GSC Biological and Pharmaceutical Sciences
eISSN: 2581-3250 CODEN (USA): GBPSC2
Cross Ref DOI: 10.30574/gscbps
Journal homepage: https://gsconlinepress.com/journals/gscbps/

(RESEARCH ARTICLE)

Check for updates

Parasitological and bacteriological survey of liquid wastes from Naze industrial clusters in Owerri, Imo state

Raymond Ikechukwu Nnadozie [1], Nicholas Chinedu Ewelike [2,*], Etienne Chinakwe [2], Nancy Nnedinma Nnodim [3], Chioma Ogochukwu Anorue [4], Joseph Uchechukwu Ozor [5] and Godfrey Ikechukwu Eberendu [6]

[1]*Department of Biology, Federal University of Technology, P.M.B 1526, Owerri, Nigeria.*
[2] *Department of Microbiology, Federal University of Technology, P.M.B 1526, Owerri, Nigeria.*
[3] *Department of Zoology and Environmental Biology, University of Nigeria, Nsukka, Nigeria.*
[4] *Department of Biology, Microbiology and Biotechnology, Alex-Ekwueme Federal University, Ndufu-Alike, Nigeria.*
[5] *Department of Animal and Environmental Biology, Imo State University, P.M.B 2000, Owerri, Nigeria.*
[6] *Department of Pediatrics, Imo State University Teaching Hospital, P.M.B 08, Orlu, Nigeria.*

GSC Biological and Pharmaceutical Sciences, 2021, 15(03), 138–142

Publication history: Received on 03 May 2021; revised on 06 June 2021; accepted on 09 June 2021

Article DOI: https://doi.org/10.30574/gscbps.2021.15.3.0157

Abstract

Liquid wastes are known to be highly contaminated and pose great public health risk, especially when indiscriminately discharged to the environment. The parasitological and bacteriological survey of liquid wastes from Naze industrial clusters in Owerri metropolis was carried out. Sewage wastewater and laundry wastewater were used as study samples. 100mls each of the samples were collected from the drainage sites with sterile screw-capped specimen bottles, and sent to the laboratory for analysis. The liquid wastes were filtered and the filtrates were used for the analysis. Parasitological analysis employed Zinc Sulphate Centrifugal Flotation Technique and Modified Ziel-Nielsen stain (Acid-Fast Staining). Parasitic ova, cysts, larva and oocysts isolated were identified using standard morphological and taxonomic keys. Bacterial isolates were identified using standard microbiological techniques and biochemical characteristics where necessary. Parasites such as *Ascaris lumbricoides, Strongyloides stercoralis, Trichuris trichiura, Enterobius vermicularis, Schistosoma mansoni, Hymenolepsis nana, Entamoeba histolytica, Gardia lamblia, Balantidium coll and Isospora belli* were isolated from the liquid wastes. Bacteria species isolated included *Erwinia amylovora, Listeria monocytogens, Escherichia coli, Salmonella typhi, Bacillus cereus, Staphylococcus aureus and Proteus vulgaris.* The results showed that the most prevalent parasite and bacteria isolated were *Ascaris lumbricoides* 49(37.6%) and *Salmonella typhi* ($3.38x10^4$ CFU/mL) respectively. These potentially pathogenic parasites and bacteria detected in these liquid wastes, pose serious threat to public health. Interventive measures such as public health education, adequate drainage and waste disposal system, regular and monitored environmental sanitation, and provision of safe and portable water supply to the study area, are recommended.

Keywords: Parasites; Bacteria; Liquid waste; Public health

1. Introduction

Liquid waste is any form of liquid residue that is hazardous to man and his immediate environment. Increasing liquid wastes generation has led to serious problems of environmental pollution, deleterious visual and aesthetic impacts and effects on human health as well as on the sustainability of physical, ecological and social system. Wastewater may contaminate the soil or ground water sources through leaching, run-off or through accumulation in drains, ponds and reservoirs [1].

*Corresponding author: Nicholas Chinedu Ewelike
Department of Microbiology, Federal University of Technology, P.M.B 1526, Owerri, Nigeria.

Copyright © 2021 Author(s) retain the copyright of this article. This article is published under the terms of the Creative Commons Attribution Liscense 4.0.

The practice of discharging liquid wastes into water bodies causes considerable damage to the ecosystem, water front inhabitants, swimmers and fishermen [2]. Liquid waste is a potential source of many human pathogenic bacteria, which pose serious health risk to the general public. Liquid waste percolate into the soil, and the transport of pathogenic bacteria and parasites from surface water to ground water, increases the vulnerability of ground water, which is the source of drinking water in many parts of the world [3, 4, 5]. This contributes significantly to the spread of diseases such as cholera, diarrhea, dysentery, malaria and typhoid fever [6, 7].

Naze Industrial Clusters located in Owerri North Local Government Area of Imo State in the south eastern Nigeria generates copious volumes of liquid wastes daily. There is no adequate liquid waste management system for the area and no information on the sanitary assessment of the liquid wastes is available. The aim of this research work, therefore, is to investigate the parasitological and bacteriological characteristics of liquid wastes from Naze Industrial Clusters with a view to providing adequate preventive measures against possible public health risks associated with the liquid wastes.

2. Material and methods

2.1. Collection of samples

100 mL samples of sewage and laundry wastewater were respectively collected from the drainage system and laundry centers in the industrial clusters, with sterile screw-capped specimen bottles. They were labeled and immediately transported to the laboratory for parasitological and bacteriological analysis. The samples were passed through a coarse sieve of 4 mm^2 pore size to filter off undesirable particles and collected in clean glass vials kept separately.

2.2. Parasitological analysis

20 mL of the filtrate was transferred to a 50 mL volumetric flask. 2 volumes of 30% sodium hypochlorite was added as a disinfectant, vigorously stirred and allowed to stand for 30 minutes. The mixture was further diluted to 50 mL mark and shaken again. Coarse particles were strained out by passing through a coarse mesh cloth into a centrifuge tube and centrifuged at 3000 rpm for two minutes. The supernatant was discarded and the bottom deposit, re-suspended in magnesium sulphate flotation fluid of specific gravity 1.3 and then centrifuge again at 3000 rpm for two minutes. The flotation fluid in the centrifuge tube was then filled up to form a positive meniscus and a cover slip was super imposed on it, and left to stand for five minutes. The cover slip was then filled with a swift action, and placed on a glass slide, and examined microscopically for the presence of parasitic eggs and cysts. Modified Ziegler Nielsen Stain (Acid-Fast Staining) was applied for isolation of the sporozoan oocyst. The parasites isolated were identified using recommended morphological and taxonomical keys [8].

2.3. Bacteriological analysis

5mLs of the filtered sample fluid were homogenized in a 50mL volumetric flask, with sterile normal saline. Sterile wire loop was used to inoculate the sample solution on the following culture media; Nutrient agar, Mc-Conkey agar and Potato Dextrose Agar (PDA). All cultures were incubated at 37℃ for 24 hours in the presence of free oxygen. Sub-culturing was done to obtain pure isolates. Only culture plates showing significant growth were selected for identification. All the bacterial isolates were identified on the basis of their morphological, physiological and biochemical characteristics.

3. Results and discussion

Table 1 shows the results of the parasitological analysis of liquid wastes from Naze industrial clusters. The parasites isolated from the liquid wastes were *Ascaris lumbricoides, Strongyloides stercoralis, Trichuris trichiura, Enterobius vermicularis, Schistosoma mansoni, Hymenolepsis nana, Entamoeba histolytica, Gardia lamblia, Balantidium coll and Isospora belli.* The bacterial species isolated from the liquid wastes are shown in table 2. The organisms were *Erwinia amylovora, Listeria monocytogens, Escherichia coli, Salmonella typhi, Bacillus cereus, Staphylococcus aureus and Proteus vulgaris.* Table 3 and 4 show the prevalence of the parasites and bacterial species in the liquid wastes respectively. Among the parasites, *Ascaris Lumbricoides* had the highest prevalence, 49(37.6 %) followed by *Entamoeba histolytica,* 32(24.6 %) while *Hymenolepsis nana* and *Schistosoma mansoni* and *Isospora belli* had the least prevalence rate of 1(0.8 %) respectively. The prevalence of the bacteria species vary in the liquid wastes. The bacterial load in the sewage is higher than in the laundry wastewater. *Salmonella typhi* had the highest count of $2.48x10^4$ CFU/mL, followed by *Staphylococcus aureus,* $1.5x10^4$ CFU/mL while *Bacillus cereus* had the least count.

Table 1 Parasite species present in liquid wastes from Naze industrial clusters

Parasites Isolated	Liquid waste	
	Sewage	Laundry waste
Ascaris Lumbricoides	+++	+
Strongyloides stercoralis	+	-
Trichuris trichiura	+	-
Enterolius vermicularis	+	-
Schistosoma mansoni	+	-
Hymenolepsis nana	+	-
Taenia Species	+	-
Entamoeba histolytica	++	+
Gardia lamblia	+	+
Balantidium coll	+	-
Isospora belli	+	-

Keys: + = Present, ++ = Highly Present, +++ = Very highly Present - = Absent

Table 2 Bacteria species present in liquid wastes from Naze Industrial Clusters

Bacteria Isolated	Liquid waste	
	Sewage	Laundry waste
Erwinia amylovora	+	-
Listeria monocytogens	+	-
Escherichia coli	+	+
Salmonella typhi	+++	+
Bacillus cereus	+	+
Staphylococcus aureus	++	+
Proteus vulgaris	+	+

Keys: + = Present, ++ = Highly Present, +++ = Very highly Present - = Absent

Table 3 Prevalence of the parasites in the liquid wastes

Parasites Isolated	Laundry waste	Sewage
Ascaris Lumbricoides	35 (16.5%)	14 (0.8%)
Strongyloides stercoralis	10 (7.7%)	0
Trichuris trichiura	8 (6.2%)	0
Enterolius vermicularis	5 (3.8%)	0
Schistosoma mansoni	1 (0.8%)	0
Hymenolepsis nana	1 (0.8%)	0
Taenia Species	4 (3.1%)	0
Entamoeba histolytica	24 (18.8%)	8 (6.2%)
Gardia lamblia	15 (6.4%)	2 (1.5%)
Balantidium coll	2 (1.5%)	0
Isospora belli	1 (0.8%)	0

Table 4 Prevalence of bacteria in the liquid wastes

Parasites Isolated	Bacteria load in Sewage (CFU/mL)	Bacteria load in Laundry waste (CFU/mL)
Erwinia amylovora	1.4×10^4	1.0×10^4
Listeria monocytogens	1.2×10^4	0
Escherichia coli	1.2×10^4	0
Salmonella typhi	2.48×10^4	1.0×10^4
Bacillus cereus	1.1×10^4	1.0×10^4
Staphylococcus aureus	1.5×10^4	1.0×10^4
Proteus vulgaris	1.1×10^4	1.0×10^4

The findings of this present study revealed high parasite and bacterial contamination of liquid waste. The results obtained from this study are consistent with the reports of previous researchers [3]. The predominance of the potentially harmful parasites and bacteria isolated from the liquid wastes is a threat to the health of the population resident in the study area who may possibly be consumers of unwashed raw vegetables irrigated with the untreated wastewater. It has been reported that eggs of *Ascaris lumbricoides* and cysts of protozoans, particularly *Entamoeba histolytica* remain viable in stabilized pond effluents used to irrigate vegetables that were eaten raw [9]. Such inadequately treated sewage water used for irrigation has been identified as increasing the risk towards the incidence of parasitic infection in both the farmers and consumers [10, 11]. There is also risk of bovine cysticercosis if reared cattle drink any body of water contaminated with the wastewater. *Giardia lamblia* isolated in this study causes giardiasis especially in the immune-compromised individuals such as younger children, the elderly, pregnant women, HIV-infected persons and others who may be exposed to life threatening situations [12]. Moreover, all the parasitic agents in the liquid wastes are capable of causing outbreak of water and food-borne diseases through the contaminative routes [13].

The potentially pathogenic bacteria recorded in this study are essentially gram positive and gram negative enteric bacteria. Their occurrence in sewage and other liquid wastes had been reported in scientific literature [14]. A number of human diseases have been attributed to have originated from community bacterial agents, especially where environmental conditions such as poor sanitation, heavy flies density and indiscriminate disposal of human and animal wastes are prevalent [15]. It is important to note that the liquid wastes in the study area is located within the industrial clusters and mini markets, where arrays of exposed food items are displayed and the common houseflies, the mechanical disease vectors abound.

4. Conclusion

This study has shown that there is high degree of parasitic and bacterial contamination of liquid wastes generated from Naze Industrial Clusters, which obviously portends a great danger to public health. It is, therefore, recommended that the liquid wastes be appropriately treated before re-use or discharged to the environment. Environmental sanitation and fumigation exercise should be periodically carried out in the study area to reduce the activities of disease vectors. Good drainage and disposal systems should be provided, and health education should be carried out in the study area to educate the public on the dangers of environmental pollution and the possible economic benefits of waste conversion.

Compliance with ethical standards

Acknowledgments

The authors are thankful to the technicians in the Department of Biology, Federal University of Technology Owerri, Nigeria for their assistance.

Disclosure of conflict of interest

The authors declare that no competing interest exists**.**

References

[1] Okojokwu OJ, Inabo H, Yakubu SE. Parasitological profile of raw wastewater and efficacy of Bioscan and filter in reduction of parasitic ova and cysts, J. Appl. Sci. Environ. Manage. 2014; 1891: 5-9.

[2] Paraskevas PA, Glokas DL, Lekkas TD. Wastewater management in coastal urban areas; the case of Greece, Water Sci. Tech. 2002; 28: 37-409.

[3] Takal JK, Quaye-Ballard JA. Bacteriological contamination of ground water in relation to septic tank location in Ashnti region, Ghana, Cogent. Environ Sci. 2018; 4(1): 206-224.

[4] Foster T, Willets J, Kotra KK. Faecal contamination of groundwater in rural Vanuatu; prevalence and predictors, J. water Health. 2019; 17(5): 737-748.

[5] Onyango AE, Okoth MW, Kunyanya CN, Aliwa BO. Microbiological quality and contamination level of water sources in Isiolo country in Kenya, J. Environ. Public Health. 2018.

[6] Adeyeba OA, Akimbo JA. Pathogenic intestinal parasites and bacterial agents in liquid waste, East Afri. Med. J. 2002; 2:76-79.

[7] Nwabor OF, Nnamonu E, Martins P, Ani C. Water and waterborne diseases; A review, Int. J. Trop. Disease. 2016; 12(4):14.

[8] Ukaga CN, Onyeka PI, Nwoke BEB. Practical medical parasitology for biological sciences and medical students. Arm Global Publication Owerri, Nigeria. 2003; P125-147.

[9] Shanthala M, Hosetti BB, Stott R. Removal of helminth parasitic eggs from waste stabilization pond at Shimoga, The bioscan. 2007; 2(1): 9-14.

[10] Damen JG, Banwat EB, Egah DZ, Allenana JA. Parasitic contamination of vegetables in Jos, Nigeria. Ann. Afric. Med. 2007; 6(3): 115-118.

[11] Uneke CJ. Potential for geohelminths parasite transmission by fruits and vegetables; Implication for risk profile J. Nutri. Envrion. Med. 2007; 16(1): 59-68.

[12] Safak K, Hilmi C, Safak G, Liyas T. The prevalence of Gavardia intestinal in dyspeptic and diabetic patience, Int. Schor. Res. Notices. 2011.

[13] Udoh SJ, Olaniran O, Adedire BA, Hassan-Olajokun RE, Olaniran OO, Onyetokeo O. Investigation on the pattern of intestinal parasites present in refuse dumps and abattoir wastes in Il-Ife, Nigeria, Bio. Med. 2019; 11:460.

[14] Dumoutet S, Scopa A, Kerje S, Krovacek K. The importance of pathogenic Organisms in sewage and sewage sludge, J, Air. Waste. Manage. Assoc. 2011; 51(6): 484-860.

[15] Adeyeba OA, Okpala N. Intestinal parasites and bacterial pathogens carried by common houseflies in wastes, Ibadan, Nigeria, Afri. J Med. Pharm. Sci. 2000; 4:53-63.