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Intestinal Parasite Infections among Food Vendors at Awkuzu, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Intestinal parasites have been known to cause severe symptoms of malnourishment and abdominal pains as well as impairment of physical and mental development especially in children. Poor hygiene among food vendors is a major risk factor for human infections with protozoan cysts, helminth eggs and larvae. This cross-sectional study on intestinal parasites among food vendors in Awkuzu, Oyi Local Government Area of Anambra State was carried out between April and June, 2021. Two hundred consenting males (32%) and females (68%) were studied under age-groups of ≤ 20, 21-30, 31-40, 41-50, and >50 years. Stool sample submitted by each participant was routinely examined in our mobile laboratory using Saline/iodine wet preparation and Formol-ether concentration techniques. Parasites were identified with standard keys. Data obtained were analyzed using the Chi-square test for homogeneity of infection among gender and age groups. Forty-eight (24.0%) of all stool samples were positive for intestinal parasite infections; with overall prevalence of 12.5, 6.0 and 5.5% for helminth, protozoa, and mixed helminth-protozoa infections, respectively. Overall frequency of infection with *Ascaris lumbricoides* was 42.7%, followed by *Strongyloides stercoralis* (24%) while *Entamoeba histolytica*, *Taenia* spp., Hookworm spp., and *Giardia lamblia* recorded 10.7, 9.3, 8.0 and 5.3% respectively. Overall gender prevalence revealed that a total of 27 (13.5 %) males were infected and 21 (10.5 %) females were infected, there was no significant difference ($p<0.05$) between infections in males and in females. Overall age prevalence revealed that more than one-third 18 (9.0 %) of the infections occurred in the ≤ 20 age group, and the least prevalence 2 (1.0%) occurred in the >50 age group. This study has

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demonstrated intestinal parasite infections among food vendors studied. Irregular deworming and poor hand hygiene among food vendors are potential risks for food-borne diseases transmission to unsuspecting food consumers. Health education and social behavioral change communication on the importance of regular deworming, improved hand hygiene and WASH practices, as well as provision of better waste management infrastructure should be put in place to prevent any outbreak of food-borne diseases in the area.

Keywords: Food vendors; intestinal parasites; risk factors; food-borne diseases; Awkuzu.

1. INTRODUCTION

Protozoan and helminthic intestinal parasites infect man and his domesticated animals worldwide. It is estimated that some 3.5 billion people are exposed to intestinal protozoa infections while about 450 million in developing tropical and subtropical countries of the world are ill from the infection [1]. Globally, 4.5 billion people are at risk, and 2 million suffer from morbidities caused by parasitic helminthes [2]. Intestinal parasites have been known to cause severe symptoms of malnourishment, poor nutrient absorption, weakness, and abdominal pains as well as impairment of physical and mental development in children [3]. Poor hygiene resulting in contamination of soil, water, edible raw fruits and vegetables [4,5] are major risk factors for human infections with protozoa cysts and eggs or larvae of helminth parasites. Proper understanding of epidemiology of intestinal parasites by food vendors is important because most food handlers could be responsible for the transmission of intestinal parasites to consumers. This study was focused on intestinal parasites and associated risk factors among food vendors in Awkuzu, Oyi Local Government Area of Anambra State, Nigeria.

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out in Awkuzu with co-ordinates: 6.2424°N, 6.9397E° in Oyi Local Government Area (LGA) of Anambra State. Awkuzu is divided into three main parts: Ezi, Ifite and Ikenga; and each section further divided into sub-villages. Ezi has Iru-Anyika, Aka-Ezi, Igbu and Ozu. Ifite section is made up of Amabo, Isioji, and Ifite-Umueri. Ikenga has Ezinkwo, Nkwelle-Awkuzu, Umuobi, Ukpomachi, Dusogu, Otoko and Umudioka. Awkuzu community is famous for its large population of over 73000 people [6] which gave it the sobriquet as "Ibilibe Ogada" (the locust swarming fame). The people are primarily engaged in farming and commerce. Awkuzu is bounded by eight different communities of Umunya and Nteje also in Oyi LGA, Ifitedunu, Ukpo and Ukwulu in Dunukofia LGA, Nando and Igbariam in Anambra East LGA, and Abba in Njikoka LGA (Fig. 1). There are many eating houses and hundreds of out-door food vendors operating at Awkuzu, especially at the Awkuzu-junction motor parks and different market environments in the area. Thus food consumers in the area may be exposed to food and water-borne diseases.

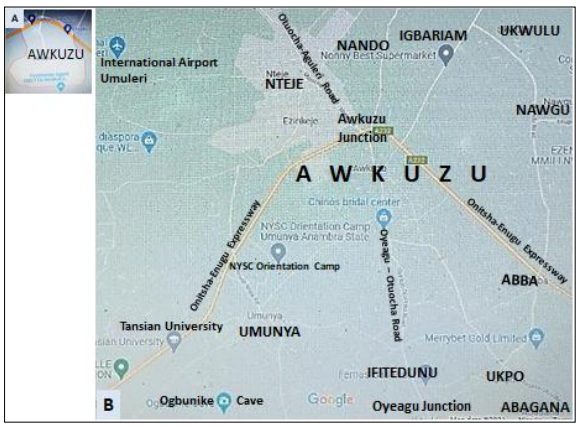

Fig. 1. Google map of Awkuzu Town [A], showing other surrounding communities [B]
Adapted from: https://www.google.com/maps/dir/

2.2 Study Design

The cross-sectional study on polyparasitism was carried out among food vendors in Awkuzu between April and June, 2021.

2.3 Study Population

All 398 food vendors observed to be operating within Awkuzu two months before and during the study period between April and June, 2021 constituted the study population.

2.4 Sample Size

Sample size formula $n = \frac{N}{1+N(e^2)}$ [7] where n is minimum sample size, N is study population, e is error term, 0.05 at 95% confidence interval, was used to determine the sample size for the study. Minimum sample size $n = \frac{398}{1+(347\ x\ 0.05^2)} = \frac{398}{1+0.995} = \frac{398}{1.995} = 199.49 \equiv 200$. Sample size n = 200 was purposively selected from consenting food vendors for the study.

2.5 Stool Samples Collection

Each participating food vendor was given a 50 ml specimen cup for stool sample collection. Information elicited from the participants through oral interviews included age, gender, hand washing habits and deworming frequency. Stool samples were analyzed in a stand-by mobile laboratory.

2.6 Stool Sample Examination

For helminthic parasites, freshly-passed morning stool samples from participants were routinely examined in our stand-by mobile laboratory using Direct faecal smears - saline and iodine wet mount preparations, and Faecal concentration procedure – formalin-ether technique [8]. Identifications of protozoan cysts, helminth eggs, larvae and segments were done using the procedures outlined in the Bench Aids for the Diagnosis of Intestinal Parasites [9].

2.7 Data Analysis

The data generated from the study were analyzed using the Chi-square method of data analysis in order to determine the homogeneity of the disease among age groups and sexes. A measure of significance P<0.05 was considered as statistically significant.

3. RESULTS AND DISCUSSION

Out of the 200 stool samples from food vendors examined, 48 (24.0%) were positive for intestinal parasite infections with prevalence of single helminth, single protozoa, and helminth-protozoa mixed infections shown in Fig. 2. Gender and age prevalence of intestinal parasite infections are shown in Table 1 while the overall frequency percentages of intestinal parasites from 48 infected food vendors are shown in Table 2. Frequency percentages of different species of intestinal parasites encountered are similarly indicated (Table 3).

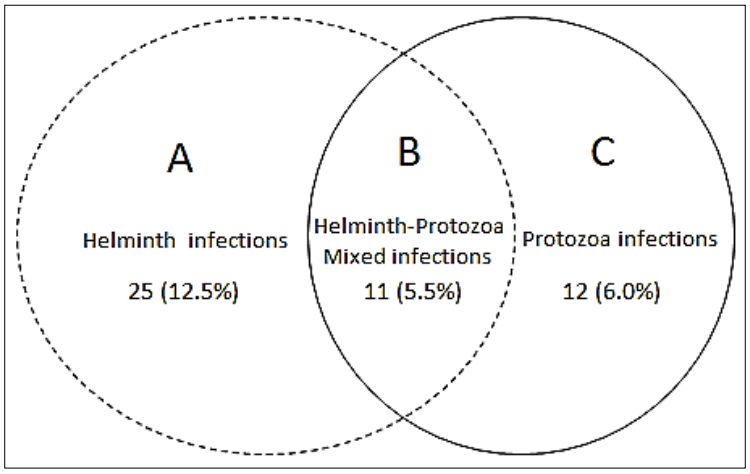

Fig. 2. Venn diagram of single and mixed intestinal parasites from food vendors examined

Table 1. Distribution of single and mixed parasitic infections among food vendors with respect to demographic factors

Characteristics of food vendors examined				Intestinal parasites in food vendors infected							
				Overall		Helminth		Protozoa		Helminth & Protozoa	
		No.	%	No.	%	No.	%	No.	%	No.	%
Gender	Male	64	32.0	27	13.5	14	7.0	7	2.0	6	3.5
	Female	136	68.0	21	10.5	11	5.5	5	4.0	5	2.0
	Total	200	100.0	48	24.0	25	12.5	12	6.0	11	5.5
Age-group (years)	≤ 20	49	24.5	18	9.0	7	3.5	6	3.0	5	2.5
	21-30	36	18.0	12	6.0	6	3.0	4	2.0	2	1.0
	31-40	65	32.5	10	5.0	6	3.0	2	1.0	2	1.0
	41-50	33	16.5	6	3.0	4	2.0	0	0.0	2	1.0
	>50	17	8.5	2	1.0	2	1.0	0	0.0	0	0.0
	Total	200	100.0	48	24.0	25	12.5	12	6.0	11	5.5

Table 2. Frequency of various species of intestinal parasites in food vendors

Parasites	Frequency	Cumulative frequency	Frequency %
Ascaris lumbricoides	32	32	42.7
Taenia species	7	39	9.3
Strongyloides stercoralis	18	57	24.0
Hookworm species	6	63	8.0
Entamoeba histolytica	8	71	10.7
Giardia lamblia	4	75	5.3
Total frequency (%)	75	75	100.0

Table 3. Frequency of various species of intestinal parasites with respect to various demographic factors

	Overall Frequency		Frequency distribution of parasite species											
			Ascaris lumbricoides		Taenia spp.		Strongyloides stercoralis		Hookworm spp.		Entamoeba histolytica		Giardia lamblia	
	f	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	42	56	21	28.0	3	4.0	10	13.3	3	4	4	8.0	1	1.3
Female	33	44	11	14.7	4	5.3	8	10.7	3	4	4	2.7	3	4.0
Total	75	100	32	42.7	7	9.3	18	24	6	8	8	10.7	4	5.3
≤ 20 y	38	50.7	17	14.7	3	4.0	9	10.7	4	5.3	3	4.0	2	2.7
21-30	22	29.3	6	8.0	2	2.7	4	6.7	1	1.3	2	2.8	2	2.7
31-40	8	10.7	3	8.0	1	1.3	3	4.0	0	0.0	1	1.3	0	0.0
41-50	3	4.0	4	6.7	1	1.3	1	1.3	1	1.3	1	1.3	0	0.0
>50	4	5.3	2	5.3	0	0.0	1	1.3	0	0.0	1	1.3	0	0.0
Total	75	100	32	42.7	7	9.3	18	24	6	8	8	10.7	4	5.3

Table 4. Deworming response of screened food vendors (n=200)

Frequency of Deworming	Infected		Not infected	
	No.	%	No.	%
Within the last six months	26	27.1	76	59.6
More than six months ago	70	72.9	28	40.4
Total	96	100	104	100

Of the 96 food vendors that were infected, 27.1% indicated that they dewormed sometime within the last 6 months, while 72.9% indicated that it had been more than six (6) months since they last dewormed. Similarly, of the 104 that were uninfected, 59.6% indicated that they dewormed within the past 6 months while 40.4% indicated that it had been more than six (6) months since they last dewormed (Table 4).

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Table 5. Risk factors for intestinal parasites among food vendors (n=200)

Risk factors		Number observed	Percentage per risk factor
Toilet facility	Water Cistern	92	46.0
	Pit Latrine	76	38.0
	Open defecation	32	16.0
	Total respondents	200	100.0
Refuse bins	Undisposed refuse bins	10	25.64
	Covered refuse bins	13	33.33
	Uncovered refuse bins	16	41.03
	Total observed	39	100.0
Hand-washing Habits	After toilet use before food handling	92	46.0
	Occasionally	108	54.0
	Total respondents	200	100.0

Percentages per risk factor for intestinal parasites among food vendors (Table 5) were deduced from questionnaires responses by food vendors. It was revealed that of 200 respondents on toilet use, 46% make use of water cisterns, 38 make use of pit latrine and 16 still practice open defecation. Similarly, percentages per risk factors for refuse bins and hand washing habits are indicated in Table 5. Undisposed and uncovered refuse bins as well as improperly washed hands at critical times like after going to the toilet and before food-handling were prevalent among these food vendors.

Ascaris lumbricoides was the most prevalent with higher frequency in younger food vendors than in older age groups. *Ascaris lumbricoides,* the most prevalent of the intestinal parasite among food vendors in the study is well-known to be transmitted through ingestion of viable *Ascaris lumbricoides* eggs in contaminated food. The practice of open defecation by some food vendors could lead to contamination of the soil by *Ascaris* eggs. *Ascaris lumbricoides* eggs are sticky, and can survive and remain viable in the environment for prolonged periods of time, and adhere to vegetables [5] and human hands when in contact with contaminated soil, leading to infection via the accidental ingestion of these parasite's eggs. The higher prevalence found in younger age groups of food vendors could be because younger people tend to be less sedentary and therefore may have more exposure to risk factors than older age groups making them the primary focus of mass chemotherapy for the control of helminths in endemic communities [10]. The high prevalence of the eggs in stool specimen of food vendors implies that they ingested the eggs either through putting hands contaminated with soil in their mouth or eating edible raw vegetables and fruits. For these reasons Ascariasis is considered a barometer of hygiene of people and communities. However, improved water, sanitation and hygiene would impact positively on prevalence of Ascariasis in communities [11], (Pickering et al., 2018).

Food vendors in the present study had single and mixed infections with both protozoa and intestinal helminths, which suggests exposure to multiple parasites with different infection routes. In the tropics, the temperature and sanitary conditions places people at risk for a range of infections with multiple protozoa and intestinal helminthes. Polyparasitism was also reported in a study conducted on school children in Vandeikya, North Central, Benue State, Nigeria where hygiene factors like type of toilet facility available was cited as a major risk factors contributing to the high prevalence of intestinal parasites in the area [12].

In the present study, males had a higher prevalence of both helminths and parasites than females but the differences were not significant. Higher prevalence in males could suggest higher exposure to risk factors for transmission of the diseases in the area. A similar pattern of prevalence with no significant gender difference was reported in Northwest Iran [13].

Some identified risk factors in the present study like improper refuse disposal, uncovered refuse bins and failure to wash hands at critical times after toileting and before eating indicated that simple sanitary habits such as hand hygiene would impact positively on intestinal parasite infection and re-infection rates. The two protozoan parasites reported in the present study are well-known causative agents of amoebiasis. Onyido et al. [14] reported that *Musca domestica*, a notorious mechanical transmitter of filth diseases especially amoebiasis, typhoid, cholera,

and helminthosis abound in refuse dumps and would ensure the probable endemicity of such diseases in an area. Some of the living conditions and open defecation habits that favour the spread of gastro-intestinal helminth infections in an area have also been reported from other parts of nearby Dunukofia LGA in the state [15]. The fact that deworming responses were poor in the present study demands that there should be more consciousness in the practice of regular and strategic deworming among the people in endemic areas. Moreover, health education and occasional reminder, as well as distribution of free drugs to at-risk-adults should be encouraged for the interruption of helminth transmission. As tailored, strategic control measures should be implemented by stakeholders for the sustained control of these diseases in endemic areas [16].

For this reason, in at-risk-communities, hygiene promotion and behavior change communication should be an important part of disease control particularly among high transmission risk groups like food handlers. The importance of hygiene in control of infectious diseases cannot be over emphasized. Even with yearly mass drug administration (MDA) as the main strategy for control of geohelminths and other neglected tropical diseases (NTDs) for sustainable impact, WHO [17] still find it necessary that these control efforts be complimented with proper water sanitation and hygiene (WASH) practices, especially in at-risk-communities like the study area and similar places in the country.

4. CONCLUSION AND RECOMMENDA-TIONS

Intestinal parasite infections have been observed among food vendors in Awkuzu. Poor hygiene and sanitation seen among these food handlers constitutes potential risks for food contamination and subsequent transmission and spread of food-borne diseases among food consumers in the community. Measures like health education and behavior change communication on the importance of regular deworming, improved hand hygiene and WASH practices, as well as provision of better waste management infrastructure should be put in place to prevent any outbreak of food-borne diseases in the area.

CONSENT AND ETHICAL CONSIDERA-TIONS

Preliminary visits to community leaders and market authorities sought for approval and their cooperation during the study. Brief health talks on hygienic handling of food materials were given to consenting participants prior to commencement of the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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