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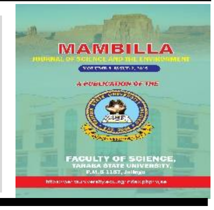

DISTRIBUTION OF INTESTINAL HELMINTHIC INFECTIONS AMONG RESIDENTS OF TAKUM LOCAL GOVERNMENT AREA, TARABA STATE, NIGERIA

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A B S T R A C T

Intestinal helminths infections are a pervasive global health issue, particularly in tropical and subtropical regions where inadequate sanitation, poverty, and limited access to healthcare services create an environment conducive to the spread. The aim of this study was to determine the distribution of intestinal helminthic infections among residents of Takum Local Government Area, Taraba State, Nigeria. A total of 300 stool samples were collected randomly from the residents of Takum and were analyzed using standard methods. Structured questionnaire was used to collect information on the demography of the respondents including sex, age, education level and occupation. Data obtained was analyzed using both descriptive (frequencies and percentages) and inferential statistics (chi-square) to determine the association between infection and the demographic characteristics of the respondents. The baseline analysis showed that males had higher infections than females for *Ascaris lumbricoides* (6.4% and 7.3%), Hookworm (32.6% and 26.8%), and *Schistosoma mansoni* (4.6% and 1.2%) respectively. However, there was no statistical significance (χ^2 = 3.233, $p = 0.357$). There was significant association between infection and age (χ^2 = 20.809, $p = 0.014$), with the highest prevalence observed among individuals under 18 years (8.8% for *A. lumbricoides,* 36.8% for Hookworm, 5.6% for *S. mansoni*). Education level did not show a significant association (χ^2 = 5.388, p = 0.799). Similarly, Occupation also showed no significant association (χ^2 = 6.636, p = 0.084). The findings from this study underscore the need for targeted public health interventions, including regular deworming campaigns, health education on proper hygiene and drug use, and improved access to effective anthelmintics. Community-based treatment strategies supervised by healthcare professionals, especially among school-aged children and vulnerable populations, should be prioritized.

1. Introduction

Intestinal parasitic infections are a pervasive global health issue, particularly in tropical and subtropical regions where inadequate sanitation, poverty, and limited access to healthcare services create an environment conducive to the spread. These infections are predominantly caused by helminths and protozoa, which can lead to a wide range of health problems, from mild discomfort to severe, life-threatening conditions (World Health Organization [WHO], 2022). Among the most common intestinal parasites are *Ascaris lumbricoides* (roundworms), *Trichuris trichiura* (whipworms), *Ancylostoma duodenale* and *Necator americanus* (hookworms), and various species of protozoa such as *Giardia lamblia* and *Entamoeba histolytica* (Bethony *et al.*, 2006). These parasites are often transmitted through contaminated food, water, or soil, making prevention and control measures more complex.

The burden of intestinal parasitic infections is particularly heavy on children and pregnant women, who are more vulnerable to the severe effects of these infections. Chronic infection can lead to significant morbidity, including malnutrition, anemia, impaired cognitive development in children, and adverse pregnancy outcomes (Hotez *et al*., 2008). In sub-Saharan Africa, Asia, and Latin America, where these infections are most prevalent, they contribute to a cycle of poverty and disease that is difficult to break without effective intervention strategies (Pullan *et al*., 2014).

Given the widespread prevalence and impact of these infections, the development and deployment of effective antiparasitic drugs have been crucial in global health initiatives.

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Ivermectin and albendazole are two of the most widely used anthelmintic drugs, each with unique properties that make them suitable for different parasitic infections. Ivermectin, discovered in the late 1970s, has revolutionized the treatment of parasitic infections in both humans and animals (Crump & Ōmura, 2011). Initially used to control onchocerciasis (river blindness) and lymphatic filariasis, ivermectin's broad-spectrum efficacy has extended its use to other parasitic diseases, including strongyloidiasis and scabies (González *et al.,* 2019). Its mechanism of action involves binding to glutamate-gated chloride channels in the parasite's nerve and muscle cells, leading to paralysis and death of the parasite (Laing *et al.,* 2017). This mechanism is particularly effective against a wide range of nematodes and arthropods, making ivermectin a vital tool in mass drug administration (MDA) programs aimed at controlling parasitic diseases in endemic regions.

Albendazole, on the other hand, is a benzimidazole derivative introduced in the 1980s that has become a cornerstone in the treatment of soil-transmitted helminths (STH) and other parasitic infections (Keiser & Utzinger, 2008). Albendazole's mechanism of action involves the inhibition of microtubule polymerization within the parasite's cells, disrupting essential cellular processes such as glucose uptake, which ultimately leads to the parasite's death (Zhang *et al.,* 2017). Albendazole is particularly effective against a wide range of helminths, including roundworms, hookworms, and whipworms, and is often used in combination with other anthelmintics in MDA programs to achieve broad-spectrum control of intestinal parasites (Albonico *et al.,* 2008).

Despite the success of ivermectin and albendazole in controlling parasitic infections, there are growing concerns about the emergence of drug resistance, particularly in regions where these drugs are used extensively in MDA programs (Geerts and Gryseels, 2000). Drug resistance not only threatens the efficacy of current treatment strategies but also underscores the need for ongoing research to identify new therapeutic targets and develop novel antiparasitic agents. Comparative studies that assess the effectiveness of existing drugs, such as ivermectin and albendazole, are therefore critical in guiding treatment protocols and optimizing the use of these drugs in various epidemiological settings (Taylor-Robinson *et al.,* 2019).

In addition to the issue of drug resistance, there is a need to consider the safety profiles and potential side effects of ivermectin and albendazole, particularly when used in vulnerable populations such as children, pregnant women, and individuals with co-morbidities (Cárdenas & Ortega, 2020). Both drugs are generally well-tolerated, but they can cause side effects ranging from mild gastrointestinal disturbances to more serious adverse reactions, particularly when administered at high doses or over prolonged periods (Garcia-Bustos *et al.,* 2021).

The comparative effectiveness of ivermectin and albendazole has been the subject of numerous studies, each contributing valuable insights into the optimal use of these drugs in different clinical and epidemiological contexts (Liu *et al.,* 2016). For instance, ivermectin has been shown to be particularly effective in treating strongyloidiasis and scabies, while albendazole is more effective against a broader range of intestinal helminths (Menzies *et al.,* 2014). However, there remains a need for comprehensive comparative studies that evaluate these drugs not only in terms of their antiparasitic efficacy but also their impact on broader health outcomes, including nutritional status, cognitive development, and overall quality of life (Steinmann *et al.,* 2011).

2. Materials and Methods

2.1 Study Area

Takum is a town and Local Government Area (LGA) located in the southwestern part of Taraba State, Nigeria. Geographically, Takum lies between latitude 7°10′N and longitude 9°59′E, making it part of the Guinea Savannah zone, characterized by tropical climate conditions with distinct wet and dry seasons. The area is bounded by other LGAs within Taraba State, such as Ussa and Donga, and also shares a border with Cameroon to the south, making it strategically significant for cross-border trade and cultural exchange.

Takum is predominantly inhabited by several ethnic groups, including the Jukun, Chamba, Kuteb, Tiv, and Hausa. This diversity has fostered a rich cultural heritage, reflected in local festivals, traditional crafts, and languages spoken in the area. The economy of Takum is primarily agrarian, with the majority of the population engaged in farming. Key agricultural products include maize, yam, cassava, and groundnuts. In addition to farming, the area is known for its local markets, where agricultural products, livestock, and crafts are traded.

2.2 Study Population

The study population comprised residents of Takum Local Government Area. About 300 participants were used in this study.

2.3 Sampling Technique and Sample Size

A stratified random sampling technique was employed to ensure that the samples are representative of the population. The sample will be stratified based on age and gender to allow for a comprehensive comparison of ivermectin and albendazole across different demographic groups.

2.4 Data Collection Methods
The primary data collection tool was structured questionnaire administered to participants to gather their demographic information.
2.5 Ethical Considerations
Ethical approval was obtained from the Taraba State ministry of health with number TRSHREC/2025/APP/001. All participants were provided with informed consent before enrolment, with assurances of confidentiality and the right to withdraw from the study at any time without any consequences. Participants diagnosed with parasitic infections provided with appropriate treatment regardless of their group assignment.
2.6 Stool sample collection
Each participant was provided with a clean, dry, wide-mouthed, screw-capped plastic container labeled with a unique identification code, along with instructions on how to collect a fresh stool sample. Participants were advised to avoid contamination of the sample with urine or water. Approximately 5–10 grams of fresh stool were collected by each participant. After collection, the stool samples were immediately transported in a cold box (4–8°C) to the laboratory within 4–6 hours of collection to maintain sample integrity. In cases where immediate analysis was not feasible, samples were preserved using 10% formalin for subsequent laboratory examination.
2.7 Laboratory analysis
Each stool specimen was thoroughly mixed, and about 1 gram was emulsified in 7–10 mL of 10% buffered formalin in a 15 mL conical centrifuge tube. The suspension was strained through a double layer of gauze to remove large debris, ensuring a smooth mixture suitable for further processing. After adding 2–3 mL of ether, the tubes were tightly stoppered and shaken vigorously for about 30 seconds to allow the solvent to dissolve fats and lighter fecal debris that could interfere with microscopic observation. The tubes were then centrifuged at approximately 3,000 rpm for two to three minutes, creating four distinct layers: a top layer of ether, a debris plug beneath the ether, a clear formalin layer, and a sediment pellet at the bottom containing the concentrated helminth eggs and larvae.
The upper layers, including the debris plug, were carefully decanted in one motion, leaving only the sediment at the bottom of the tube. This sediment was resuspended in a small amount of formalin, and a drop of the concentrated mixture was placed on a clean glass slide. One preparation was mounted in normal saline to observe the general morphology, while another was prepared with a drop of iodine solution to enhance visualization of internal structures. Each slide was examined under a light microscope at low (10×) and high (40×) magnification. The presence and type of helminth eggs or larvae were identified based on their characteristic morphological features, such as the thick, mammillated shells of *Ascaris lumbricoides* eggs, the barrel-shaped eggs of *Trichuris trichiura* with bipolar plugs, or the thin-shelled eggs of hookworms.
All findings were recorded in a structured data sheet for each participant, noting whether the sample was positive or negative and specifying the species detected.
2.8 Data Analysis
Data analysis was conducted using SPSS version 25. Descriptive statistics, including means and standard deviations were calculated for baseline demographic and clinical characteristics of the participants. Chi-square was used to determine the association between the infection level and the demography of the participants. All analysis were done at a 95% confidence interval with $p \leq 0.05$.

3. Results
Table 1: Intestinal helminthic infection among residents of Takum Local Government Area in relation to sex

Sex	No. Examined	*A. lumbricoides* (%)	Hookworm (%)	*S. mansoni* (%)	χ^2	p-value
Male	218	14 (6.4)	71 (32.6)	10 (4.6)		
Female	82	6 (7.3)	22 (26.8)	1 (1.2)	3.233	0.357
Total	300	20 (6.7)	93 (31.0)	11 (3.7)		

There is no statistical significance ($\chi^2 = 3.233$, $p = 0.357$).

Table 2: Intestinal helminthic infection among residents of Takum Local Government Area in relation to age

Age Group	No. Examined	*A. lumbricoides* (%)	Hookworm (%)	*S. mansoni* (%)	χ^2	p-value
<18	125	11 (8.8)	46 (36.8)	7 (5.6)		
18–28	80	1 (1.2)	28 (35.0)	1 (1.2)	20.809	0.014
29–39	66	4 (6.1)	13 (19.7)	1 (1.5)		
>40	29	4 (13.8)	6 (20.7)	2 (6.9)		

There is significant association between infection and age ($\chi^2 = 20.809$, $p = 0.014$).

Table 3: Intestinal helminthic infection among residents of Takum Local Government Area in relation to education

Education Level	No. Examined	*A. lumbricoides* (%)	Hookworm (%)	*S. mansoni* (%)	χ^2	p-value
No formal	136	12 (8.8)	44 (32.4)	6 (4.4)		
Primary	74	4 (5.4)	24 (32.4)	3 (4.1)	5.388	**0.799**
Secondary	49	1 (2.0)	13 (26.5)	1 (2.0)		
Tertiary	41	3 (7.3)	12 (29.3)	1 (2.4)		

Education level did not show a significant association ($\chi^2 = 5.388$, p = 0.799).

Table 4: Intestinal helminthic infection among residents of Takum Local Government Area in relation to occupation

Occupation	No. Examined	*A. lumbricoides* (%)	Hookworm (%)	*S. mansoni* (%)	χ^2	p-value
Non-farmers	82	6 (7.3)	17 (20.7)	2 (2.4)		
Farmers	218	14 (6.4)	76 (36.9)	9 (4.1)	6.636	0.084

Occupation also showed no significant association ($\chi^2 = 6.636$, p = 0.084).

4. Discussion

The findings of this study showed the distribution of intestinal helminths and associated factors among the residents of Takum Local Government Area. The results showed that while females exhibited a slightly higher prevalence of hookworm (32.6%) and *Schistosoma mansoni* (4.6%) compared to their male counterparts (26.8% and 1.2%, respectively), the observed differences were not statistically significant. This suggests that both genders are similarly exposed to helminthic infections in the area. These findings contrast the finding of Nematian *et al.* (2004), which found significant differences in infection rates between sexes, often linked to gender-based occupational roles and hygiene behaviors. In this study, similar exposure levels may be due to shared environmental and socioeconomic conditions across both sexes.

However, age was significantly associated with infection prevalence. Individuals under 18 years old exhibited the highest rates of *Ascaris lumbricoides* (8.8%) and hookworm (36.8%). This finding coincides with the findings of Asaolu *et al.* (2002) and Oyedeji *et al.* (2011), who noted that younger individuals are more vulnerable due to factors such as lower immunity, frequent soil contact, and limited hygiene awareness. These factors contribute to increased susceptibility among children and adolescents, which highlights the need for targeted school-based deworming programs in Takum.

While educational status does not show significant statistical relationship with infection prevalence, the highest rates were observed among residents with no formal education. This aligns with the findings of Ojurongbe *et al.* (2011), who reported that lower education levels were often associated with poor hygiene practices and inadequate knowledge about parasite transmission.

Occupational status similarly indicated that farmers had higher infection rates of hookworm (36.9%) compared to non-farmers (20.7%), with no statistical significance. Farming activities, particularly those involving barefoot work and contact with contaminated soil, are known risk factors for helminth infections, as noted in studies by Auta *et al.* (2013). Despite the non-significance in this study, the elevated rates among farmers underline the occupational hazards that contribute to the persistence of these infections.

5. Conclusion

The findings from this study underscore the need for targeted public health interventions, including regular deworming campaigns, health education on proper hygiene and drug use, and improved access to effective anthelmintics. Community-based treatment strategies supervised by healthcare professionals, especially among school-aged children and vulnerable populations, should be prioritized. Ultimately, reducing the burden of helminthic infections in Takum requires a holistic approach that combines treatment, prevention, and sustained health infrastructure improvements.

6. Recommendations

The following recommendations are made from the results of this study;

1. Regular mass deworming campaigns should be organized, especially targeting children and young adults under 18 years of age who were found to be more vulnerable. These programs should be coordinated through schools and primary healthcare centers to ensure wide coverage and proper supervision.
2. Public health education focusing on personal hygiene, environmental sanitation, and the risks of self-medication should be intensified. Community sensitization programs can reduce reinfection rates and promote proper drug use, including the importance of completing prescribed doses.
3. Healthcare authorities should ensure consistent availability of effective anthelmintics, particularly Ivermectin, which was found to be more effective than Albendazole in controlling hookworm infections. Efforts should also be made to subsidize the cost of these drugs to increase affordability for low-income populations.
4. Strengthening local healthcare systems to provide early diagnosis, follow-up, and proper drug administration is essential. Health facilities should be equipped to monitor treatment outcomes and prevent re-infection through continuous surveillance and timely intervention.

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