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Original article

Prevalence and associated risk factors of intestinal parasitic infections among food handlers in Kano Metropolis, Kano State, Nigeria

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ABSTRACT

Background: Intestinal parasitic infections are among the most common infections worldwide and are still the cause of major human morbidity and mortality. World Health Organization (WHO) estimated about 3.5 billion people are affected with intestinal parasitic infections and yearly more than 200,000 deaths are reported. The aim of this study was to determine the prevalence of intestinal parasitic infections among commercial food handlers in Kano Metropolis. **Methods:** Stool samples were collected from 126 food handlers. The samples were examined by direct wet mount and formol-ether concentration technique. **Results:** The overall prevalence of intestinal parasitic infections was 14.3%. *Entamoeba histolytica* was found to be the most prevalent among the parasites detected with prevalence of 5.6%. This was followed by Hookworm (4.0%), *Ascaris lumbricoides* (2.4%), *Trichuris trichiura* (1.6%) and *Entamoeba coli* (0.8%) respectively. No statistically significant association existed between awareness of parasite transmission, source of water and intestinal parasitic infections ($P > 0.05$). A statistically significant association was found between hand washing, walking barefooted and intestinal parasitic infections ($P<0.001$). **Conclusion:** This study revealed a relatively high prevalence of intestinal parasitic infections among food handlers with *Entamoeba histolytica* being the most prevalent. Appropriate health education concerning personal hygiene should be given to food handlers so as to prevent intestinal parasitic infections.

Introduction

Intestinal parasitic infections are among the most common and widespread infections worldwide [1,2] and are still the major cause of human morbidity and mortality [3]. World Health Organization (WHO) estimated that about 3.5 billion people are affected with intestinal parasitic infections; 450 million are symptomatic and more than 200,000 deaths are reported annually [4]. The means of exposure to intestinal parasites include, consumption of contaminated food, water and undercooked meat, skin adsorption and via fomites [5].

Intestinal parasites produce a variety of symptoms in those infected, most of which manifest themselves in gastrointestinal complications and general weakness [6]. Gastrointestinal symptoms such as nausea, diarrhea, abdominal pain and dysentery negatively impact on nutritional status, including loss of appetite, decreased absorption of micronutrients, weight loss and intestinal blood loss that can often lead to anemia. They may also cause mental and physical disabilities, delayed growth in children, and skin irritation around the vulva and anus [7].

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The most common causes of intestinal parasitic infections are through contamination of food, water, fruits and vegetables by asymptomatic carriers of diseases and eventually transmit to the individual who uses them [8]. Food sold in markets may be contaminated by hands that have not been properly washed after defecation or by fomites or from flies that land on both food and stool hence increasing the risk of transmission to consumers [9]. Therefore, commercial food handlers with inadequate knowledge on food safety and poor personal hygiene could be the source of foodborne pathogens including parasites [10]. The transmission and spread of intestinal parasitic infections via food handlers is a common and persistent problem worldwide. Approximately 10 to 20% of food-borne disease outbreaks emanates from contamination of foods by the food handlers [11]. Healthy preparation, transportation, preservation and distribution of food can help prevent contamination with intestinal parasites. We therefore carried out this study to determine the prevalence and risk factors of intestinal parasitic infections among food handlers in Kano metropolis, Kano state Nigeria.

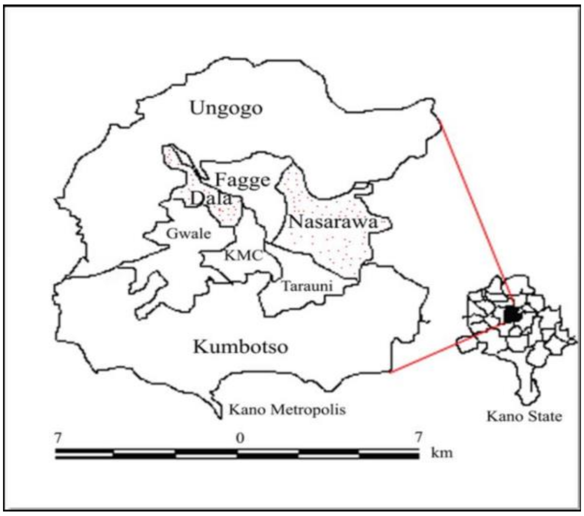
Subjects and Methods

Study design

It is a cross-sectional study comprised of 126 food handlers selected from 14 restaurants by two stage cluster sampling technique.

Study area

The study was conducted within Kano Metropolis. Metropolitan Kano has a population of more than 4 million and is the major trading hub of Northern Nigeria. Similarly, the modern Kano metropolis is a conurbation of eight Local Government Areas (LGAs) around the main city, which formed the study area for this study [8].



Inclusion and exclusion criteria

The study included food handlers not on any treatment for intestinal ailment, those who consented to participate in the study and excluded food handlers on treatment for intestinal infections, those suffering from diarrheal disease and those who declined to give consent.

Sample size determination

The sample size for this study was determined using the formula;

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

n= Minimum sample size

Z= (standard normal deviates) =1.96

P= (prevalence rate) = 9% = 0.09 (Kheirandish *et al*.[19])

Q= Complementary proportion of P (1-P) = (1 - 0.09) = 0.91

d= Tolerable margin of error = 5% (0.05)

$$n = \frac{(1.96)^2 \times 0.09 \times 0.91}{(0.05)^2}$$

$$n = \frac{0.31462704}{(0.0025)}$$

n = 125.9 ≈ 126

Ethical consideration

Ethical permission was sought from the Ministry of Health, Kano state, prior to commencement of the study. A draft of the research proposal was reviewed by the research and ethics committee of the Ministry before the approval was given. Written and verbal consent were also obtained from the participants.

Sample collection

Stool samples were collected from food handlers. Each food handler was provided with an empty clean, dry and leak-proof universal container with collection instructions. The collected stool samples were transported to the Department of Medical Laboratory Science, Bayero University, Kano for analysis.

Parasitological Techniques

1. Macroscopy

All stool samples collected were examined macroscopically for colour, consistency (formed, semi-formed, unformed or watery) and constituents (presence of blood, mucus and adult parasites). The findings were recorded appropriately.

2. Microscopy

Direct wet mount preparation of the fecal specimen

(a) Saline preparation

Procedure

A drop of fresh physiological saline was placed on a clean, dry, glass slide. Using an applicator stick, a small amount of the fecal specimen was picked and mixed with the saline and gently covered with a cover glass avoiding air bubbles and over flooding. The entire saline preparation was examined microscopically for larvae and ova of helminth, ciliates, trophozoites and cysts, of protozoan using 10x and 40x objective lenses as described by Chessbrough [12].

(b) Iodine preparation

Procedure

A drop of fresh iodine was placed on a clean, dry, glass slide. Using an applicator stick, a small amount of a well-mixed stool was picked and homogenized in the iodine and covered with a cover glass avoiding air bubbles and over flooding. The entire iodine preparation was examined microscopically for the presence of larvae, eggs, and cysts of parasites as described by Garcia and Bruckner [13].

Formal-ether sedimentation technique

Procedure

Using a piece of stick, 1g (pea-size) of feaces was emulsified in 4 ml of 10% formol water in a screw-cap tube. Further 3ml of 10% v/v formol water was added, caped, and mixed well by shaking. The emulsified feaces was sieved and the sieved suspension collected in a beaker. The suspension was transferred to a conical (centrifuge) tube made up of Polypropylene and continued as described by Cheesbrough [12]

Statistical analysis

The data obtained were analyzed using Statistical Package for Social Sciences version 20.0 (IBM, Chicago, IL, USA) software and presented in tables. Associations between Food handlers, risk factors and intestinal parasitic infections were determined using fisher exact test. $P \leq 0.05$ was considered statistically significant at 95% confidence interval.

Results

Of the 126 stool specimens examined, eighteen 18(14.3%) samples were positive for intestinal parasitic infections. The age-group of the study population varied between 15 - 60 years

Age and ethnic group of the subjects had no significant association with intestinal parasite infection ($P>0.05$). as shown in **table (1)**. A statistically significant association exists between gender of the participants and intestinal parasitic infections ($P = 0.048$) **(Table 1)**.

Parasite specific infection rate revealed that *Entamoeba histolytica* had the highest prevalence of 7(5.6%), followed by Hookworm 5(4.0%), *Ascaris lumbricoides* 3(2.4%), *Trichuris trichiura* 2(1.6%), and *Entamoeba coli* 1(0.8%) respectively. While 108(85.7%) of the participants had no intestinal parasite infection as indicated in **table (2)**.

Table 3 shows the risk factors associated with intestinal parasitic infection among food handlers. The study revealed that 94.4% of the respondents had no knowledge of parasite transmission, only 5.6% of the respondents had knowledge on parasite transmission. On the other hand, 24.6% of the food handlers were not regularly washing their hands, and there exist a statistically significant association between hand washing and intestinal parasitic infections ($P < 0.001$). There was no statistically significant association between source of water and intestinal parasitic infections ($P > 0.05$). Walking barefooted was a significant risk factor to acquisition of intestinal parasitic infections ($P< 0.001$) as shown in **table (3)**.

Table 1. Prevalence of intestinal parasitic infections among food handlers with respect to socio-demographic characteristics (n = 126).

Characteristics	Number Infected	Prevalence (%)	*P* value*
Age group			*0.584*
15 – 30	11	61.1	
31 – 45	5	27.8	
46 – 60	2	11.1	
Total	**18**	**100**	
Gender			0.048^{S}
Male	7	38.9	
Female	11	61.1	

Total	**18**	**100**	
Ethnic group			*0.642*
Hausa	18	100	
Fulani	0	0	
Yoruba	0	0	
Total	**18**	100	

*Fisher Exact test, S= significant, P < 0.05 is statistically significant

Table 2. Prevalence of intestinal parasites among food handlers (n = 126).

Intestinal parasites	Number infected	Prevalence (%)
Protozoa		
Cyst of *Entamoeba histolytica*	7	5.6
Cyst of *Entamoeba coli*	1	0.8
Helminths		
Ova of *Hookworm*	5	4.0
Ova of *Ascaris lumbricoides*	3	2.4
Ova of *Trichuris trichiura*	2	1.6
Number infected	18	14.3
Number non-infected	108	85.7
Total	**126**	**100**

Table 3. Assessment of risk factors associated with intestinal parasitic infections among food handlers.

Factors	**Number Infected**	**Prevalence (%)**	***P* value***
Awareness of transmission			*1.000*
Yes	0	0	
No	18	100	
Total	**18**	100	
Regular Hand washing			*0.000^S*
Yes	3	16.7	
No	15	83.3	
Total	**18**	100	
Source of water			*0.642*
Tap	6	33.3	
Borehole	3	16.7	
Well	9	50	
Total	**18**	100	
Walking barefooted			*0.000^s*
Yes	14	77.8	
No	4	22.2	
Total	**18**	**100**	

S = significant, P < 0.05 is statistically significant, *Fisher exact test.

Discussion

Intestinal parasitic infections are normally associated to living conditions, personal and environmental hygiene, availability of clean water supply, adequacy of health facilities and sanitation practices.

The overall prevalence of intestinal parasitic infections in this study is 14.3%. This is lower than 41.2% reported by **Egbuobi et al.** [14] in a research carried out to assess the parasitic carrier status of the population of food vendors around the University of Nigeria Teaching Hospital Enugu, in Enugu State, Nigeria. Other studies recorded a high prevalence rates of 33.9% in Qatar [15], 31.8 to 37.2% in Turkey [16,17] and 31.94% in Saudi Arabia [18]. Other studies of intestinal parasites found in the food handlers reported lower prevalence than the present study; this include 11.9% in Khorramabad Iran by **Kheirandish et al.** [19].

Age group specific infection rate shows a higher prevalence (61.1%) of intestinal parasitic infections among age group of 15-25years. This is in contrast to the highest prevalence observed among the age group 25-40 years by **Kheirandish et al.** [19] This is because behaviorally and environmentally, food hawkers and vendors are within the age range of 15-25 years in the area where this study was conducted.

The pattern of intestinal parasitic infections among the study participants showed that females have the highest prevalence rate of 8.7% as against their male counterpart with 5.6%. Similar study in Enugu reported the same higher prevalence in female (44.2%) than male (36.8%) participants [14]. This might be due to the absolute domination of females in food businesses in the study area.

Among the ethnic groups that participated in this study, 74.6% of the participants belongs to Hausa ethnic group, 23.0% belongs to Fulani and 2.4% belongs to Yoruba. Hundred (100%) of those infected with intestinal parasites were Hausas. The reason for the high prevalence among this group could be attributed to the absolute domination of Hausas and by extension, minimal number of other ethnic groups in the study area.

Entamoeba histolytica was found to be the most prevalent among the parasites detected in this study. One reason for this is that transfer of protozoa is much easier than the transfer of the eggs or larvae of worms [20,21]. In a research conducted by other researchers across the globe, a higher prevalence of *Entamoeba histolytica* (52.4%) was reported in Enugu, Nigeria by **Egbuobi et al.** [14]. But in Saudi Arabia a much lower prevalence of 2.78% was reported18. However, *Entamoeba coli* recorded a higher prevalence of 4.3% by **Kheirandish et al.** [19] and 4.37% by **Majed et al.** [18] than 0.8% of the present study.

A prevalence of 4.0% for hookworm infection was recorded in this study. This is lower than 7.5%, in a similar study conducted in Saudi Arabia by **Majed et al.** [18] and higher than 2% by **Sanches et al.** [22] and 2.5% by **Al-lahham et al. [**23]. The 2.4% prevalence recorded for *Ascaris lumbricoides* in this study is higher than 0.8% reported by **Majed et al.** [18] and lower than 9% and 4.9% recorded by **Sanches et al. [**22] and **Al-lahham et al.** [23] respectively. *Trichuris trichiura* was reported low in Jordan with a prevalence of 1.1% by **Al-lahham et al.** [23], this is similar to 1.6% recorded in the present study.

On the awareness of the participants on intestinal parasitic infections, the result showed that 100% of those found affected had no knowledge on intestinal parasitic infection. This result disagrees with the report of **Labib et al. [**24] where majority of food handlers had excellent knowledge of food borne infection. This implies that the respondents in this study are not likely to put in place the food safety measures required to prevent food borne infection and ensure food safety.

Risk factors to intestinal parasitic infections in the study area revealed that 83.3% of those found affected are not washing their hands regularly. This coincides with ascertion of **Nyarango et al.** [9] that food may be contaminated by hands that have not been washed after defecation or from flies that land on both food and feces hence increasing the risk of transmission of intestinal parasites for consumers. Similarly, 50% of the infected persons used well as their source of water. This result conforms to the findings of **Isyaku et al.** [25] in Sokoto and another report in South Africa26. Among those infected, 77.7% walked bare footed. This finding might be as result of poor environmental sanitary conditions.

Conclusion

This study reveals that intestinal parasites infection was relatively common among food handlers with overall prevalence of 14.3%, females were more infected than males and *Entamoeba histolytica* was the most prevalent intestinal parasite observed. Irregular handwashing and walking via footed were the risk factors statistically associated with intestinal parasitic infections in the present study.

Contributors

This work was carried out in collaboration among all authors. Author Kumurya AS designed the study, performed the statistical analysis and interpretation of data. Author Bunza NM wrote the protocol, the first draft of the manuscript and revised it critically for important intellectual content. Author Asma'u SM managed literature searches and the analyses of the study. All the authors read and approved the final manuscript.

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Conflicts of interests

The authors declared that there are no conflicts of interest.

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