Original Research Article

PREVALENCE OF INTESTINAL PARASITIC INFECTIONS AMONG PATIENTS ATTENDING USMANU DANFODIYO UNIVERSITY TEACHING HOSPITAL, SOKOTO, NIGERIA

ABSTRACT

Background: Intestinal parasitic infection is one of the major health issues in developing countries particularly in Sub -Saharan Africa. It has been estimated to affect about 3.5 billion people globally and 450 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 intestinal parasitic infections among patients attending Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria

Study Design: This was a cross-sectional, descriptive study

Place and Duration of Study: This study was conducted among patients attending Usmanu Danfodiyo University, Teaching Hospital, Sokoto, Sokoto state, between May to November 2017.

Methodology: A total of 243 participants were enrolled in the study. Standard parasitological examination was carried out on stool samples using microscopy followed by formal ether concentration methods

Results: Finding revealed that 29 (12%) were positive for intestinal parasitic infections. Males recorded higher prevalence than the females with 19 (11.9%) and 10 (11.8%), respectively. Intestinal parasites continue to remain a serious public health problem in North-western Nigeria.

Conclusion: Low level of education, occupational status, poor water supply were among the significant risk factors for these infections. Creating awareness, level of sanitation, water supply and deworming programme among school children will reduce prevalence and intensity of parasitic infections among the study community.

Keywords: Prevalence study, Intestinal parasitic infection, UDUTH, Sokoto State, Nigeria.

1.0 INTRODUCTION

Intestinal parasitic infection is one of the major public health burden in developing countries particularly in Sub -Saharan Africa. It has been found to affect about 3.5 billion people globally and 450 million people are thought to be ill as a result of such infections, the majority being children [1]. In Nigeria, intestinal helminthes infections have continued to prevail because of poor standards of living, poor environmental sanitation and ignorance of simple health promoting behaviours[2,3].Intestinal helminthes infections are most common in school age children and they tend to occur in high intensity in this age group [4,5,6].

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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 [7,8] and [9] and also causing high morbidity and mortality rate.

Parasitic 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 [10,11]. 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. Intestinal parasitic infections such as amoebiasis, ascariasis, hookworm infection and trichiuriasis are among the ten most common infections in the world [12].

In Nigeria there is dearth of information on the magnitude of intestinal parasitic infections and predictors among patients attending Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria. Information generated could be used for planning public health control programmes which is aim as an important step for initiation of treatment and prevention strategies as well as reducing morbidity and mortality due to parasitic infections in the area.

3.0 MATERIALS AND METHODS

3.1 STUDY AREA

The study area is Usmanu Danfodiyo University Teaching Hospital, a tertiary health facility located in Sokoto metropolis, the Sokoto State Capital. It serves as a referral centre for more than 10 million people of the Nigerian States of Sokoto, Zamfara and Kebbi; and neighbouring Niger and Benin Republic in the West African sub-region[13].

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 [13]. 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 [14]. Sokoto State has semi-arid climate and vegetation is largely Sudan Savannah with an annual rainfall between 500 – 1300mm and temperature ranges between 150℃ and over 400℃ during warm days [13].

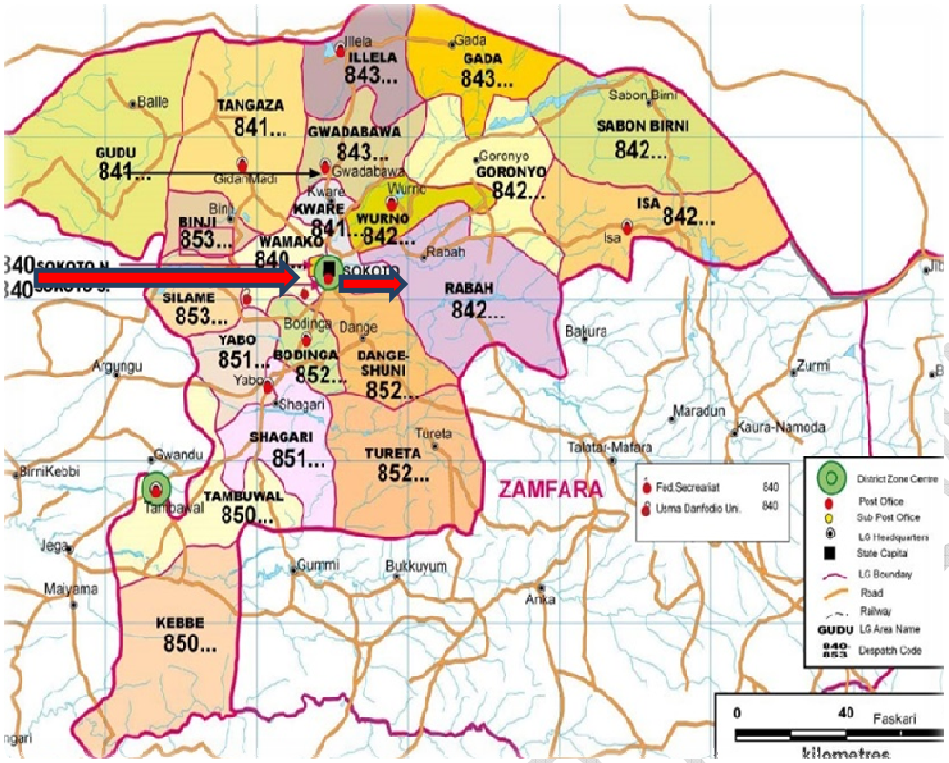

Figure 11.Map of Sokoto State Showing Study Area [13].

3.2 STUDY DESIGN

This is a cross-sectional descriptive study that was carried out on 243 samples collected from UDUTH Service laboratory, from May to November 2017.

3.3 SUBJECT AND SELECTION

The subjects were selected or recruited in UDUTH Service laboratory using systematic sampling method to recruit all patients that meet the inclusion criteria.

3.3.1 Inclusion criteria:

1. All patients with uncontaminated stool sample (formed, semi formed and unformed) were recruited for study and
2. Patients who give their consent to participate in the study.

3.3.2 Non inclusion criteria:

1. Patients with stool sample contaminated with urine or mixed with soil were excluded from the study and
2. Patients who refuse to give consent in the study.

3.4 SAMPLE SIZE

The sample size was calculated using the formula outlined below

$$n = \frac{(z-a)^2 (p) (1-p)}{d^2}$$ [15].

And with the prevalence (p) estimated according to the study that was carried out in Sokoto that reveals that the intestinal parasitic infection has a prevalence of 17.5%. Hence, it was used to calculate the sample size. [16].

Where; n= Sample size

Z= standard normal deviate at 95% $(1.96)^2$

p = prevalence 17.5%, 17.5/100 = 0.175

q = complement of p (1-p)

d = precision 5% (0.05)

$n = (1.96)^2 \times 0.175 \times (1-0.175) / (0.05)^2$

n = 221

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

Actual sample size = 243 patients

3.5 SAMPLING METHOD

A systematic sampling method was used to recruit all patients that meet the inclusion criteria.

The laboratory register had about six hundred patients (600) that submitted their stool for evaluation in the previous year (January 2016 to December 2017). This was used to determine the sampling frame.

K=N/n: 600/243 = 2.5 ~ 3

A sampling interval of 3 was achieved.

Using simple random sampling; the first patient was chosen between number 1 and 3 for the first week of study.

For any randomly chosen numbered patient; thereafter a sampling interval of 3 would be used for the subsequent patients that present themselves at the facility until the sample size is achieved.

3.6 SAMPLE COLLECTION

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

3.7 STUDY TOOL

The questionnaire was design as a structured questionnaire before it was administered to obtained patient information. It was structured into the following subheadings; demographic information, socio-economic data, clinical history and laboratory investigation. The questionnaire was pretested and validated at a similar site to the study area in the state specialist hospital, Sokoto; corrections was made thereafter where necessary.

3.8 SAMPLE PROCESSING

3.8.1 Macroscopy

The procedure for macroscopy was done as outlined below;

1. Presence of worms: The presence of adult helminthes or segments example: *Ascaris, Taenia species, Enterobius vermicularis and gravid Taenia species* would be determined.

2. Consistency (degree of moisture): This varies with diet but certain clinical conditions associated with parasite presence may be suggested by particular consistencies. It were described 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.

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

5. Abnormal features seen (composition): This can be mucus, blood or fat globules. They were determined and reported as appropriate.

3.8.2 DIRECT MICROSCOPIC EXAMINATION USING NORMAL SALINE AND IODINE PREPARATION

The procedure is outlined below;

About 1-2mg of stool were emulsified in 1-2 drops of normal saline (0.9%) or Lugol's iodine solution. Then a cover-slip were placed and then the slide were scanned under the x10 and x40 objectives

lenses of a light microscope. Saline direct smear is used mainly for the detection of intestinal protozoa trophozoites motility. Iodine direct smear allows the examination of the characteristics features of the protozoa and the identification of the *Entamoeba histolytica/dispar* (*Entamoeba histolytica/dispar*) cyst from the commensal Entamoeba coli. [17]

3.8.3 SEDIMENTATION METHOD

Formalin ethyl ether sedimentation method were used.

3.8.3.1 PRINCIPLE

Is a qualitative method that sediment various types of parasites by gravity or by centrifugal force [18].

3.8.3.2 Formal ether concentration technique

Procedure

A 0.5g of faecal sample was added to a glass container containing 10mls of 10% formalin and then mixed thoroughly. A Funnel was placed on a gauge and strain into a 15mls centrifuge tube and centrifuge for 2minutes at 1500 rpm. Then the supernatant was discarded and the sediment was re-suspended into 10mls of physiological saline, and centrifuge for 2 minutes at 1500 rpm. The supernatant was discarded and the sediment re-suspended again in 7mls of 10% formaldehyde, 3mls of ether (diethyl) was also added. The tube with a glass stopper was closed and shacked vigorously to mix, and then the stopper was removed and centrifuge for 2minutes 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. [19].

3.9 DATA COLLECTION METHODS

Data was collected by the researcher himself. Data were entered independently at two separate occasions using Microsoft Excel 2016. Double data entry analysis was done to ensure data quality.

3.10 ETHICAL COSIDERATION

Ethical clearance was obtained from the ethics and research committee of UDUTH, Sokoto. And consent was sought from the patient prior to sample collection.

3.11 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 was used to determine associated risk factors of the infections. Values were considered statistically significant at $p< 0.05$.

4.0 RESULT

The result of this study revealed that from a total of 243 participants selected for this study, an overall prevalence of (12%) were found corresponding to 29 subjects positive for intestinal parasitic infections.

Table 1, Shows the socio-demographic characteristics of variable with respect to marital status, gender, age group and tribe. Of the total study subjects 160 (65.3%) are males and 83 (34.7%) female among the subjects 38 (15.5%) were married and 205 (84.5%) single. The age ranges shows 21-25 years have the highest frequency of 83 (33.9%) followed by 16-20 years then 0- 5 years and 26-30 years 13 (5.3%) with the least.

Based on the source of water participants consumed, those that drink sachet water had 72 (31.4%) followed by those that consume 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 consumed other source of water with 23 (9.4%). With regards to occupation, higher frequency was recorded among 114 (47.3%) students, likewise highest among those that are civil servant 47 (19.2%) then unemployed with 41 (16.7%), then those that are business men with 26 (10.6%), while the least was found among those that are farming 15 (6.1%) (Table 1).

Table 2, 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 about 124 (51.4%) have high frequency of diarrhoea and 119 (48.6%) had not.

With regards to washing of hand before eating about 193 (79.6%) do not wash their hand before eating while 50 (20.4%) wash their before eating (Table 1).

Likewise highest among age group ranges 11-15 years of (36.8%) and the least among 31 and above years. There was a statiscally significant difference by aged group ($p<0.004$). The males showed a higher prevalence of intestinal parasite infections of 11.9% than the females that shows a prevalence rate of (11.8%). However, this is not statistically significant ($p>0.05$).(Table 1).

Prevalence of intestinal parasitic infection among study population based on characteristic of the variable(s) shows that those that consumed river/stream water 12 (26.5%) have highest risk of intestinal parasitic infection, followed by those that drink other source of water with prevalence of 8 (24.8%) then followed by those that drink well water with 4 (10.8%), Tap water (4.8) and lastly those

that consumed sachet water have the lowest prevalence of 1 (1.4%). Comparing the different prevalence rates in relation to intestinal parasites by water source is statistically significant (p<0.001)(Table 1).

The distribution of intestinal parasitic infection among study population base on frequency of eating vegetables, walking bare footed, type of toilet facility, diarrhoea, dysentery, abdominal pain and fever. Out of 243 participants about 20 (16.8%) are recorded with diarrhoea and 8 (7.1%) had not. There was a statiscally significant difference of (p<0.019) by diarrhoea.(Table 2).

The distribution of intestinal parasitic infection among study population base on the characteristic variable (s) as shown in table 8. It was observed that those who eat less hawked food had the highest risk of parasitic infection with 97 (65.5%) followed by those that do not eat hawked food at all with 69 (27.6%); while those who engage more often in eating hawked food with 97 (65.5%) were the least infected with intestinal parasite. Comparing the difference in mode of eating hawked food has no statistically significant difference (p<0.060) (Table 2).

240 **Table 1: Socio-demographic characteristics of variable with respect to marital status, gender,**
241 **age group, and tribe.**

Variable(s)	Frequency (F)	Percentage (%)
Marital status		
Married	38	15.5
Single	205	84.5
Gender		
Male	160	65.3
Female	83	34.7
Age group (years)		
0-5	33	13.5
6-10	19	7.8
11-15	19	7.8
16-20	55	23.3
21-25	83	33.9
26-30	13	5.3
31 and above	21	8.6
Tribe		
Hausa	200	82
Igbo	9	3.7
Yoruba	6	2.4
Fulani	20	8.6
Others	8	3.3
Educational status		
None	84	34.3
Informal	16	6.5
Primary	30	12.2
Secondary	40	16.3
Tertiary	73	30.6
Occupation		
Business	26	10.6
Farming	15	6.1
Civil servant	47	19.2
Unemployed	41	16.7
Student	114	47.3
Monthly income		
High	31	12.7
Average	108	44.9
Low	104	42.4
Water source		
Tap water	62	25.3
Well water	37	15.1
River/stream	49	20.0
Sachet water	72	31.4
Others	23	9.4

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Table 2: Socio-demographic characteristics of variable with respect to population characteristics of the variables

Variable(s)	Frequency (F)	Percentage (%)
Frequency of eating vegetables		
Frequent	68	27.8
Not frequent	161	66.5
Not at all	14	5.7
Do you walk bare foot		
Yes	180	73.5
No	63	26.5
Type of toilet facility		
Pit latrine	55	23.3
Bucket latrine	45	18.4
Open space	43	17.6
Flush	100	40.8
Diarrhoea		
Yes	119	48.6
No	124	51.4
Dysentery		
Yes	62	24.9
No	181	74.7
Abdominal pain		
Yes	87	34.7
No	156	64.1
Fever		
Yes	32	12.2
No	211	86.5
Headache		
Yes	44	18
No	197	81.2
Do you wash your hand before eating		
Yes	50	20.4
No	193	79.6
Vomiting		
Yes	25	10.2
No	218	89.0
Frequency of eating Hawk food		
Often	50	6.9
Less	97	65.5
Not at all	67	27.6
Intensity of Infection		
No infection	214	88.2
Light infection	29	11.8

Table 3 : Distribution of intestinal parasitic infection among study population with respect to the characteristics variable(s) listed below.

Variables	Intestinal parasites				*p*-value [a]
	Infection		No infection		
	N	%	n	%	
Marital status					
Married	3	(7.90)	35	(92.1)	0.905
Single	26	(12.6)	181	(87.4)	
Gender					
Male	19	(11.9)	141	(88.1)	0.413
Female	10	(11.8)	75	(88.1)	
Age group (years)					
0-5	5	(15.2)	28	(84.8)	0.004 *
6-10	4	(21.1)	15	(78.9)	
11-15	6	(36.8)	12	(63.2)	
16-20	6	(10.5)	50	(89.5)	
21-25	5	(6.00)	78	(94.0)	
26-30	2	(15.4)	11	(84.6)	
31 and above	0	(0.00)	21	(100.0)	
Educational status					
None	7	(8.3)	77	(91.7)	0.021*
Informal	2	(6.5)	14	(87.9)	
Primary	3	(10.0)	27	(90.0)	
Secondary	29	(72.5)	11	(27.5)	
Tertiary	6	(8.0)	69	(92.0)	
Occupation					0.905
Bussiness	3	(11.5)	23	(88.5)	
Farming	1	(6.7)	14	(93.3)	
Civil Servant	7	(14,9)	40	(85.1)	
Unemploye	4	(9.8)	37	(90.2)	
Students	14	(12.1)	102	(87.9)	
Monthly income					
High	2	(6.5)	29	(93.5)	0.408
Average	16	(14.5)	94	(85.5)	
Low	11	(10.6)	93	(89.4)	
Water Source					0.001*
Tap water	3	(4.8)	59	(95.2)	
Well water	4	(10.8)	33	(89.2)	
River/Stream	12	(26.5)	35	(44.8)	
Sachet water	1	(1.4)	73	(98.6)	
Others	8	(24.8)	15	(65.2)	

Key:

a = Pearson chi-square test

n = Number of parasites

* = Statistically significant

Table 4: Distribution of intestinal parasitic infection among study population base on Characteristic variable(s) as shown in the table.

Variable(s)	Intestinal parasite				*p*-value [a]
	Infection		No infection		
	N	%	N	%	
Frequency of eating vegetables					
Frequent	11	(16.2)	57	(83.8)	0.201
Not frequent	18	(11.0)	145	(89.0)	
Not at all	0	(0.00)	14	(100)	
Do you walk bare foot					
Yes	25	(13.9)	155	(86.1)	0.098
No	4	(6.20)	61	(93.8)	
Type of toilet facility					
Pit latrine	9	(15.8)	48	(84.2)	0.379
Bucket latrine	39	(18.1)	6	(20.7)	
Open space	41	(19.0)	2	(6.90)	
Flush	12	(12.0)	88	(88.0)	
Diarrhoea					
Yes	20	(16.8)	99	(83.2)	0.019 *
No	8	(7.10)	116	(92.9)	
Dysentery					
Yes	5	(8.20)	56	(91.8)	0.500
No	24	(13.1)	159	(86.9)	
Abdominal pain					
Yes	5	(5.90)	80	(94.1)	0.530
No	24	(15.3)	133	(84.7)	
Fever					0.808
Yes	4	(13.3)	26	(86.7)	
No	25	(11.8)	187	(88.2)	
Headache					0.364
Yes	4	(9.1)	40	(90.9)	
No	25	(23.7)	174	(87.4)	
Do you wash your hand					0.307
Yes	8	(16.0)	42	(84.0)	
No	21	(10.8)	174	(89.2)	
Vomiting					0.979
Yes	3	(12.0)	22	(88.0)	
No	26	(11.8)	194	(88.2)	
Habit of eating Hawk food					
often	2	(3.8)	50	(96.2)	
Less	19	(16.4)	97	(83.6)	
Not at all	8	(10.4)	69	(89.6)	

Key:a = Pearson chi-square test

0 = No infection

5.1 DISCUSSION

This study reveals a parasitic prevalence rate of 12% among 243 patients attending the Usmanu Danfodiyo University Sokoto Teaching Hospital, which were selected at random from May to November, 2017.

The low prevalence of this study is in line with the study observed in North western Nigeria of 15.67% by [19] and 12% in South India by [20]. However, the results are considerably lower than studies reported in North western Nigeria by [21], North central Nigeria by [22], western Tajikistan by [23] and North eastern Ethiopia by [24]. 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 little more susceptible to infection (11.9%) than the females (11.8%), this finding was found to be similar with that reported by [26]. This might 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. And also due 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 [27].

Prevalence is not dependent on sex among the sampled population which disagrees with the work of [26] who observed a higher prevalence of intestinal parasite in females than in males. And the work contrast with that of [28], who reported that male 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 [21, 29]. This study is also similar to the work of [30], who reported highest prevalence in the ages 9-10 years among children [30]. Even though WHO confirmed that intestinal protozoan parasite (IPP) are dependent on age and greater severity of the infection is found in the younger children [31]. This could be attributed to the different host responses and other related factors such as the nutritional status [32].

The most common intestinal parasitic infection identified in the community include amongst others *H. nana*, *Ascaris lumbricoides, G. lamblia, E. histolytica* and Hookworm specie. However Hookworm and *A. lumbricoides* recorded the highest prevalence of 15 (51%) followed by *G. lamblia* and *E. histolytica* 9 (31%) and *H. nana* recorded the least prevalence of 5 (17.2%). This finding was similar to those reported in Ethiopia [28], and in contrast with the study in Nigeria [33].

In this study, occupation, monthly income eating of hawked food, presence of latrine and frequency eating of vegetables were not significantly associated with intestinal parasitic infections. However, according to the study conducted by [34] and [35] 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 intestinal parasite through their unwashed hands and the contamination of vegetables with faecal materials in the farm. Season could be another important predictor of intestinal parasitic infections especially during rainy season where agricultural activities is said to be highest. This finding is in agreement with the findings of other researchers that indicated seasonal variations contributed to the higher prevalence of the disease [36,37].

5.2 CONCLUSION

This present study revealed that there is low prevalence of intestinal parasitic infection among patients attending Usmanu Danfodiyo University Teaching Hospital, Sokoto.

The different potential risk factors assessed in the study include occupation, educational status, water source, and type of toilet facility were strongly associated with intestinal parasitic infection. However,

the low prevalence might be attributed to proper management of organic refuse, public health Enlightment about the risk of intestinal parasitic 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 intestinal parasitic infection, personal and environmental hygiene, and improving the quality of drinking water source.

REFERENCES

[1] WHO (2000). World Health Report 2000 Conquering Suffering Enriching humanity. World Health Organisation: Geneva.

[2] Nwosu ABC (1981). The community of soil transmitted helminth infection of humans in a hyper-endemic area of southern Nigeria. *Annals Trop Med Parasite,***75**: **Pp** 197-203.

[3] Udonsu, J. K. (1984). Necator americanus: a cross-sectional study of rural community in relay to some clinical signs. *Annal. Trop. Med. Parasitol.***78**: 443-445.

[4] Albonico, M. Wright, V. Jape, K. Haji, H. J. Taylor, M. Savioli, L. Bickle, O. (2002). Soil transmitted nematode infections and mebendazole treatment in Mafia Island School children. *Annal Trop Med Parasitol*, **96**:717-726.

[5] Alvañiz AFA, de Castro EC, Tablizo BJB, Flores MJC, Maghirang ESV, Esmeli LAR, Pacificador AY, Sumalapao DEP. Prevalence, physiologic effects, and risk factors of soil-transmitted helminth infections among grade school children. National Journal of Physiology, Pharmacy and Pharmacology. 2017;7(9):907-913.

[6] Flores MJC, Bautista YM, Carandang LGE, Go KM, Olalia MBIT, Maghirang ESV, De Peralta AS, Esmeli LAR, Sumalapao DEP. Risk factors associated with intestinal parasitic infections among school children. Annual Research & Review in Biology. 2018;24(4):1-6.

[7] Nokes, C. S. M. Grantham-Mcgregor, A.W. Sawyer, E.S. Looper. D.A.P Bundy (1992).Parasitic helminthic infection and cognitive function in school children.

[8] Nokes, C. Bundy, DAP (1994). Does helminth infection affect mental processing and educational achievement? *Parasitol Today*.**10**: **Pp** 14-8.

[9] Sackey, M. E. Weigel, M. M. Armijos, R. X. (2003**)**. Predictors and nutritional consequences of intestinal parasitic infections in rural Ecuadorian children.*J. Trop. Pediatr.***49**: 17-23.

[10] Yakubu, N. Musa, G. Yakubu, S. E. (2003). Seasonal changes in the distrinution and infection rate of Schistosoma intermediate hosts in River Kubanni and its tributaries. *Bio Res Com* 2003, **15**:207-214.

[11] Wang, K. Tang, D. Wang, M. Lu, J. Yu, H. Liu, J. (2009). Journal of cell science 122(Pt12):20556

[12] WHO (1987). Report Series 749: Prevention and control of intestinal parasitic infections. Geneva: WHO; 1987.

[13] Sokoto State Business Directory (SSBD) (2007).A Publication of the Commerce Department, Ministry of Commerce, Industry and Tourism, Sokoto. Pp 14-18.

[14] UNFPA Annual report (2013). Publisher UNFPA ISBN 978-0-89714-994-5.

[15] Taofeek, I. (2010). Sample Size Determination. Research Methodology and Dissertation Writing for Health and Allied Health Professionals 1st edition, Cress Global Link Limited, Abuja, **Pp** 74-75.

[16] Muhammad, I. M., Umoru, A. M., Isyaka, T. M., (2014). Intestinal parasitic infections among patients attending a Tertiary Health Institution in North-eastern Nigeria.*American Journal of Research Communication*, **2**(6): 88-96.

[17] Cheesbrough, M. (2005). District Laboratory Practice in tropical countries part 1, Cambridge University Press, and International U.K. **Pp** 184-205.Children in southeast *Nigeria.Journal 7, Environmental health***. 1**(2); 8-64.

[18] Ochei, J. Kolhatkar, A. (2000). Medical Laboratory Science.Theory and Practice. Tata Mcgraw-Hill Publishing Company Limited: New Delhi.2nd Edition, **Pp** 331-349.

[19] Garba, D. D. Thomas, H. Z. Jatau, E. D. Inabo, H. I. (2014). Prevalence of intestinal helminths among primary school children in chikun and kaduna south local Government Area of Kaduna state, Nigeria. J. Med. Res. Vol 2(2), Pp 6-1.

[20] Baragundi, M. C. Sonth, S. B. Solahannwar, S. Patil, C. S. (2011). The prevalence of parasitic infections in patients attending teritiary care hospital, Nat J Bas Med Sci; **2**(1):314.

[21] Kabiru, M., Mohammed, R.A., and Julia O. (2015). Intestinal Parasitic Infection and Assessments of Risk Factors in North-Western, Nigeria: A community based study. *International Journal of Pharma Medicine and Biological Sciences,* **4:2**

[22] Ikeh, E., M. Obadofin, B. Brindeiro, (2006). Intestinal parasitism in rural and urban areas of North Central Nigeria, an update, *Internet J. of Microbiology*, vol. 2, no. 1.

[23] Matthys, B. M. Bobieva, G. Karimova, Z. Mengliboeva, V. Jean, Richard, (2011). Prevalence and risk factors of helminths and intestinal protozoa infections among children from primary schools in Western Tajikistan, Parasites and Vectors, vol. 4, no. 195, **Pp**. 1-13.

[24] Missaye, A. D. Mulat, A. Alemu, and Agersew, A. (2013). Prevalence of intestinal parasite and associated risk factors among HIV/AIDS Patients with pre-ART and on-ART Clinic, North-east Ethiopia*, AIDS Researh Therapy J,* vol. 10, no. 7, **Pp**. 1-9.

[25] Okon, K.O. Moses, A. E. Zailani, S. B. Tettey, E. N. (2003). ''Prevalence of human intestinal parasites in a semi-arid area of Nigeria: A five year review''. *Nig. J exptl app biol***17**: 503-24.

[26] Brooker, S, Hotez P. J. Bundy, D. A. (2008). Hookworm-Related Anaemia. Among Pregnant Women: *A Systematic Review of Trop.***Pp** 2-4.

[27] Atu, B.O. Galadima, M. and Alice, F. (2006). Prevalence of intestinal parasites in Etulo, Benue State Nigeria.*Nig. J. of Parasitology*; 7: **Pp** 1-16.

[28] Gelaw, A. A. Belay, Nigssie, B. (2013).Prevalence of intestinal parasitic infections and risk factors among School children at the university of Gondar Community School, North-west Ethiopia, a cross sectional study, BMC Public Health, vol. 13, no. 1, pp. 257.

[29] Abou-EL, F. R. Salama, Taha, N. (2009). "Predictors of intestinal parasitic infection among pre-school children in Rural Lower Egypt, *The Egyptian Journal of Community Medicine,* vol. 27, no. 1, **Pp**. 1-9.

[30] Oguoma, V. M. Anyasodor A. E. Mbata, T. I. (2008). Valence of Intestinal Protozoan parasites among children aged 5-12 years in Owerri Metropolis South Eastern Nigerian. *Trop. J. Health Sci*; 15(2): **Pp** 43-48.

[31] WHO (2005). De-worming for health and development.Report of the third global meeting of the partners for parasite control**.**

[32] Adekunle, L. (2002). Intestinal parasites and nutritional status of Nigerian children. Afr. J. Biomed.Res, 5: **Pp** 115-119.

[33] Akinbo, F. O. Omorigie R. Eromwan, R. (2011). Prevalence of intestinal parasites among patients in tertiary hospital in benin city, Nigeria. North American journal of medical science 3(10):462-464.

[34] Erko, B. Medhin, G. (2003). Human helmenhasis in wodogenet, southern Ethiopia,with emphasis on geohelmethasis, *Ethiop MED J*: 41: **Pp** 333-44.

[35] Asrat, A. Tewodros, D. Alemayehu, W. (2011). Prevalence and risk factors of intestinal paraties among Delgi school children, North Gondar, Ethiopia.Journal of parasitology and vector Biology Vol. 3(5) Pp 75-81. ISBN 21-41-2510

[36]Miller SA, Rosario CL, Rojas E, Scorza JV. Intestinal parasitic infection and associated symptoms in children attending day care centres in Trujillo, Venezuela. Trop Med Int Health. 2003;8:342-7.

[37] Nasiri V, Esmailnia K, Karim G, Nasir M, Akhavan O. Intestinal parasitic infections among inhabitants of Karaj City, Tehran province, Iran in 2006-2008. Korean J Parasitol. 2009;47:265-8..