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Research Paper

# Prevalence of Intestinal Helminth Parasites and Its Association with Hygiene in Funtua Local Government Area, Katsina State, Nigeria

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## ABSTRACT

Intestinal helminth parasites are one of the most common parasites which causes significant public health burden globally with children being the most vulnerable population group. A study was conducted to determine the prevalence of intestinal helminth parasites and its association with hygiene practices in Funtua local government, Katsina state, Nigeria. A total of 180 stool samples were collected from school-aged children across six primary schools and analyzed using Kato-Katz techniques. Also, a questionnaire was used to assess the level of hygiene. An overall prevalence of 41.7% was recorded. Four intestinal helminth parasites were observed; *Ascaris lumbricoides* with highest prevalence of 36.7%, *Trichuiris trichura* 6.1%, Hookworms 6.1% and *Schistosoma mansoni* with the least prevalence of 4.4%. Prevalence based on gender showed that male had the highest prevalence of 53.7% compared to female with 31.6% (RR>1). Those that do not washed vegetables before use recorded high prevalence of 78.9% than those that washed 40.2% (RR<1). The high prevalence was observed among those with untrimmed fingernails (46.3%) compared to 36.5% with trimmed fingernails (RR<1). The presence of helminthes parasites was found to be associated with hygiene in the study area. There is need for health education to the general public on good personal hygiene.

***Keywords:*** Prevalence, Intestinal helminths, Hygiene, Parasites, Funtua.

## INTRODUCTION

Intestinal helminths parasites affect an estimated of 1.5 billion people worldwide. Infection with helminths parasites mostly affects the poorest and deprived communities where sanitation and hygiene practices are poor. Inadequate access to safe and clean drinking water also influenced high prevalence of heliminth parasites in areas of sub-Saharan Africa, China, South America and Asia (1). The most common helminth parasites causing significant public health problems in the world, includes; Human roundworm (*Ascarias lumbricoides)*, Human whipworm (*Trichuris trichiura)*, Human hookworms (*Ancylostoma duodenale* and *Necator americanus*), and Intestinal schistosome (*Schistosoma mansoni)* in most cases (2).

Inappropriate human waste disposal increases the risk of infection with the helminth parasites (3). Soil polluted with human faeces acts as source of infection with helminth parasites like, *Ascaris lumbricoides*, *Trichuris trichiura*, Hookworm, *Strongyloides stercoralis*. Helminth (4) are widely distributed throughout the tropics and sub-tropical regions as a result of favourable climatic condition which is important for the transmission and general survival of helminths (5). Sufficient moisture and warm temperature are vital environmental factors required for the development of larvae in the soil (Brooker and Michael, 2000). Also, several factors such as socio-economy, illiteracy, poverty, high population density, inadequate water, sanitation and hygiene (WASH) services have been identified as an important epidemiological factors that increases the risk of infection with helminth parasites (6,7).

High infections with helminth parasites are more encountered among children, especially pre-school and school-aged children than other age groups. All over the world more than 270 million pre-school-aged children are infected with one or combination of soil-transmitted helminths (STHs) and about 550 million of school-aged children (1). Helminth infections in children can lead to so many burden like physical distress, malnutrition and cognitive impairment and consequently decrease societal productivity and in adverse cases leads to pregnancy complications (5,8).

Hygiene is a set of practices performed to preserve health (9). Hygiene involve various practices to achieve cleanliness and sterility which includes, frequent bathe, washing hands, trimming of fingernails, washing vegetables and so on (9). A personal hygiene is an important thing that helps to combat germs on the body that could lead to bad odour and diseases (10). There are also many health implications of having poor hygiene, resulting in so many hygiene-related diseases, such as; intestinal helminthiases, schistosomiases, Enterobiasis, tooth decay, ringworm disease, etc (11).

This study was conducted to determine prevalence of helminth infection and assess the association with hygiene practices in the study area. The study will help to generate information the status of helminth infection and and the level of hygiene in the study area.

## MATERIALS & METHODS

**Study Area:**

Funtua Local Government Area is one of the local government areas in Katsina State. It is located on the latitude and longitude $11^0 32^1$N and $7^0 19^1$E respectively with an average temperature of $32^0$C and relative humidity of 44 per cent. It is one of the premier local governments in Nigeria, created after the local government reforms in 1976. The study area has been an industrial and commercial centre since colonial days, presently it houses most of the industries located in Katsina State-such as; Funtua Textiles Limited, Fertilizer Blending Company, West African Cotton Company, Lumus Cotton Ginnery, Funtua Bottling Company etc. Undoubtedly, the single greatest influence on the growth of Funtua local government has been the coming of rail-line.

**Research Design**

A cross-sectional study was conducted in Funtua local government area of Katsina State between April and May, 2023. The primary schools' pupils were used as subject for this study. A total number of 180 primary school pupils were selected across six primary schools in the study area. The schools are, Gudindi Model Primary School, Shehu Primary School, Idris Girls' Primary School, Sambo Primary School, Maigamji Primary School and Gardawa Primary School. In order to ensure true representation, the study subjects were drawn from different classes (i.e Primary 1 – 6) across each sampling school. Structured questionnaires in form of interview were administered to the pupils to obtain information on their daily hygiene practices. Stool samples were collected from the participants for the detection of intestinal helminth parasites.

**Sample Size Determination**

The sample size was determined using the Lorentz's formula ($n= z^2pq/d^2$) as adopted by Bala *et al.* (12), where; n= Sample size, z= Standard normal deviation at 95% confidence interval (z-score= 1.96), d=

Tolerable error of 5% (0.05), q= 1-p, and P=Prevalence from the previous study; the prevalence obtained from the previous study conducted in Wamakko and Tambuwal local government areas, Sokoto State, Nigeria by Iduh *et al.* (13) was 16.0%. Therefore, by substitution;

$$\mathbf{n} = \frac{Z^2pq}{d^2}\ \mathbf{n} = \frac{1.96^2 \ .\ 0.16(1-0.16)}{0.05^2} = 161$$

Based on the sample size formula, 161 samples were required for this study but the authors decided to round it up to 180 samples.

**Research Approval**

Approval to conduct this study was granted by the Education Secretary (ES) – Funtua Local Government Education Authority (LGEA). Also consent of the school heads, parents and study participants were obtained before commencement of the study. The aim of the study was explained to all the study stakeholders. Anonymity was guaranteed to each participant in order to have clear responses and cooperation. Participation is voluntary and any participants reserved the right to withdraw from this study at any point deemed wish.

**Sample Collection**

Stool samples were collected from the primary school pupils using a sample bottle. The study participants were requested to bring their stool samples. A proper procedure on how to collect stool sample in hygienic way were demonstrated to the participants. Each stool sample was clearly leveled with unique identification number. The stool samples were put in a thermo-cool box fully loaded with ice and transported to Parasitology laboratory of the Department of Zoology, Usmanu Danfodiyo University, Sokoto for analysis. Samples were preserved with 10% aqueous formalin.

**Stool Analysis and Identification of Intestinal Helminth Parasites**

The Stool samples collected were processed and analyzed using Kato-Katz operation procedures as described by WHO (14). A Kato-Katz template size 41.7mg (hole 6mm x 1.5mm thick) was placed on the centre of slide and a piece of sieved was put on top of the template. A small portion of faecal sample was put into the small hole of the template through the sieve which was placed on top of the template. The spatula was used to pass the faeces through the sieve down to the slide. After filling the template hole with faeces, then the template was carefully removed leaving the cylinder faeces on top of the template. The cylinder stool on the slide was covered with cellophane pre-soaked with glycerol-malachite green solution. The hydrophilic cellophane strip was then firmly pressed against the faeces to ensure faecal materials were evenly spread on the microscopic slide. The slide was carefully taken to microscope for viewing. First viewed under x10 magnification and later switched to x40 for more details of the parasite. The prepared smear was examined in a systematic manner. All prepared slides were examined within one hour of preparation to minimize the risk of hookworm egg disappearance. Identification of the helminth parasites was aided by the Bench Aids for the Diagnosis of Intestinal Parasites (14).

## STATISTICAL ANALYSIS

The data obtained were analysed using Statistical Package for Social Sciences (SPSS) version 20. The prevalence of intestinal helminth parasites was determined using descriptive statistics. The association between prevalence of intestinal helminth parasites and other variables such as, gender, age, and hygiene parameters was determined using Relative Risk (RR) formula. The threshold for all statistical significance was considered at 95% Confidence interval.

## RESULT

Out of 180 stool samples collected, 75 were identified to be positive with helminths parasites. An overall prevalence of 41.7% was recorded.

Table 1 shows four intestinal helminth parasites as observed; *Ascaris lumbricoides* with the highest prevalence of 36.7%, *Trichuiris trichiura* and Hookworms with the same prevalence of 6.1%, and *Schistosoma mansoni* recorded least prevalence 4.4%.

**Table 1: Prevalence of Intestinal Helminths Infection in the Study Area**

| Intestinal Helminths | Frequency | Percentage (%) |
|---|---|---|
| *Ascaris lumbricoides* | 66 | 36.7 |
| *Trichuris trichiura* | 11 | 6.1 |
| Hookworm | 11 | 6.1 |
| *Schistosoma mansoni* | 8 | 4.4 |
| Total | 75 | 41.7 |

Table 2 shows male had high prevalence 53.7% compared to female 31.6%. The Relative Risk (RR) analysis showed that the occurrence of helminth infection increased in male (exposed) than female (RR>1).

**Table 2: Prevalence of Helminth Infection based on Gender.**

| **Factor** | **Helminth Infection** | | | |
|---|---|---|---|---|
| **Gender** | **Infected** | **Non-Infected** | **Total** | **Percentage (%)** |
| Male | 44 | 38 | 82 | 53.7 |
| Female | 31 | 67 | 98 | 31.6 |
| Total | 75 | 105 | 180 | 41.7 |

**Relative Risk (RR) = 1.69, RR >1)**

Table no 3 shows prevalence based on age showed that ages between 6 – 10 years had highest prevalence 43.1%, while 11 – 15 years had 41.4% and those ages 21 – above years recorded 0.00% prevalence of helminth parasites. Result of binary logistic regression showed no statistical significance between age and helminth infection (P>0.05)

**Table 3: Prevalence of Helminth Infection based on Age**

| **Factor** | **Helminth Infection** | | | |
|---|---|---|---|---|
| **Age Group** | **Infected** | **Non-Infected** | **Total** | **Percentage (%)** |
| 6 – 10 | 22 | 29 | 51 | 43.1 |
| 11 – 15 | 53 | 75 | 128 | 41.4 |
| 21 – above | 0 | 1 | 1 | 0.00 |
| Total | 75 | 105 | 180 | 41.7 |

Table no 4 Shows Hand washing after defecation was identified to be constant habit across all the study subjects (100%).

**Table 4: Prevalence of Hand washing after Defecation among the Study Subjects**

| Hand washing after Defecation | Frequency | Percentage (%) |
|---|---|---|
| Yes | 180 | 100.0 |
| No | 0 | 0.00 |
| Total | 180 | 100.0 |

Table 5 shows prevalence based on materials used to wash hand after defecation which indicated 53.3% used water only to wash hand after defecation, 28.8% used water and soap, and 46.8% used water and sand. Statistical analysis showed no significant association between materials used to wash hand after defecation and occurrence of helminth infection (P>0.05).

**Table 5: Prevalence of Helminth Infections based on the Materials used for Hand washing after Defecation**

| Materials used to Wash hand after Defecation | Helminth Infection | | | |
|---|---|---|---|---|
| | **Infected** | **Non-Infected** | **Total** | **Percentage (%)** |
| Water only | 32 | 28 | 60 | 53.3 |
| Water and Soap | 21 | 52 | 73 | 28.8 |
| Water and Sand | 22 | 25 | 47 | 46.8 |
| Total | 75 | 105 | 180 | 41.7 |

Table no 6 showed prevalence of 41.9% among those that do wash hand before meal and 0.00% among those that do not wash hand before meal. No statistical association observed between hand washing before meal and the occurrence of helminth parasites. In respect to prevalence of helminth among those that wash hand after 41.3% and 100% among those that do not wash hand after meal. The result of RR analysis showed that hand washing after meal reduced the rate of helminth incidences (RR<1).

**Table 6: Prevalence of Helminths Infections in relation to Hand washing before and after Meal.**

| Parameters | Helminth Infection | | | |
|---|---|---|---|---|
| **Hand washing before meal** | **Infected** | **Non-Infected** | **Total** | **Percentage (%)** |
| Yes | 75 | 104 | 179 | 41.9 |
| No | 0 | 1 | 1 | 0.0 |
| Total | 75 | 105 | 180 | 41.7 |
| Hand washing after meal[a] | | | | |
| Yes | 74 | 105 | 179 | 41.3 |
| No | 1 | 0 | 1 | 100.0 |
| Total | 75 | 105 | 180 | 41.7 |

**(RR= 0.41, RR<1)[a]**

Table 7 Subjects that do not wash vegetables before use had high prevalence 78.9% compared to those that wash vegetables before used 40.2%. The result of RR analysis from this study showed that the rate of disease occurrence reduced by frequently washing vegetables before use (RR<1).

**Table 7: Prevalence of Helminths Infection based on Vegetables Washing before Use**

| Factor | Helminth Infection | | | |
|---|---|---|---|---|
| **Washing Vegetable** | **Infected** | **Non-Infected** | **Total** | **Percentage (%)** |
| Yes | 45 | 67 | 112 | 40.2 |
| No | 30 | 38 | 68 | 44.1 |
| Total | 75 | 105 | 180 | 41.7 |

**(RR= 0.91, RR<1).**

Table 8 shows those subjects that wore shoes frequently recorded high prevalence 43.4% than those walking barefooted 21.4%. The result of RR analysis from this study showed that not frequent wearing of shoe reduced the incidences of helminth infections (RR<1).

**Table 8: Prevalence of Helminth Infection based on Shoe wearing**

| Factor | Helminth Infection | | | |
|---|---|---|---|---|
| **Shoe Wearing** | **Infected** | **Non-Infected** | **Total** | **Percentage** |
| Yes | 72 | 94 | 166 | 43.4 |
| Not always | 3 | 11 | 14 | 21.4 |
| Total | 75 | 105 | 180 | 41.7 |

**(RR= 0.49, RR< 1)**

Table 9 shows those with untrimmed fingernails showed high prevalence 46.3%, compared to those with trimmed fingernails 36.5%. The RR analysis indicated the decreased of helminth incidences by trimming of fingernails (RR<1).

**Table 9: Prevalence of Helminth Infections based on Status of Fingernails**

| **Factor** | **Helminth Infection** | | | |
|---|---|---|---|---|
| **Fingernail** | **Infected** | **Non-Infected** | **Total** | **Percentage** |
| Trimmed | 31 | 54 | 85 | 36.5 |
| Not trimmed | 44 | 51 | 95 | 46.3 |
| Total | 75 | 105 | 180 | 41.7 |

**(RR= 0.78, RR<1).**

## DISCUSSION

The result obtained from this study indicated the presence of intestinal helminth parasites in Funtua local government area, Katsina state with an overall prevalence of 41.7%. Based on the overall prevalence observed in the study area, the area can be classified as a high risk zone according to the World Health Organisation disease specific thresholds (15). The high prevalence recorded in the study area could be attributed to the soil contamination and other hygiene related practices. This agreed with the findings of Auta *et al.* (16) where they associate high prevalence obtained in their study with the soil contamination and hygiene. This might also be attributed to the poor hygiene practice among the study subjects, such as untrimmed fingernails, improper hand washing, habit of not washing vegetables before used and other hygiene measures. The prevalence recorded from this study was higher than 12.0% obtained by Iduh *et al.* (13) in Wamakko and Tambuwal local government area of Sokoto, Nigeria; 26.0% prevalence observed by Badamasi and Liadi (17) in Malumfashi local government area of Katsina state, Nigeria; 30.9% by Guadie *et al.* (18) among primary school children in Dembi district, southwest Ethiopia; 28.1% recoreded by Yaji *et al.* (19)among school children in Aliade, Gwer-East local government area, Benue state, Nigeria. It was however less compared to the 60.3% prevalence recorded by Ahmed and Sani (20) in Katsina metropolis, Katsina state, Nigeria; 63.5% by Manir *et al.* (21) in Dutsinma area, Katsina state, Nigeria; 45.0% by Ngenegbo *et al.* (22) in a rural community in Nigeira. The differences in prevalence might be due to the availability of the potential risk factors and variability in daily hygiene practices among the various study subjects. However, differences in climatic condition influence the survival and the general distribution of helminth parasites.

The high prevalence among male subjects than female observed in this study might be attributed to the frequent exposure of male to the risk places and lifestyle variation among gender, such as farming, playing football in contaminated soil and some other domestic errands. This conform with the finding of (13,23,24) where they observed high prevalence of helminth parasites among male than female and attributed their finding with exposure. In contrast, Tofa *et al.* (25) in Dawakin-Kudu, Kano; Idowu *et al.* (26) in Ogun state; Sugianto *et al.* (27) in Antiga village, Bali; as well as Bismack *et al.* (7) in Kouoptamo Noun division, west region, Cameroon found female to be more infected with helminth parasites than male and attributed their findings with unhygienic practice and engaging in farming activities similar to male.

Children aged 6 – 10 years had high prevalence compared to other aged groups in this study. This might be due to often exposure to infective places such as, playing ground (probably faecally contaminated soil), or they often engaged in domestic errand, such as fetching water (probably from infected water bodies), farming in polluted soil, gathering firewood from nearby bushes (probably open defecation sites), and some other domestic activities which increased their vulnerability. It might also be due to unconsciousness of this age group about good personal hygiene. This was in conformity with findings of John and

Magaji (4); Singh and Idris (28). Furthermore, contradict that of Alemu *et al.* (29); Auta *et al.* (30); Badamasi and Liadi (17) who observed high prevalence among different aged categories.

The result showed washing hand after defecation was constant across all the study participants. This might be due to cultural norms and religious obligations. The only variability observed among the study participants was in term of materials used to wash hand after defecation. In that respect, those used water only to wash hand after defecation recorded highest prevalence of helminth infections. This could be due to the fact that water doesn't have cleansing and disinfecting agents, hence not sufficient to remove pathogens completely. Furthermore, when hand wash with water and soap, the soap significantly assists in removal of contaminants from the hands as well as disrupting the activities of microorganism, because soap has cleansing and disinfecting agents. Similar findings from the previous studies conducted by Bala *et al.* (12) in Sokoto, Nigeria; Khanum *et al.* (31) in Dhaka city, Bangladesh found high prevalence of infection among those that used only water to wash hand after defecation than to those that used either water and sand or water and soap. Therefore, maintaining proper hand hygiene especially after defecation reduced risk of infection with helminth parasites (4).

The result based on hand washing before and after meal showed that no significant association between prevalence of helminth infections and hand washing before meal. But in respect to hand washing after meal and prevalence of helminth, significant associations were found as relative risk analysis shows that washing hand after meal reduce the risk of infection with helminth parasites. This findings agrees with that of (29,32) where they observed relationship between occurrence of helminth infections with hand washing after meal.

Finding of this study in respect to prevalence of helminth infections in relation to vegetables washing before consumption showed that, study participants who do not wash raw vegetables before consumption had high prevalence than those that often wash raw vegetable before consumption. This might be due to the fact that the vegetables consumed have been contaminated with helminths eggs, probably human faeces was used as a manure. A findings by Hamza *et al.* (33) supported this finding where they observed high percentage of helminth eggs from unwashed vegetable samples and comparatively none was observed from a thoroughly washed vegetable samples. This might be due to the fact that the raw vegetables harbour helminth eggs and when not properly washed increased the risk of infection with helminth parasites. Kudah *et al.* (34) also found 57.5% of the vegetables samples collected from different markets were contaminated to one or more type of parasite eggs.

Those often wore shoes recorded the highest prevalence of helminth infections compared to those subjects that sometimes walked barefooted. This could be due to the fact that some of the helminth parasites observed from this study were not directly connected with walking barefooted (e.g *Ascaris*, *Trichuris*, schistosomes). This finding was in conformity with the findings of Kumurya *et al.* (35) and contradicted Muluneh *et al.* (36) in North-west, Ethiopia; Rahimi *et al.* (24) in Kandahar, Afghanistan, where they found high prevalence of helminth infections among those that walk barefooted.

Those with untrimmed fingernails recorded high prevalence of helminth infections. This might be due to the fact that untrimmed fingernails harboured dirty substances which might contain helminth eggs and thereto facilitated faeco-orally transmission. Agreed with this finding, Belete *et al.* (37) in Jimma, Ethiopia; Yusuf *et al.* (38) ; Bala *et al.* (12) in UDUS main campus, Sokoto.

## CONCLUSION

The high prevalence of helminth infection recorded was associated with poor hygiene practices. Based on the high prevalence of helminth infection recorded, the study area can be classified as helminth endemic zone.

## *Declaration by Authors*

**Ethical Approval:** Approved

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**Conflict of Interest:** The authors declare no conflict of interest.

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