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Assessment of Soil Transmitted Helminths among Children Under Five Years in Some Selected Local Government Areas in Taraba State, Nigeria

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Abstract

Soil-transmitted helminths (STHs) are a significant public health concern, particularly in low-income countries. This study was conducted across six selected LGAs in Taraba State, Nigeria, which aimed to determine the prevalence of STHs among children under five. The study involved 2,283 children, and stool samples were collected and analyzed using standard parasitological techniques. The results showed that 181 (7.9%) of the children were infected with STHs. Among the male children, 103 (8.9%) were infected, with hookworm being the most common (4.6%). In contrast, 78 (7.7%) of the female children were infected, with hookworm also being the most prevalent (2.7%). The study found that the overall prevalence of STHs was higher in males than females, but the difference was not statistically significant. According to the World Health Organization's (WHO) classification, the study area was found to have moderate endemicity of STHs infections. The study recommends strengthening routine deworming programs among under-five children to reduce the morbidity and mortality associated with STHs infection.

Keywords: Assessment, Soil Transmitted Helminths, Under -five Children.

INTRODUCTION

Soil-transmitted helminths are among the list of the global marginalized diseases (Abdi *et al*., 2016). The STHs include *Ascaris lumbricoides*, *Trichuris trichiura*, *Ancylostoma duodenale* and *Necator americanus*, and *Strongylitis stercoralis* which share a number of features. The infectious stages develop outside the host in the soil. Moreover, all the STHs lead to mainly mild chronic, rather than severe acute disorders in the human host, and can usually be treated with the same antibiotics [World Health Organization (WHO), (2012].

Globally, over 2 billion people are affected with STH where ascariasis accounts for almost 1.2 billion infections while trichiurasis and hookworm (Ancylostoma duodenale and Necator americanus) responsible for over 800 million and 740 million infections, respectively (Pullan and Brooker, 2010). The global burden of STH infection is estimated at between 5 and 39

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million disability-adjusted life years (DALYs) and in 2010, 5.18 DALYs were estimated as associated with STH infections (Brooker, 2010). The greater burden of STH infection is found in the tropical countries including tropical South America, China, East Asia, and Sub-Saharan Africa (Bethony et al., 2006). According to the WHO estimate 42 countries in Africa are endemic for STH with 284 million cases occurring in both school age and pre-school age children. These children require periodic administration of preventive chemotherapy (WHO, 2017)

The different species of STHs: Ascaris lumbricoides*, Trichuris trichura* and hookworm (*Ancylostoma duodenal*e and *Necator. americanus*) are endemic in tropical and subtropical areas of the world and are included in the list of the 20 neglected tropical diseases (NTDs) recently updated by World Health Organization (WHO, 2020). Eco-climatic conditions, geo-locality, socioeconomic, environmental, behavioral, cultural and demographic factors (particularly age) influence the prevalence of infection with different types of intestinal parasites (Mahfouz *et al*., 1997).

Infected children are nutritionally and physically impaired. STH's feed on host tissues including blood resulting in loss of protein and iron and chronic blood loss (CDC, 2022). Mal-absorption of nutrients is exacerbated by these worms and importantly Ascaris lumbricoides may possibly compete for vitamin A. Tricuris tricuria can cause diarrhea and dysentery (WHO, 2022). STH infections in young children may in the long-term cause developmental and growth disorders that can cause cognitive decline due to impairment of the brain's maturation process, affecting future learning and education (Blouin et al., 2018),

Several studies about the prevalence of intestinal parasites were conducted, which showed protozoan infections were more common than helminth infections (Sayyari *et al*., 2005). The reason for this is that the transfer of protozoans is much easier than the transfer of the eggs or larvae of worms (Jacobsen *et al*., 2007) and the use of self-medication is restricted to helminths (Dagnew *et al*., 2012).

Human activities and lifestyle choices, especially those influenced by poverty, poor sanitation and limited access to health care play a significant role in transmission of STHs. Additionally, walking barefoot and consuming unwashed fruits and vegetables also increase the risk of infection. This study aimed to investigate the prevalence of STHs among children under five in six LGAs of Taraba State, Nigeria.

MATERIALS AND METHODS

Study Area

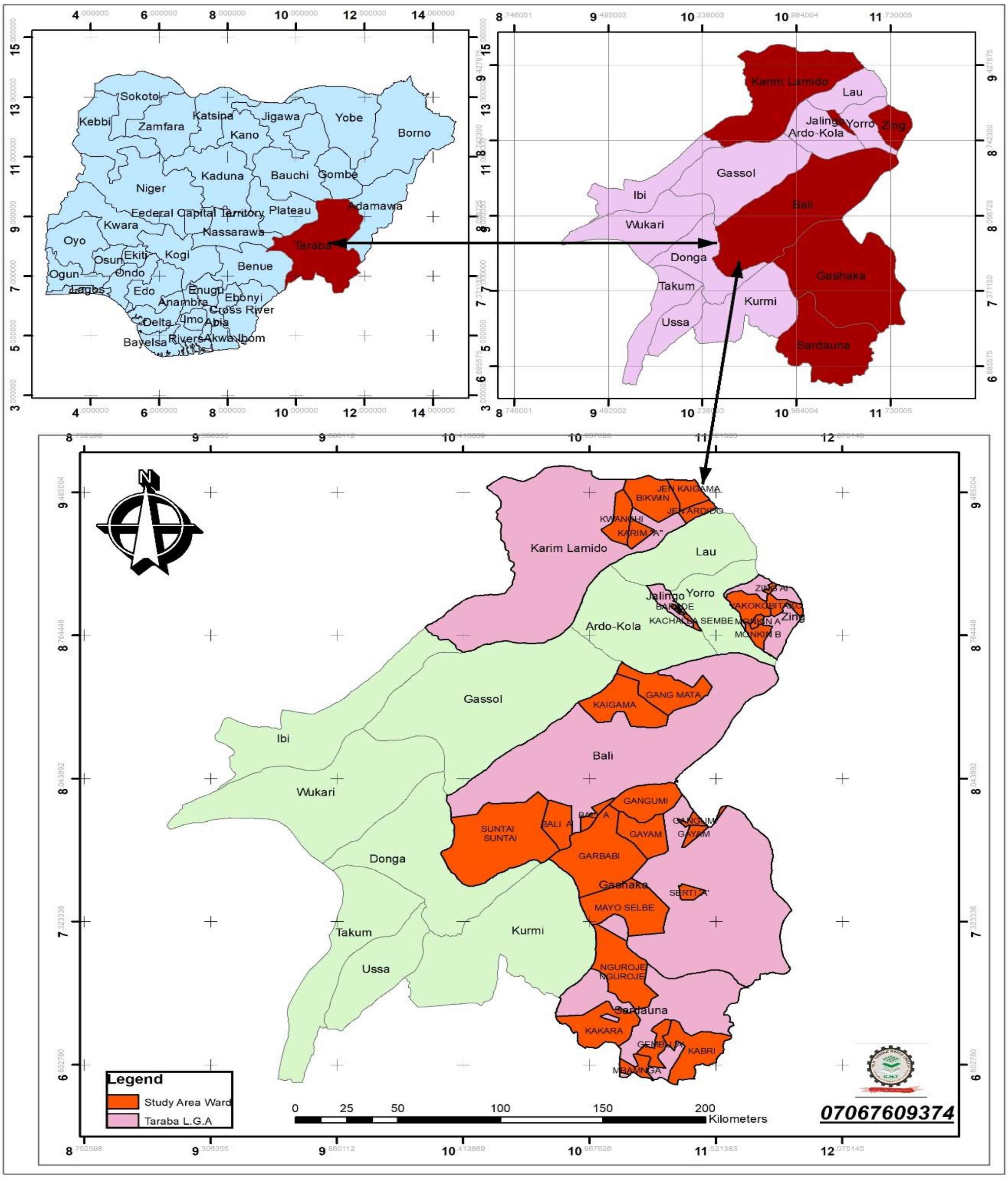

Figure 1: Map of Taraba State Nigeria showing the study area

The research was carried out in Taraba State, North-eastern Nigeria which lies approximately between latitude 6.494189°and 9.634663° North and between longitude 9.104619° and 11.914303° east with a total population of 2,294,800 (National Population Commission, (NPC), 2006]. It is bounded in the north by Bauchi State and Gombe State, Adamawa State in the Northeast, Republic of Cameroun to the south and south east, Benue State in the Southeast and, Nassarawa and Plateau States in the west. Taraba State is renowned for its commercial production of staple crops such as maize, rice, sorghum, millet, cassava and yam. The state's economy is also driven by diverse activities including poultry, cotton production, and various traditional crafts.

Ethical Clearance

The necessary approval was secured from the Taraba State Ministry of Health. The Local Government Management/Executives of the respective LGAs were notified prior to the commencement of the survey, also traditional leaders of the respective LGAs as well as villages heads of the selected communities also, to seek for consent and approval. They were informed of their right to participate or withdraw from the research before, during and even after the research with no consequence. They were assured of the confidentiality of the results from research outcome.

Determination of sample size

The sample size was determined using Araoye (2004) formula. The calculation involved the following parameters: a confidence level of 95% (z=1.96), an estimated proportion of 0.5 and a desired accuracy of 0.05. Substituting these values into the formula

$n = \frac{z^2pq}{d^2}$ resulted to a required sample size of 384 for each LGA. However, a total sample of 2,283 was retrieved from 2,304 questionnaires distributed.

Stool sample collection

Well labelled sterile plastic containers were used to collect 2,283 stool samples from under-5 children in the selected households. The mother/child were reminded on the procedures for collecting stool samples into the container. The samples were collected at the appointed time and preserved immediately using 10% formalin. The preserved samples were conveyed to the laboratory for analysis and examination. All stool samples collected were analyzed using formal-ether concentration technique (Cheesbrough, 2006). The eggs were identified based on morphological features (Chiodini *et al.*, 2001).

Laboratory Procedures (formol-ether concentration techniques)

A 1g fecal sample was emulsified in 4ml of 10% formalin water using a rod or stick. The mixture was then diluted with an additional 3-4ml of formalin water, capped, and shaken well. The emulsified sample was sieved, and the suspension collected in a beaker. The suspension was then transferred to a centrifuge tube, and 3-4ml of diethyl ether was added. The tube was stopped, mixed for 1 minute, and then centrifuged at 3000rpm for 1 minute. The layer of fecal debris was loosened from the tube sides using a stick or pipette stem, and the tube was inverted to discard the ether, debris, and formalin water. The sediment was re-suspended, mixed, and transferred to a slide. A coverslip was applied, and the sample was observed under a microscope (Cheesbrough, 2006).

Data analysis

All data collected were analyzed using Statistical Package for Social Sciences (SPSS) version 23.0. Simple percentage (%) was used to determine the prevalence of STHs. Chi-square (X^2) was used to determine the association of STHs with socio-demographic characteristics of children under -5years. All statistical values were considered significant at $p<0.05$.

Results

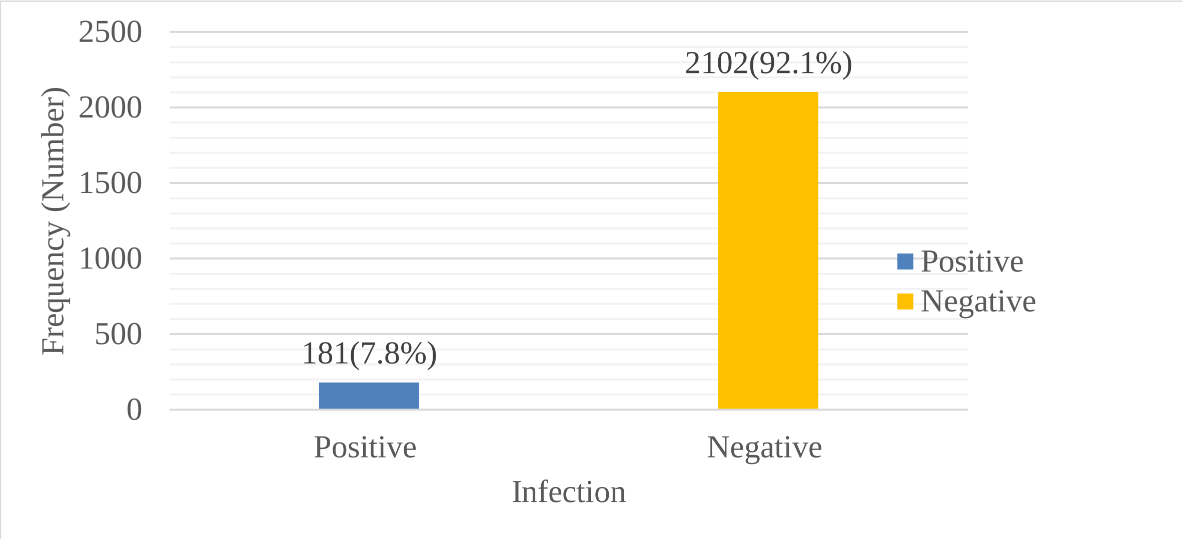

Figure 1: Prevalence of STHs among Under-5 Children in the Study Area

Table 1: Prevalence of STHs with Relation to gender among Under-5 Children in the Study Area

Variable	Freq. (%)	STHs				Total no.+ve (%)	p Value
		HW	TT	AL	SS		
Gender							
Male	1263 (55.3)	45	18	20	20	103 (8.2)	0.523
Female	1020 (44.7)	28	21	17	12	78 (7.7)	
Total	2283 (100)	73	39	37	32	181 (7.9)	

Key: *AL= A. lumbricoides, TT=T. trichiura, HW= Hookworm, SS = S. stercolaris*

Table 2: Prevalence of STHs with Relation to Age among Under-5 Children in the Study Area

Variable	Freq. (%)	STHs				Total no.+ve (%)	p Value
		HW	TT	AL	SS		
Age (months)							
0-12	359 (15.7)	11	3	8	4	26 (7.2)	0.909
13-24	275 (12.0)	12	8	5	3	28 (10.2)	
25-36	624 (27.3)	19	10	9	8	46 (7.4)	
37-48	651 (28.5)	18	13	10	12	53 (8.1)	
49-59	374 (16.4)	13	5	5	5	28 (7.5)	
Total	2283 (100)	73	39	37	32	181(7.93)	

Key: *AL= A. lumbricoides, TT= T. trichiura, HW= Hookworm, SS = S. stercolaris*

Out of 2,283 under-5 children studied, 181 (7.9%) were infected with soil-transmitted helminths (STHs), while 2,102 (92.1%) tested negative as presented in fig. 1 above. Among the 1,263 male children examined, 103 (8.9%) had STH infections, with hookworm being the most prevalent (4.6%). In contrast, 78 (7.7%) of the female children were infected, with hookworm again being the most common (2.7%). Although males had a higher overall prevalence of STH infections, the difference was not statistically significant (p>0.05).

Regarding the age of the children as presented in table 1, those aged 37-48 months had the highest prevalence of STHs infections (8.1%), while those aged 0-12 months had the lowest. Hookworm infections were most common in the 0-12 months' age group (3.1%). However, there were no significant differences in the prevalence of STH infections between the different age groups.

The study also found that at least one type of STH was present in each of the six Local Government Areas (LGAs) studied. Lau LGA had the highest prevalence of STH infections (11.1%), while Sardauna LGA had the lowest (5.8%). However, there were no significant differences in the prevalence of STH infections between the different LGAs as shown in table 2.

DISCUSSION

The cumulative prevalence of STHs was 7.9%, with the most common prevalence for Hookworm 73(3.2%) and T. trichiura 39(1.7%) was recorded in the current study. WHO has classified STH endemic areas as high transmission (where prevalence is >50%), moderate transmission (where prevalence is between 20%-50%), and low transmission (where prevalence is <20%) (WHO, 2020). Based on the WHO classification of STHs infection prevalence, the study area would be classified as low prevalence. This result was lower than the study by Karshima, (2018) who reported 54.8% in a systematic review and meta-analysis from 1980-2015 among children in Nigeria, also Idowu *et al*., (2019) and Idowu *et al*. (2022) who reported 32% and 69.9% respectively in a study on the prevalence of soil-transmitted helminth infection among children under 5 years from urban and rural settings in Ogun state, Nigeria. In addition, it is slight lower than that of Nougning (2012) in the localities of Bambui and Bambili, North West Region of Cameroon who also recorded a prevalence of 8.5% among residents. It was still relatively lower than the prevalence (13.8%) reported by Ephrem *et al*. (2015) in Ethiopia. However, this overall prevalence is relatively high as compared to the 0.9% recorded by Vincent et al., (2017) in the Same district.

Age of parents/caregivers, occupation, family size and location differences may be explained by variations in socioeconomic status, regular de-worming campaigns, improvement in hygienic conditions, climatic and geographic conditions, as well as local endemicity of the study area for these particular parasites. Low-intensity soil transmitted helminth infections have been reported by Pasaribu *et al*. (2019) in Indonesia and Awharitoma *et al*. (2020) in Nigeria. In a study in Yemen, Al-Mekhla *et al*. (2016) noted that low intensities of soil transmitted helminth infections may still harm children's health and quality of life.

Four parasitic helminths were identified including *A. lumbricoides, T. trichiura,* Hookworms and *S. stercolaris* with specific prevalences of 1.6%, 1.7%, 3.2% and 1.4% respectively. This result is similar with the findings by Imam *et al*. (2017) and Oyebamiji *et al*. (2018) in Ibadan south-west Nigeria respectively. These results are almost similar to the values obtained by Idowu *et al*. (2022), who recorded 4.37% in *A. lumbricoides*, 2.75% in *T. trichiura* and 1.57% in Hookworm infections but relatively low as compared to those registered in Dschang by Tchakounté *et al.* (2018) (*A. lumbricoides*: 18%, *T. trichiura*: 36%, Hookworm: 11%). These low specific rates may be due to public awareness, improvement of environmental sanitation and the national de-worming campaign for the fight against gastro-intestinal parasites. From the overall prevalence of intestinal helminths, hookworm comprised the most prevalent helminth parasite (3.2%). This aligns with mapping results conducted in Ogoja Local Government Area in 2014, which reported hookworm as the most prevalent soil-transmitted helminth, followed by T. trichiura and A. lumbricoides. Hookworm infection is influenced by habits such as not wearing footwear regularly (Alelign *et al*. 2015).

The overall prevalence of infections among males (8.2%|) and females (7.7%) was very close and showed no signicant difference (p>0.05). This shows that children were exposed to a similar risk of infection by these helminths. Similar results have been reported by Ntonifor *et al*. (2015) in Cameroon and Salawu *et al*. (2014) in Nigeria. However, the prevalence of hookworm, *A. lumbricoides,* and *S. stercolaris* were higher in males than in females. Oyibo *et al*. (2017), in a study in Ebonyi, reported helminth infection to be significantly higher in males than in females. Similarly result obtained in Nigeria by Abelau *et al.* (2021) who recorded a higher prevalence in males (23.6%) than in females (20.2%) and by Akinseye *et al*., 2020. Also, in Cameroon by Maffo *et al*. (2015) in Dschang, Cameroon and Mohammed *et al*., al. (2020) in Ethopia who observed prevalences of 10.9% and 4.32% respectively but suggested that more studies should be done to ascertain whether helminth infection is gender-dependent. In contrast, Nkengazong *et al*. (2019) in Cameroun reported a higher prevalence of A. lumbricoides and T. trichiura in females compared to males and attributed this to different patterns of soil contact. The presence of these helminthes in both genders is a clear indication that infection with helminth parasites is not gender dependent meanwhile Tchakounté *et al*. (2018) observed a significant difference in the prevalence of helminth parasites between both genderes in Cameroon.

CONCLUSION

THs infection was prevalent among the under-5 children studied with intermediate endemicity according WHO criteria for endemicity classification. Age and gender association with STHs was not significant (p>0.05).

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