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Investigating the Effects of Abattoir Activities on Human and Physical Environments in Ughiole and Aviele, Edo State

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ABSTRACT

Investigating the detrimental effects of abattoir operations on the physical environment and human health in Ughiole, Aviele, Edo State, is the goal of this study. Meat industry depends on abattoirs, but if they are not properly managed, their operations can seriously harm the environment and pose health risks to the general public. Among the main focus of the study are waste management procedures related to abattoir operations. Environmental sampling, field surveys, and interviews with locals and abattoir employees were all used in the data collection process. The incorrect disposal of animal waste adds to soil and water pollution, endangering local agriculture and drinking water supplies, according to preliminary results. The study's findings highlight the necessity of sustainable abattoir operations in Ughiole, Aviele, to safeguard the physical environment and public health. More investigation is advised to examine long-term effects and successful intervention techniques.

Keywords: Abattoir operations, Environment, Health, Effects, Ughiole-Aviele, Public

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INTRODUCTION

The most important issue in all meat processing plants is maintenance of proper hygiene and adequate sanitary conditions. An abattoir may be defined as an approved facility registered by the regulatory agency for hygiene slaughtering and inspection of animals, processing and effective preservation and storage of meat products for human consumption [1]. Animal slaughtering generates livestock waste spills that can introduce enteric pathogens and excess nutrients into surface water and can also contaminate groundwater in spite of its obvious benefits of meat supply and useful by-products like leather and skin [1;2]. Abattoir operations produce a characteristic highly organic waste with relatively high levels of suspended solids, liquid and fat. The solid waste includes condemned meat (which is rare), undigested intestine, bones, horns, hairs and aborted foetuses. The liquid waste is usually composed of dissolved solids, blood, gut contents, urine and water. Animal food is always microbiologically contaminated by organisms living in it, naturally or entering it from processing operations. By the year 2020, there will be more than 6.5 billion people in the world, and half of these figures will be residing in urban areas. The diet of rural communities is higher in calories but less diversified, whereas city dwellers have a varied diet that is rich in animal proteins and fats and characterised by higher consumption of meat, poultry, milk, dairy products and fish [2;4]. Large quantities of carcasses and offals are introduced into towns every day as high numbers of livestock from ranches or nomadic herds are slaughtered to satisfy the increasing demand for meat.

Waste has always been present in our urban cities, they have been casually discarded, and in the past they have caused little concern. The disposal of solid waste in the country has been assuming disturbing dimension as most authorities concerned with waste management have allowed their accumulated heaps of waste in the cities to create pollution problem of public health and the environment. Waste from abattoir and their indiscriminate dumping belches out stench and odour of the offensive type. [5;6;7], in his paper titled “Man and His environment”, the type of an urban society depends upon its cleanliness, and a healthy urban economy requires that wastes are properly and efficiently disposed. But unfortunately, one of the menacing, crippling and excruciating problems of urban places in the third world countries is indiscriminate dumping and inefficient disposal of waste and lack of effective strategies to control waste. The inability of the disposal authorities to involve waste generators in their disposal implementation strategies has compounded the ugly situation in our urban cities in Nigeria.

As the rate of growth of the population is brought into play coupled with the increasing complexities of social life, then a picture of increased health hazard is brought out [8]. It is obvious that the indiscriminate dumping of waste on

our roads creates an ugly site. Sometimes, besides stinking, it blocks our roads, and extreme cases cause road accidents. The most disheartening is the dumping of abattoir waste along the gutter, which blocks the waterways and forms breeding grounds for mosquitoes and other diseases. The strategies needed could minimise indiscriminate dumping and discharge of waste into the environment, if not complete elimination, because attitude change, economic reuse and recycling of waste among the generators seem to offer useful solutions. Pollution from domestic, industrial and abattoir sources create a variety of problems in the atmosphere and in the hydrological cycle. It contributes to land degradation and is responsible for indoor and outdoor air pollution, vector-borne diseases, and depletion of resources for waste disposal and bears a significant part of the vulnerability of the population to disease [10;11]. The gravity of the situation is underscored by the fact that environmental factors are responsible for almost one quarter of all diseases in developing countries [12], of which Nigeria is a typical example.

Studies in Nigeria established that poor waste management is responsible for the environmental and health hazards associated with abattoirs [13]. On entering most abattoirs in Nigeria, one immediately sees the glaring evidence of poor sanitation and a hazardous environment. This includes dilapidated slaughtering and processing facilities, inadequate clean water supplies, no refrigerators and lack of facilities for the collection and storage of waste [14]. Proper sewage or waste disposal systems are also lacking. Wastes are disposed of directly into streams and rivers, which are very common in Nigeria [13]. There is no disposal management or treatment system. And the meat is also washed in the same water. The animal waste, such as blood, bones, intestinal content, tissues, hides and skin, are scattered in huge piles in and around the abattoirs [13;14]. This attracts flies and a stench that affects adjoining residences. All these hazards are a result of untrained abattoir personnel as well as butchers that are ignorant of sanitary principles and poverty. The waste is also responsible for environmental change, stigmatisation of residences and depreciation in the value of adjacent properties [15]. The animal waste and wastewater contribute to adverse health outcomes. Zoonotic agents that have also been demonstrated in slaughtered animals in Nigeria include Mycobacterium tuberculosis, Mycobacterium bovis, Leptospira spp., Campylobacter sp., Yersinia sp., Clostridia spp., and Listeria, among others [16]. Other disease-causing infectious agents encountered at the abattoirs include Escherichia coli (E. coli) O157, Salmonella and Campylobacter [17]. Others include Brucella abortus, Brucella melitensis, Brucella suis, and Salmonella spp. [16] The meat transportation is done by motorbike, wheelbarrow and open vehicles which have multipurpose use, such as carrying cement, timber and any item to be carried from markets, and this becomes a source of physical contamination [18].

This research study therefore will make recommendations after analysing the present situation, which issues as a result of lack of involvement of these waste generators in its control and lack of total awareness of the urban dwellers, and the sanitary units of attitude needed and acquired through environmental strategies and awareness will definitely check urban abattoir waste.

RESEARCH METHODOLOGY

Study area

The study was conducted in the Ughiole community, Aviele, Edo State, Nigeria. On the 6th of September 2023. It is located in the western part of the city of Estako West local government area. Edo State. Which has the total population of 197,609. Ughiole abattoir is situated within the commercial areas and surrounded a few meters away from supermarkets, residential houses and educational institutions. The abattoir performs most of their activities in the morning from 4am to night at 11am. The major animals slaughtered were cattle, goats and rams. Their operational activities are usually on demand by the community, neighbouring communities and during festivities.

Data collection

Data was collected using a structured questionnaire on residential neighbourhoods which included several questions that were asked if they suspect any disease related to the abattoir hazard, comfortability with the presence of an abattoir in their surroundings, source of their drinking water, insect and fly disturbance, blockage of gutters, possible relocation due to abattoir activities, etc., using the agreed, strongly agreed, disagreed and strongly disagreed responses.

Research questions

The method used to carry out this research is called the questionnaire method. The method was achieved by visiting Ughiole slaughterhouse. And the questions asked are stated as follows:

1. Do the abattoir activities cause any air pollution, such as smoke, odour, nuisance, etc.?
2. Does waste product from the abattoir cause soil pollution, such as contamination of surface and
3. underground water, as well as river bodies, etc.?
4. Does the abattoir's activities lead to the persistence of insects and flies around the environment?
5. Does the stigma emanating from the abattoir make people relocate?
6. Does the noise from the abattoir activities cause inconvenience to the people living around the
7. environment?
8. Does the environmental pollution from the abattoir scare prospective investors away?
9. Does the environmental pollution from the abattoir cause any deterioration of physical properties?

10. Does the smell from this abattoir cause illness?
11. Does the stigma from the abattoir cause any marketability difficulties?
12. Does the negative environmental impact of the abattoir activities increase the demand for basic
13. amenities?

Water analysis

The study adopts a combination of qualitative and quantitative methodology, including laboratory testing and sample analyses gotten from the field. Water quality depends on the bio-physicochemical composition of the water. The data was collected from both primary and secondary sources, but most of the information was obtained from the primary source. The primary sources of data include reconnaissance surveys, field observations and the water sample analysis that was carried out in a standard laboratory. The secondary source of data includes the vital information that was gotten from urban planning, journals, seminar papers, textbooks and the internet.

Data collection

A total of three sampling points were selected, two from the abattoir and one outside the abattoir and they are described as follows;

(a) Hand dug well 9.76m away from the abattoir effluent dump well; and

(b) Borehole of 16.80m from the abattoir effluent dump well.

Reconnaissance and field observation

A reconnaissance survey was carried out to familiarise the researcher with the various environmental characteristics of the study area. During this process, some vital information was obtained, and this formed a foundational knowledge that helped to enhance the planning and costing as well as the preparation of materials needed for the study. This was also done to get information regarding the kinds of animals kept and slaughtered in the abattoir, get comprehensive knowledge on how the animals are being slaughtered, and also know the existing waste management practices and source of water in the abattoir.

Water samples were collected with two containers; one from the well in the abattoir, and the other from the borehole in the abattoir so as to ascertain if the abattoir effluents contaminate the groundwater or not, the containers were properly washed before going to the sampling point and each container was finally washed with the water from the wells and borehole in the sampling point. The water samples were collected between 6:00 am and 6:30 am when the water had settled; the water samples were collected before the arrival of anyone at the sampling point because continuous fetching of water from the wells and the borehole can cause the water to change colour and become muddy. After collecting the water samples, the containers were covered and labelled as well as borehole. They were stored in coolers and then transported to the laboratories for analysis.

Laboratory analysis of water samples

The laboratory analysis of the water samples was carried out at the Owena River Basin, Benin City, Edo State. The water samples were tested for selected physical, chemical and biological parameters such as total dissolved solids (TDS), total suspended solids (TSS), biological oxygen demand (BOD), pH, nitrate, turbidity and total coliform. The laboratory analyses were carried out using standard analytical methods and procedures for water quality analysis.

Data analysis

The data that were collected from the laboratory analysis of the water samples were further analysed using different statistical tools. The result gotten from the laboratory test was used to compare the WHO and NAFDAC standards for drinking water.

RESULTS AND DISCUSSION

The investigation into the negative effects of abattoir activities on both human health and the physical environment in Ughiole, Aviele, Edo State, reveals significant findings that highlight the multifaceted impacts of these operations. Abattoirs are essential for meat processing; however, their activities can lead to various environmental and health challenges if not managed properly. The outcomes of the research questions were shown in Table 1 as follows:

Table 1: Observations on research questions

	Option	SA	A	SD	D
1.	Does the abattoir activities cause any air pollution such as, smoke, odor, nuisance etc.	8	7	20	15
2.	Does waste product from the abattoir causes soil pollution such as contamination of surface, underground water, as well as river bodies etc.	17	10	14	9
3.	Does the abattoir activities lead to persistence of insect and flies around the environment?	10	9	20	11
4.	Does the stigma emanate from the abattoir makes people to relocate?	15	10	14	11
5.	Does the noise from the abattoir activities causes inconveniency to the people living around the environment?	18	12	11	9

6.	Does the environmental pollution from the abattoir scares prospective investors away?	13	14	10	13
7.	Does the environmental pollution from the abattoir causes any deterioration of physical properties?	11	8	16	15
8.	Does the smells from this abattoir causes illness?	18	12	6	14
9.	Does the stigma from the abattoir causes any marketability difficulties?	7	12	9	22
10.	Does the negative environmental impact of the abattoir activities increase the demand for basic amenities?	21	15	8	6

SA= Strongly Agreed; A= Agreed; SD= Strongly disagreed; D= Disagreed

Table 2: Chi square

OBSERVED VALUE(O)	EXPECTED VALUE(E)	(O-E)	$(O-E)^2$	$\frac{(O-E)^2}{E}$
10	5.8	4.2	17.6	3.0
8	5.6	2.4	5.8	1.0
3	6.6	-3.6	13.0	2.0
2	5.0	-3.0	9.0	1.8
9	5.3	3.7	13.7	2.6
6	5.1	0.9	0.8	0.2
5	6.0	-1.0	1.0	0.2
1	4.6	-3.6	13.0	2.8
12	6.6	5.4	29.1	4.4
7	6.3	0.7	0.5	0.1
4	7.5	-3.5	12.3	1.6
3	5.6	-2.6	6.8	1.2
8	5.3	2.7	7.3	1.4
6	5.1	0.9	0.8	0.2
3	6.0	-3.0	9.0	1.5
4	4.6	-0.6	0.4	0.1
5	6.3	-1.3	1.7	0.3
2	6.1	-4.1	16.8	2.8
10	7.1	2.9	8.4	1.2
8	5.4	2.6	6.8	1.3
6	9.1	-3.1	9.6	1.1
9	8.8	0.2	0.04	0.005
13	10.3	2.7	7.3	0.7
8	7.8	0.2	0.04	0.005
8	6.1	1.9	3.6	0.6
11	5.9	5.1	26.0	4.4
4	6.9	-2.9	8.4	1.2
1	5.2	-4.2	17.6	3.4
1	7.1	-6.1	37.2	5.2
5	6.8	-1.8	3.2	0.5
13	8.0	5.0	25.0	3.1
9	6.1	2.9	8.4	1.4
2	6.6	-4.6	21.2	3.2
6	6.3	-0.3	0.09	0.01
10	7.5	2.5	6.3	0.8
8	5.6	2.4	5.8	1.0
4	7.1	-3.1	9.6	1.4
3	6.8	-3.8	14.4	2.1
9	8.0	1.0	1.0	0.1
12	6.1	5.9	34.8	5.7

In chi-square, whenever the calculated value is greater than the tabulated value, then we can state that our null hypothesis is rejected and the alternate hypothesis is accepted, which means there is a significant relation between the variables. Finally, we can say that the Ughiole community abattoir activities do have a significant effect on human health. So therefore, the experiment shows that there is a need to carry out water analysis.

Water Pollution:

The study found that wastewater from abattoirs often contains high levels of organic matter, pathogens, and chemicals such as blood and offal. This effluent typically flows into nearby water bodies without adequate treatment, leading to contamination. Water samples collected from rivers near the abattoir showed elevated levels of biochemical oxygen demand (BOD) and total coliform counts exceeding safe limits.

The finding on water tests and analysis is explained as follows:

i. Physical

These include colours, odours, taste, temperature, turbidity, etc.

ii. Chemical

Aluminium, arsenic, barium, cadmium, chloride, chromium, conductivity, copper, cyanide, fluoride, hardness, hydrogen sulphate, iron, lead, magnesium, manganese, mercury, nickel, nitrate, nitrite, pH, sodium, sulphate, total dissolved solids, zinc, etc.

iii. Biological

Detergent, mineral oil, pesticides, polyaromatic hydrocarbons, total organic carbon and phenols, amongst others.

Table 3: Physical parameters

Parameter	Unit	The maximum permitted levels (WHO)	Health Impact
Colour	TCU	15	None
Odour	-	Unobjectionable	None
Taste	-	Unobjectionable	None
Temperature	O Celsius	Ambient	None
Turbidity	NTU	5	None

Table 4: Chemical parameters

Parameter	Unit	The Maximum Permitted Levels (WHO)	Health Impact	Note
Aluminum (A1)	Mg/L	0.2	Potential neuron degenerative disorder	Note 1
Arsenic (AS)	Mg/L	0.01	Cancer	
Barium	Mg/L	0.7	Hypertension	
Cadmium (Cd)	Mg/L	0.003	Toxic to the kidney	
Chloride (C1)	Mg/L	250	None	
Chromium (Cr6+)	Mg/L	0.05	Cancer	
Conductivity	Mg/L	1000	None	
Copper (Cu+2)	Mg/L	1.	Gastrointestinal disorder	
Cyanide (CN-)	Mg/L	0.01	Toxic to the thyroid and nervous system	
Floride (F-)	Mg/L	1.5	Fluorosis skeletal tissue (bone and teeth) morbidity	
Hardness (as CaCO3)	Mg/L	150	None	
Hydrogen Sulphide (H2S)	Mg/L	0.05	None	
Iron (fe+2)	Mg/L	0.3	cancer, interference with Vitamin D metabolism, affects mental development in infants, toixc to central and peripheral nervous systems.	
Lead (Pb)	Mg/L	0.01	consumer acceptability	Magnesium (mg+2)
Magnesium (mg+2)	Mg/L	0.20	neurological disorder	
Manganese (Mn+2)	Mg/L	0.2	Affects the kidney and the central nervous system	
Mercury (Hg)	Mg/L	0.001	Cyanosis and asphyxia in infants under three months	
Nitrate (NO3)	Mg/L	0.02	Cyanosis and asphyxia in infants under three months	
Nitrite (NO3)	Mg/L	50	None	
PH	Mg/L	6.5-8.5	None	
Sodium (Na)	Mg/L	200	None	
Sulphate (SO4)	Mg/L	300	None	

Total dissolved solids	Mg/L	500	None
Zinc (Zn)	Mg/L	3	None

Table 5: Concentration of parameters of groundwater sample in the study area in comparison with the WHO and NAFDAC standard for drinking water

S/NO	Parameter	Borehole	Well	WHO	NAFDAC
1.	PH	6.70mg/l	5.50mg/l	6.5-8.5mg/l	6.5-8.5mg/l
2.	BOD	0.09mg/l	7.08mg/l	4mg/l	4mg/l
3.	Turbidity	3.69mg/l	18.10mg/l	5.0mg/l	not specified
4.	Hardness	170mg/l	19.0mg/l	100.500mg/l	100mg/l
5.	Total dissolved solid	54.15mg/l	84.73mg/l	250.500mg/l	500mg/l
6.	Nitrate	1.06mg/l	22.78mg/l	10.50mg/l	10mg/l
7.	Fe (Iron)	0.65mg/l	1.0mg/l	1.3mg/l	1.0mg/l
8.	Pb (lead)	0.004mg/l	0.3mg/l	0.01mg/l	0.4mg/l
9.	Total coliform	27.43mg/l	63.62mg/l	10mg/l	10mg/l
10.	TSS	0.81/mg/l	8.0mg/l	Not specified	Not specified

Variation in the concentration of the parameters between well water, borehole water, WHO standard and NAFDAC standard is explained as follows:

1. **pH:** The borehole water has a pH value of 6.70 6.70mg/l while the well water has a pH value of 5.50 5.50mg/l. The WHO and NAFDAC standard for drinking water ranges from 6.5 to 8.5 mg/l; therefore, the result for the borehole and well is not in variance with the WHO and NAFDAC standard for drinking water.
2. **BOD:** The borehole water has a BOD value of 0.09 mg/l, while the well water has a BOD value of 7.08 7.08mg/l. The WHO and NAFDAC standard are 4 4mg/l, therefore borehole water is in accordance with the WHO and NAFDAC standard, while the well water is at variance with the WHO and NAFDAC standard.
3. **TURBIDITY:** The borehole value for turbidity is 3.69, while the well water has a turbidity of 18.10, so the WHO and NAFDAC value is 5.0 mg/l. Therefore, the result for the borehole is within the range, which is at variance with the WHO and NAFDAC value.
4. **HARDNESS**: The borehole value for hardness is 170 170mg/l while the well water has a hardness of 190 190mg/l. The WHO and NAFDAC values for hardness are 100-500 mg/l and 100 100mg/l. Therefore, they both melt the WHO and NAFDAC values for hardness.
5. **TOTAL DISSOLVED SOLID (TDS):** The borehole and values for the TDS are 54.15 54.15mg/l and 84.73 mg/l. The WHO and NAFDAC values for TDS are 250-500 mg/L and 500 500mg/l respectively. Therefore, they are in accordance with the WHO and NAFDAC standards for drinking water.
6. **NITRATE:** The nitrate value for the borehole is 1.06 mg/l, while the nitrate value for the well is 22.78 mg/l. The WHO standard is 10-50 mg/l, while for NAFDAC it is mg/l, indicating the well value is at variance with the NAFDAC standard, while that of the borehole is in accordance with both standards.
7. **Fe:** The Fe value for the borehole is 0.65 0.65mg/l and the Fe value for well water is 1.0 1.0mg/l. The WHO standard ranges from 1-3 mg/l, while for NAFDAC it is mg/l, indicating that they are not in variance with the WHO and NAFDAC standards for drinking water.
8. **Pd:** The Pd value for the borehole is 0.004 0.004mg/l and the Pd value for well water is 0.03 mg/l. The WHO standard is 0.0 0.0lmg/l while the NAFDAC standard is 0.4 0.4mg/l indicating that the values are not at variance with both standards.
9. **Total Coliform:** The value for the borehole is 2.7-43 mg/l, and the value of well water is 63.62 mg/l. The WHO and NAFDAC standard is 10 10mg/l indicating that the result is at variance with both standards.
10. **TSS:** The value for the borehole is 0.81 0.81mg/l and the well water value is 8.0 8.0mg/l. The WHO and NAFDAC standards for drinking water are not specified.

CONCLUSION

From the analysis of the result obtained by the study, the following conclusion can be drawn:

i. There is no doubt that the pollution generated by Ughiole abattoir effluent is clear evidence that the meat processing industry has a potential for generating large quantities of concentrated effluent which would worsen the scarcity of clean water availability to the generality of the population.
ii. A large amount of water is used and generates a lot of wastewaters at Ughiole abattoir. This study estimated 50 million and 43 million litres of water and waste per day, respectively.
iii. The effluent from Ughiole abattoir is highly concentrated, and it is discharged in a pit without treatment. The existing septic tank is no longer functional.

iv. Blood is collected separately; it is mixed with other waste and cleaning water. It highly contributes to the pollution load in the pit by increasing its BOD and COD.

v. Public health hazards to the people living in the abattoir and its vicinity were observed through different uses like washing and recreation.

vi. Solid waste like condemned meat is disposed of, but potential contamination of groundwater was observed because the pits into which the condemned meat is buried are not cemented.

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