In brief, 1 gram of the stool sample was placed in a test-tube and 5 ml of normal saline was added and emulsified thoroughly. It was then centrifuged at 3000 rpm for 3 min and supernatant discarded. The process was repeated until the supernatant was clear. 7 ml of 10% formal-saline was added to the deposit and was mixed thoroughly, 3 ml ether was added and covered with a rubber bank and shaken vigorously and centrifuged at 3000 rpm for 3 min. The supernatant was discarded and the deposit was examined by light microscopy at x10 and x40 magnifications respectively for the presence of ova or cyst of the parasite [15].

## 2.6 Statistical Data Analysis

The data obtained were analyzed using Smith's Statistical Package (version 2.8, California, USA). Chi-square test was conducted at 95% confidence interval and P values ≤ 0.05 were considered statistically significant.

## 3. RESULTS AND DISCUSSION

The negative impact of Ascariasis particularly on school age children can never be over emphasized. This is because their physical and mental health, nutrition and learning ability are affected [11]. This current study was conducted to evaluate the prevalence and socio-demographic determinants of Ascariasis among primary school pupils in Central Nigeria. A total of 300 pupils (100 from each of the 3 selected primary schools) majority of whom were aged 11-15 years (180/300), males (170/300), urban settlers (283/300) and whose parents were businessmen (214/300) were recruited and screened for Ascariasis. From the results of this study, 49(16.3%) pupils were positive for Ascariasis of which 24(24.0%) were from Ahmadu Maikwato, 19(19.0%) from Nurudeen and 6(6.0%) from Model Science primary schools (Fig. 1).

The overall 16.3% prevalence of Ascariasis recorded in this current study was higher than the 6.2% reported among secondary school students in Akwanga [16], 11.75% among primary school pupils in Kebbi State [17], 13.0% and 0.2% among school age children in Lafia and Vom respectively [18,19]. It was however lower than the 28.0% reported among school children in Central Nigeria [20], 51.8% and 67.0% among primary school children in Rivers and Ijebu respectively [21,22]. Additionally, higher prevalence of the parasitic infection has also been reported in other endemic countries such as Sri Lanka (40.2%), Rwanda (44.8%), Ethiopia (61.9%), Sudan (64.4%) and India (75.7%) [23-27]. The observed varying prevalence rates from different studies were possibly impacted by different locations and study population types with different associated risk factors notably level of personal and environmental hygiene [3,6].

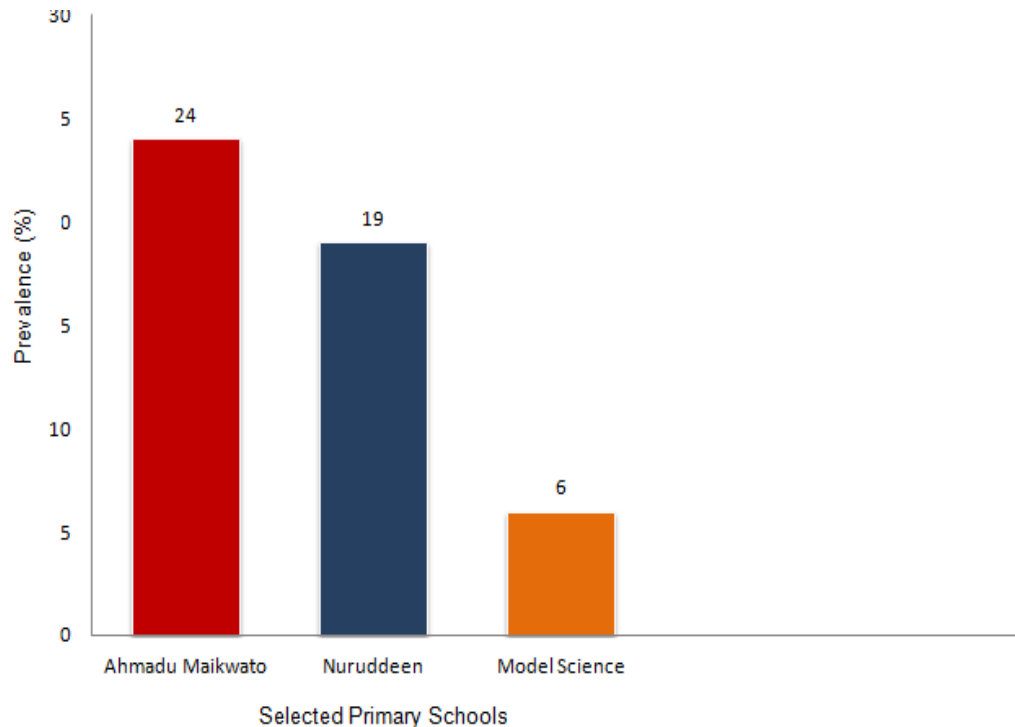
In relation to age of the participants, higher prevalence of the infection was recorded among pupils aged ≥16 years (33.3%) compared to those aged 6-10 years (16.2%) and 11-15 years (14.4%) (Table 1). However, this difference was

not found to be statistically significant ( $P>0.05$ ). This agrees with previous reports of Mamman and Maikenti [16] and Azamu et al. [20] but disagrees with that of Ayuba et al. [14] who reported higher prevalence of the infection among refugees aged <10 years. The higher prevalence observed among pupils aged  $\geq 16$  years in this study may be because children of that age range are more matured and are usually actively involved in outdoor activities such as hawking, fetching water, and farming which may expose them to the parasite.

Similarly, gender was not significantly associated with prevalence of Ascariasis in this study ( $P>0.05$ ). However, male pupils were more infected (19.4%) with the parasite than their female counterparts (12.3%) (Table 1). This is in consonance with the reports of other previous studies conducted in Nigeria and elsewhere [14,17,18,24,25]. This observation is possibly due to the fact that male children engage more in activities such as swimming, farming, playing football which may likely put them at risk of the infection. It may also be as a result of restriction of female children to their homes particularly in this part of the country which may reduce their chances of exposure to the parasite.

Furthermore, we observed that pupils from rural areas in this current study were more infected with *A. lumbricoides* (19.4%) than those from urban areas (15.6%) (Table 1). Although this observed difference was not found to be statistically significant ( $P>0.05$ ), notwithstanding, other previous studies carried out in rural areas also reported higher prevalence of the parasitic infection [1,5,28]. This is expected because most rural areas in Nigeria are attributed to poor sanitary conditions, inadequate or lack of social amenities such as safe water supply and low financial status.

Finally, occupation of parent was also not associated with rate of Ascariasis in this study ( $P>0.05$ ). Nonetheless, pupils whose parents were farmers had higher prevalence of the infection (21.9%) than those whose parents were civil servants (16.7%) and businessmen (15.4%) (Table 1). This observation is in agreement with the report of Azamu et al. [20] who also recorded higher prevalence of the infection among children whose parents/guardians were farmers. This may be because most Nigerian farmers are rural settlers and live in conditions which may put them at the risk of the infection.



**Fig. 1. Prevalence of ascariasis among primary school pupils in North Central Nigeria in relation to schools**

**Table 1. Prevalence and distribution of ascariasis among primary school pupils in North Central Nigeria in relation to socio-demographic factors**

<b>Socio-demographic factor</b>	<b>No. Examined (N=300)</b>	<b>No. Positive (N=36)</b>	<b>Prevalence (%) (Overall=12.0)</b>	<b>P-value</b>
<b>Age (Years)</b>				
6-10	99	16	16.2	
11-15	180	26	14.4	
≥16	21	7	33.3	0.9501
<b>Gender</b>				
Male	170	33	19.4	
Female	130	16	12.3	1.0765
<b>Location</b>				
Urban	238	37	15.6	
Rural	62	12	19.4	1.0043
<b>Occupation of parent</b>				
Farming	32	7	21.9	
Civil service	54	9	16.7	
Business	214	33	15.4	1.0007

#### 4. CONCLUSION

This study reveals the presence of Ascariasis among primary school pupils in the study population which was found to be higher among pupils aged ≥16 years, males, from rural areas and whose parents were farmers. Therefore, there is the need for more extensive preventive and control measures such as improvement in personal and environmental hygiene, health education and regular deworming of pupils as this will go a long way in eliminating the parasitic infection in the year 2025 as advocated by United Nations.

#### CONSENT

All pupils included in this study completed and signed an informed consent form with the help of their teachers.

#### ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have been conducted in accordance with the ethical standards laid down in the 1975 Declaration of Helsinki. Ethical approval to conduct this study was obtained from the Research Ethics Committee of Federal Medical Centre Keffi. Approval was also obtained from the Local Government Council Education Authority, the Authorities of the various schools as well as from the pupils used for the study.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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