Analysis and investigation of water contamination and its effects among the Dwellers ofAyamelum Local Government Area, Anambra State

Comment [AYA1]: Recast: Evaluation of Water Contamination and its Health Implications on the Residents ofAyamelum Local Government Area, AnambraState, Nigeria

ABSTRACT

In this research on theanalysis and investigation of water contamination and its effects among the dwellers ofAyamelum Local Government Area, Anambra State, a total of 200 water samples collected from the inhabitants were examined for Cryptosporidiosis.Data obtained were analyzed using SPSS (statistical package for social Science) Version 20.0 based on significance contamination level ($P \geq 0.05$). Out of the total respondents 10.00% were below 10yrs, 21.00% were between 11 to 20yrs, 16.00% were between 21-30yrs, 17.00% were between 31-40yrs, 10.00% were between 41-50yrs, 20.00% were between 51-60yrs while 6.00 % were between 61-70yrs. 66.00% were male while 34.00% were female. About 29.00% of the respondents depend on borehole, 25.00% on Lake/river/stream, and 16.00% on rainwater while 29.00% depends on table/sachet water.The result showed a Prevalence of 56(14.00%) for Salmonellosis and 36(8.00%) for Crystosporidiosis with a 12(3.0%) co-infection rate of Salmonellosisand Crystosporidiosisfrom water. In terms of distribution with regard to towns, Umueje had the most prevalence of 6(30.00%) for Salmonellosis and 6(50.00%) for Cryptosporidiosis while Umumbo, Igbakwu and Ifite had the least 2(10.00%) for Salmonellosis and 0.00% for Cryptosporidiosis. Age specific prevalence showed that *Cryptosporidium* parasite was highest in 11-20yrs 6(14.28%) while Salmonellosis infection was highest in age group of 21-30 yrs 8(25.00%). People with diarrhea 12(46.15%) are household who depends on Well water 6(50.00%), lake/river/stream 16(32.00%) and borehole for drinking water 10(17.24%). This finding clearly explained the sources of drinking water should be treated. It is necessary to improve sources of drinking water to prevent *Cryptosporidium* infection and Salmonellosis.

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Comment [AYA4]: Recast: The study recommends that water from various sources should be investigated and treated before use and all sources of water should be improved to prevent and curb infections from Cryptosporidium infection and Salmonellosis.

Key words: - Water Contamination, Rainwater, Lake Water, River Water, Stream Water, contamination level, water samples, Economic activities, Water pollution, Cryptosporidium infection and Salmonella infections

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1.0 INTRODUCTION

Water contamination is the pollution of water bodies, mostly by human activities. Water bodies include lake, River, oceans, aquifers and ground water. Water is polluted, when contaminants are introduced into the natural water bodies. It can lead to degradation and destruction of aquatic ecosystem. Again, this can lead to public health problems for living downstream, as they may use the same polluted river water for bathing or drinking or irrigation. Water pollution is the presence of high level of pollutants in water in such a way that it is no longer suitable for drinking, bathing, cooking and other uses (Olaniran, 1995) and this might be the trending

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worldwide cause of death. Water pollutions are now a day's considered not only in terms of public health problem, but also in terms of conservation, aesthetics and preservation of natural beauty and resources.

Polluted water with an excessive pollution that makes it unhealthy for human use. However, it is toxic water that cannot be used for essential human purposes like cooking, drinking, and agriculture. This can also cause cholera, diarrhea, dysentery, poliomyelitis and typhoid (World Health Organization, 2010). Water is vital to the existence of all living organisms, but this valued resource is increasingly being threatened as human populations grow and demand more water of high quality for domestic purposes and economic activities, (Onwuzurike*et al*., 2019). The significance of water to human and other biological systems cannot be over emphasized, and there are numerous scientific and economic facts that, water storage or its pollution can cause severe decrease in productivity and deaths of living species (Garden *et al.*,2010). Clean and plentiful water provide the foundation for prosperous communities. We rely on clean water to survive, yet right now we are heading towards water crisis. Over the last years, in many African countries, a considerable population growth has taken place, accompanied by a steep, increase in urbanization, industrial and agricultural land use. This entails an increase in discharge of a wide diversity of pollutants to receiving natural water bodies and has caused undesirableeffects on different components of the aquatic environment (Saad*et al.,* 1984). As a result, there is need for global growing management and utilization of natural resources to be improved, so as to reduce the amount of waste and pollution generated by human activities. The quality of any surface or ground water is a function of either or both human activities and natural influences, (Stark *et al*.,2001). It is now generally accepted that aquatic environment cannot be perceived simply as holding tanks that supply water for human activities, rather, these environments are complex matrices that requires careful use to ensure sustainable ecosystem functioning.

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2.0 THE STUDY AREA

2.1 Location of the Study

The study covered the following towns. Anaku, Omor, Umueje, Omasi, Igbakwu, Umumbo, Umerum and Ifite-Ogwuari.Anakuin Ayamelumlocal Government Area of Anambra State, Nigeria.Ayamelum Local Government Area lies, in Anambra North Senatorial Zone, within the Decimal Minutes Seconds ofLongitude 6^0 33' 12.78"N and Latitude 6^0 59' 12.98"E(Figure 1).

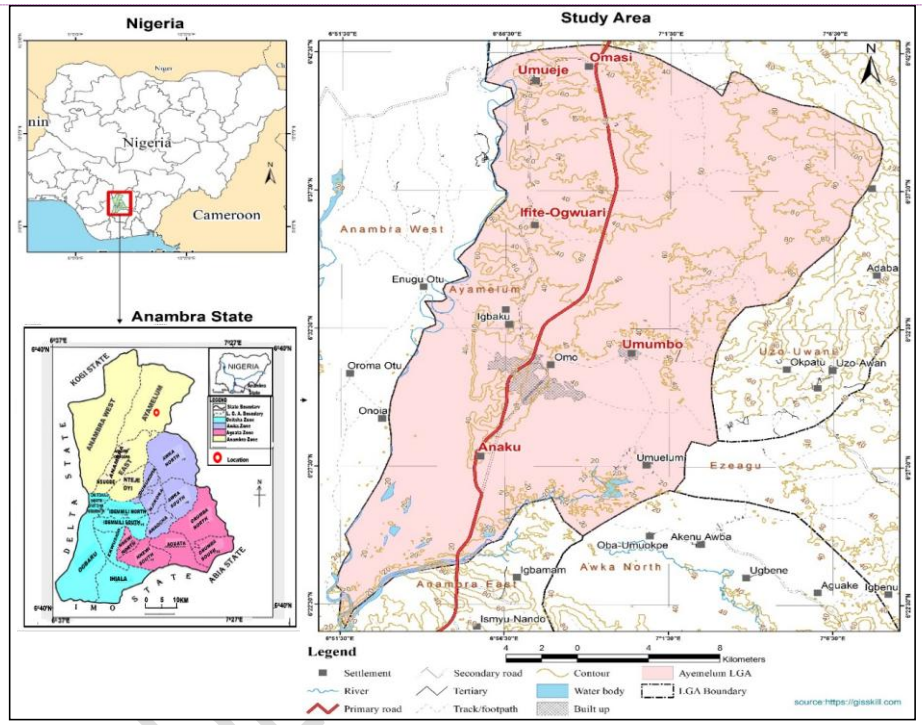

Figure 1: Map of Ayamelum Local Government Area, showing the study Area.

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The study area is bordered by “Omabala River, which is a tributary of the River Niger (North), Aguleri, Ezu River (South), Omorand Umuerum communities (East). Although the towns in the study area share common boundary with Kogi by appellation “Ogbe”, which is derived from its linkage with the Benin Empire (1440-1897) of the defunct Bendel State (now Edo State) and Igala Kingdom of Kogi State in Nigeria,this originated Anaku as the land of warriors.Kogi is easily accessible from Umueje about (25 km). Anaku is easily accessible from Onitsha (about 50 km) and OtuochaAguleri (about 20 km). Umumbo is easily accessible from Enugu about (7 km) and has abundant natural resources.Fishing, farming (mainly known for rice farming) and Hunting are the predominantly occupations in the study area. Ayamelum soil is mostly clay, it is of forest zone.

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3.0 METHODOLOGY AND DATA COLLECTION

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3.1 Sample Collection:

A total of 200 water samples were collected between Augusts to September 2022 from eight different towns which make up the Local Government area. Simple Random sampling technique was applied to collect water samples; the participant Age range was between 10 to 70years old. The representative towns under study were considered randomly to reflect even geographical spread. This helped ascertain the health risk associated with pathogenic protozoan and the town with the highest prevalence.

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3.2 Water Sample Collection

Water samples were collected from venation streams, rivers, ponds, rain water, lake and other sources of water were collected from the various towns in the local Government for examination using random measure.

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3.3 Water Sample Analysis

3.3.1 Sedimentation Method

About 15ml from each water sample collected was transferred into a conical test tube and centrifuged at 1500rpm for 5mins, the supernatant were discarded and 10ml of normal saline was

added into the sediment and stirred for 5min, then the solution was centrifuged at 1500 rmp for 5min, (Demen, *et al* 2007), and the supernatant was discarded. Then the sediment was mixed and a drop was added on the centre of a clean grease free slide and a drop of luguus-iodine was added using pasture pipette, a clean cover slip was placed gently to examine bubble and over flowing. Then the preparation was examined under microscope for parasite cyst and ova using x10 and x40 objective lens.

3.4 Ethical Consideration

Institutional approval was obtained from Anambra State Ministry of Health Research Ethics Committee. Also, informed verbal consent was obtained from all the participants before administering the questionnaire. The participants were informed about the research, its objectives and participation was voluntary. Participants were assured that every data collected would be handled confidentially and would be used for research purposes.

3.5 Statistical Analysis

Data obtained were analyzed using SPSS (statistical package for social Science) Version 20.0. The data were analyzed and interpreted using analysis of variance (ANOVA), to determine the significant difference between the mean of *Cryptosporidium* parasites and *Salmonella spp* examined based on the geographical location of the water and stool samples. The analysis was based on significance contamination level ($P \geq 0.05$). Also by assigning a numerical number to the number of parasite cysts, oval, and trophozoite seen during the analysis such as positive (+) for present and negative (-) for absent.

4.0 RESULTS AND INTERPRETATION

Comment [AYA30]: DISCUSSION

4.1 Prevalence of *Cryptosporidium* and Salmonellosis Infection among People Living in Ayamelum Local Govt. Area

Table 1 shows the prevalence of SalmonellosisandCryptosporidiosis among inhabitants of Ayamelum Local Government Area, Anambra State. The result depicts that out of200 water samples examined, 36(18.00 %) were positive for Salmonellosis and 24(12.00 %) positive for Cryptosporidiosis.

Table 1: Prevalence of Salmonellosis and Cryptosporidiosis among Inhabitants of Ayamelum Local Government Area, Anambra State

	(n=200)
Infection	**No of positive result (%) in water**
Salmonellosis	36 (18.00 %)
Cryptosporidiosis	24 (12.00 %)

4.2 Prevalence of Salmonellosis and Cryptosporidiosis with Respect to Towns within the Local Government Area.

Table 2 and figure 2showed the distribution of participants with respect to towns, the participants were drawn from 8 different villages in Anyamelum LGA. Omasi contributed 4(20.00 %) for Salmonellosis and 0.00 % for Cryptosporidiosis while Umumbo contributing 2(10.00 %) for Salmonellosis and 0.00 % for Cryptosporidiosis, Igbakwu contributed 2(10.00 %) for Salmonellosis and 0.00 % for Cryptosporidiosis, Umerum contributed 0.00 % for Salmonellosis and 2(16.67 %) for Cryptosporidiosis. Others included 2(10.00 %) for Salmonellosis and 4(33.33 %) for Crytosporidiosis in Ifite, 2(10.00 %) for Salmonellosis and 0.00 % for Cryptosporidiosis in Omor, 2(10.00 %) for Salmonellosis and 0.00 % for Cryptosporidiosis in Anaku while Umueje had the most contribution of 6(30.00 %) for Salmonellosis and 6(50.00 %) for Crytosporidiosis. There was significant difference in terms of distribution of participants and prevalence P > 0.001.

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Table 2: Prevalence of Salmonellosis and Cryptosporidiosis with respect to towns in Ayamelum Local Government Area, Anambra State

S/N	Name of villages	No of samples	No infected with Salmonellosis (%)	No infected with Cryptosporidiosis (%)
1	OMASI	14	4 (20.00)	0.00
2	UMUMBO	24	2 (10.00)	0.00
3	IGBAKWU	26	2(10.00)	0.00
4	UMERUM	20	0.00	2 (16.67)
5	IFITE	28	2(10.00)	4 (33.33)
6	OMOR	40	2(10.00)	0.00
7	ANAKU	22	2(10.00)	0.00

8	UMUEJE	26	6(30.00)	6 (50.00)
	TOTAL	200	20 (100.00)	12 (100.00

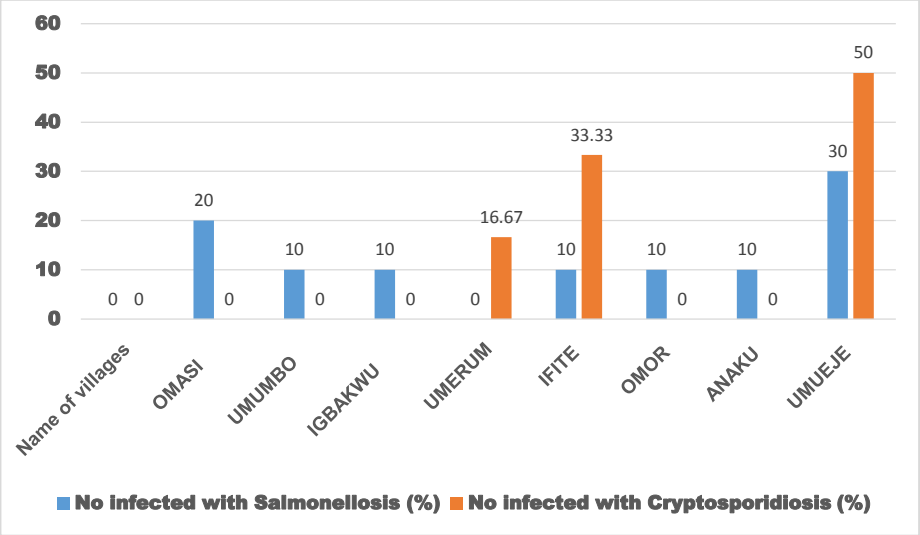

Figure 2: Prevalence of Salmonellosis and Cryptosporidiosis with respect to towns in Ayamelum Local Government Area, Anambra State

4.3 Relationship between *Cryptosporidium* and Salmonellosis Infection among People Living in Ayameluim Local Govt Area

Table 3 showed the Co-infection of Salmonellosisand Cryptosporidiosis in water samples from Ayamelum Local Government Area, Anambra State. From the result, 10(2.50 %) of the water samples showed co-infection of Salmonellosis *and* Cryptosporidiosis

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Table 3: Co-infection of Salmonellosisand Cryptosporidiosisin both stool and water samples from Ayamelum Local Government Area, Anambra State

Samples	No of sample examined	No of positive result (%) for Salmonellosis	No of positive result (%) for Cryptosporidiosis	No of positive result for both infection

Water sample	200	36 (18.00 %)	24 (12.00 %)	10 (2.50 %)

4.4 Predisposing Factors and Indicators for *Cryptosporidium* Infection among People Living in Ayameluim local Govt Area

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Table 4 revealed that prevalence of *Cryptosporidium*source of drinking water. In termof sources of drinking water, household with lake/river/stream as their only source of drinking water have a high prevalence of *Cryptosporidium* infection 12(24.00 %) out of 50 samples, household with borehole 6(10.30 %) out of 58 samples, well water 6(50.00 %) out of 12 samples. Spring water, table/sachet water showed no positive results.

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Table 4: Relationship of *Cryptosporidium* among Inhabitants ofAyamelum Local Government Area, Anambra with Respect to water sources

Variable	No. of samples for each categories	No positive samples based on categories	Prevalence for each categories	*P- value*
Source of drinking water				
Borehole	58	6 (10.30%)	6 (3.00%)	0.367
Spring	24	0 (0.00%)	0 (0.00%)	
Well	12	6 (50.00%)	6 (3.00%)	
Lake/river/stream	50	12 (24.00%)	12 (6.00%)	
Table/satchet water	24	0 (0.00%)	0 (0.00%)	
Rain water	32	0 (0.00%)	0 (0.00%)	

Table 5 and figure 3 showed the predisposing factors for Salmonellosis among inhabitants of Ayamelum Local Government Area such as Household that makes use of borehole as source of drinking water showed 10(17.24 %) out of 58 samples, spring 2(8.33 %) out of 24 samples, well water 6(50.00 %) out of 12 samples, table/sachet 2(8.30 %) out of 24, lake/river/stream 6(50.00 %) out of 50 samples and rain water showed no positive results out of 32 samples.

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Table 5 Relationship of Salmonellosis among inhabitants ofAyamelum Local Government Area, Anambra State with respect to water sources

Variable	No. of samples for each categories	No.(100%) positive samples based on categories	Prevalence for each categories	*P- value*
Source of drinking water				
Borehole	58	10(17.24%)	10(5.00%)	0.367
Spring	24	2 (8.33%)	2 (1.00%)	
Well	12	6 (50.00%)	6 (3.00%)	
Lake/river/stream	50	16 (32.00%)	16 (8.00%)	
Table/sachet water	24	2 (8.30%)	2 (1.00%)	
Rain water	32	0 (0.00%)	0 (0.00%)	

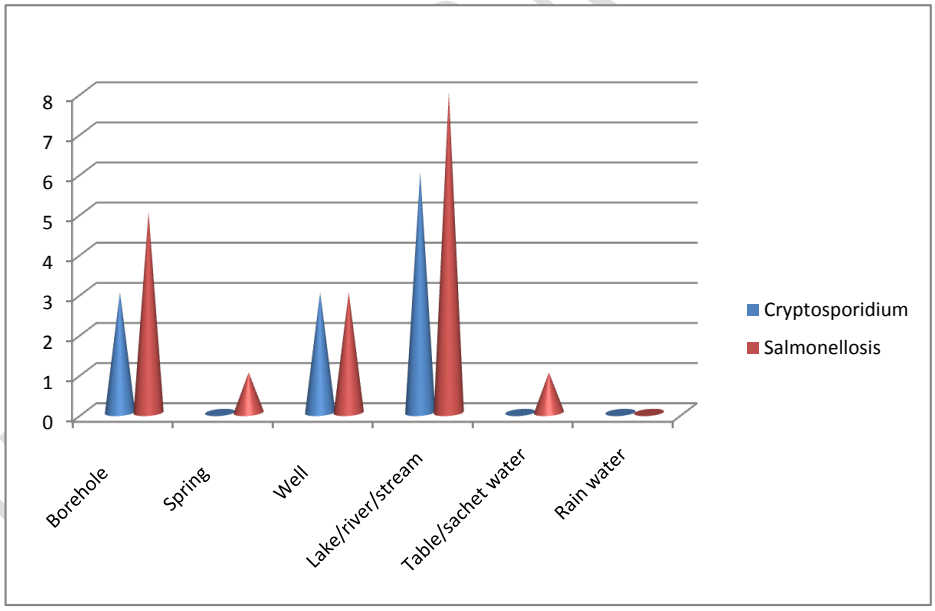

Figure 3: Prevalence of *Cryptosporidium* and Salmonellosis infection with respect to sources of drinking water among people living in Ayamelum local Govt Area

5.0 CONCLUSION AND RECOMMENDATIONS

Even though, *Cryptosporidium* sppoocysts are resistant to many disinfectants, but it can be inactivated by heating water up-to 62 °C. Likewise, the WHO guidelines for drinking water quality also suggest that *Cryptosporidium* sppoocysts are non-viable and can be inactivated at 60 °C. There was a very low risk of infection to those who usually use boiled water for drinking. In addition, present study also revealed that individuals who were consuming un-boiled surface water were at greater risk (p = 0.007) for *Cryptosporidium* infection, while those who used boiled water for consumption were found protective against infection. The drinking water is rarely disinfected and is often contaminated by untreated infectious human excreta, which puts the local residents at great risk of intestinal parasitic infections. Safer drinking water is an urgent need in the rural regions of Ayamelum LGA.During present study, the human feces were often found near surface water and houses and in some towns the sewage and toilets waste water were freely flowing to the surface water sources which is a concern for possible water-borne transmission of *Cryptosporidium* infection. These findings also suggest that individuals consuming surface water (for drinking or bathing purposes) were at risk for infection. Most of the participants were from villages and rural areas where birds, cats and dogs are commonly wandering freely, which may be a route for subsequent zoonotic spreading of oocysts, contaminating the soil and water with their feces. Cows, buffalos and other domestic animals are also seen drinking and bathing in the surface water (rivers, streams and canals) along with children.A study from eight villages in Anyamelum LGA showed that *Cryptosporidium* and salmonella infection was prevalent inLake/river/stream (6 positive out of 25 samples), followed by household with Borehole and Well (3 positive each out of 29 and 6 samples).

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