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Prevalence of Intestinal Parasites among Children Accessing Medical Healthcare at the Federal Medical Centre Keffi, Nasarawa State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Authors MAA and MO designed the study, collected samples, performed laboratory and statistical analyses, and wrote the first draft of the manuscript. Authors II, AAO, and AOI designed the study, and managed literature searches, Authors SIO, AKA, BEO, and KOS wrote the protocols and managed the analyses of the study. All authors read and approved the final manuscript.

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ABSTRACT

Aim: This work was conducted between the period of April 2022 and March 2023 to investigate the prevalence and predisposing factors of enteric parasites among children accessing medical healthcare at the Federal Medical Center keffi, Nasarawa State.
Study Design: The study was a cross-sectional study.
Methodology: Fresh stool specimens were collected into sterile bottles from children aged 1-15 (246 males and 194 females) who accessed medical healthcare at the Federal Medical Center keffi, Nasarawa State between the period of April 2022 and March 2023. Information such as age, gender, and drinking water sources were obtained from the subjects through a structured questionnaire. The stool specimens were observed visually for colour, consistency, and presence of blood, pus, and adult worms while the concentration of the eggs, cysts, and larvae of the intestinal parasites was carried out using the formol ether method and viewed with X10 and X40 magnifications of the binocular microscope. Data obtained from this study were analyzed using the chi-square test by the use of Statistical Package for Social Sciences (SPSS) version (21.0). Values obtained were considered significant at 95% probability.
Results: An overall prevalence of 27.26% was obtained in the study participants with a total of five species of intestinal parasites identified. The parasites include; *Entamoeba coli, Entamoeba histolytica, Giardia lamblia, Strongyloides stercoralis,* and *Trichomonas hominis*. *Entamoeba. histolytica* was the most prevalent (15.45%) while *S. stercoralis* was the least prevalent (1.36%). In this study, males recorded a higher prevalence of *Entamoeba. histolytica* (16.49%) than females (14.63%) likewise for *E. coli* (5.14%) and (4.07%), *Strongyloides stercoralis* (1.55%) and (1.22%) respectively. In contrast, females recorded a higher prevalence of *Giardia lamblia* (2.85%) than males (2.58%) and *Trichomonas hominis* (3.25%) and (1.03%) respectively. The prevalence of intestinal parasites varied significantly among the age groups, with the age group 1-5 years being the most susceptible to *E. histolytica* (45.71%). Children who drank river water had the highest prevalence of parasitic infection (57.14%) while those who drank borehole water had the lowest majority (14.29%).
Conclusion: The high prevalence of intestinal parasites observed in this study in relation to the sources of drinking water of the subjects suggests a major predisposing factor to intestinal parasitic infections. Therefore, the provision of potable drinking water and public enlightenment on proper hygiene practices in the study area is of great importance.

Keywords: Intestinal parasites; children; prevalence; sources of drinking water.

1. INTRODUCTION

Enteric protozoan infections are a leading cause of morbidity and mortality in children, especially in developing countries such as Nigeria [1,2]. Having knowledge of the distribution of enteric parasitic diseases, as well as the areas of overlap, is critical for identifying hotspots where there is a need for consolidated prevention and control interventions [3-5]. In underdeveloped areas, these actions are particularly important as social determinants such as deficiencies in sanitation, poor personal hygiene and human cohabitation with domestic animals, favour the maintenance of infections, reinfections and coinfections [6]. These resultant infections can lead to impairments in physical and cognitive development, and eventually death [7].

Infections are mainly established when infective stage(s) (cysts or eggs/larvae) of the protozoa are transmitted via ingestion of water, soil or food contaminated by faeces [8]. Enteric parasitic infection is one of the neglected tropical diseases (NTD) that thrive where there is poverty. Populations most affected are the poor, living in isolated rural areas, urban slums or crisis-prone areas [9,10]. Soil-transmitted helminth infections especially hookworm infection which causes childhood and maternal anaemia, result in the greatest disability, and the highest burden of neglected tropical diseases [11]. The resultant physiologic changes as a result of these infections include iron-deficiency anaemia, growth retardation in children, intestinal obstruction and some other physical and mental health problems [12,13].

Helminths such as *Trichuris trichiura*, *Ascaris lumbricoides* and hookworms as well as protozoa such as *Entamoeba histolytica* cause infection in 800, 1,400, 1,200 and 48 million people respectively worldwide [14,15]. Studies have shown that more than three billion people are infected with intestinal parasites with the prevalence being higher among children below six years old by varying degrees in countries around the globe [16]. Varying prevalent rates have been reported across Africa [8,45,48,51, 52, 55 and 56]. Similarly, the prevalence of intestinal parasites among children has been reported in different parts of Nigeria [1, 3, 12, 14, 24-26, 30-33, 37, 47,49 and 54]. The reported prevalence in Nasarawa state varies across the different local Governments including Keffi [22,29,40-42,57-59]. Children are more susceptible to intestinal parasitic infections amounting to the most significant risk population and can contribute to malnutrition, especially among children in daycare centers and orphanages. This is due to ignorance, low levels of safety, direct contact and sharing toys with other children, absence of functional sanitary facilities and overcrowding [17]. An exemplary case is the Infections of *Giardia lamblia* which damages the intestinal mucosa and results in malabsorption of nutrients, particularly fat [18,19]. The high prevalence of intestinal parasites among children globally and especially in developing countries which Nigeria is one has prompted the need to investigate the prevalence in the study area.

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out at Federal Medical Centre Keffi, Nasarawa Nigeria (Fig. 1). Keffi is located approximately 68km from Abuja, the Federal Capital Territory and 128km from Lafia, the capital of Nasarawa State [Fig. 1]. It is located geographically between latitude $8^0$3'N of the equator and longitude $7^0$50'E and situated at an altitude of 850m above sea level [20].

2.2 Sample Size Determination

In this study, the total number of samples was estimated using the standard formula described by [21]

$$\boldsymbol{N} = \boldsymbol{Z}^2\boldsymbol{pq}/D^2$$

Where; N=sample size,
Z= standard normal distribution at 95% confidence interval=1.96,

p= prevalence rate of 54.55% recorded by [22].

q=1-p

D= the allowable error, which is taken as 5% =0.05

Substituting the values in the formula;

q=1-p (1- 0.55) =0.45

$$N = \frac{1.96^2 \times 0.55 \times 0.45}{0.0025} = \frac{0.950769}{0.0025} = 380 \quad N = 380$$

This represents the minimum number of samples to be collected

2.3 Inclusion Criteria

Only children between the ages of 1 and 15 years who have not taken any anti-parasitic drugs in recent past 3 weeks were enrolled for this study.

2.4 Exclusion Criteria

Children more than 15 years of age, those who are on anti-parasitic drugs, and those who did not consent were excluded from the study.

2.5 Samples and Data Collection

A total of 440 fresh stool samples were collected from participants who consented to sterile bottles from children aged 1-15 years (246 males and 194 females) who are accessing medical healthcare at the Federal Medical Center keffi, Nasarawa State between April 2022 and March 2023. Information such as age, gender, and drinking water were obtained from the subjects through the administration of a structured questionnaire

2.6 Examination of Stool Samples

Samples were collected in sterile universal containers, labelled properly, and taken to the Parasitology Unit, Medical Laboratory Services Federal Medical Centre Keffi. Direct wet mount and formol ether concentration technique described by [23] was used for the preparation of the stool samples. Thereafter, the stool preparation was transferred onto a clean slide, and a drop of iodine was added before covering it with a cover glass and observed microscopically using the X10 and X40 magnifications.

Fig. 1. Map of Nasarawa state with the study area highlighted in yelllow

2.7 Data Analysis

Prevalence of intestinal parasitic infection among the examined children was calculated using the number of infected children divided by the number of children examined. The significance of the infection among the children was tested by Chi-square (X^2). Values obtained were considered significant at 95% probability using the statistical package for social sciences (SPSS) version 21.0.

3. RESULTS

3.1 Identified Intestinal Parasites and their Prevalence

Of the total of 440 children examined, 122 (27.26%) were infected with intestinal parasites. The parasites detected include; *Entamoeba histolytica* 68(15.45%), *Entamoeba coli* 20(4.55%), *Giardia lamblia* 12(2.27%), *Trichomonas hominis* 10(2.27%) while *Strongyloides stercoralis* and cases of co-infection were 6(1.36%) respectively as shown in Table 1.

3.2 Overall Prevalence of Intestinal Parasites Concerning Some Socio-demographic Variables

Table 2 showed the prevalence of intestinal parasites among the children examined about age and gender and sources of drinking water. Children aged between 1-5 had a higher prevalence of 46 (65.71%) followed by those aged 6-10 38(19.59%) while those aged 11-15 had the least prevalence 32(18.18%) (*P*=.05). Females had a higher prevalence of 62(31.96%) than males 54(21.95%) (*P*=.05). The prevalence with regards sources of drinking water was higher among children who drank river water 20(57.14%) followed by those who drank rainwater 21(35.00%) while the lowest prevalence was seen among children who drank borehole water 9(14.29%) (*P*=.05).

Table 1. Overall prevalence of intestinal parasites among children attending federal medical centre Keffi

Intestinal Parasites	No. Positive	Prevalence (%)	*P*. value
Entamoeba coli	20	4.55%	
Entamoeba histolyica	68	15.45%	
Giardia lamblia	12	2.27%	0.000
Strongyloides stercoralis	6	1.36%	
Trichomonas hominis	10	2.27%	
Co-infection	6	1.36%	
Total	122	27.26%	

Table 2. Prevalence of intestinal parasites among children attending federal medical centre Keffi with regards to Sociodemographic variables

Age Groups (Years)	Number Examined	Number Negative	Number Positive	Prevalence	P-value
1-5	70	24	46	65.71%	
6-10	194	156	38	19.59%	0.000
11-15	176	144	32	18.18%	
Gender					
Males	246	192	54	21.95%	0.018
Females	194	132	62	31.96%	
Sources of Drinking Water					
Well	160	117	43	26.88%	
Tap	122	99	23	18.85%	
Borehole	63	54	9	14.29%	0.001
River	35	15	20	57.14%	
Rain	60	39	21	35.00%	
Total	440	324	348	27.26%	

4. DISCUSSION

This study was conducted to determine the prevalence of intestinal parasites among children accessing health care in Federal Medical Centre (FMC) Keffi, Nasarawa State Nigeria. The overall prevalence of intestinal parasites was 27.62 %. Enteric parasites detected in this study include *Entamoeba coli* (4.55%), *Entamoeba histolyica* (15.45%), *Giardia lamblia* (2.27%)*, Strongyloides stercoralis* (1.36%), *Trichomonas hominis* (2.27%) with *P*= .05*.* Also, co-infection was observed in this study with a prevalence of 1.36%*. E. histolitica* had the highest prevalence of 15.45% while *S. stercoralis* had the least prevalence of 1.36%. These intestinal parasites have been reported in several parts of Nigeria including [10] in Kaduna metropolis, [24] in Gwagwalada, Abuja, [25] in Benue, [26] in Delta State and Ilorin by [27]. It appears that the detection of these intestinal parasites among school-age children is primarily due to low standards of personal hygiene, poor sanitary conditions, poverty, lack of toilet facilities, and lack of portable drinking water [28].

The overall prevalence of 27.26% obtained in this study agrees with a prevalence of 27.2 % reported in some communities in Akwanga Local Government area of Nasarawa State [29]. Similarly, [1] reported an overall prevalence of 27.66% in Rivers State Nigeria. Also, [30] reported a prevalence of 27.3% in Katako area, North-Central Nigeria. The prevalence obtained in this study is higher than the 23.6% and 23.32% reported by [27, 31] respectively, both in Ilorin, Kwara State Nigeria and a prevalence of 16. 2% reported in Okpokwu, Benue State Nigeria by [32], also [30] reported a prevalence of 21.2% among preschool children in Kushe, North-Central Nigeria. In a study carried out in Southern Nigeria, [33] reported a prevalence of 23.95% among primary school-aged children. Elsewhere, a prevalence of 22.43% was reported by [34] in Egypt, 24.8% was reported by [35] in Sudan, and a prevalence of 22.2% was reported by [17] in India. On the contrary, a very low prevalence of 5.9% was reported in Europe over five years [36]. A slightly higher prevalence of 29.0% was reported by [37] among selected age groups within Okada South-South Nigeria while a prevalence of 30% was reported by [38] in Abia State Nigeria. Similarly, a prevalence of 34.2% was reported among primary school children in three geo-political zones of Imo State Nigeria by [12] and 38.6% among public primary school children in Ibadan Oyo Nigeria by [39]. Generally, the result obtained in this study is low compared to what was obtained in other local government areas of Nasarawa State. The result obtained by [22] in two local Government areas of Nasarawa state gives a prevalence of 54.55%. Similarly, a prevalence of 47.5% was reported by [40] in Lafia, Nasarawa State, also a prevalence of 33.5% among school-age children in Lafia was reported by [41]. In another study carried out in Karu, Nasarawa State by [42], 45.1% was reported among school children in two communities of Auta balefi. Studies from other parts of the country with higher prevalence have also been reported. The difference in prevalence could be a result of seasonal variation in sample collection, processing and the overall differences in living standards across study areas.

With respect to gender difference, this study shows a prevalence of 32.99% among females while 21.95% was recorded for males (*P*=.05). This is in agreement with reports by [43] in Minna Niger State, Nigeria, who reported that females had a higher rate of infection at 94% while males were 51.4%. Also, [17] in India reported that females had a prevalence of 56% while males were 43.9%. On the contrary, the prevalence of intestinal parasites was 29% among males while it was 20.9% among females reported by [44], [38] in Abia State Nigeria, reported 42.86% for males and 23.08% for females. [30] reported a prevalence of 57.60%, in males while 42.40% was reported for females in North-Central Nigeria. [45] in Egypt reported a prevalence of 58% for males and 42% for females while [46] reported a prevalence of 64.8% among males and 35.1% in females in Pakistan.

This study showed the highest prevalence of enteric parasites among children aged 1-5 (65.71%) followed by those aged 6-10 (19.59%) and those aged 11-15 (18.18%) respectively with *P* =.05. A similar case was reported by [26] with children aged 5-7 having a prevalence of 54.22% while those aged between 14-16 years had a prevalence of 42.86 %. Similarly, the rate of infection was high among children of 6-8 (77.63%) and 9-11 (85.00%) years of age compared to those aged 12-14 (53.13%), In Abia State Nigeria, [38] reported the highest prevalence rate in the age group of 5-8 years 24 (32.43%) whereas 9-12 years age group had the lowest prevalence rate of 24 (27.91%). [47] in North Eastern Nigeria reported a prevalence of 85.7% among children aged 6-8, while the least prevalence of 77.7% was reported in the 13- 16 years age bracket. Furthermore, [24] in Gwagwalada, FCT, Abuja Nigeria reported a prevalence of 28(43.1%) among children aged 4 to 5 years Also, [35] reported the highest prevalence rate (35%) among the 6-8 years age groups, while the lowest prevalence rate (10.3%) was reported among 12-14 years age groups. A high prevalence rate of 54.22% among the age group 5-7 years while the age group 14-16 years recorded the lowest prevalence of 42.86% as reported by [26] among school children in Deta State Nigeria. Conversely, [46] reported a higher prevalence among children aged 10-12 (94.2%) compared to those aged 4-6 (72%), while [45], reported an overall prevalence of 32% among children aged 11-20 years. Studies have shown that children in these age groups often spend more of their leisure time outdoors, playing both in school and at home, and are fond of picking food from the floor and touching unclean surfaces that end up in their mouths. They are also more often in contact with soil and eat indiscriminately with unwashed hands [34]. Also, the lack of sanitation facilities or non-functional sanitation facilities may be a factor contributing to the high prevalence of intestinal parasites among these age groups [48].

The relationship between the overall detection of enteric parasites and the source of drinking water was exploited in this study with *P*=.05. For well water it was 26.88%, tap water: 18.85% borehole: 14.29%, river: 57.14%, and rainwater was 35.00% respectively. The highest prevalence was recorded among children who used river water (57.14%) while the least was recorded among those who used borehole water (14.29%). Reports within and outside Nigeria show varying prevalence with regard to sources of drinking water. [27] reported a prevalence of 45% among children who drank river water in Kwara, Nigeria, similarly, [49] in Katsina-ala, Benue State reported a prevalence of 29.6% among children who obtained their drinking water from streams, 45.5% from wells, 37.8% from rivers, 26.1% from taps and 0.0% from water vendors. In other parts of Africa, [50] from Kenya reported that children who used rainwater for drinking were more likely to have intestinal protozoan parasite infections than those who used tap water, bought water from vendors, or used water from other sources as not being significant. However, [51] reported in Ethiopia that drinking water from river sources was rated as the highest associated risk with 36.8% of parasitic infections. Also in Ethiopia, [52] reported a significant relationship between sources of drinking water and the detection of parasites. Rainfall and agricultural residues that transfer parasites to drinking water sources contribute to the spread of the parasites and in turn the high prevalence [53].

5. CONCLUSION

The prevalence obtained in this study shows a high presence of intestinal parasites Iiin Federal Medical Centre Keffi, Nasarawa Nigeria, the prevalence was found to be higher in females than in males. Children between ages 1-5 years had a higher prevalence of infection compared to others. Significant relationship between sources of drinking water and the detection of parasites was found.

CONSENT

Written informed consent was taken from each participant.

ETHICAL APPROVAL

The ethical approval for this research was obtained from the Health Research Ethics Committee, Federal Medical Centre Keffi (NHREC/2012/2012).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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