Prevalence of Waterborne Diseases in Bade, Nguru and Machina Local Government Areas of Yobe State-Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author AAA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author YK managed the analyses of the study and the literature searches. Both authors read and approved the final manuscript.

Article Information

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ABSTRACT

Waterborne diseases are mainly caused by consuming food or water tainted with faecal matter or urine of human or animal which contains pathogens. Records have shown that Yobe State is one of the states in Nigeria that have recorded mortalities due to waterborne infections. This study is aimed at identifying common waterborne diseases such as cholera, typhoid, infectious hepatitis, giadiasis, amoebiasis, and dracunculiasis between 2017 and 2019 in three local Government Areas (L.G.As) of Yobe State. Personal interview was employed to generate information from the local people on sources of drinking water in three sampled geo – political wards (Bade, Nguru and Machine L.G.As). Results revealed that most of the dwellers in the study area drink from non – potable water sources such as faucets, hand pump, wash boreholes, wells, rivers, pools and creeks. Results also show that people from the study area do not drink potable water. A total of 1204 cholera cases were reported between 2017 and 2019 in the study areas with Machina L.G.A having the highest number of cases (446) representing 37.04% of the total cases. Mortality due to cholera outbreak in all the surveyed LG.As was 124 with Bade L.G.A having the highest number

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(43) constituting 34.68% of total mortalities in the study areas. A total of 11,938 persons were infected with typhoid during the study period and Nguru L.G.A recorded the highest number of infections (4,438) representing 37.18% of total infections. Gender based percentage prevalence of typhoid in the study is higher in males (52.83%) than females (47.18%). Recommendations on how to overcome the menace have been highlighted.

1. INTRODUCTION

Waterborne diseases, according to United Nations International Children Emergency Fund (UNICEF) [1] are diseases mainly caused by consuming water tainted with either human or animal faecal matter or urine which contains pathogens. Mietinen [2] added that in addition to the transmission through drinking water, waterborne diseases are also transmitted through the use of contaminated water for preparing food, recreation or other domestic purposes. Poor environmental sanitation plays an important role in the transmission of waterborne diseases. Yousefi et al. [3] pointed out that one of the fastest ways of contracting waterborne diseases is through dinking of contaminated or non-potable water. Clasen et al. [4] also reported that contaminated, unclean or tainted water are major causes of morbidity and mortality throughout the world while Ismail and Elnaeem [5] opined that one of the main causes of death and illness in developing countries is waterborne disease associated with poor sanitary condition. World Health Organization (WHO)/UNICEF [6] earlier reported that about 2.6 billion, almost half the population of the developing world, do not have access to adequate sanitation. WHO [7] further reported that the mortality rate associated with waterborne diseases, the world over is more than 5 million people, making it the leading cause of disease and death in the world [8]. According to Department for International Development (DID) [9] over 80% of people with unimproved drinking water and 70% of people without improved sanitation live in rural areas. In conflict-affected areas of countries around Lake Chad including Nigeria, more than 5.6 million children are at increased risk of contracting waterborne diseases such as cholera and diarrheal infections at the onset of rainy season [10]. 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 [11]. It has been estimated that about 1.8 million people die from diarrheal diseases annually, many of which have been linked to the consumption of tainted or non-potable waters [11].

1.1 Common Waterborne Diseases

Common waterborne diseases around the globe, according to Anderson and Bohan [12] include amoebic and bacterial dysenteries, typhoid fever and cholera. In sub-Saharan Africa the common waterborne diseases are cholera, typhoid, infectious hepatitis, giardiasis, amoebiasis and dracunculiasis [11]. In Nigeria the most common waterborne diseases are cholera, dracunculus, hepatitis and typhoid [13]. Out of the common waterborne diseases the most devastating, throughout the world, are cholera and typhoid [14].

1.2 Outbreak of Waterborne Diseases

Contaminated, tainted or non portable water as a potential source of disease outbreak throughout the world is well documented. Nwabor, Nnamonu, Martins and Ani [11] reported that contamination of water has been globally recognized as one of the leading cause of disease outbreaks. Anderson and Bohan [12] reported that the use of contaminated water in food, irrigation or food processing plays an additional role in disease outbreaks. Anderson and Bohan [12] further reported that surface water (river, well, creek, pool, and flood) has been responsible for the largest reported waterborne disease outbreaks. Nigeria has been reported as one of the countries in the world that has unsafe water supplies [15]. Waterborne diseases including cholera, dracunculiasis, hepatitis and typhoid have been reported in different parts of Nigeria. Available data showed that cholera, in Nigeria, occurs often with large scale outbreak [16] with a total of 1,741 cases of death between 2002 and 2008 in 14 States [16]. In their survey of Waterborne Infectious Diseases (WBID) in the United States, Morris and Levin [17] reported outbreaks of amoebic dysentery, typhoid fever, cholera, giardiasis and salmonellosis. Pande [18] reported cholera outbreak affecting more than 30 people in fishing

village (Katwe) in south-western Uganda while Mackenzie, et al. [19] reported the 1993 outbreak of cryptosporidiosis in Milwaukee, Wisconsin, in the United States.

In the developing world, according to Ajayi, Olukunle and Boboye [20], not less than 5% of deaths are caused by typhoid fever in endemic areas. On the effect of typhoid fever on gender and age in Ondo State, Nigeria, Ajayi, et al. [20] reported highest (11.16%) infection among males of age group 10-25 while the least occurrence (4.00%) was observed in females of 61-80 years of age. Similarly, Ajayi, et al. [20] found out that the highest percentage frequency (76%) of typhoid fever in Akure, Ondo State is among those who drink well water.

1.3 Waterborne Diseases Outbreak in Borno and Yobe States

Following the nine years insurgency in north eastern Nigeria, the states of Borno and Yobe have been having waterborne disease outbreaks due to displacement of persons from their homes leading to consumption of non-potable water. Outbreaks of Cholera have been reported in Borno and Yobe States. Idowu [21] reported that United Nations warns on outbreak of cholera in four Local Government Areas (L.G.A) of Yobe State with a total of 404 cases and 15 deaths. Medicins Sans Frontieres (MSF) [22] showed concern over outbreak of waterborne diseases in Damaturu, Yobe State; Gwoza, Pulka, Rann, Monguno in Borno State due to displacement of persons in the crises areas. UNICEF [23] reported cholera outbreak in Monguno,

Guzamala, Jere, Dikwa, Mafa and Maiduguri Metropolitan council in Borno State in August 2017 with a total of 5,365 cases and 61 deaths.

Available literature shows that there is paucity of information on the prevalence of waterborne diseases in Bade, Nguru and Machina L.G.As of Yobe State. This study is therefore aimed at surveying the prevalence of waterborne diseases in the three L.G.A of Yobe State with a view to identifying them and their incidence between 2017 and 2019.

2. MATERIALS AND METHODS

2.1 Study Area

The study area (Fig. 1) includes Bade, Nguru and Machina L.G.As of Yobe State. Bade L.G.A, with its headquarters at Gashua, is 185km from Damaturu, the state capital. It has an area of 772 km² and a population of 139,782 at the 2006 census. It is located at $12^{o}52"5^{o}N$ $11^{o}2"47^{o}E$. Nguru town, the headquarters of Nguru L.G.A of Yobe State, Nigeria is located near the Hadejia River at $12°52'45''N$ $10°27'09''E$. It has an area of 916 km² and a population of 150,632 at the 2006 census. Nguru is approximately 253km from Damaturu, the state capital. Machina is a L.G.A in Yobe State, Nigeria with its headquarters at Machina town. Machina is located about 298km from Damaturuat $13°08'11''N$ $10°02'57''E$. It shares a border in the north with The Republic of Niger. It has an area of 1,213 km² and a population of 61,606 at the 2006 census. Most of the residents of Bade, Nguru and Machina L.G.A are rural dwellers.
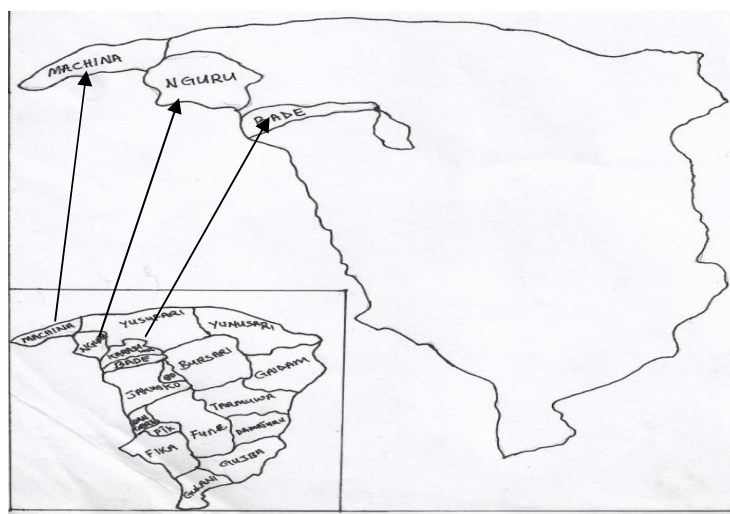

Fig. 1. Map of Yobe State showing study area

2.2 Instrument and Methods of Data Collection

Personal interview was employed to elicit information from the local people on sources of drinking water in three geo-political wards each of Bade, Nguru and Machina L.G.As. The sampled geo-plotical wards of Bade L.G.A include Zango, Usur/Dawayo and Sugum/Tagali wards while those of Nguru L.G.A are Bulabulin, Garbi/Bambori and Majakura wards. Sampled geo-polital wards of Machina L.G.A comprise of Karjidi, DolenMachina and Falmaram wards.

A total of 810 persons from the study area were randomly sampled irrespective of literacy level using simple random sampling technique for oral interview. Exactly 270 persons from each L.G.A (90 persons per ward) were randomly selected for oral interview to find out their sources of drinking water. The oral interview lasted for 45 days (18 respondents per day).

Types of waterborne diseases and their incidences were determined at primary health care units of each L.G.A through formal request to the Coordinators for release of data on the prevalence of waterborne diseases between 2017 and 2019 within the study area. Ethical clearance was also sought from the Coordinators.

3. RESULTS

The field survey revealed that most of the dwellers of Bade, Nguru and Machina L.G. As drink form non-potable water. The main sources of drinking water in the study area include faucets, hand pumps, wash boreholes, wells, rivers, pools and creeks. Few individuals use bottled, table or tap water as their major source of drinking water. In addition most of the faucets water in all the L.G.As are vended in jerry cans by water vendors due to distance of the water source from households. Similarly, the study revealed that only two waterborne diseases namely cholera and typhoid fever are prevalent in the area. Nigeria's common waterborne diseases such as hepatitis, giardiasis, amoebiasis and dracunculiasis have not been documented as outbreak in Bade, Nguru and Machina L.G.As between 2017 and 2019.

3.1 Sources of Drinking Water and Domestic Uses of Residents of Selected Geo-political Wards in Bade, Nguru and Machina L. G. As of Yobe State

Sources of water for drinking and domestic use of residents of Bade, Nguru and Machina L.G.As of Yobe State are presented in Table 1. Results show that majority of the people do not drink potable waters (bottled, table and tap). According to Table 1 only 1.11, 2.59% and 11.85% of the 270 sampled residents of Zango, Usur/Dawayo and Sugum/Tagali geo-political wards in Bade L.G.A drink potable water as their stable drinking water. The majority (22.96%) of residents of Bade L.G.A drink form hand pump water while 22.59 and 18.89% of the residents drink from well and wash borehole respectively. Others are river (14.81%) and other water sources (5.19%). The source of water of most dwellers of Nguru L.G.A was hand pump. This water source constitutes 25.93% of all drinking waters in Nguru L.G.A. Other water sources such as well, wash borehole and river constitute 24.07, 21.11 and 9.63% respectively. Bottled, table and tap waters constitute 0.74, 1.48 and 10.74% respectively. In Machina L.G.A 35.93% of dwellers drink hand pump water. Percentage consumption of well, river and other water sources were 25.56, 14.07 and 12.22% respectively while bottled, table and wash borehole sources recorded 0% utilization in Machina L.G.A.

Water from different sources consumed by residents of Bade, Nguru and Machina L.G.As of Yobe State are broadly classified into potable and non potable waters. Potable water in this study include bottled, table and tap waters while hand pump, wash borehole, well, river, creek and pool waters are categorized as non-portable water.

3.2 Consumption of Potable and Non Potable Water in Bade, Nguru and Machina L. G. As of Yobe State

Table 2 shows the consumption rate of portable and non potable waters in the studied L.G.As. Results show that all the L.G.As have high rate of consumption of non potable water with Machina L.G.A having the highest consumption rate (87.78%) of non potable and lowest (12.22%) consumption of potable water. Nguru L.G.A recorded 87.04% and 12.96%

consumption of non potable and potable waters respectively. Bade L.G.A recorded the lowest (84.44%) and highest (15.55%) consumption of non potable and potable waters respectively.

3.3 Prevalence of Cholera Infection in Bade, Nguru and Machina L. G. As from 2017 to 2019

Prevalence of cholera infections in Bade, Nguru and Machina L.G.As of Yobe State between 2017 and 2019 are presented in Table 3. In 2017 a total of 456 cases of cholera were reported. The highest cholera outbreak was recorded in Bade L.G.A with a total of 197 (43.20%) cases. Machina L.G.A recorded 148 (32.46%) infections while Nguru L.G.A recorded 111 infections representing 24.34% of the total infected persons in the area.

In 2018 a total of 640 cases of cholera infections were reported in Bade, Nguru and Machina L.G.As of Yobe State with Nguru L.G.A having the highest infections (241) which constitutes 37.66% of the total infections in all the L.G.As. Machina L.G.A recorded 223 (34.84%) cases while Bade L.G.A recorded 176 cholera infected persons representing 2.81% of the total infected persons in all the L.G.As.

There were 108 cholera cases in 2019 across the studied L.G.As with Bade L.G.A, recording zero (0.00%) outbreak while Machina and Nguru L.G.As had 75 (69.44%) and 33 (30.56%) cases respectively. A total of 1204 cholera cases were reported between 2017 and 2019 in the study area. Machina L.G.A recorded the highest number of cases (446) representing 37.04% of the total reported cases. Nguru L.G.A recorded 385 (31.98%) cases while Bade L.G.A had 373 infections representing 30.98% of the total cholera cases in the study area.

3.4 Mortality Due to Cholera Infections in Bade, Nguru and Machina L. G. As from 2017 To 2019

Recorded mortalities due to cholera infections in Bade, Nguru and Machina L.G.As from 2017 to 2019 are presented in Table 4. In 2017, Bade L.G.A recorded the highest mortality (25) representing 54.35% of the total reported mortalities (46) in all the surveyed L.G.As in the year 2017. Nguru L.G.A recorded 11 (23.91%) mortalities while the lowest mortality (10) representing 21.73% of all mortalities in the year 2017 were recorded in Machina L.G.A.

In 2018 death rate was highest in Nguru L.G.A with 29 mortalities representing 38.67% of all recorded mortalities in the surveyed L.G.As. Machina L.G.A recorded 28 (37.33%) mortalities while Bade which had the lowest mortality rate recorded 18 (24.00%) deaths.

Recorded mortality was highest in Machina L.G.A with 2 mortalities which is equivalent to 66.67% of all mortalities (3) in 2019 while Nguru L.G.A recorded 1 death i.e. 33.33% of the mortalities in all the surveyed L.G.As. Bade L.G.A recorded no cholera outbreak in 2019.

Total mortality due to cholera outbreak in all the surveyed L.G.As was 124 with Bade L.G.A having the highest number of deaths of (43) constituting 34.68% of mortalities in the study area. Nguru L.G.A recorded 41 (33.06%) deaths while Machina L.G.A recorded 40 deaths representing 32.23% of the total mortalities in all the L.G.As.

3.5 Incidence of Typhoid Fever in Bade, Nguru and Machina L. G. As of Yobe State between 2017 and 2019

The incidence of typhoid fever infections in the study area (Bade, Nguru and Machina L.G.As) are presented in Table 5. Nguru L.G.A recorded 1975 cases of typhoid fever in the year 2017 representing 43.08% of cases in all the L.G.As. This was followed by Bade L.G.A which recorded 1358 (29.62) infections. The least infection was recorded in Machina L.G.A with a total of 1251 infections which is equivalent to 27.29% of infections in all the L.G.As.

Machine L.G.A, in 2018, recorded the highest typhoid fever infections (1776) equivalent to 45.77% infection in all the L.G.As. Nguru L.G.A recorded 1182 (30.46) cases of typhoid fever. Bade L.G.A had the lowest number of typhoid infections (922) which is equivalent to 23.76% of all infections in the L.G.As.

In 2019 Nguru L.G.A recorded the highest incidence of typhoid fever (1238) constituting 35.64% of total cases of typhoid in the study area. Machina L.G.A had 1238 infections representing 35.64% typhoid cases in all the studied L.G.As. The least recorded incidence of typhoid was in Bade L.G.A which recorded 955 cases, equivalent to 27.49% of cases in all the surveyed L.G.As.

Table 1. Sources of drinking waters of people living in Bade, Nguru and Machina L. G. As of Yobe State

LGA	Geo-political ward	Water Source								Total
		Bottled	**Table**	**Tap**	**Hand pump**	**Wash Borehole**	**Well**	**River**	**Others**	
Bade	Zango	03	05	25	30	15	06	02	04	90
	Usur/Dawayo	00	02	05	22	28	20	10	03	90
	Sugum/Tagali	00	00	02	10	08	35	28	07	90
	Total	03	07	32	62	51	61	40	14	270
	Percentage	1.11	2.59	11.85	22.96	18.89	22.59	14.81	5.19	100.00
Nguru	Bulabulin	02	04	12	15	21	25	05	06	90
	Garbi/Babmori	00	00	08	26	18	25	10	03	90
	Majakura	00	00	09	29	18	15	11	08	90
	Total	02	04	29	70	57	65	26	17	270
	Percentage	0.74	1.48	10.74	25.93	21.11	24.07	9.63	6.30	100.00
Machina	Karjidi	00	00	20	40	00	17	05	08	90
	DolenMachina	00	00	05	35	00	20	17	13	90
	Falmaram	00	00	08	22	00	32	16	12	90
	Total	00	00	33	97	00	69	38	33	270
	Percentage	00	00	12.22	35.93	00	25.56	14.07	12.22	100.00

Table 2. Percentage consumption of potable and non potable water by residents of Bade, Nguru and Machina L. G. As of Yobe State

Type of water	Percentage consumption of Water/L.G.A		
	Bade (%)	Nguru (%)	Machina (%)
Potable	15.55	12.96	12.22
Non Potable	84.44	87.04	87.78
Total	100.00	100.00	100.00

Table 3. Number and percentage prevalence of cholera in Bade, Nguru and Machina L. G. As from 2017 to 2019

LGA	Infections			
	2017	2018	2019	Total
Bade	197(43.20)	176(27.50)	00(0.00)	373(30.98)
Nguru	111(24.34)	241(37.66)	33(30.56)	385(31.98)
Machina	148(32.46)	223(34.84)	75(69.44)	446(37.04)
Total	456(100.00)	640(100.00)	108(100.00)	1204(100.00)

Values in parenthesis () are percentages

Table 4. Number and percentage mortalities due to cholera outbreak in Bade, Nguru and Machina L. G. As from 2017 to 2019

LGA	MORTALITY PER YEAR			
	2017	2018	2019	Total
Bade	25(54.35)	18(24.00)	00(0.00)	43(34.68)
Nguru	11(23.91)	29(38.67)	01(33.33)	41 (33.06)
Machina	10(21.74)	28(37.33)	02(66.67)	40 (32.26)
Total	46(100.00)	75(100.00)	03(100.00)	124(0.00)

Values in parenthesis () are percentages

Table 5. Incidence of Typhoid Infections in Bade, Nguru and Machina L. G. As of Yobe State from 2017 to 2019

LGA	Infection per year			
	2017	2018	2019	Total
Bade	1358(29.62)	922(23.76)	955(27.49)	3235(27.09)
Nguru	1975(43.08)	1182(30.46)	1281(36.87)	4438(37.18)
Machina	1251(27.29)	1776(45.77)	1238(35.64)	4265(35.73)
Total	4584(100.00)	3880(100.00)	3474(100.00)	11938(100.00)

Values in parenthesis () are percentages

A total of 11938 persons were infected with typhoid between 2017 and 2019 in Bade, Nguru and Machina L.G.As with Nguru L.G.A having the highest (4438) infections to represent 37.18% of 11938 typhoid cases in the L.G.As. In Machina L.G.A a total of 4265 (35.73%) infections were recorded. The lowest number of infections (3235) was reported in Bade L.G.A representing 27.09% of cases in Bade, Nguru and Machina L.G.As from 2017 to 2019.

3.6 Mortality Due to Typhoid Infections in Bade, Nguru and Machina L. G. As from 2017 To 2019

The death rates following Typhoid Infections in Bade, Nguru and Machina L.G.As from 2017 to 2019 are presented in Table 6. In 2017 Nguru L.G.A recorded the highest mortality. Total number of morality was 44 (50.00%). Least mortality of 18 (20.45%) was recorded in Bade L.G.A while Machina L.G.A recorded 26 (29.55%).

Similarly, Nguru L.G.A recorded the highest mortality in 2018 with a total of 37 or 51.39% of mortalities in all the L.G.As. Similarly, a total of 24 (33.33%) deaths were reported in Machina L.G.A while Bade L.G.A recorded 11 (15.28%).

Out of the 231 total mortalities recorded in all the L.G.As between 2017 and 2019, Nguru L.G.A recorded the highest mortality rate with total of

113 (48.92%) deaths. This was followed by Machina L.G.A which recorded 75 (32.47%) deaths while Bade L.G.A had 43 (18.61%) mortalities.

3.7 Incidence of Cholera by Sex in Bade, Nguru and Machina L. G. As between 2017 and 2019

Fig. 2 shows percentage infection of cholera based on sex in Bade, Nguru and Machina L.G.As from 2017 to 2019. In all the surveyed L.G.As males in Bade L.G.A were most infected with percentage infection of 35.81% while Nguru and Machina L.G.A srecorded 34.14% and 30.05% incidences respectively. Cholera incidence among females was highest in Machina with percentage infection of 43.75% and least in Bade L.G.A (25.95%) while Nguru L.G.A recorded 30.30% infection.

3.8 Incidence of Cholera by Age in Bade, Nguru and Machina L. G. As between 2017 and 2019

Cholera infection according to age of citizens of Bade, Nguru and Machina L.G.As between 2017 and 2019 are presented in Fig. 3. In Bade L.G.A persons within ages 17-40 years were most affected by cholera while the least affected were persons in ages 41-80 years. The percentage infections of persons within ages 0-16, 17-40 and 41-80 years in Bade L.G.A are 25.76, 50.02 and 6.87% respectively. In Nguru L.G.A persons within ages 41-80 years are most affected by cholera with percentage infection of 43.30% while persons within 0-16 years were the least affected (27.78%). Incidence of cholera among persons of ages 17-40 in the same L.G.A (Nguru) was 29.80%. The data also showed that people within ages 41-80 years in Machina L.G.A were most infected (49.83%) by the cholera bacteria followed by persons within ages 0-16 years (46.47%) while the least affected age group was ages 17-40 with 20.00% incidence. People of ages 17-40 recorded the highest cholera infection (42.12%) followed by ages 0-16

(33.36%) while ages 41-80 recorded the lowest cholera infection in all the L.G.As.

3.9 Typhoid Fever Infection by Sex in Bade, Nguru and Machina L. G. As between 2017 and 2019

Fig. 4 shows Percentage infection of typhoid by sex in Bade, Nguru and Machina L.G.As between 2017 and 2019. Out of the 5627 males infected with typhoid fever bacteria in all the surveyed L.G.As, 1416 (25.16%) were from Bade L.G.A. The highest percentage male infection was recorded in Nguru L.G.A where 2285 males were infected which represents 40.61% of total infected males in all the L.G.As. Total number of males infected with typhoid in Machina L.G.A was 1926 i.e. 34.23% of the total infected males in all the studied L.G.As.

A total of 6301 females were infected with the typhoid fever bacteria in Bade, Nguru and Machina L.G.As between 2017 and 2019 with Machina L.G.A having the highest number of infected females (2339) representing 37.12% of total infected females in the study area. Bade L.G.A recorded the lowest number of typhoid infection (1809 or 28.71%) among females whereas Nguru L.G.A recorded 2153 infections i.e. 34.17% of total female infections in the study area.

4. DISCUSSION

In sub-Saharan Africa, particularly Nigeria, studies have shown that common waterborne diseases are cholera, typhoid, infectious hepatitis, giardiasis, amoebiasis and dracunculiasis [11]. In line with the study of [11] common waterborne diseases in the present study are cholera and typhoid. There was no record of the outbreak of infectious hepatitis, giardiasis, amoebiasis and dracunculiasis in Bade, Nguru and Machina L.G.As. The outbreak of cholera and typhoid in the study area could be attributed to high consumption (86.42%) of tainted or non-potable water by the people.

Table 6. Number and percentage mortalities due to typhoid infections in Bade, Nguru and Machina L.G. As from 2017 to 2019
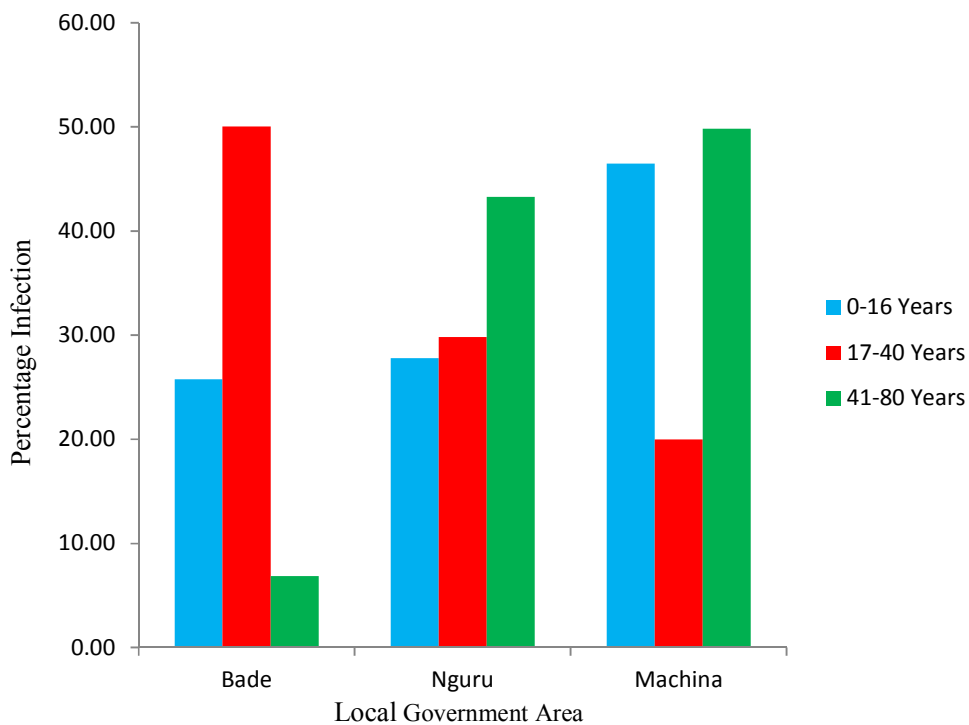
LGA	Mortality per year			
	2017	2018	2019	Total
Bade	18(20.45)	11(15.28)	14(19.72)	43(18.61)
Nguru	44(50.00)	37(51.39)	32(45.07)	113(48.92)
Machina	26(29.55)	24(33.33)	25(35.21)	75(32.47)
Total	88(100.00)	72(100.00)	71(100.00)	231(100.00)

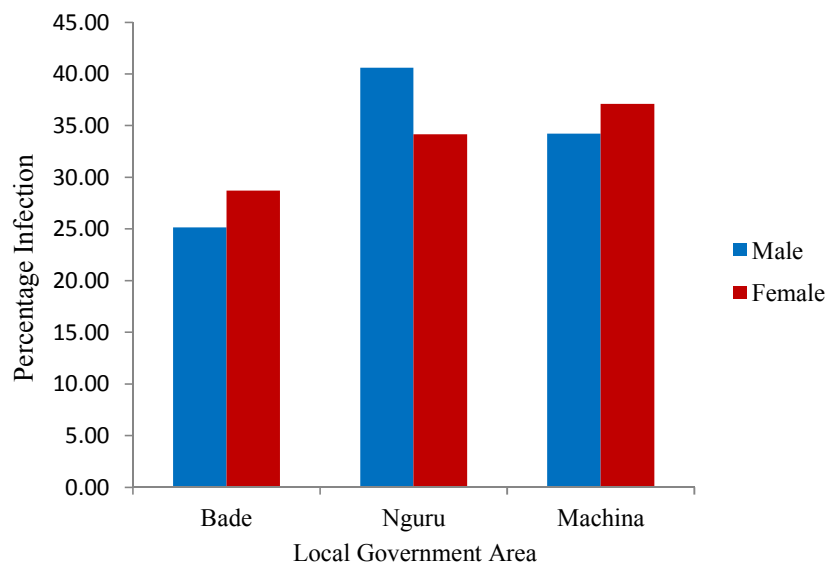*Values in parenthesis () are percentages*
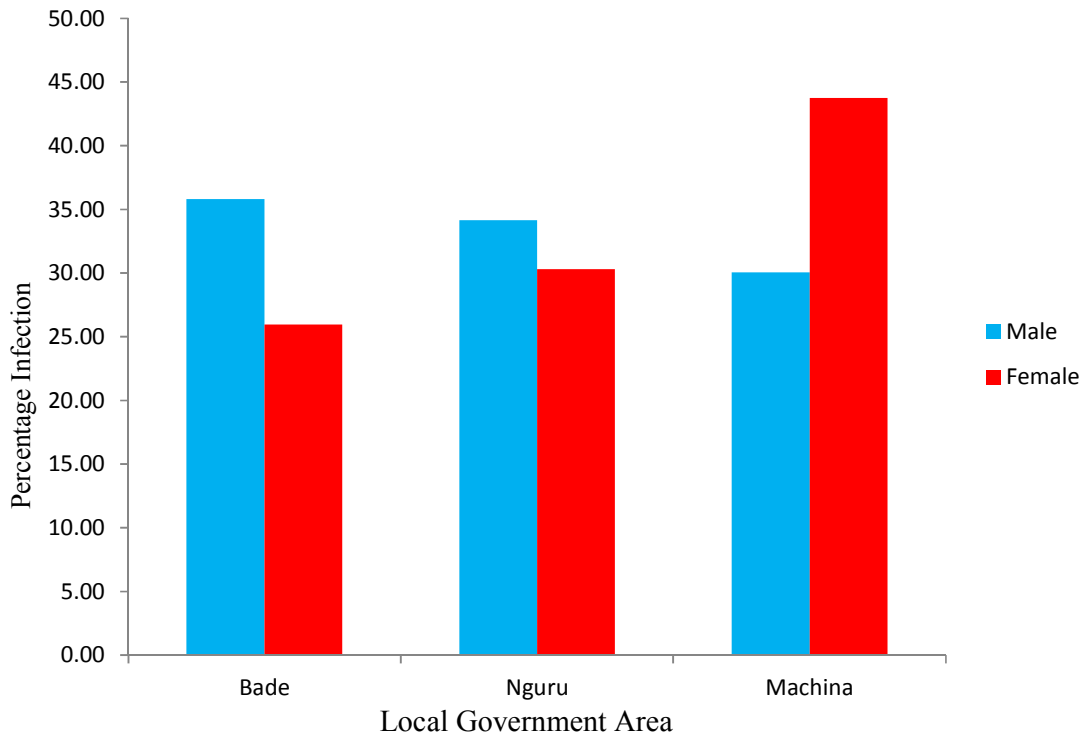
Fig. 2. Percentage infection of cholera by sex in Bade, Nguru and Machina L.G. As between 2017 and 2019

Fig. 3. Percentage infection of cholera by age in Bade, Nguru and Machina L.G. As between 2017 and 2019

Fig. 4. Percentage infection of typhoid by sex in Bade, Nguru and Machina L.G. As between 2017 and 2019

This result corroborates the report of [11] that 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. The present findings also agree with the report of [15] that Nigeria is one of the countries in the world with unsafe water supplies. Bade, Nguru and Machina L.G.As in the present study could be part of the L.G.As that United Nations earlier warned to have cholera outbreak in Yobe State [21].

In the present study a total of 1,204 cholera cases with 124 mortalities were recorded in Bade, Nguru and Machina L.G.As. Similar findings have earlier been reported by [23] in some L.G.As of Borno State, Nigeria where 5,365 cases of cholera and 61 mortalities were recorded in 2017. The present findings also corroborate the report of [21] that 404 cases and 15 deaths due to cholera outbreak occurred in four L.G.As of Yobe State. This study also showed that Machina L.G.A has the highest incidence (37.04%) of cholera from 2017 to 2019. This could be attributed to the high (87.78%) and low (12.22%) percentage consumption of non potable and potable water respectively by the citizens.

Typhoid infection in the study area is high with Bade L.G.A having the highest infection

(37.18%). This is similar to the finding of [24] who reported that 45.76% of 271 test persons in Benin, Edo State, Nigeria are typhoid positive. The high infection rate of typhoid in the present study could also be attributed to the consumption of non potable water in the study area.

Gender based prevalence of typhoid in the present study is higher in males (52.83%) than females (47.18%). This is probably due to higher consumption of non potable water by males than females since males are involved in drinking well, river, creek and pool waters than females when working on farms and other activities away from their houses. This result differs from the findings of [25] that typhoid is more prevalent in screened females (54.80%) than males (42.20%) in Abeokuta, South-Western Nigeria due to variation in feeding habits and personal hygiene.

Prevalence of typhoid based on age in the present study shows that highest percentage infection (42.12%) was among people of ages 17-40 years which is higher but similar to the findings of [20] who reported highest (11.16%) typhoid infection among age group 10-25 in Akure, Ondo State, Nigeria.

5. CONCLUSION

Conclusively, consumption of tainted, contaminated or non potable water is an undisputable means of contracting waterborne diseases such as cholera and typhoid. Majority of

residents in the study area consume non potable water hence are prone to common waterborne infections such as Cholera and Typhoid.

6. RECOMMENDATIONS

Enlightenment on implications of consuming non-potable water and educating the populace on methods of treating it prior to drinking will not only significantly reduce the prevalence of waterborne diseases but will also maintain healthy population in Bade, Nguru and Machina L.G.As of Yobe State.

CONSENT

As per international standard or university standard written patient consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

Ethical clearance was also sought from the Coordinators.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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