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Gastro Intestinal Helminths among Hausa-Fulani in Wamakko and Tambuwal Local Government Area of Sokoto, 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

Background: Gastro Intestinal Helminths infection is one of the major health burdens in developing countries particularly in Sub -Saharan Africa. It has been estimated to affect about 2.5 billion people globally and 250 million people are thought to be ill as a result of such infections, the majority being children.
Aims: The study aimed to determine the prevalence and associated risk factors of gastro intestinal helminths infections among people of Wamakko and Tambuwal local government area in Sokoto state.
Study Design: This was a cross-sectional, descriptive study.
Place and Duration of Study: The study was conducted among Hausa- Fulani in wamakko and Tambuwal area in Sokoto, from June 2019 to October 2019.
Methodology: Parasitological examination was carried out on stool samples from 243 participants using microscopy following formal ether concentration methods.
Results: Finding revealed that 29 (12%) were positive for gastro intestinal helminths infections. Males recorded more prevalence (11.9%) than the females (11.8%).

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Conclusion: Gastro intestinal helminths parasites continue to remain a serious public health problem in North-western Nigeria. Low level of education, occupational status, and poor water supply seems to be among significant risk factors for these infections. Creating awareness, increase level of sanitation, good water supply and de-worming programme among school children will reduce prevalence and intensity of gastro intestinal helminths parasitic infections in the study area.

Keywords: Helminths; Hausa-Fulani; prevalence; infection; parasites.

1. INTRODUCTION

Gastro intestinal helminths infection is one of the major health burdens in developing countries particularly in Sub -Saharan Africa. It has been estimated to affect about 2.5 billion people globally and 250 million people are thought to be ill as a result of such infections, the majority being children [1].

The word 'helminths' is a general term meaning 'worm', but there are many different types of worms. Prefixes are therefore used to designate types: platy-helminths for flat-worms and nematy-helminths for round-worms [2]. All helminths are multicellular eukaryotic invertebrates with tube-like or flattened bodies exhibiting bilateral symmetry. They are triploblastic (with endo-, meso- and ecto-dermal tissues) but the flatworms are a coelomate (do not have body cavities) while the roundworms are pseudo-coelomate (with body cavities not enclosed by mesoderm). In contrast, segmented annelids (such as earthworms) are coelomate (with body cavities enclosed by mesoderm) [1].

In Nigeria, intestinal helminths infections have continued to prevail because of poor standards of living, poor environmental sanitation and ignorance of simple health promoting behaviours [3], [4]. Gastro intestinal helminths infections are most common in school age children and they tend to occur in high intensity in this age group [5]. These infections have been associated with an increased risk for nutritional anaemias, protein energy malnutrition, growth deficits in children, physical weakness and low educational performance of school children and also causing high morbidity and mortality rate [6].

Gastro intestinal helminths infections are governed by behavioural factors, biological environmental, socioeconomic and health systems factors. Local conditions such as quality of domestic and village infrastructure; economic factors such as monthly income, employment and occupation and social factors such as education influence the risk of infection, disease transmission and associated morbidity and mortality [7].

Clinical signs of infection vary considerably depending on the site and duration of infection. Larval and adult nematodes lodge, migrate or encyst within tissues resulting in obstruction, inflammation, oedema, anaemia, lesions and granuloma formation. Infections by adult cestodes are generally benign as they are not invasive, but the larval stages penetrate and encyst within tissues leading to inflammation, space-occupying lesions and organ malfunction. Adult flukes usually cause obstruction, inflammation and fibrosis in tubular organs, but the eggs of blood flukes can lodge in tissues causing extensive granulomatous reactions and hypertension [8].

These infections are more prevalent among the poor segments of the population. They are closely associated with low household income, poor personal and environmental sanitation, and overcrowding, limited access to clean water, tropical climate and low altitude. Gastro intestinal helminths infections such as hydatid disease, taeniasis, hookworm infection and cysticercosis are among the ten most common infections in the world [9].

2. MATERIALS AND METHODS

2.1 Study Area

The study area is Wamakko and Tambuwal local government area in Sokoto State. The sokoto state serves as a referral centre for more than 10 million people of the Nigerian States of Sokoto, Zamfara and Kebbi; and neighboring Niger and Benin Republic in the West African sub-region [10].

Sokoto State is located at the extreme part of North-Western Nigeria between longitude 3° and 7° east and between latitude 10° and 14° north of the equator. It shares borders with Niger-

Republic to the North, Kebbi State to the South-West and Zamfara State to the East [10]. The state covers a total land area of about 32,000 square kilometres and a population of 4,602,298 million based on 2013 projection [10]. Sokoto State has semi-arid climate and vegetation is largely Sudan Savannah with an annual rainfall between 500 – 1300mm and temperature ranges between 150°C and over 400°C during warm days [10].

2.2 Study Design

This is a cross-sectional descriptive study that was carried out on 243 samples collected from Hausa- Fulani in wamakko and Tambuwal area in sokoto , from June 2019 to October 2019.

2.3 Subject and Selection

The subjects were selected or recruited in Wamakko and Tambuwal area using systematic sampling method to recruit all participants that meet the inclusion criteria.

2.3.1 Inclusion criteria

All participants who gave their consent to participate in the study.

2.3.2 Exclusion criteria

All Participants who refused to give consent in the study.

2.4 Sample Size

The sample size was calculated using the formula outlined below

$$n = \frac{(z1\text{-}a)^2 (p) (1\text{-}p)}{d^2}$$ [11]

And with the prevalence (p) estimated according to the study that was carried out in Sokoto showing a prevalence of 17.5% for the gastro intestinal helminths [12].

Where; n= Sample size

z = standard normal deviate at 95% $(1.96)^2$
p = prevalence 17.5%, 17.5/100 = 0.175
d = precision 5% (0.05)
n = $(1.96)^2$ x 0.175 x (1-0.175) / $(0.05)^2$
n = 221

Using an attrition rate of 10%. Therefore; 221 + (0.1 x 221)

Actual sample size = 243 patients

2.5 Sampling Method

A systematic random sampling method was used to recruit all participants.

2.6 Sample Collection

An approximate amount of 100g faeces was collected into clean, dry and screw cap, leak proof container.

2.7 Data Collection Methods

Data was collected and entered independently at two separate occasions using Microsoft Excel 2016. Double data entry analysis was done to ensure data quality.

2.8 Study Tool

The questionnaire was designed as a structured interviewer administered questionnaire. It was structured into the following subheadings; demographic information, socio-economic data, clinical history and laboratory investigation. The questionnaire was adapted from previous studies. The questionnaire was pretested and validated at a similar site to the study area in the state specialist hospital, Sokoto. Corrections were made thereafter where necessary.

2.9 Sample Processing

2. 9.1 Macroscopy

The procedure for macroscopy was done as outlined below;

1. Presence of worms: The presence of adult helminths or segments example: *Ascaris, Taenia species, Enterobius vermicularis and gravid Taenia species* was examined.

2. Consistency (degree of moisture): This consistency was observed and recorded as hard, formed, semi-formed and diarrhoeic (watery).

3. Colour: Any abnormal colour example, pale yellowish passed in steatorrhoeac conditions such as Giardiasis, dark or black-stools occur when iron or bismuth is taken or when there is intestinal haemorrhage were determined.

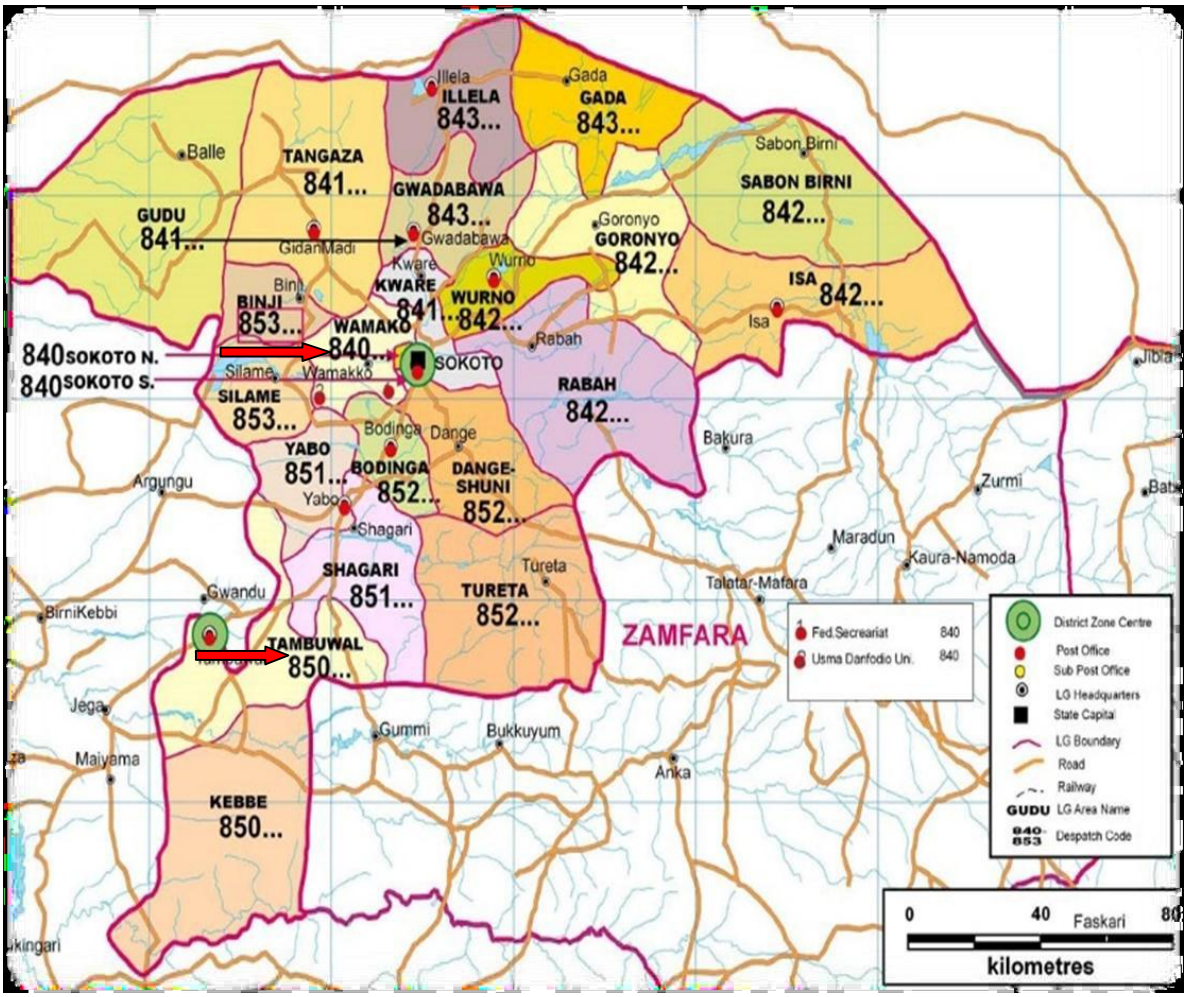


Fig 1: Map of Sokoto State Showing Study Area [10]

Key:

Study Area

4. Pathologic odour: This can be offensive or non-offensive and it were determined.

5. Abnormal features seen (composition): Abnormal features were observed such as blood and fat globules. They were determined and reported appropriately.

3. Direct Microscopic Examination Using Normal Saline and Iodine Preparation

About 1mg of stool was emulsified in a drop of normal saline and Lugol's iodine solution respectively. It was then centrifuged, the supernatant discarded and the sediment was dropped on a clean grease free glass slide and a cover-slip was placed on the preparation and the slide was examined under x10 and x40 objective lens. Saline direct smear is used mainly for the detection of motility. Iodine direct smear allows the examination of the characteristics features of the parasite and the identification of hymenolepsis ova [13].

4. SEDIMENTATION METHOD

4.1 Formol Ether Concentration Technique

4.1.1 Procedure

Faecal sample (0.5g) was added to a glass container containing 10 ml of 10% formalin and then mixed thoroughly. A Funnel was placed on a gauge and strained into a 15 ml centrifuge tube

and centrifuged for 2 minutes at 1500 rpm. The supernatant was discarded, and the sediment was re-suspended into 10 ml physiological saline, and centrifuged for 2 minutes at 1500 rpm. The supernatant was discarded and the sediment re-suspended again in 7ml of 10% formaldehyde, 3 ml of ether (diethyl) was also added. The tube with a glass stopper was closed and shaken vigorously to mix, and then the stopper was removed and centrifuged for 2 minutes at 1500 rpm. The supernatant was poured out and the sediment carefully placed on a clean glass slide and covered with cover slip and this was examined at x10 and x40 objective [14].

4.2 Statistical Analysis

Data was entered into the statistical package for social sciences (SPSS) version 20. Analysis for categorical variable was carried out using Chi-square test to determine the association. Simple and multiple logistic regression analysis were used to determine associated risk factors of the infections. Values were considered statistically significant at $p < 0.05$.

The results for this research were tabulated, summarized as graphical figures and presented based on the findings.

5. RESULTS

The results of this study revealed that from a total of 243 participants selected for this study, an overall prevalence of 29 participants (12%) was found to be positive for gastro intestinal helminths infections.

5.1 Prevalence of Gastro Intestinal Helminths Infection

Table 1, Shows the distribution of gastro intestinal helminths infection among study population based on marital status, gender, age group, and tribe. In age distribution, the prevalence of infection recorded was more among age range of 11-15 years (36.8%) and the least in 31 years and above. There was a statistically significant difference (p<0.004). The males showed a more prevalence of gastro intestinal helminths infections of 11.9% than the females (11.8%). However, this is not statistically significant (p>0.05).

Table 2, Shows the distribution of gastro intestinal helminths infection among study population based on educational status, occupation, monthly income and water source. Based on the sources of water; those that consumed river/stream water 13 (26.5%) have more risk of gastro intestinal helminths infection, followed by those that drink other source of water with prevalence of 24.8% then closely followed by those that drink well water (10.8%) and lastly those that consumed sachet water have the lowest prevalence (1.4%). Comparing the different prevalence rates in relation to gastro intestinal helminths by water source is statistically significant (p<0.001).

Table 3, Shows the distribution of gastro intestinal helminths infection among study population based on frequency of eating vegetables, walking bare footed, type of toilet facility, diarrhoea, dysentery, abdominal pain and fever. Out of 243 participants, 20 (16.8%) are infected with diarrhoea and 9 (7.1%) had none. There was a statistically significant difference (p<0.001)

Table 4, Shows the distribution of gastro intestinal helminths infection among study population based on intensity of the parasite, fever, headache, do you wash your hand before eating, vomiting and Habit of eating hawkers food. Observation shows those who eat less hawked food had more risk of gastro intestinal helminths infection with 19 (61.4%) followed by those that do not eat hawked food at all with 8 (10.4%); while those who engage more often in eating hawked food with 2 (3.8%) were the least infected with gastro intestinal helminths. Comparing the difference in mode of eating hawked food was statistically significant (p<0.040).

5.2 Simple and Multiple Logistic Regression Analysis for gastro Intestinal helminths Infection

Table 5, Shows the various risk factors associated with gastro intestinal helminths infection by age group, water source, diarrhoea and educational status in univariate analysis. The result shows that, infection with gastro intestinal helminths was found to be higher among those that consumed well water by 0.22 times (OR; 95% CI, 0.05, 0.87: p-value 0.031) higher compared to those that drink sachet water by 0.03 times (OR; 95% CI, 0.00, 6.0.22: p-value 0.001). There was significant difference statistically in the variables observed (p<0.001).

Table 6, shows multiple logistic regression analysis with respect to gastro intestinal helminths infections in relation to water source. In multivariate analysis, this was done using binary logistic regression and entered by stepwise method with 95% CI of factors that remained significantly associated with gastro intestinal helminths infection with water source; sachet water 10.4 (OR: 95% CI; 2.47, 44.3; *p*-value 0.001), well water 7.10 (OR; 95% CI, 1.89, 26.6; *p*-value 0.004), There was statistically significant difference in the variables observed ($p<0.05$).

Table 7, Shows the distribution of intestinal parasitic infection. The prevalence intensity of gastro intestinal helminths infections identified in faecal samples is Hookworm (Plate I) and *Ascaris lumbricoides* with prevalence of 51%, *hymenolepsis nana* (17.2%) (Plate 2), *trichuris trichura* (31%).

5.3 Socio-Demographic Characteristics Of Gastro Intestinal Helminths Infection

Table 8 shows the socio-demographic characteristics of variable with respect to marital status, gender, age group and tribe. Out of the total study participants, 160 (65.3%) are males and 85 (34.7%) female while with respect to marital status 38 (15.5%) were married and 207 (84.5%) were single. The highest prevalence was found among age group 0-5, 6-10, 11-15, 16-20, 21-25, 26-30 and 31 years and above with prevalence of 13.5%, 7.8%, 7.8%, 23.3%, 33.9%, 5.3% and 8.6% respectively.

Table 9 shows the socio-demographic characteristics of variable with respect to educational status, occupation, monthly income, and water source. Based on the source of water participants consumed, those that drank sachet water had 74 (31.4%) followed by those that consumed tap water 62 (25.3%) then followed by those that consumed river/stream 49 (20%) and well water 37 (15.1%) and lastly those that drank other source of water with 23 (9.4%). In regards to occupation, higher frequency was recorded among 116 (47.3%) students, followed by those that are civil servant 47 (19.2%) followed by unemployed 41 (16.7%), those that are business men 26 (10.6%), while the least was found among those that are farming 15 (6.1%).

Table 10 shows the socio-demographic characteristics of variable with respect to frequency of eating vegetables, type toilet facility, diarrhoea, dysentery, abdominal pain, fever and do you walk bare foot. Out of 243 participants, 126 (51.4%) have high frequency of diarrhoea while 119 (48.6%) had none.

Table 11 shows the socio-demographic characteristics of variable with respect to intensity of parasite, headache, do you wash your hand before eating, vomiting and habit of eating hawk food. In regards to washing of hand before eating about 195 (79.6%) do not wash their hand before eating while 50 (20.4%) wash their before eating.

Table 1. Distribution of gastro intestinal helminths parasitic infection among study population based on marital status, gender, age group, and tribe

Variables	Intestinal helminths				Total		*p*-value [a]
	Infection		No infection				
	n	%	n	%	n	%	
Marital status							
Married	3	(7.90)	35	(92.1)	38	(100.0)	0.905
Single	26	(12.6)	181	(87.4)	207	(100.0)	
Gender							
Male	19	(11.9)	141	(88.1)	160	(100.0)	0.413
Female	10	(11.8)	75	(88.1)	85	(100.0)	
Age groups (years)							
0-5	5	(15.2)	28	(84.8)	33	(100.0)	0.004 *

Variables		Intestinal helminths			Total		*p*-value [a]
	Infection		No infection				
	n	%	n	%	n	%	
6-10	4	(21.1)	15	(78.9)	19	(100.0)	
11-15	7	(36.8)	12	(63.2)	19	(100.0)	
16-20	6	(10.5)	51	(89.5)	57	(100.0)	
21-25	5	(6.00)	78	(94.0)	83	(100.0)	
26-30	2	(15.4)	11	(84.6)	13	(100.0)	
31 and above	0	(0.00)	21	(100.0)	21	(100.0)	
Tribe							
Hausa	24	(11.9)	177	(88.1)	201	(100.0)	0.569
Yoruba	8	(3.70)	1	(3.4)	9	(100.0)	
Igbo	0	(0.00)	6	(100)	6	(100.0)	
Fulani	4	(19.0)	17	(81.0)	17	(100.0)	
Others	0	(0.00)	8	(100)	8	(100.0)	

*Key: a = Pearson chi-square test, n = Number of parasites, * = Statistically significant*

Table 2. Distribution of gastro intestinal helminhs infection among study population based on Educational status, occupation, monthly income and water source

Variable(s)		Intestinal helminths			Total		*p*-value [a]
	Infection		No infection				
	n	%	n	%	n	%	
Educational status							
None	7	(8.3)	77	(91.7)	84	(100.0)	0.021 *
Informal	2	(6.5)	14	(87.9)	16	(100.0)	
Primary	3	(10.0)	27	(90.0)	30	(100.0)	
Secondary	29	(72.5)	11	(27.5)	40	(100.0)	
Tertiary	6	(8.0)	69	(92.0)	75	(100.0)	
Occupation							
Business	3	(11.5)	23	(88.5)	26	(100.0)	0.905
Farming	1	(6.7)	14	(93.3)	15	(100.0)	
Civil servant	7	(14.9)	40	(85.1)	47	(100.0)	
Unemployed	4	(9.8)	37	(90.2)	41	(100.0)	
Student	14	(12.1)	102	(87.9)	116	(100.0)	
						(100.0)	
Monthly income							
High	2	(6.5)	29	(93.5)	31	(100.0)	0.408
Average	16	(14.5)	94	(85.5)	110	(100.0)	
Low	11	(10.6)	93	(89.4)	104	(100.0)	
Water source	3	(4.8)	59	(95.2)	62	(100.0)	0.001 *
Tap water	4	(10.8)	33	(89.2)	37	(100.0)	
Well water	13	(26.5)	36	(44.8)	49	(100.0)	
River/stream	1	(1.4)	73	(98.6)	74	(100.0)	
Sachet water	8	(24.8)	15	(65.2)	23	(100.0)	
Others							

*Key: a = Pearson chi-square test, n = Number of parasites, * = Statistically significant, Others = dam water*

Table 3. Distribution of gastro intestinal helminths infection among study population based on frequency of eating vegetables, do you walk bare foot, type of toilet facility, diarrhoea, dysentery, abdominal pain and fever

Variable(s)	Intestinal helminths				Total		*p*-value [a]
	Infection		No infection				
	n	%	n	%	n	%	
Frequency of eating vegetables							
Frequent	11	(16.2)	57	(83.8)	68	(100.0)	0.201
Not frequent	8	(11.0)	145	(89.0)	163	(100.0)	
Not at all	0	(0.00)	14	(100)	14	(100.0)	
Do you walk bare foot?							
Yes	25	(13.9)	155	(86.1)	180	(100.0)	0.098
No	4	(6.20)	61	(93.8)	65	(100.0)	
Type of toilet facility							
Pit latrine	9	(15.8)	48	(84.2)	57	(100.0)	0.379
Bucket latrine	39	(18.1)	6	(20.7)	45	(100.0)	
Open space	41	(19.0)	2	(6.90)	43	(100.0)	
Flush	12	(12.0)	88	(88.0)	100	(100.0)	
Diarrhoea							
Yes	20	(16.8)	99	(83.2)	119	(100.0)	0.019 *
No	9	(7.10)	117	(92.9)	126	(100.0)	
Dysentery							
Yes	5	(8.20)	56	(91.8)	61	(100.0)	0.500
No	24	(13.1)	159	(86.9)	183	(100.0)	
Abdominal pain							
Yes	5	(5.90)	80	(94.1)	85	(100.0)	0.530
No	24	(15.3)	133	(84.7)	157	(100.0)	

Key: a = Pearson chi-square test, 0 = No infection, 1-100 = Light infection, 101-400 = Moderate infection, 401-1000 = Heavy infection, 1000 and above = Very heavy infection

Table 4. Distribution of gastro intestinal helminths infection among study population based on fever, headache, do you wash your hand before eating, vomiting and habit of eating hawk food

Variable(s)	Intestinal helminths				Total		*p* -value [a]
	Infection		No infection				
	n	%	n	%	n	%	
Fever							
Yes	4	(13.3)	26	(86.7)	30	(100.0)	0.808
No	25	(11.8)	187	(88.2)	212	(100.0)	
Headache							
Yes	4	(9.1)	40	(90.9)	44	(100.0)	0.364
No	25	(23.7)	174	(87.4)	199	(100.0)	
Do you was your hand?							
Yes	8	(16.0)	42	(84.0)	50	(100.0)	0.307
No	21	(10.8)	174	(89.2)	195	(100.0)	

Variable(s)		Intestinal helminths			Total		*p* -value [a]
	Infection		No infection				
	n	%	n	%	n	%	
Vomiting							
Yes	3	(12.0)	22	(88.0)	25	(100.0)	0.979
No	26	(11.8)	194	(88.2)	220	(100.0)	
Habit of eating hawk food							
Often	2	(3.8)	50	(96.2)	52	(100.0)	0.060
Less	19	(16.4)	97	(83.6)	116	(100.0)	
Not all	8	(10.4)	69	(89.6)	77	(100.0	
Intensity of gastrointestinal helminths infection							
No infection	0	(0.0)	216	(100)	216	(100.0)	0.001*
Light infection	29	(100)	0	(0.00)	29	(100.0)	

Key: a = Pearson chi-square test, 0 = No infection, 1-100 = Light infection, 101-400 = Moderate infection

Table 5. shows simple logistic regression analysis with respect to gastro intestinal helminths infections in relation to age group, water source, diarrhoea, habit of eating hawked food

Variable (s)	* b	** EXP (B) OR (95% CI)	Wald Statistic	*p*- value
Age group (years)				
26-30	0	1.00	0.00	0.998
0-5	19.480	2.88	0.00	0.998
6-10	19.881	4.30	0.00	0.998
11-15	20.664	9.42	0.00	0.998
16-20	19.063	1.90	0.00	0.998
21-30	18.456	1.04	0.00	0.998
30 and above	19.498	2.90	0.00	0.998
Water source				
Others	0	1.00		
Tap water	-2.35	0.09 (0.23, 0.40)	10.2	0.001 *
Well water	-1.48	0.22 (0.05, 0.87)	4.65	0.031 *
River/stream	-0.39	0.67 (0.23, 1.96)	0.51	0.474
Sachet water	-3.66	0.03 (0.00, 0.22)	11.1	0.001 *
Diarrhoea				
Yes	0	1.00		
No	-0.966	2.63(1.14, 6.02)	5.18	0.023 *
Educational Status				
None	0	1.00		
Informal	0.520	1.57 (0.29, 8.36)	0.281	0.596
Primary	0.201	1.22 (0.29, 5.06)	0.770	0.782
Secondary	1.428	4.17 (1.47, 11.79)	7.256	0.007
Tertiary	-0.044	0.95 (0.30, 2.98)	0.006	0.939

*Key: *Regression Co-efficient, ** Crude odds ratio, * = Statistically significant, Others = dam water*

Table 6. shows Multiple Logistic Regression Analysis with respect to gastro intestinal helminths infections in relation to diarrhoea

Variable (s)	* b	** EXP (B) AOR (95% CI)	Wald Statistic	*p*- value
Water source				
Others	0	0		
Tap water	0.869	2.38 (0.50, 11.3)	1.197	0.274

Variable (s)	* b	** EXP (B) AOR (95% CI)	Wald Statistic	*p*- value
Well water	1.960	7.10 (1.89, 26.6)	8.446	0.004 *
River/stream	-1.312	0.26 (0.02, 2.65)	1.261	0.261
Sachet water	2.350	10.4 (2.47, 44.3)	10.193	0.001 *

*Key: *Regression Co-efficient, ** Adjusted odds ratio, * = Statistically significant, Others = dam water*

Table 7. shows intensity of gastro intestinal helminths infection

Parasites	Intensity parasitic infection					Total (%)
	No I (%)	I.I (%)	M.I (%)	H.I. (%)	V.H.I (%)	
Hookworm and Ascaris	0 (0.0)	15 (51.7)	0 (0.0)	0 (0.0)	0 (0.0)	15 (100)
Tricuris tricura	0 (0.0)	9 (31.0)	0 (0.0)	0 (0.0)	0 (0.0)	9 (100)
H. Nana	0 (0.0)	5 (17.2)	0 (0.0)	0 (0.0)	0 (0.0)	5 (100)

Table 8. Socio-demographic characteristics of variable with respect to marital status, gender, age group, and tribe

Variables (V)	Frequency (F)	Percentage (%)
Marital status		
Married	38	15.5
Single	207	84.5
Gender		
Male	160	65.3
Female	85	34.7
Age group (years)		
0-5	33	13.5
6-10	19	7.8
11-15	19	7.8
16-20	57	23.3
21-25	83	33.9
26-30	13	5.3
31 and above	21	8.6
Tribe		
Hausa	206	8.2
Igbo	9	3.7
Yoruba	6	2.4
Fulani	21	8.6
Others	8	3.3

Table 9. Socio-demographic characteristics of variable with respect to educational status, occupation, monthly income, and water source

Variables (V)	Frequency (F)	Percentage (%)
Educational status		
None	84	34.3
Informal	16	6.5
Primary	30	12.2
Secondary	40	16.3
Tertiary	75	30.6
Occupation		
Business	26	10.6
Farming	15	6.1
Civil servant	47	19.2

Variables (V)	Frequency (F)	Percentage (%)
Unemployed	41	16.7
Student	116	47.3
Monthly income		
High	31	12.7
Average	110	44.9
Low	104	42.4
Water source		
Tap water	62	25.3
Well water	37	15.1
River/stream	49	20
Sachet water	74	31.4
Others	23	9.4

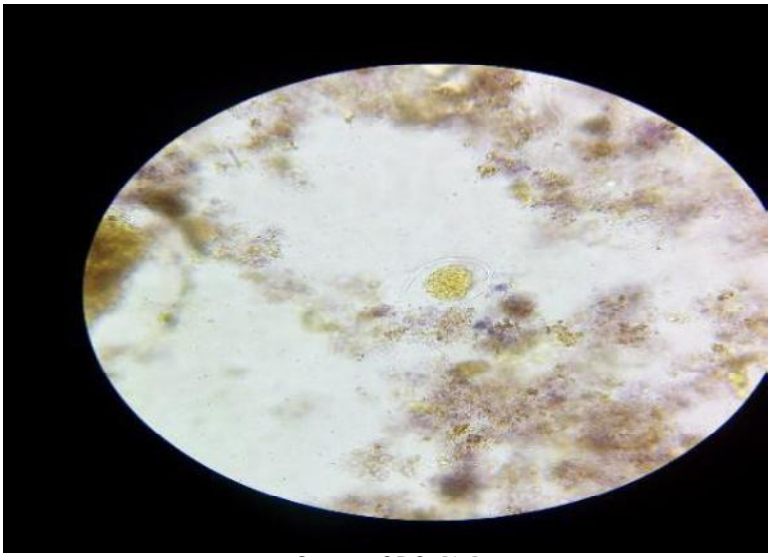
Table 10. Socio-demographic characteristics of variable with respect to frequency of eating vegetables, do you walk bare foot, type toilet facility, diarrhoea, dysentery, abdominal pain and fever

Variables (V)	Frequency (F)	Percentage (%)
Frequency of eating vegetables		
Frequent	68	27.8
Not frequent	163	66.5
Not all	14	5.7
Do you walk bare foot		
Yes	180	73.5
No	65	26.5
Type of toilet facility		
Pit latrine	57	23.3
Bucket latrine	45	18.4
Open space	43	17.6
Flush	100	40.8
Diarrhoea		
Yes	119	48.6
No	126	51.4
Dysentery		
Yes	61	24.9
No	183	74.7
Abdominal pain		
Yes	85	34.7
No	157	64.1
Fever		
Yes	30	12.2
No	212	86.5

Table 11. Socio-demographic characteristics of variable with respect to headache, do you wash your hand before eating, vomiting and intensity of helminths

Variables (V)	Frequency (F)	Percentage (%)
Headache		
Yes	44	18.0
No	199	81.2
Do you wash your hand before eating		
Yes	50	20.4
No	195	29.6
Vomiting		
Yes	25	10.2

Variables (V)	Frequency (F)	Percentage (%)
No	220	89.0
Habit of eating hawk food		
Often	50	6.9
Less	97	65.5
Not all	69	27.6
Intensity of Helminths infection		
No infection	216	88.2
Light infection	29	11.8



Source: CDC, [15]

Plate 1. Ova of Hookworm in iodine stained preparation under x40 objective lens using light microscope

Source: CDC, [15]

Plate 2. Ova of *H.nana* in saline preparation under x40 objective lens using light microscope

6. DISCUSSION

This study reveals a gastro intestinal helminths prevalence rate of 12% among 243 in Wamakko and Tambuwal local government area, which were selected at random from June 2019 to August 2019.

The low prevalence of this study is in line with the study observed in North eastern Nigeria of 15.67% by Muhammad *et al.* [16] and 12% in South India by Baragundi *et al.* [17]. However, the results are considerably lower than studies reported in North western Nigeria by Gupta *et al.* [18], North central Nigeria by Ikeh *et al.* [19], western Tajikistan by Matthys *et al.* [20] and North eastern Ethiopia by Missaye *et al.* [21]. The lower prevalence might be due to improved environmental sanitation, better knowledge of personnel health and hygiene, economic and educational status of the subjects found in the study area.

The present study revealed that males gender are more susceptible to infection (11.9%) than the females (11.8%), this finding was found to be similar with that reported by Okon *et al.* [22]. This may be due to the common feeding pattern in which a great number of men eat outside their homes while on daily activities to earn a living. It may also be attributed to the contamination of soil by human faeces, use of raw sewage for agricultural purposes; use of waste water irrigated vegetables and contaminated imported vegetables [23].

Prevalence is not dependent on sex among the sampled population which disagrees with the work of Atu *et al.* [24] who observed a higher prevalence of intestinal parasite in females than in males. The work is in contrast with the fidings of Gelaw *et al.* [25] who reported that female was found to have higher prevalence rate in his study carried out in North western Ethiopia.

However, 11-15 years aged group and 6-10 years had a highest prevalence of 36.8% and 21.1% respectively. This finding was found to be similar with that reported by Ikeh *et al.* [19] and Abou-EL *et al.* [26]. This study contradicts the work of Oguoma who reported more prevalence in the ages 9-10 years among children [27]. This could be attributed to the different host responses and other related factors such as the nutritional status [28].

Results shows that there is strong association between gastro intestinal helminths infections and water source of the participants (p<0.05). Thus, well water are at higher risk of infection 7.10 time (OR; 95% CI 1.89, 26.6 p-value 0.004) compared to those that consumed other source of water and a statistically significant difference was observed (p<0.05) (Table 6). This is in agreement with result found in north western Ethiopia by Ayalew *et al.* [29] and Alemu *et al.* [30]. This may be due to water contaminated with soil that contains cyst and eggs of parasitic organisms that led to intestinal infection.

In this study Occupation, monthly income eating of hawked food, presence of latrine and frequency eating of vegetables were not significantly associated with gastro intestinal helminths infections. However, according to the study conducted by Erko *et al.* [31] and Amuta *et al.* [32], they were strongly associated with infections. This is more likely due to high level of education, better sanitation condition, better knowledge about the faeco-oral transmission of gastro intestinal helminths through their unwashed hands and the contamination of vegetables with faecal materials in the farm.

Results shows that there is a strong association between gastro intestinal helminths infections and education status of the participants (p<0.05). However, secondary school participant are at higher risk of infection 4.17 time (OR; 95% CI, 1.47, 11.79; p-value 0.007) compared to those in the primary school and a statistically significant difference was observed (p<0.05) but it was not significant (Table 5). This is in contrast with the result found in Benue, Nigeria by Amuta *et al.* [32]. Reason for this lies in the continual exposure of the secondary school students to contaminated environment, being more active, and playful to contaminated soil thus more vulnerable to gastro intestinal helminths infections.

7. CONCLUSION

This present study revealed that there is low prevalence of gastro intestinal helminths among Hausa- Fulani in Wamakko and Tambuwal Local Government Area in Sokoto.

The different potential risk factors assessed in the study includes occupation, educational status, water source, type of toilet facility e.t.c and were strongly associated with gastro intestinal helminths infection. However, the low

prevalence might be attributed to proper management of organic refuse, public health enlightment about the risk of gastro intestinal helminths infections, adequate supply of clean water, proper drainage and use of sites for defaecation.

Therefore, all stakeholders should give attention to raise awareness about control of gastro intestinal helminths infection, personal and environmental hygiene, and improving the quality of drinking water source.

CONSENT AND ETHICAL APPROVAL

Ethical clearance was obtained from the ethics and research committee of ministry of Health Sokoto. And consent was sought from the participants prior to sample collection.

RECOMMENDATIONS

Based on the present findings, the following recommendations were made;

1. Maintaining high standards of personal and domestic hygiene can be good strategies to control these infections in the area.
2. Avoiding contact with contaminated water, food and clothing.
3. High standard of education and adequate health education.
4. The current de-worming programme by some agencies and non-governmental organizations (NGOs) should be cost effectiveness and use of potent but safe anti-helminthic drugs.
5. The water used for drinking and domestic purposes is a source of transmission of intestinal parasitic infections. Therefore, it should be treated properly before used.
6. Enhancing socioeconomic status and improving sanitation facilities
7. Public enlightenment and emphasis on personal hygiene and clean environment may be necessary in the prevention and control of parasitic infections among children in rural areas.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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