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SURVEY OF WATER BORNE PROTOZOAN PARASITES IN DRINKING WATER SOURCES OF SOME SELECTED COMMUNITIES IN GOMBE METROPOLIS, GOMBE STATE

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ABSTRACT

The aim of this research is to access the availability of different types of water borne protozoan parasites and the impact on the overall health of the people in communities within the study area. A survey of different water sources was conducted for possible water borne protozoan parasites and the impact on the overall health of the people in communities within the study area. The study was carried out in four different communities within Gombe metropolis. Microscopic examination of the sediments after centrifugation of the water samples was the principal method employed in the analysis. A retrospective study was conducted at different primary health care centers within the communities. In order to ascertain the incidence of water borne infections in the study area, hospital records kept in the health centers were used. Case notes of subjects from 2016 to 2018 in each of the community was considered. The case notes were assessed for diagnosis of various water related infections. Out of the 100 water samples collected and examined, 86 samples were positive with protozoan parasites. The result of the study indicate that water from well is the most contaminated (46.64 %). Three different protozoan parasites were identified; this include *Giardia lamblia*, *Cryptosporidium parvum* and *Entamoeba histolytica. Giardia lamblia* was the most prevalent. The result of the retrospective study conducted at different primary health care centers from 2016 to 2018 indicates a progressive decrease in the number of patients with reported complaints of water related diseases. The highest complaint diagnosed cases was recorded in 2017. Age distribution of water-borne related infections cases revealed the highest incidence among the age group of 10-15 years. The protozoan parasites encountered were noted to affect human health. As such, public education on the importance of personal hygiene and optimal environment sanitation have been recommended.

Keywords: Water Borne Disease; Protozoan Parasites; Gombe

INTRODUCTION

Water is an essential resource for life. Water is used by everyone, every day. Not only do all people need drinking water to survive, but water plays an important role in almost every aspect of our lives from recreation to manufacturing computers to performing medical procedures. The significance of water to human and other biological systems cannot be over emphasized, and there are numerous scientific and economic facts that water shortage or its pollution can cause severe decrease in productivity and deaths of living species (Garba, *et al.,* 2008; Garba,*et al.,* 2010). Reports by Food and Agricultural Organization (FAO) of U.S.A revealed that in African countries, particularly Nigeria, water related diseases had been interfering with basic human development (FAO, 2007).

According to World Health Organization reports, more than 80 infectious diseases can be transmitted by water leading to various water borne diseases.

Clean drinking water is important for overall health and it plays a most substantial role in infant and child health. (Nwabor, *et al*., 2016).Over the recent years however, concerns have been raised over the microbial quality of drinking and domestic usage of water (Fewtrell *et al.,* 2001; Rosenberg, 2003; Khaniki, *et al.,* 2010).

Water plays an important role in almost every aspect of our lives, but when contaminated by parasites, however, it can cause a variety of illnesses such as Cyclosporiasis and Giardiasis (WHO, 2003). Several parasites have emerged as significant cause of food and water-borne diseases in the whole world. This is achieved through consumption of contaminated food and water (Odikamnoro, 2016). Report by Food and Agricultural Organization (FAO) of U.S.A revealed that in African countries particularly Nigeria, water related diseases had been interfering with basic human development. Most of the studies on epidemiology of human Cryptosporidiosis, Giardiasis and Amoebiasis have been carried out in developed countries and there is little data on the occurrence of these infections in other areas (Bakir, *et al.,* 2003).

UNICEF reports that about 2.6 billion which is almost half the population of the developing world do not have access to adequate sanitation with over 80 per cent of people with unimproved drinking water and 70 per cent of people without improved sanitation live in rural areas. In Nigeria, a vast majority of people living along the course of water bodies still source and drink from rivers, streams and other water bodies irrespective of the state of these water bodies without any form of treatment. These natural waters contain a myriad of microbial species, many of which have not been cultured, much less identified. The number of organisms present varies considerably between different water types, and it is generally accepted that sewage-polluted surface waters contain greater number of bacteria than unpolluted waters (UNICEF, 2010).

Over the recent years however, concerns have been raised over the microbial quality of drinking and domestic usage of water (Khaniki, *et al.,* 2010). It has also been observed that the sources of water available for consumption within communities in Gombe metropolis are borehole reservoirs, well water, tap water and rain water which are not well treated and may harbor pathogenic parasites which may pose serious hazard to human health. It is against this background that this research was conducted. The present study accessed the availability of different types of water borne protozoan parasites and the impact on the overall health of the people in communities within the study area.

MATERIALS AND METHODS

Study Design

The research was carried out in Gombe Metropolis. Gombe town lies between the latitude $10^0 17' 13.97'' N$ and $11^0 9' 58.45'' E$ longitude, occupying an area of about $52 km^2$. The communities chosen for the study were randomly selected. The locations were Tudun-wada, Bolari, Pantami and Jeka-dafari. These communities were chosen because it has been observed that they have mainly three water sources which are hand dug well, borehole and tap water. Majority of the well also dry up during dry season making the people of the community to suffer untold hardship of water during dry seasons, this make them get water from any available sources regardless of the unhygienic state. They also use rain water during rainy season. They make use of open refuse dumps such as dumping them into

nearby bushes, burn them or dumping by the roadside.

Sampling and Processing

A total of hundred 2-litre water samples were collected with a sterile sample bottle from different locations between the months of April-June, 2018. Forty (40) water samples from hand dug wells, 30 water samples from tap and 30 samples from boreholes. Sampling bottles were properly labelled with the name of the source, collection number, area and date of collection.

The samples were taken immediately to the Laboratory of Biological Sciences Department Gombe State University for macroscopic and microscopic examination. All water samples were stored at 4^{o} C and processed within 48 hours of collection.

The method used was centrifugation and microscopy, the samples collected were left to stand for eight hours after which the supernatant was carefully decanted from the deposit after which the sediment were put in the centrifuging tubes using the pipette to ensure that the water is on equal levels on the tubes and also for proper balancing in the centrifuge, in case of any remaining deposit in the sample bottles, a little drop of detergent and water solution was added to rinse it out. The sediments were centrifuged at 3000 rpm for 15 minutes. The supernatant was discarded and the pipette tip was used to collect the deposit and placed on a clean slide. Smears of sediments were made on grease free slide; it was stained with lugols iodine. The stained slides were covered with cover slip and observed under the light microscope using 10X, and 40X objective lens for focusing and identification of parasites respectively.

Identification of Parasites

Parasites were identified using standard guide .The parasite morphological structures of the ova, cyst, oocyst or adult when focused under the microscope were observed.

Retrospective Study

A retrospective study was conducted at primary health care centers within these communities. In order to ascertain the incidence of water borne infections in the study area, records kept in the health centers were used. Case notes of subjects from 2016 to 2018 in each of the community was considered. The case notes were assessed for diagnosis of various water related infections. Data such as patient's age, sex and diagnosed infection were collected for further analysis.

RESULTS

Out of the one hundred (100) water samples collected and examined from different communities, 86 samples were identified to be positive for the presence of parasites giving an overall prevalence of 86 %.(Table 1).The percentage distribution of the parasites indicated that water from well was the most contaminated with 48.64 % positivity for parasites, followed by borehole 34.45 % and tap water with 16.89 %. On the whole, different parasites were encountered in the study. They include *Giardia lamblia*, *Crysporidium parvum*, and *Entamoeba histolytica*. Age distribution of water borne parasites cases in the health care centers showed that children from 1-9 years accounted for the highest prevalence in Bolari (30.64 %) followed by children of less than one year (28.48 %). In Pantami and Tudun wada, age group of 10-15 were the most prevalent. Similarly in Jekadafari, 10-15 years age group accounted for the highest prevalence. As shown in Figure 1, 2, 3, and 4 respectively. The result of the retrospective study conducted at different primary health care centers from 2016 to 2018 indicates a progressive decrease in the number of patients with reported complaints of water related

diseases. The highest complaint diagnosed cases were recorded in 2017.

Table 1: Waterborne parasites found in the samples obtained from different water sources

Water Sources	Total No. of Water Sample	Positive Samples No. (%)	Total No. of Parasite Found	Prevalence %
Well water	40	40 (46.51)	37	49.33
Tap water	30	20 (23.25)	12	16.00
Bore hole water	30	26 (30.23)	26	34.66
Total	100	86 (86)	75	(99.99)

Table 2: Waterborne parasites found in the samples obtained from different water sources

Water Sources	Total No. of Sample	Total Positive Samples No. (%)	Total No. of Parasite found (%)	Number of Positive Parasite found in Sample
Well water	40	40 (46.51)	15 (37.5)	*Giardia lamblia*
			9 (22.5)	*Crysporidium parvum*
			13 (32.5)	*Entamoeba histolytica*
Tap water	30	20 (23.25)	7 (35)	*Crysporidium parvum*
			5 (25)	*Entamoeba histolytica*
Bore Hole water	30	26 (30.23)	6 (23.07)	*Crysporidium parvum*
			10 (38.46)	*Giardia lambia*
			10 (38.46)	*Entamoeba histolytica*
Total	100	86 (86)	75 (75)	

Table 3: Reported cases of water related illness in Pantami from 2016 to 2018

Diagnosis of reported complaint	2016 (%)	2017 (%)	2018 (%)	Total
Diarrhea	169 (29.28)	109 (14.78)	52 (13)	330 (19.25)
Dysentery	40 (6.93)	38 (5.15)	54 (13.5)	132 (7.70)
Amoebiasis	243 (42.11)	290 (39.34)	141(35.25)	674 (39.32)
Gastroenteritis	48 (8.31)	97 (13.16)	112 (28.00)	257 (14.99)
Typhoid Fever	40 (6.41)	197 (26.72)	38 (9.5)	275 (16.04)
Cholera	37 (6.41)	6 (0.81)	3 (0.75)	46 (2.68)
Total	577(33.66)	737 (42.99)	400 (23.33)	1714 (100)

Table 4: Reported cases of water related illness in Bolari from 2016 to 2018

Diagnosis of reported complaint	2016 (%)	2017 (%)	2018 (%)	Total (%)
Diarrhea	173 (27.03)	147 (26.34)	117 (21.62)	437 (25.12)
Dysentery	47 (7.34)	64 (11.46)	62 (11.46)	173 (9.99)
Amoebiasis	129 (20.15)	132 (23.65)	199 (36.78)	460 (26.45)
Gastroenteritis	104 (16.25)	58 (10.39)	37 (6.83)	199 (26.45)
Typhoid Fever	168 (26.25)	145 (25.98)	63 (11.64)	376 (21.26)
Cholera	19 (2.96)	12 (2.15)	63 (11.64)	94 (5.4)
Total	640 (36.8)	558 (32.08)	541 (31.10)	1739 (100)

Table 5: Reported cases of water related illness in Tudun-Wada from 2016 to 2018

Diagnosis of reported complaint	2016 (%)	2017 (%)	2018 (%)	Total (%)
Diarrhea	49 (6.51)	184 (22.49)	47 (14.92)	280 (14.85)
Dysentery	85 (11.30)	119 (14.54)	44 (13.96)	248 (13.15)
Amoebiasis	278 (36.96)	274 (33.49)	124 (33.36)	678 (35.86)
Gastroenteritis	262 (34.84)	170 (20.78)	40 (12.69)	472 (25.03)
Typhoid Fever	37 (4.92)	62 (7.57)	60 (19.04)	159 (8.43)
Cholera	41 (5.45)	9 (1.10)	0 (0)	50 (2.65)
Total	752 (39.89)	818 (43.39)	315 (16.71)	1885 (100)

Table 6: Reported cases of water related illness in Jeka-Dafari from 2016 to 2018

Diagnosis of reported complaint	2016 (%)	2017 (%)	2018 (%)	Total (%)
Diarrhea	138 (20.14)	170 (23.61)	114 (19.48)	422 (21.20)
Dysentery	53 (7.73)	94 (13.05)	71 (12.13)	218 (10.95)
Amoebiasis	111 (16.20)	121 (16.8)	135 (23.07)	367 (18.44)
Gastroenteritis	53 (7.73)	116 (16.11)	88 (15.04)	257 (12.91)
Typhoid Fever	318 (46.42)	195 (27.08)	176 (30.08)	689 (34.62)
Cholera	12 (1.75)	24 (3.33)	1 (0.17)	37 (1.85)
Total	685 (34.42)	720 (36.18)	585 (29.39)	1990 (100)

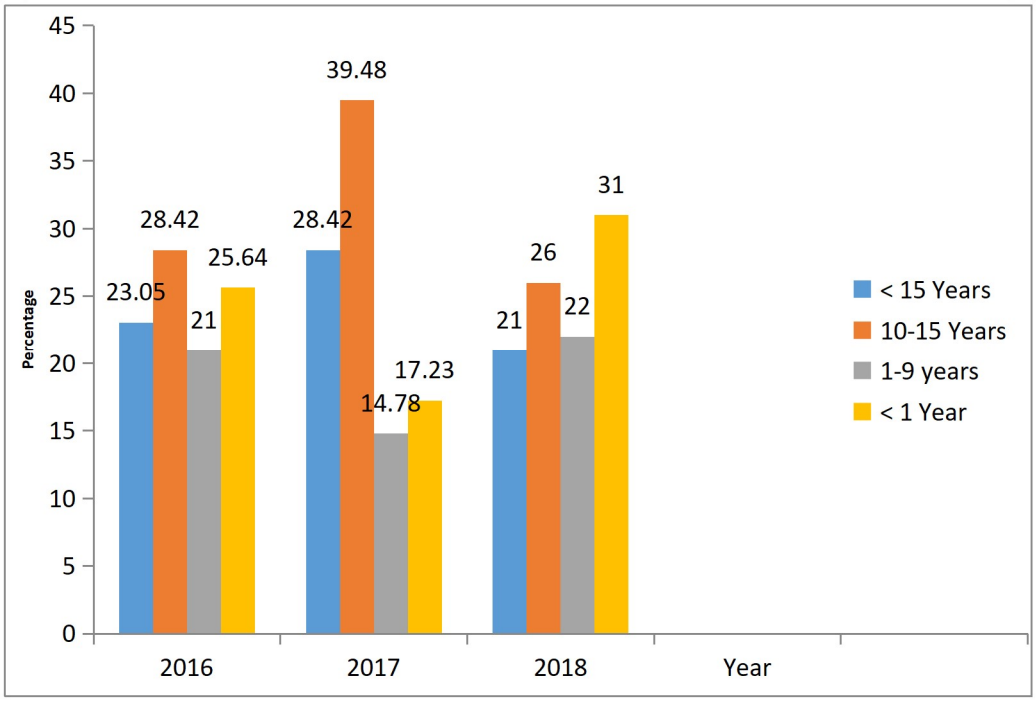

Figure 1: Reported Cases of Age and water related illness in Primary Health Care Centre, Pantami From 2016 to 2018

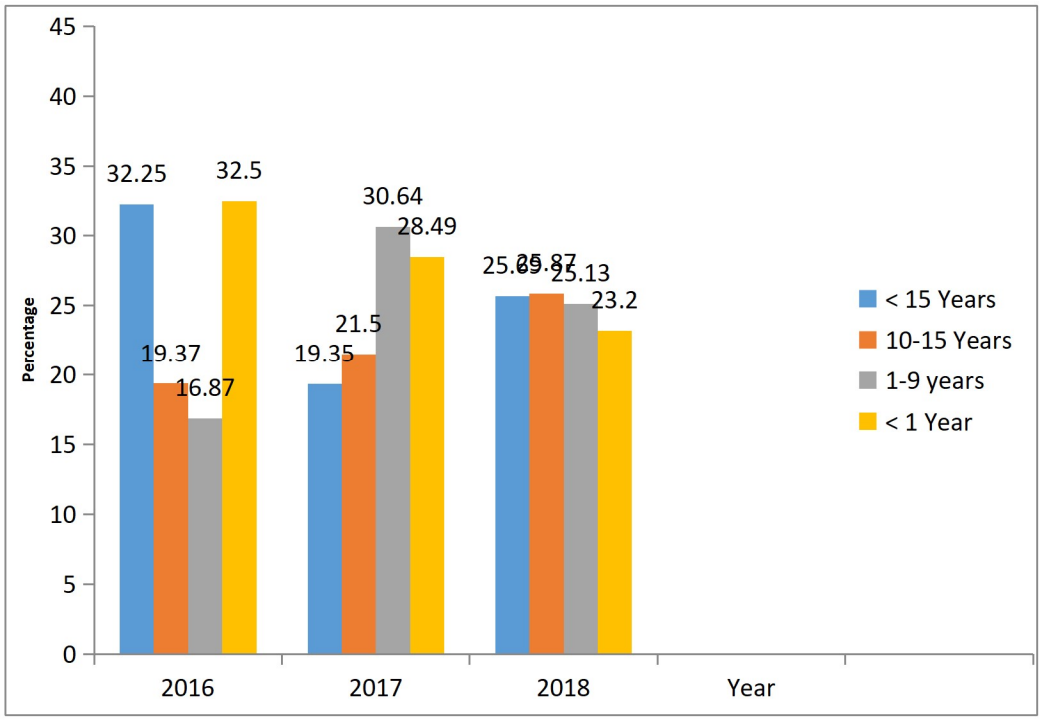

Figure 2: Reported Cases Age and water related illness in Primary Health Care Centre, Bolari From 2016 to 2018

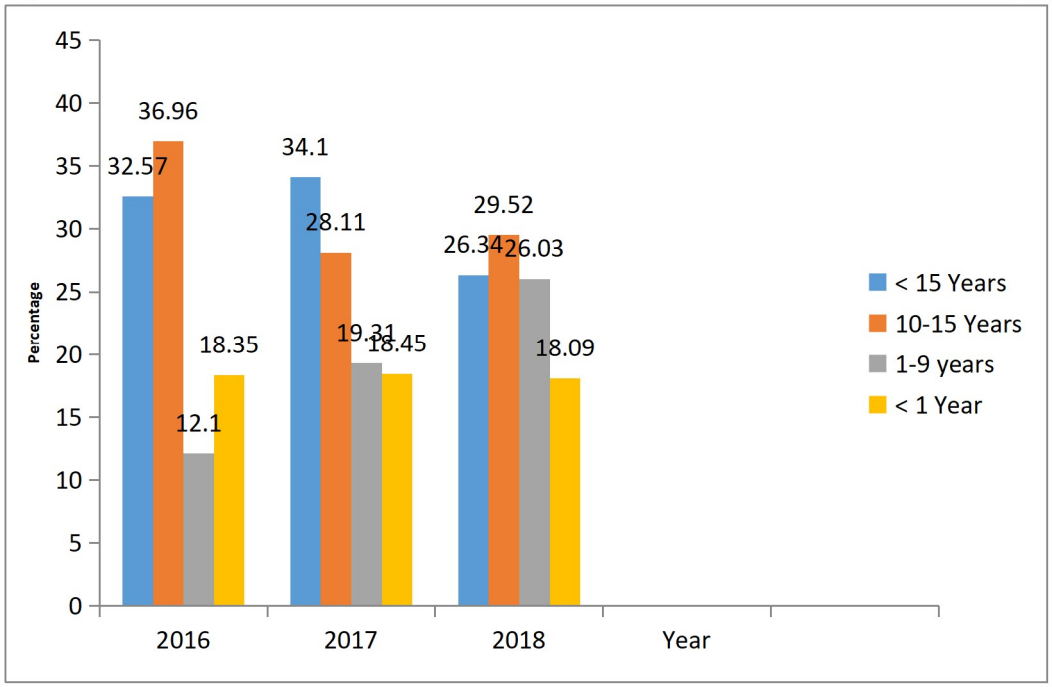

Figure 3: Reported Cases of Age and water related illness in Primary Health Care Centre, Tudun-wada from 2016 to 2018

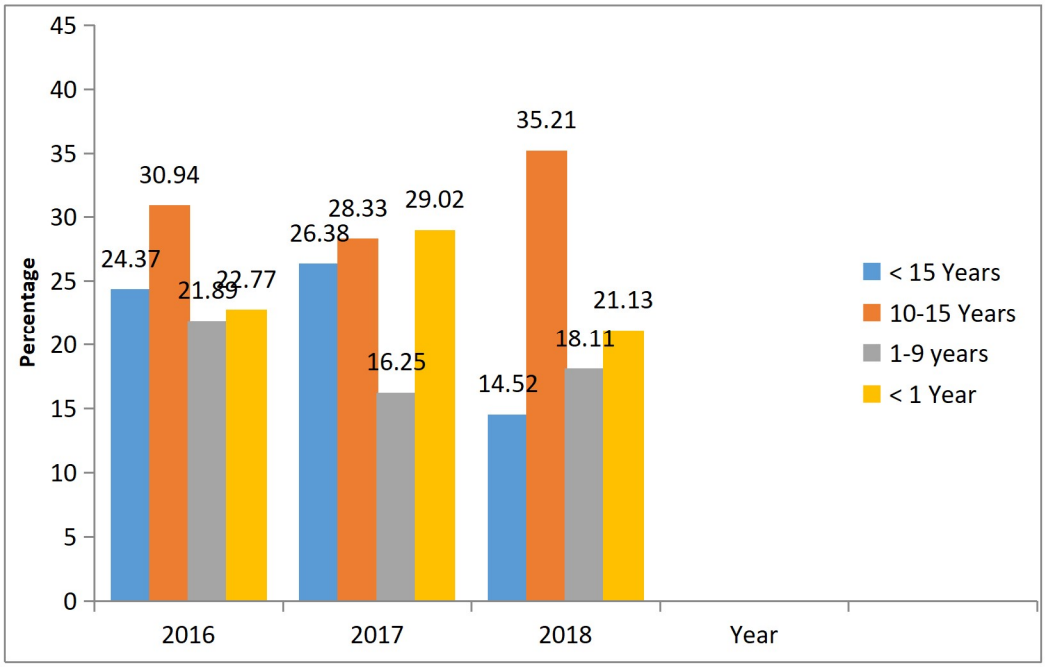

Figure 4: Reported cases of Age and water related illness in Primary Health Care Centre, Jeka-Dafari From 2016 to 2018

DISCUSSION

This research has shown that *Giardia lamblia* was most prevalent in the study area. Cr*ysporidium parvum* was found but on a minimal level. These parasites were observed to be in their cystic and oocystic forms. The identification of parasites in various sources

of water agrees with the study done by *Bakir et al., (2003) on drinking water sources. Ani et al. (2015) also isolated* C.parvum*, Giardia* spp and *E. histolytica* in different sources of drinking water in Abakilaki, Ebonyi State.

The results show a high prevalence of this parasite in various water sources within the study area. *E.histolytica* was also present in high number. Infection with this parasite explained the reason for the cases of water borne related infection (amoeabiasis) within the study area and this is due to contamination of different water sources by the parasites. *G.lamblia* was the most prevalent. The presence of this parasite can cause giardiasis. The presence of *G. lamblia* was observed majorly in wells and streams, this agrees with the report of (Inaji *et al.,* 2016).

According to this research *G. lamblia* is typically associated with surface water sources (wells).*C.parvum* was also found but on a minimal level and this is due to contamination of drinking water by animals in which diarrhoea is the most common symptoms. Their presence is due to contact with water that has been faecally contaminated according to Cheesebrough (2002).Jekadafari has the most occurrence diagnosed cases of water borne diseases followed by Tudun wada, Bolari and Pantami .The highest incidence of water borne infection among the age group of 10-15 might be attributed to lack of personal hygiene by the children.

CONCLUSION

The outcome of the study indicates clearly the present of variety of protozoan parasites in water sample sources and a significant statistical difference was noticed between the types of water sources and sites as well as the contamination. Studies have shown that Giardia, Cryptosporidium and Entamoeba are well recognized water borne parasites, caused a number of outbreak worldwide. The public health significance of these results is that the pathogenic protozoan parasites may pose serious hazard to human health, especially the young age group due to their poor sanitary habits

It can be deduced that the number of parasites in water samples vary between water sources in the study area and there is also a significant difference in the prevalence of waterborne diseases from 2016 to 2018.

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