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Case Report

Epidemiological Survey for Water-Related Diseases around Kainji and Jebba Dams, Nigeria

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Submitted: 26 February 2018

Accepted: 30 March 2018

Published: 31 March 2018

ISSN: 2373-9282

Abstract

This is community-based cross-sectional study covering the riverine settlements around the Kainji and Jebba Lakes, where the incidence and prevalence of waterborne diseases are reported in the past studies and confirmed through the community consultation. The study area falls in three States: Niger, Kwara and Kebbi. The methods of data collection employed in the study involved:- House hold survey using structured questionnaires - Focused group discussions -Collection of physiologic specimen from the household for investigation and analysis. The major water related diseases found included malaria, schistosomiasis, lymphatic filiariasis and onchocerciasis

Keywords

- Epidemiology
- Water-related diseases
- Prevalence
- Incidence
- Dams
- Nigeria

ABBREVIATIONS

IDA: International Development Association; HIV: Human Immunodeficiency Virus; LGA: Local Government Administration; NTD: Neglected Tropical Diseases; TB: Tuberculosis; WHO: World Health Organization; WRDSEM: Water Resource Development Sustainable Ecosystem Management

INTRODUCTION

Construction of dams, formation of man-made lakes and the development of irrigation projects in tropical areas introduce important ecological and social changes in the environment that produce a number of risks to human health apart from the evident benefits brought to a country or region [1-8]. The most significant are vector/ snail borne parasitic diseases. In Sudan, the Sennar Dam which was completed in 1925, initiated the Gezira-Managil Irrigation Scheme, the largest single irrigation system in the world, resulting in an increased prevalence of malaria and schistosomiasis ensued and remained a major public health problems in the scheme [4], Fenwick [5]. In Egypt the construction of the low dam at Aswan in the early1930s allowed perennial irrigation in a number of provinces in Egypt. This resulted in an increase of urinary schistosomiasis from 2-11% to 44-75 % (Khalil, 1949, quoted by Hunter et al. [3]. Also, the construction of dam on the River Volta in Ghana increased the prevalence of urinary schistosomiasis from 5-10% in the Volta basin before construction, to 90% in the same area after construction., [6]. High prevalence of schistosomiasis around large dams in Nigeria, Senegal, Sierra Leone, Tanzania and Zambia were reported, [7]. The risk of diseases in water resource development areas will further increase as the result of uncontrolled immigration urbanization and movements of refuges, inadequate resettlement, loss of traditional economic activities, unemployment, insecurity and insufficiency of the family budget with its consequences on educational, hygienic and nutritional conditions [3]. This study aims at assessing how the construction and operation of Kainji and Jebba Reservoirs in Nigeria have impacted riparian communities in relation to the water–related diseases and to find out the extent to which the environmental and social conditions prevailing in the communities have enhanced the prevalence of the diseases.

The federal Government of Nigeria received a credit from the International Development Association (IDA) of the World Bank for the Niger Basin Authority-Water Resources Development and Sustainable Ecosystems Management (WRD-SEM) Project, which is a regional project. The Power Holding Company of Nigeria (PHCN) is the National Implementation Agency (NIA) for the Nigerian component of the project, and it intends to apply part of the proceeds of this credit to payments for consultancy services for the establishment of Dam Safety System for Kainji and Jebba Dams in Nigeria. Kainji and Jebba hydropower plants are located on the Niger River in North-Western Nigeria, approximately 100 km apart. This article covers the epidemiological survey for water related diseases.

MATERIALS AND METHODS

Ethical clearance and ethical considerations

It is required by law in Nigeria that such study requires prior approval from the National Health Research Ethical Committee (NHREC) of the Federal Ministry of Health. The Consultant **(Principal Investigator**, Prof Mutamad Ahmad Amin, and Professor of human Parasitology) made an ethical clearance application through Transmission Company of Nigeria **(TCN)** incorporating the project areas and targeted communities, survey methodology and the resumes of the professionals.

Consents were obtained from the community following extensive discussion to explain the objectives and the work plan of the study. The study has been approved by the ethical committees of the Federal Ministry of Health Nigeria**.** The study group will benefit from this study by providing them with free medical examination, diagnosis and treatment even for other common diseases. They will not be exposed to any risk by being recruited in this study. The whole community from which the study population was drawn will benefit from the research because the source of infection will be reduced by treating all positive individuals in the study group. Identifying a suitable method for treatment and monitoring for reducing the morbidity of schistosomiasis will be useful to all communities facing this problem**.**

Study area

Map: epidemiological survey for waterborne diseases in Kainji and Jebba dam areas Epidemiological Surveys,

Community-based cross-sectional study

Population under study were statistically drawn from Riverine settlements in Niger, Kebbi and Kwara States.

Sampling Procedure

The entire study area around Kainji and Jebba Lakes was divided into three independent areas based on the States; Niger, Kebbi and Kwara states. The sample size for each State was calculated using the following well-known sampling equation (Cochran, 1963):

$$SS = Z^{2*} p^{*}(1-p)/c^{2}$$

$$n = \frac{z^2 * p * q}{c^2}$$

$$p = PopulationPrevalence, in\%; q = 100 - p$$

$$c = Maximumacceptablerandomsamplingerror, 5\%$$

As the riverine population of each State is significantly large, and accurate prevalence data was not available, the prevalence p was assumed to be 50%. Accordingly, the sample size was determined as follows:

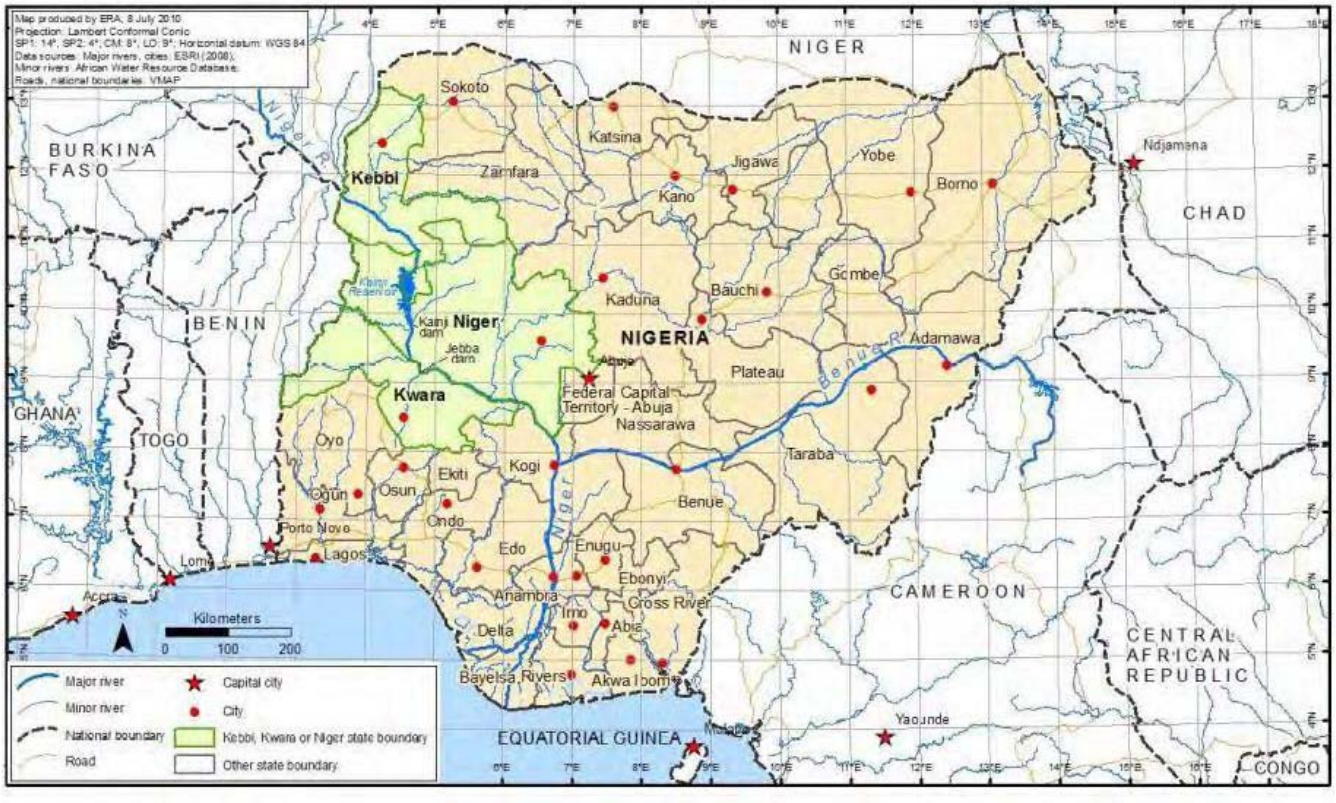
Where $z = ConfidenceLevel, 95\% = 1.96$

SS = 1.962 *0.5*(1-0.5)/0.052 = 0.9604/0.0025 = 384.14

Accordingly, a population size of approximately 400 people was surveyed across each State. Using a multi-stage cluster sampling method, each LGA represents a cluster from which settlements were selected. The first settlement was selected using a table of random numbers while the subsequent settlements were selected at intervals of 20 settlements to achieve 5% of the overall riverine settlements in the survey universe. A total of 21 settlements were selected in the end for the survey. Subsequently households were selected randomly from each survey sample frame and five volunteers were selected from each households based on the expected average of five persons per household. The exclusion criteria were households with less than five members.

Data collection

The methods of data collection employed in the study involved:



House hold survey using structured questionnaires

Focused group discussions

Collection of physiologic specimen from the household for investigation and analysis

Questionnaire

Semi structured questionnaires were used to collect data from selected households. The questionnaires were developed in English and translated into the local language and back to English language to ensure consistency in the meanings of the words in the local language. The questionnaire was pre tested in Tada community in Borgu LGA and was properly adapted to the communities before it was utilized in the field. Households were first enumerated in all the selected settlements and households were then selected proportionate to the size of the settlements. Interviewers were also selected and trained on the questionnaires before being dispatched to the field. The criteria for the selection of the interviewers were based on the ability to understand and speak local languages. In each household the head of the household or his representative was interviewed after obtaining a voluntary written informed consent following all the explanations on the purpose of the survey. A copy of the signed consent form is also kept with each household that participated in the survey for reference.

The following information was addressed by the questionnaires

- Detailed demographic information,
- Occupation
- Income levels
- Sources of water
- Animal husbandry
- Interaction with water bodies
- Sanitary practices
- Awareness of water borne diseases
- Availability and practice of treatment of water borne disease etc

Focused group discussion and key informant interviews

A total of six communities were selected for the focused group discussion across the three states. The communities are: Tungan Makera in Yauri LGA, Tungan Mairuwa in Ngaski LGA all in Kebbi state, Tada, Fakun all in Borgu LGA of Niger state, Sakin Jirgi (Ikpata Jebba) in Moro LGA and Lokomoshe in Kaiama LGA all in Kwara state. In each state, two communities were selected as sentinel villages to represent the remaining communities. The selection of villages were based on previous consultations and reports of high prevalence of water borne diseases in the communities (Hospital reports ,Ministry of Health) or previous reports of outbreaks of water related diseases in the communities. Seven to nine participants were selected in each of the communities and to ensure homogeneity, different categories of community members like youth, male and female adults were interviewed separately. Community members were pre informed of the discussion session and the participants were nominated by the communities but however participation was voluntary. Most discussions were around the existence of water borne diseases in the communities, their perception about the common causes of water borne diseases, the common diseases in the communities, the sanitary practices including the handling of human wastes.

Collection of physiological samples for investigation and analysis

Physiologic samples such as urine for schistosomiasis (*Schistosoma haematobium*), blood samples for malaria parasites and lymphatic Filiariasis microfilaria, skin snips for onchocerciasis volvulus microfilaria and stool samples for *Schistosoma mansoni* and soil transmitted helminths and enteric organisms were all collected in the field during the survey. Samples were collected from 5 members of the household where questionnaires have been administered. Participation in the testing of physiologic samples was voluntary and the cases all signed a written consent after the procedures and the purpose of the study have been explained to them. The laboratory was organized into a mobile laboratory that was easily mounted or dismantled in each village after each day. This was because the villages were scattered and far apart with many hard to reach areas hence it was not feasible to transport specimen out of the villages within reasonable time. All sample collection and testing was conducted immediately and the outcome recorded in each village. The individuals that were positive for any of the diseases being investigated were given free treatment for the diseases

The Laboratory techniques included

-Screening for onchocerciasis using skin snip biopsies

Screening for Lymphatic Filariasis -blood smear -

- Screening for malaria with Rapid test strips

- Screening for S.haematobium by urine centrifugation method, [8]

- Screening for Schistosoma mansoni and helminthic infection, [9]

Method of data analysis

Results of surveys were analyzed adapting the surveys and the questionnaire to the Statistical Package for the Social Sciences (*SPSS*). Participatory observation and intensive interviews data were transacted, arranged labeled. Categories were provided accordingly patterns of responses in relation to the observed phenomenon were produced to make sensible and meaning of the findings.

RESULTS AND DISCUSSION

House hold survey using structured questionnaires

Nine LGAs were selected basically because they were listed as riverine LGAs and households were distributed proportionate to the total number of the settlements around Kainji and Jebba dam areas. Borgu LGA with 26.7% of all the settlements surveyed has the highest number of settlement living around the dam. This is sharply followed by Yauri LGA with 22.6% of the total

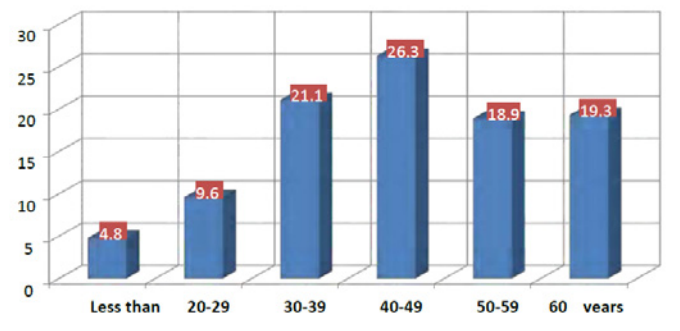


Figure 1 Age group of respondents.

The highest percentage of the respondents was between the ages of 40-49 years with 26.3%. The age group 30 – 39 years with 21.1% has the second highest number of the respondents while respondents below 20 years were the least with 4.8% (Fig 1). Sex distribution showed that most of the respondents were unevenly distributed among the sexes. Thus while the males account for 88.9% of the respondents, the females account for only 11.1%. This is probably because of the norms and tradition that does not allow females respond to interviews unless permitted by their husbands. Occupation by states showed that 85% of the respondents from Kebbi state were engaged in farming making it the most important livelihood support for the community with very little diversification. Only 3.7% are traders and 1.2 were civil servants. In the case of Niger state, even though farming is still the predominant occupation of the people, a significant percentage of them still engage in other sources of livelihood support. This is very important even in the exposure to the water bodies and propagation of water borne diseases.

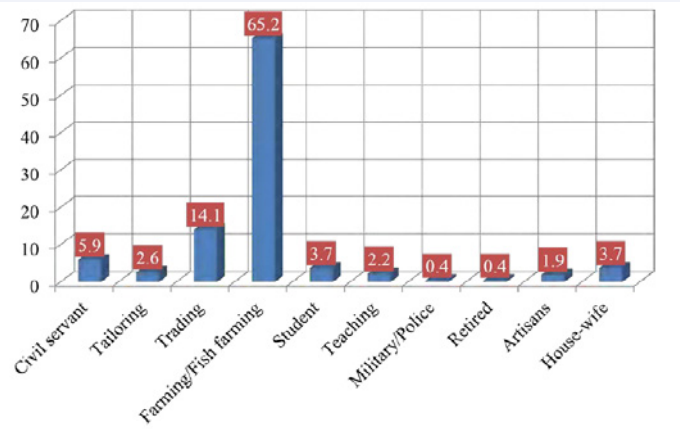


Figure 2 Cupation of respondents

Shows that 65.2% of the respondents were farmers, and farming in these communities both combine crop, animal and fish farming. This is the predominant occupation of the community followed by trading which accounts for 14.1% of the respondents. They are only very few civil servants (5.9%) and military and paramilitary which each accounts for 0.4% has the least number of people engaged in the profession across all surveyed settlements.

settlements around the dam areas. Magama and Mashegu with 0.7% of the overall riverine settlements have the least.

Analysis of the duration of the respondents in the communities showed that only 15.2 % of the respondents spent less than 20 years in the communities. The remaining respondents have spent durations ranging from 20 years to greater than 60 years. This is particularly important in the propagation of disease like malaria, onchocerciasis, LF, etc for instance in malaria stable environment, individuals who have spent longer periods in the community develops immunity against the parasite and therefore suffer less complication from malaria while on the other hand individuals who have had shorter period of stay in such environment may be prone to more severe forms of complication from infection with malaria. Similarly onchocerciasis takes as long as 12-18 years for the manifestation of the signs and symptoms of the disease following the bite of black fly with infective larvae.

Sources of water supply

Use of water for both domestic and agricultural purposes depends on the availability and access to water in the communities. Communities living around Kainji and Jebba lakes in the three states depend majorly on the river for both domestic and agricultural purposes. 69.9% of the communities use only the river as the only source of water communal stand pipe or private stand pipe is used by 3.7% of the population

In the communities in Kwara state, 97.5% of the community members use the River as the only household water source and therefore have no alternative water sources. Only 2.5% of the communities have access to communal stand pipe. Similarly in the communities at the upstream of Kainji Lake in Kebbi state.

At the LGA and settlement level, the communities in Agwara and Kaiama LGAs have no alternative water source as 100% of the riverine communities use the river as the only source of water for both domestic and agricultural purposes. Communities in Magama are privileged to have 50% of its households using either the private stand pipe or the communal stand pipes. Also communities in Mashegu LGA have 50% of the communities using the communal stand pipe .There is significant correlation between water source and distribution of water borne diseases. Use of open water bodies contaminated by microbes have been responsible for various water borne diseases ranging from typhoid diseases, cholera, dysentery etc. frequent exposure to the river may also be associated with other disease like malaria, schistosomiasis, onchocerciasis, lymphatic filiariasis.43% of all the surveyed settlement did not have access to safe drinking water as the river was the only source of water for household activities. 41% of the communities around the lake cultivate gardens. The gardens were ideal habitats for breeding of mosquitoes.

Storing water at home is a common practice in the communities around the lake. Nearly all the households (98.9%) visited stored water overnight. Water storage around homes is in open containers, favorable habitats for the breeding of mosquitoes.

Method of sewage disposal is very important in the spread of diseases transmitted through oral faecal routes. Many water borne and water related diseases such as cholera, typhoid fever; dysentery, polio, and soil transmitted helminths and even schistosomiasis are transmitted through contamination of the water by human waste. Only 57% of the communities around Kainji and Jebba lakes had latrines, LGAs like Magama and Mashegu had the poorest handling of human waste as none of the households had latrines. This was different in the communities up stream in Yauri and Agwara which 91.7% and 85.7% of the communities respectively had latrines. Other LGAs like Borgu had 54.2%, Mokwa has 80%, Moro, 35.1%, Kaiama 9.5% and Ngaski, 73.7%. At the settlements level, three communities namely; Magobiti in Ngaski LGA, Zamare in Yauri LGA and Tungan Makera in Yauri LGA all had 100% of households with latrines. On the contrary, 4 communities namely Tungan Gadi and Alh Konido in Kaiama LGA, Ang Makeri in Magma LGA and Gungawa in Mashegu LGA had households without a single toilet facility.

There were nine diseases listed as the most common diseases in the communities. These diseases are malaria, Bilharzia, typhoid, anaemia, stomach ache, diarrhoea and vomiting, high blood pressure, and ulcer and eye problem. In all the settlements surveyed, malaria was the commonest health problem in all the communities around Kainji and Jebba dam areas with 92.8% of all the respondents. This was followed by Bilharzia which had 3.4% and Typhoid fever with 0.8% of the respondents while anemia, ulcer, eye problem, high blood pressure, stomach ache, diarrhoea and vomiting each accounted for only 0.4%. 72.5% of all the households surveyed had diarrhoea and or abdominal ache in the previous week before the survey. The entire household in 4 settlements namely Tungan Dutse, Magobiti, Zamare and Ang Makeri had diarrhoea the week preceding the survey. We may also recur that these were the settlements with poor handling of human waste with almost all their household using the bush for defecation of all the settlements and households that had diarrhoea and abdominal ache, 58.3% went to hospitals seeking medical care, and 13% used traditional remedies at home while 1.6% either had self-medication or did nothing about it. The remaining 1.2% sought for treatment from the pharmacy shop. Gungun Maso, with 33.3%, Tungan Mairuwa and Ikpata Jebba each with 42.9% of the respondents respectively had the lowest healthcare seeking behaviour among the communities surveyed. Knowledge about bilharzia in the communities around Kainji and Jebba dam areas varies from one settlement to another. 67% of the communities have heard and understand what Bilharzia is while 31.8% did know about the disease. 4 communities representing 19% of all the surveyed communities had full knowledge of the disease. These communities were Fakun, Tungan Dutse, Zamare and Ang Makeri. However, only a few households in Alh Konido

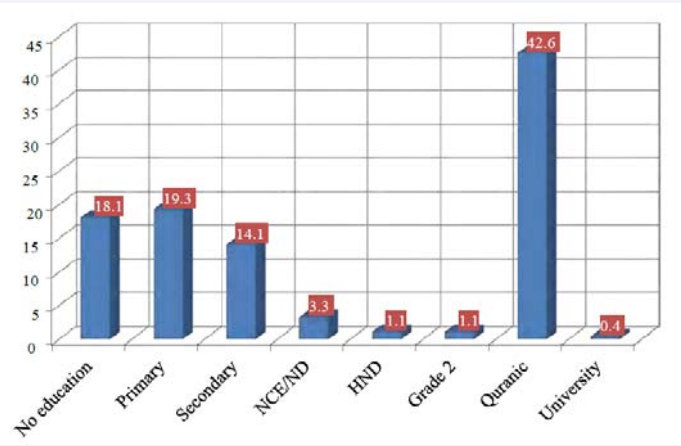


Figure 3 Education Status of the respondents
Showed that 42.6% of the respondents have Qur'anic education (pre-primary school education) as their highest educational qualification, while 19.3% of the respondents were primary school leavers. 18.1%of the respondents have no form of education whether western or Islamic. Only 14.1% of the respondents attempted secondary school. The university graduate only account for 0.4% of the respondents. The level of education has been known the affect lifestyle and disease transmission.

Table 1: study area.

STATE	NIGER STATE					KEBBI STATE		KWARA STATE		TOTAL
LGA	AGWARA	BORGU	MAGAMA	MOKWA	MASHEGU	YAURI	NGASKI	MORO	KALAMA	
NUMBER OF SETTEMENTS	75	86	17	58	8	70	83	7	34	438
TOTAL OF POPULATION	55,412	86,684	3,896	105,619	2,191	54,100	112,485	8,820	8,005	437,212
NO OF HOUSEHOLDS	5,352	9,661	753	6,555	990	8,392	10,758	904	1,067	44,432

The study area covers the riverine settlements around the Kainji and Jebba Lakes, where the incidence and prevalence of water-borne diseases are expected and reported in the past studies and confirmed through the community consultation. The study area falls in three States: Niger, Kwara and Kebbi.

Table 2. Relationship of the respondents to the household head.

Above shows the distribution of respondents by their relationship with the head of households. 74.9% of all respondents were the head of households, followed by the sons and wives with 8.1% and 6.7% respectively. Brothers and sisters to the head of households with 0.4% each had the least percentage of the respondents. Questionnaires were administered to the head of the household or his/her representative. Participation of all respondents and that of the family members were voluntary, however, the decision of the household head in most cases influences the participation of other members of the family.

Relation to HH	Frequency	%	Valid %	Cumulative %
HH (Household Head)	202	74.8	74.8	74.8
Brother	11	4.1	4.1	78.9
Son	22	8.1	8.1	87.0
Wife	18	6.7	6.7	93.7
Inlaw	3	1.1	1.1	94.8
Grandson	1	.4	.4	95.2
Father	3	1.1	1.1	96.3
Sister	1	.4	.4	96.7
Daughter	1	.4	.4	97.0
No response	8	3.0	3.0	100.0
Total	270	100.0	100.0	

Table 3. Gender of the individuals tested.

Age distribution of the cases that were involved in the survey is very important in the analysis of the outcome of the tests conducted in the communities. This is because some diseases are preferentially distributed among certain age groups. The highest numbers of volunteers were aged between 5-9 years which constitutes 13.9% of the respondents followed by age group 10 – 14 years (12.6%) and 25-29 years (11.4%). The age group with the lowest frequencies was 45-49 years (4.2%) and 50 – 54 years (4.3%).

States	Male	Female	Total
Kebbi	52.2%	47.8%	100.0%
Niger	46.2%	53.8%	100.0%
Kwara	55.3%	44.8%	100.0%
Total	51.0%	49.0%	100.0%

Table 4. DISTRIBUTION OF INDIVIDUALS TESTED BY AGE ACROSS STATES.

Age of the cases	Kebbi	Niger	Kwara	Total
Less than 5 years	8.7	2.8	7.5	6.2
5 - 9 years	16.3	12.2	13.5	13.9
10 - 14 years	11.4	12.9	13.5	12.6
15- 19 years	6.4	10.7	8.3	8.6
20 - 24 years	6.9	12.7	9.5	9.8
25 - 29 years	8.2	15.1	10.5	11.4

30 - 34 years	8.2	7.9	9.3	8.4
35 - 39 years	8.9	9.6	7.3	8.6
40 - 44 years	7.9	5.0	5.0	5.9
45 - 49 years	4.2	3.1	5.5	4.2
50 - 54 years	4.7	3.9	4.3	4.3
55 years and above	8.2	4.1	6.0	6.0
Total	100.0	100.0	100.0	100.0

Table 5: PREVALENCE OF SELECTED DISEASES BY STATES.

	Schistosomiasis	Onchocerciasis	Malaria	Lymphatic Filiariasis
States	Positive	Positive	Positive	Positive
Kebbi	49.7	0.4	24.9	0.0
Niger	34.9	1.1	16.8	1.5
Kwara	33.0	1.1	16.3	0.5
Total	38.8	0.9	19.1	0.9

Table 6: PREVALENCE OF SELECTED DISEASES BY LGAs.

	Schistosomiasis	Onchocerciasis	Malaria	Lymphatic Filiariasis
LGA	Positive	Positive	Positive	Positive
Agwara	60.0	0.0	11.4	0.0
Borgu	27.7	1.8	15.3	2.0
Mashegu	50.0	0.0	30.0	0.0
Magama	50.0	0.0	30.0	0.0
Mokwa	40.8	0.0	19.2	0.0
Moro	8.1	0.0	14.4	0.0
Ngaski	47.5	1.7	22.0	0.0
Yauri	50.5	0.0	25.9	0.0
Kaiama	54.4	2.2	17.9	1.2
Total	38.8	0.9	19.1	0.9

Table 7: DISTRIBUTION OF SELECTED WATER BORNE DISEASES BY OCCUPATION.

Occupation	Schistosomiasis	Onchocerciasis	Malaria	Lymphatic Filiariasis
	Positive	Positive	Positive	Positive
Farming	32.4	0.6	12.0	0.0
Fishing/Farming	30.6	0.0	15.0	0.0
House Wife	23.1	0.0	12.0	0.9
Students	19.0	2.8	10.0	0.0
Civil servants	7.7	0.0	3.8	0.0
Pupil	63.6	2.4	35.1	0.0
None	68.0	7.1	34.3	13.0
Artisan	10.0	0.0	10.0	0.0
Business/Trading	19.5	0.0	4.9	0.0
Livestock	41.7	0.0	8.3	0.0
Total	38.8	0.9	19.1	0.9

Table 8: DISTRIBUTION OF THE PREVALENCE OF SELECTED WATER BORNE DISEASES BY AGE GROUP.			
	Schistosomiasis	Onchocerciasis	Malaria
age regroup	Positive	Positive	Positive
Less than 5 years old	72.2	50.0	39.7
5 - 9 years	76.3	20.0	48.5
10 - 14 years	60.5	4.8	26.9
15- 19 years	39.8	0.0	19.6
20 - 24 years	32.2	.9	6.7
25 - 29 years	21.8	0.0	8.5
30 - 34 years	21.6	0.0	2.9
35 - 39 years	20.4	0.0	11.2
40 - 44 years	18.1	0.0	9.7
45 - 49 years	13.7	0.0	9.8
50 - 54 years	7.8	0.0	7.8
55 years and above	21.1	0.0	10.5
Total	38.8	0.9	19.1

Table 9: PREVALENCE OF SELECTED ORGANISMS IN THE STOOL BY LGAs.									
Estate	No.Ova or parasites seen	E.coli	S.mansoni	E.Histolytica	No. sample provided	Hook worm ova seen	T.Trichuira	Ascaris ovum seen	Total
Agwara	85.7	0.0	0.0	2.9	2.9	5.7	2.9	0.0	100.0
Borgu	97.8	0.0	0.0	0.0	1.5	.7	0.0	0.0	100.0
Mashegu	90.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	100.0
Magama	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
Mokwa	86.8	0.0	0.0	0.0	3.9	8.5	0.0	.8	100.0
Moro	99.5	0.0	0.0	0.0	.5	0.0	0.0	0.0	100.0
Ngaski	96.1	0.0	0.0	0.0	0.0	2.0	0.0	2.0	100.0
Yauri	92.4	.4	.4	0.0	.4	4.7	.7	1.1	100.0
Kaiama	77.2	.9	0.0	0.0	0.0	16.3	.5	5.1	100.0
Total	91.6	.2	.1	.1	1.0	5.3	.3	1.4	100.0

(28.6%) and Kumugi Kpata (37.8%) had knowledge of the disease. of the 67% that had knowledge of bilharzias, 30.9% of the households believed that bilharzia is contracted by swimming in rivers infested with the parasites, 23.4% believed that drinking any bad water can cause the disease, 4.2% specifically relates the diseases to the use of the river Niger for any purpose whatsoever. 1.5% believed it is gotten by working in the sun or due to excessive cold.

Only 61.9% of the respondents with knowledge of bilharzia believed that it can be treated, All the respondent in 4 (19%) of the communities such as Zamare, Ung Makeri, Fakun and Tungan Dutse believed absolutely that it is curable, some other 6 (29%) communities namely, Jebba Ikpata (32.4%), Alh Konido (28.6%), Gungun Maso (33.3%), Gana Jebba (27.3%), Hikiya (42.9%) and Adungu (43.8%) did not strongly believe that bilharzias is curable. Of all the respondents that believed that bilharzias is curable, 13% believed it can be cured using local remedies, 48.1% believed it can be cured with orthodox medicines from hospital. 65.3% of the households had a member of the family who suffered Bilharzia, in the past while 33.2% had not. 5 (29%) of all the surveyed communities all had household members (100%) suffered bilharzia in the past. The communities were Ang Makeri, Adungu, Zamare, Magobiti, Tungan Dutse and Fakun. Gana Jebba had the least number of households who suffered Bilharzia. 98.1% of all the settlements surveyed have households that suffered malaria in the month prior to the survey. And only 0.8% of the households had malaria in the previous month.

On the method of transmission of malaria, 93.2% believed it is transmitted by mosquito while1.5% believe it is from the river and 0.8% believe it is the cold whether that is responsible for the malaria transmission. Others (2.6%) believe it is by working in the Sun. some households in 4 (19%) settlements believe malaria is transmitted by use of water from the river mainly Gungun Chukeke (14.3%) Ikpata Jebba (2.7%), Tungan Gadi (6.7%), and Lokomoshe (5.0%). Others who believe it is the hard work in the sun include: Monai (4.2%), Gana Jebba (9.1%), Tungan Gadi (6.7%), Alh Konido (14.3%) and Tungan Makera (10%). 92.5% of households believe that malaria can be prevented. However, in 3 communities are 1.5% of all households who believe malaria cannot be prevented; such households are Hikiya (14.3%),

Magobiti (16.7%) and Shagunu (5.6%) 90.6% of all households across the communities in Kainji and Jebba dam areas have suffered malaria in the month prior to the survey. 83.8% of all the households had treated their malaria in the hospital, while 6.4% was treated with local remedies. Only 1.9% of the malaria cases were treated by self-medication using drugs from local pharmacy shops. Most cases of treatment with local remedies were in Kumugi Kpata (42%) of all malaria cases in the settlement; this is sharply followed by Fakun with 25% of their malaria cases.

Only 66.4% of the households surveyed have insecticide treated nets for the prevention of both malaria and lymphatic filiariasis. Interestingly very remote settlements such as Tungan Mairuwa, Magobiti, Tungan Dutse, and Ungwan Makeri all have 100% of their households with insecticide treated nets. Conversely, most households in Gana Jebba (45.5%), Ikpata Jebba (43.2%) Zamare, Gungun Maso, Adungu and Gungawa each with 50% of the households having insecticide treated nets. Among the households that have insecticide treated nets, there is very little consistency in the utilization of the mosquito treated nets as a means of malaria and LF prevention in the communities. Only 56.6% of all the communities that have insecticide treated nets had used it consistently in the last week prior to the survey.

Ownership of radio and indeed other modern electronic equipment in the villages to an extent is a measure of the economic power of the households. 74.3% of the surveyed households have radio. In about 19% of all the surveyed communities, namely Gungun Chukeke, Zamare, Ungwan Makeri, and Ikpata Jebba, all (100%) of the households have radio. Only 42.6% of all the households surveyed had television. In 6 villages namely Malale, Gungun Chukeke, Kumugi Kpata, Alh Konido, Tungan Dutse and Ungwan Makeri, there was no single household with television.

Most households surveyed around Kainji and Jebba dam areas have permanent structures with family dwelling. 28.2% of the households live in houses with cement walls and cement floor while 71.4% live in houses constructed with mud walls and mud floor. Most of the houses with cement walls were constructed during the resettlement process.

Sanitation and environmental hygiene are important in the control and prevention of communicable diseases. Households were described based on observation of presence of visible rubbish, human or animal excreta around the households. 18.9% of all the households surveyed were adjudged to be clean with no signs of rubbish, human or animal excreta around the households. 63.7% of the households however were mildly littered with animal dung, human excreta and rubbish from households. 17% of the households were adjudged to be very dirty with human and animal dung all littered around the households.

Only 1.5 % of the surveyed households had lymphatic filiariasis in the previous month mainly in two settlements namely: Ikpata Jebba (2.7%) and Tungan Makera (10%). Lymphatic filiariasis is not a common disease among the communities and there has been an effective lymphatic filiariasis elimination program which has drastically reduced the incidence of the disease in the communities. 4.5% of all the respondents had a member of their household, who has suffered onchocerciasis in the past. Most cases were reported in six settlements namely Shagunu (13.9%), Monai (4.2%), Jebba Ikpata (2.9%), Malale (12.5%), Hikiya (28.6%), Tungan Makera (6.7%). A settlement is considered endemic if the prevalence of the diseases is 10% and above, and the threshold for intervention is a prevalence of 20%.

Analysis of laboratory data

In the laboratory component of the survey of the communities living around Kainji and Jebba dam areas across the three states, majority of the cases were House wives which constitutes 29.4% of the cases, farmers were disaggregated into strict crop farmers, fish farmers, livestock farmers and those that combine fish farming and crop farming. The aggregation of all the farmers irrespective of the types gives 29.4% of all the cases tested. However majority of the cases are either crop farmers (13.9%) or the combination of both crop and fish farming (13.8%). 12% of the cases are pupils, 3.3% are students while 4% are traders. Fishermen and livestock farmers constitute 0.8% and 0.9% respectively of the cases. There is near equal distribution of the occupation across the states with very marginal difference. There was also near equal distribution of the cases by sex across all the communities in the three states. 51% of the cases were males while 49% were females. There was only slight variation in the distribution of the sexes across the three states.

Age distribution of the cases that were involved in the survey is very important in the analysis of the outcome of the tests conducted in the communities. This is because some diseases are preferentially distributed among certain age groups. The highest numbers of volunteers were aged between 5-9 years which constitutes 13.9% of the respondents followed by age group 10 – 14 years (12.6%) and 25-29 years (11.4%). The age group with the lowest frequencies was 45-49 years (4.2%) and 50 – 54 years (4.3%).

the outcome of the laboratory investigations on the selected water borne diseases around Kainji and Jebba dam areas, the outcome has been analyzed as above

Schistosomiasis

The total prevalence of schistosomiasis in the entire communities around Kainji and Jebba dam areas is 38.8%. Across the states, communities around the dam in kebbi state has the highest prevalence of schistosomiasis (49.7%) of all tested cases this is to say that almost half of everyone living along the dam areas in the state has infestation with *Schistosoma haematobium* which causes urinary schistosomiasis. This is followed by Niger state with prevalence of 34.9% and finally by Kwara state with prevalence of 33.0.

Onchocerciasis

The total prevalence of onchocerciasis across the entire communities living around Kainji and Jebba dam areas from the above result was 0.9%. Niger and Kwara state share equal highest prevalence of 1.1% each. Kebbi state had the lowest prevalence of 0.4%. It is interesting to know that the prevalence of onchocerciasis was not significant and the disease may due to long years of treatment with Ivermectin in the communities is beginning to be eliminated as a disease of public health and socio-economic importance in Nigeria.

Malaria

Malaria has been a major disease endemic in all surveyed communities. Across the communities surveyed around Kainji and Jebba dam areas, the prevalence of malaria was 19.1%. Kebbi states accounts for the highest prevalence of malaria in all the surveyed communities in the states with a prevalence of 24.9% while Niger and Kwara states had Prevalence of 16.8% and 16.3% respectively.

Looking at the prevalence of the diseases by LGA, Agwara in Niger state has the highest prevalence of schistosomiasis (60%) , this is followed by Kaiama LGA with a prevalence of 54.4% and Yauri (50.5%) . others like Mashegu, Magama LGAs have prevalence of 50% respectively. Moro LGA has the lowest prevalence of schistosomiasis (8.1%).

The prevalence of onchocerciasis is limited to only three LGAs namely Borgu (1.8%), Ngaski (1.7%) and Kaiama (2.2%). Malaria is endemic in all the LGAs and the prevalence is well distributed in all the LGAs, Magama and Mashegu have the highest prevalence of 30% each. Lymphatic filiariasis is prevalent in only 2 LGAs namely Borgu (2.0%) and Kaiama (1.2%) LGAs. Though the prevalence of the disease is considered small but it has reached the threshold for intervention which is 1% prevalence for any given population. It is recommended that any community with prevalence of 1% and above should be considered for the treatment of a whole LGA.

In comparing the prevalence of the selected water borne diseases among the various occupations of the cases, it has been discovered that the prevalence of three of the four diseases being tested are highest among the population whose occupation could not be identified. This population has the highest prevalence for schistosomiasis, onchocerciasis and lymphatic filiariasis. However among the population with documented occupation, schistosomiasis has the highest prevalence among the pupils (63.6%) followed by livestock farmers (41.7%), crop farmers (32.4%). Farmers who combine both crop and fish farming have the prevalence of 30.6%. the occupation with the least prevalence for schistosomiasis are the civil servants with 7.7% and then the artisans with a prevalence of 10%, students and traders are next in that order with a prevalence of 19% and 19.5% respectively. Similarly both malaria prevalence (35.1%) and onchocerciasis prevalence (2.4%) were also highest among school students.

The various diseases were also disproportionally distributed across the different age groups in the communities surveyed. Schistosomiasis prevalence was highest among children aged 5 – 9 years (76.3%) followed by children less than 5 years (72.2%), and the children aged 10-14 years of age (60.5%).This explains in part the reason why the strategy for control of schistosomiasis is targeted at school aged Children (SAC) provided school enrolment in the communities are 100%. Furthermore the age groups with the least prevalence of schistosomiasis were 50-54 years with a prevalence of 7.8 years. Onchocerciasis prevalence from the results above shows the highest prevalence still among children less than 5 years of age (50%) followed by age 5 – 9 years (20 %). Similarly malaria prevalence has also been found to be highest among children aged 5 – 9 years (48.5%) followed by children aged below 5 years (39.7%). The least prevalence of malaria is found among age groups 30 -34years (2.9%), 20 -24 years (6.7%) and 50-54 years (7.8%) in that order.

Prevalence of soil transmitted helminths has also been given in the tables as above. 16% of the stool samples in Kaiama LGA have ova of hookworm seen, while the prevalence is 10% in mashegu and 8.5% in Mokwa LGAs. Case of ascaris was found in Ngaski (2.0%), Yauri (1.1%), Kaiama (5.1%) and Mokwa LGA (0.8%). *Schistosoma mansoni* which is the intestinal form schistosomiasis was found only in Yauri LGA, *E. histolytica* was documented in Agwara LGA (2.9%).

CONCLUSION

Dams are crucial part of the economic and social development, as such, they aim to achieve important socio-economic development objectives including poverty reduction. Nevertheless, they are invariably accompanied by a range of unintended impacts on the natural environment and on human communities.

The present study document major water borne diseases among age groups and across gender. Malaria is at the top of the list and reported in all the state (Figure 1-3).

Malaria, Schistosomiasis and diarrheaol diseases were reported in most communities as a result of intensive water contact activities and poor hygiene. The adverse impact of dams on human health is increasingly recognized but there are few efforts to mitigate its effects either at the planning or implementation stage. There is a need for intensive health education in schools and in the community. Clustering of the villages around water sources need to be reconsidered (Table 1-9).

ACKNOWLEDGEMENTS

The authors acknowledge with thanks the support and hospitality received from the Nigerian communities and hospitals staff .We also acknowledge and appreciate the great efforts days and nights of the diagnostic and treatment teams.

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Cite this article

Amin M (2018) Epidemiological Survey for Water-Related Diseases around Kainji and Jebba Dams, Nigeria. Ann Clin Pathol 6(2): 1132.