Abattoir Waste Management Practices and the Associated Effect on Soil Physicochemical Quality in Port Harcourt Metropolis., Rivers State, Nigeria

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Abstract
Abattoirs are significant contributors to food security; however, the waste they generate poses environmental and public health concerns when not properly managed. The aim of the study was therefore to assess abattoir waste management practices and the associated effect on Soil physicochemical Quality in Port Harcourt, Rivers State, Nigeria. This study examined Abattoir waste management practices and it effect in the physicochemical characteristics of soils in Mgbuosimini and Mile 3 abattoirs in Port Harcourt Metropolis, Nigeria. A structured questionnaire was designed and served as the source of data on the management of abattoir in the two abattoirs. Soil samples were collected from the two abattoirs sites. The soil sampling involved four (4) different points, such as lairage, slaughtered slab, animal waste storage area and 50 meters away from the abattoir are (control sample. Findings revealed that the major waste types identified were blood (97.4%), wastewater (97.4%), and animal feces (89.7%). Open burning (79.4%) and direct discharge into rivers (89.7%) were the dominant waste disposal methods. 100% of the waste from both abattoirs was disposed of without prior treatment. The result of the physicochemical parameters showed elevated pH values (7.7–8.5), indicating alkaline conditions, high phosphate (2.3–38.9 mg/kg) and nitrate concentrations (5.2–43.3 mg/kg), and increased total organic carbon (TOC), with Mile 3 (6.96%) higher than Mgbuosimini (2.21%). This study has shown that abattoir activities have a significant influence on the physicochemical characteristics of the soil environment. Therefore, proper waste treatment and improved waste collection to reduce environmental contamination are recommended.

Keywords: *Abattoir activities; physicochemical; soil samples; slaughter, Port Harcourt.*

1. Introduction

Management of abattoir wastes has been of great concern in Nigeria (Abdullahi et al., 2023; Awari et al., 2020; Ayeni et al., 2024). Almost every day in all the urban and rural markets in Nigeria, animals are slaughtered while the meats are sold to the public for consumption (Ezeohaa and Ugwuishiwu, 2011). The constant dumping of abattoir waste without adequate treatment in our markets has led to the outbreak of diseases in the society (Ogunseye et al., 2021). The upsurge in the prevalence of communicable and zoonotic diseases such as tuberculosis within the society today makes abattoir waste as disease surveillance points (Sampson & Deele, 2022).

The waste products from slaughterhouse operations are categorized as fats, which are frequently heavy in organic solids and liquids. Urine, dissolved particles, water, intestinal contents, and blood are frequently present in the liquid. Hairs, injured fetuses, undigested food that has been eaten, condensed meats, and blood are examples of solids, whereas fats and oil are the constituents of fat waste (Dan et al., 2018). By releasing large amounts of effluents into the soil, these produced wastes have also had an impact on the soil medium. These then seep into the soil mass, leading to significant contamination of the soil and water.

Research has shown that the soil sample surrounding abattoirs may exhibit a variety of altered physicochemical characteristics as a result of slaughterhouse wastewater (Akanni et al., 2019). Numerous compounds may be present in the contaminated soil, suggesting possible pollution problems (Ariyo & Obire, 2021).

2. MATERIALS AND METHODS

Description of Study Area

This study was conducted at two different abattoirs within Port Harcourt metropolis. These abattoirs include Mgboushimini Abattoir and Mile 3 Abattoir. Mile 3 is within latitude 4047’54.93 N and longitude 6059’31.53 E, and Mgbuoshimini is situated at 4048’25.98 N latitude and 6058’11.66 E longitude. These locations were chosen as a result of their activities and their population density.

Study Design

The study adopted the use of cross-sectional descriptive study design.

Study Population

The study population consists of all abattoir operators in two selected abattoirs within Port Harcourt Metropolis: Mgboushmini Abattoir and Mile 3 Abattoir.

Sample size and Sampling Techniques

A non-probability convenience sampling technique was employed to select the study participants. Out of 150 Abattoir workers from both site, 54 workers from Mgboushmini Abattoir completed the questionnaire, while 63 workers from Mile 3 Abattoir responded. In total,117 abattoir workers participated in the study. Out of the six (6) abattoirs identified which includes: Iwofe abattoir, Choba abattoir, Agip abattoir, Rumuokoro Abattoir, Mile 3 abattoir, and Mgbuoshimini abattoir. Mile 3 and Mgbuoshimini Abattoir were randomly selected based on population density.

Methods of data collection and Instrumentation

A structured validated interviewer-administered questionnaire was used in collecting the data for the study. The questionnaire was made up of part A and B. Part A collected information on the socio-demographic details of the respondents. Part B was used in collecting information regarding management of Abattoir waste.

Method of Soil Sample Collection

Soil samples were collected in sterile polythene bags using a sterile hand shovel at a depth of 0 - 15cm. The Samples were labeled properly transported to the laboratory and subjected to physicochemical procedures.

Description of Sample Points

Soil samples were collected from four points within the abattoir for laboratory analysis, as indicated below

Sampling point K: The region where the live animals are kept
Sampling point S: The region where the animals are slaughtered
Sampling point B: The region where the waste bone is stacked
Sampling point C: A control point 50m from the site.

Validity and Reliability of Instrument

The instrument was presented for content and construct validity from supervisors and two other experts in public Health research, from the Department of Public Health Science, Rivers State University. Copies of the questionnaire with the list of the research objectives and question were given to the aforementioned expert for corrections. As suggested by Taherdoost (2016), validation of questionnaire was applied to ensure that the interview questions were genuine and reliable. The coefficient of 0.9 was considered a reliability coefficient as a test-retest coefficient of 0.5 will be enough to justify the use of a research instrument.

Ethical Consideration

Ethical approval was obtained from the Department of Public Health Ethics Committee of Rivers State University. Respondents were informed that participation in the study is voluntary and they could withdraw from the study at any time. The purpose and nature of the study was clearly explained; informed consent was obtained from participants.

Determination of the Physicochemical Properties of the Soil Samples

Parameters such as temperature, pH, nitrate, total organic carbon, and phosphate were determined using the methods from APHA (1998). The temperature of the soil at the various locations was determined in situ at a depth of 010cm, using a digital thermometer (Pen Style Digital Thermometer). The pH was measured using a calibrated multi-parameter (HANNA HI 9828) pH meter with a 10:25 (w/v) soil to water ratio. The nitrate nitrogen was determined by the brucine method, based on the reaction of the nitrate ion with brucine sulfate in a 13N H_2SO_4 solution at 100 °C, and the absorbance of the resultant color was measured at 410 nm wavelength. The total organic carbon was determined using the rapid oxidation method and the Atomic Adsorption Spectrophotometer (AAS).

Statistical Methods

Data was analyzed using the statistical package for social sciences (SPSS) version 25. Descriptive statistics was used to derive frequencies and percentages for the sociodemographic characteristics. A One-way Analysis of Variance (ANOVA) was used to check for significant difference between each of the different samples and the control sample. The mean separation was analyzed using Tukey High significant difference (HSD). The level of statistical significance was set as $P < 0.05$.

3. RESULTS

Socio-demographic information of the respondents

From the data obtained from the field as presented in Table 1, a total of 117 abattoir workers participated in this study, comprising 54 from Mgbousmini and 63 from Mile 3 Abattoir. From both abattoirs out of which all were males. The Age distribution of the abattoir workers showed that the age group of 40 and above had the highest percentage (50%) in Mgbousmini Abattoir, and the 18-25 Age group had the lowest percentage (11.1%). In Mile 3 Abattoir, the Age group 40 and above had the highest percentage (52.3%) while the age group 18-25 had the least percentage (19.0%). The overall result also revealed that the age group 40 and above had the highest percentage of 51.3%. The result of the Marital status of the Abattoir workers showed that most of the respondents were married. In Mgbousmini Abattoir, 77.8% were married, 6.6% were single, and with one separated respondent. While in Mile 3 Abattoir, 71.4% were married, 23.8% were Single. The overall result showed that 74.4% are married. The Educational level of the abattoir workers indicated that 38.9% of the respondents from Mgbousmini Abattoir had Primary and Secondary Education, while 22.2% had no formal Education. None of the respondents had tertiary education. In Mile 3 Abattoir, 42.8% of respondents had primary Education, while 28.6% had either non-formal or secondary Education. Among all respondents contacted, 41.0% had primary Education (Table 1). The result of the Religions of the Abattoir workers showed that in Mgbousmini Abattoir 50% were Christian and 50% were Muslim. In Mile 3 Abattoir 57% were Muslim and 42.8% were Christian. The overall showed that Muslim were more representing 53.8% as shown in table 1 below.

Table 1. Demographic information of the respondents

Variables	Mgbousimini Abattoir No 54 (%)	Mile 3 Abattoir No 63 (%)	Overall
Gender			
Male	54(100)	63(00)	117(100)
Female	-	-	-
Age			
18-25	6(11.1)	12(19.0)	18(15.4)
26-39	21(38.9)	18(28.6)	39(33.3)
40-above	27(50)	33(52.3)	60(51.3)
Martial Status			
Single	9(16.6)	15(23.8)	24(20.5)
Married	42(77.8)	45(71.4)	87(74.4)
Separated	3(5.6)	-	-
Divorced	-	-	-
Widowed	-	3(4.8)	3(2.6)
Level of Education			
Non-Formal	12(22.2)	18(28.6	30(25.6)
Primary	21(38.9)	27(42.8)	48(41.0)
Secondary	21(38.9)	18(28.6)	39(33.3)
Tertiary	-	-	-
Religion			
Christian	27(50)	27(42.8)	54(46.1)
Muslim	27(50)	36(57.1)	63(53.8)
Traditionalist	-	-	-

Abattoir Activities and Waste Management Practices

The number of animals Slaughtered (per day) reveals that in Mgbousimini Abattoir, 7-10 cows are slaughtered daily while goats are not. In mile 3 Abattoir, 5-7 cows are slaughtered while 10 -25 goats are slaughtered daily (Table .2). Data on the categories of waste generated at the study locations revealed that blood waste had the highest frequency (100%), and wastewater was produced by 94.4% of the workers in Mgbousimini Abattoir. In Mile 3 Abattoir, wastewater had the highest percentage (100%), and hooves as well as horns had the lowest percentage (19%). Overall shows blood and water waste had the highest rate of 97.4%, while hooves were produced in low amounts (20.5%) as shown in Table 2 below

The result of the Abattoir waste management practices showed that 88.9% of the respondents practiced dumping and discharge into the rivers, and 83.3% practiced open burning in Mgbousmini Abattoir. In Mile 3 Abattoir, the use of dump and discharge in Rivers had the highest percentage of 90.5%, and 38.0% practice the use of dump pit. The overall results indicated that 89.7% of respondents used dumping and discharging into rivers as the primary method for managing abattoir waste. The study showed that landfilling is not practiced in any of the abattoirs. The result of the frequency of waste removal from the Abattoir location showed that 50% cart away the waste once daily, and 50% twice daily for Mgbousmini Abattoir. In Mile 3 Abattoir, 28.6% cart away the waste once a day and 71.4% twice a day. The results of waste treatment before disposal showed that both Abattoirs do not practice waste treatment before disposal (Table 2).

Table 2. Abattoir Activities and Waste Management Practices

Variables	Mgbousimini abattoir Frequency (%)	Mile 3 Abattoir frequency (%)	Overall
No of Animals slaughtered (per day).			
Cows	7-10	5-7	
Goats	-	10-25	
Categories of Waste generated at the study locations			
Bone	30(55.6)	30(47.6)	60(51.2)
Blood	54(100)	60(95.2)	114(97.4)
Animal Feaces	48(88.9)	57(90.4)	105(89.7)
Horns	30(55.6)	12(19.0)	42(35.8)
Wastewater	51(94.4)	63(100)	114(97.4)
Hooves	12(22.2)	12(19.0)	24(20.5)
Abattoir Waste Management Practice.			
Dump pit	18(33.3)	24(38.0)	42(35.8)
Open Burning	45(83.3)	48(76.2)	93(79.4)
Landfill	-	-	-
Discharge in rivers	48(88.9)	57(90.5)	105(89.7)
Frequency of waste removal from the abattoir locations.			
Once Daily	27(50)	45(28.6)	
Twice Daily	27(50)	18(71.4)	

Waste Treatment Before Disposal		
Yes	-	-
No	54(100)	63(100)

PhysicoChemical Characteristics of the Different Soil Samples from the Abattoir Site

Results for the physicochemical properties of selected abattoir soils and their Controls are presented in Table 3. Mgbousmini showed that the highest temperature was recorded in sample C (control) with a value of 30.3^{0}C while the lowest temperature was recorded at sample K (where animals are kept). In Mile 3 Abattoir, the highest temperature was recorded in sample S (where animals are slaughtered) with a value of 30^{0}C °C and the lowest temperature at sample K (where animals are kept) with a value of 28^{0}C. The pH results varied between 7.7 and 8.5, with the highest obtained at the sample point where Bones are stacked. The lowest pH was obtained from sample S (where animals are slaughtered) for Mgbousmini Abattoir. For Mile 3 Abattoir, the highest pH was 8.3 at sample B (where bones are stacked), and the lowest value was 7.7. The result of the analysis for Phosphate for Mgbousmini Abattoir showed the highest Phosphate at sample K (where animals are kept), was 38.0 mg/kg, and the lowest value, 3.7 mg/kg, was obtained in Sample C(control). In Mile 3 Abattoir, the lowest value of Phosphate 2.3 mg/kg was obtained from sample C (control), while the bone stack had the highest value of 38.9 mg/kg. For Nitrate, the result showed that sample S had the highest value of 43.3 mg/kg, and sample C(control) had the lowest value of 5.2 mg/kg for Mgbousmini Abattoir. For Mile 3 Abattoir sample B (where bones are stacked had the highest value of 27.7mg/kg, while the control had the lowest value of Nitrate (7.55). The Total Organic Carbon result showed that for Mgbousmini Abattoir, the highest (4.19) and lowest values (1.40) were obtained from sample B (where bones are stacked) and sample C(control), respectively. In Mile 3 Abattoir, the highest and lowest values were obtained from sample K (where animals are kept) and sample C (control), respectively. The mean physicochemical properties of the abattoir soil sample, as indicated in Table 4, had the highest mean temperature of 30 °C in Mgbousmini and the value of 29±0.82 in Mile 3 Abattoir. A mean pH value of 8.28±0.17 was obtained from Mgbousmini Abattoir, while the pH value of 8.05±0.25 was obtained from Mile 3 Abattoir. The highest mean phosphate was 23.88±14.89mg/kg as obtained in Mgbousmini abattoir, while the lowest value recorded was 19.23±16.18mg/kg obtained in Mile 3 samples. The Mean physicochemical characteristics of soil samples associated with different abattoir activities showed that sample C(control) and sample S (where animals are slaughtered) had the highest mean temperatures, 30.5±2.12 and 30±0.00, respectively, while sample K (where animals are kept) had the lowest value (28.5±0.71). The result showed that sample B (where bones are stacked) had the highest pH (8.40±0.14) and sample K (where animals are kept) had the lowest (7.95±0.35). For phosphate, the highest (31.6±9.05) and lowest (31.6±9.05) values are obtained from sample K (where animals are kept) and sample C(control), respectively. Total organic carbon (TOC) had the highest and lowest mean values of 8.70±9.77 and 0.83±0.81 obtained from sample K (where animals are kept) and sample C(control), respectively (Table 4). Statistical analysis, however, revealed no significant statistical difference ($p > 0.05$) between each point sampled with different abattoir activities.

Table 3. Physicochemical characteristics of soil samples from the different points in the locations studied

Sample code	TEMPERATURE (^{0}C)	pH	Phosphate (mg/kg)	Nitrate (mg/kg)	TOC (%)
Mgboshimini					
C	32	8.3	3.7	5.2	1.40
B	30	8.5	22.4	20.4	4.19
K	29	8.2	38.0	10.5	1.79
S	30	8.1	31.4	43.3	1.44
Mile 3					
C	29	8.1	2.3	7.55	0.26
B	29	8.3	38.9	27.7	5.93
K	28	7.7	25.2	15.3	15.6
S	30	8.1	10.5	13.3	6.05

Table 4. Mean physicochemical characteristics of soil samples from the different locations studied

Sample code	Temperature (°C)	pH	Phosphate (mg/kg)	Nitrate (mg/kg)	TOC (%)
Mgboshimini	30.25±1.26	8.28±0.17	23.88±14.89	19.85±16.85	2.21±1.33
Mile 3	29±0.82	8.05±0.25	19.23±16.18	15.96±8.49	6.96±6.36
P-value	0.1466	0.1895	0.6871	0.6946	0.1938

Table 5: Mean physicochemical characteristics of soil samples associated with different abattoir activities

Sample Code	Temperature (oC)	pH	Phosphate (mg/kg)	Nitrate (mg/kg)	TOC (%)
C	30.5±2.12	8.20±0.14	3.00±0.99	6.38±1.66	0.83±0.81
B	29.5±0.71	8.40±0.14	30.7±11.7	24.1±5.16	5.06±1.23
K	2+8.5±0.71	7.95±0.35	31.6±9.05	12.9±3.39	8.70±9.77
S	30±0.00	8.10±0.00	31.6±9.05	28.3±21.2	3.75±3.26
P-value	0.4587	0.2990	0.1441	0.3129	0.5605

Note. C = Control; B = Area where bones are stacked; K = Area where live animals are kept; S = Area where animals are slaughtered.

4. DISCUSSION

Abattoir Activities and Waste Management Practices

The findings of this study show that the daily slaughter of animal's ranges between 5–10 cows for both Abattoirs and 10- 25 goats for Mile 3 Abattoir only. The variations in slaughter rates between the two abattoirs affect the type and amount of waste generated, directly affecting waste management practices. Similarly, the study conducted by Sabo et al., (2025) in Jigawa State revealed that the daily slaughter of animal's ranges between 26 – 33 cows/camels and 80- 100 goats/sheep, suggesting that the number of animals slaughtered varies according to the season.

In this study, the most common waste types produced at the abattoir sites were bone, wastewater, and blood. The prevalence of animal feces and blood as abattoir waste is consistent with previous findings (Adebowale, 2019; Ogboeli et al., 2025). Additionally, research has shown that bone waste can be processed into animal feed and is frequently sold alongside meat, making it a manageable issue (Daniel et al., 2021). Although slaughterhouse waste contains a lot of potentially dangerous germs for people, it also makes an excellent substrate for the production of biogas (Okafor et al., 2024). This suggests that the numerous wastes produced by butcher shops not only provide a significant challenge to deal with environmental management, but they are also linked to some infectious organisms that may be harmful to humans, depleting air quality, and perhaps transferable patterns of antibiotic resistance (Okereke et al., 2019).

The method of waste disposal variable indicates that the most common methods employed for disposing of waste generated in abattoirs in the study were discharge into Rivers and open burning. This result disagrees with the findings of previous researchers (Mamhobu-Amadi et al., 2019; Ogboeli et al., 2025), who found that open dumping is the major waste disposal method at abattoirs in Nigeria. In a study by Akanni et al., (2019), this unrestricted dumping of abattoir waste resulted in the pollution of the nearby well and stream water, found to contain E. coli and other harmful organisms from animal waste. However, deliberate action towards curtailing open dumping and discharging into Rivers and channeling wastewater to the surrounding would help address environmental hazards and risks associated with the unethical disposal methods. The frequency of waste collection revealed the various responses of participants of the study. From the responses of the respondents, one fifth and one third from Mgbousimini Abattoir and Mile 3 Abattoirs respectively pointed out that waste generated in the abattoirs is collected once daily, while one fifth and one seventh from Mgbousimini and Mile 3 Abattoirs respectively opined that generated waste in the study area are collected twice daily. This agrees with the study of Abdullahi et al., 2023; Fatunsin et al., 2023. The implication of these results thus suggests that waste generated in these abattoirs should be collected on a daily basis. Regarding waste treatment within the two abattoir facilities, the majority stated that there was no provision to get abattoir waste treated. This finding agrees with Akanni et al. (2019), who inferred that almost all the abattoir facilities in Nigeria dispose of their waste on land or streams with or without pretreatment, with grave implications for the aquatic environment. This inaction on abattoir waste treatment was also reported by Bello and Oyedemi (2009).

Physicochemical Properties of different Abattoirs' soil samples

Abattoir activities significantly impact soil physicochemical properties, influencing soil health, microbial activity, and potential environmental pollution. Parameters such as temperature, pH, phosphate, nitrate, and total organic carbon (TOC) are crucial in assessing soil quality and its ability to sustain biological functions. The findings from this study provide insights into how abattoir waste management practices affect soil composition.

The temperature (°C) ranges for the two abattoir soils studied and their Controls were 28°C to 30°C and 29°C to 32°C, respectively. The results also indicate that abattoir soils recorded varied temperatures and were lower than those of their respective Controls. The reasons for the differences in the temperatures among the abattoir soils may be attributed to factors such as variation in the water content of the abattoir soils, soil relief, and cover (Chikwendu et al., 2019). The temperature range for the abattoir soils obtained in this study is lower than (33.60- 35.30)°C, as reported by for abattoir soils from Port Harcourt, Rivers State, but higher than (18.80 – 21.43) °C reported by Adegoke et al. (2021) for abattoir soils from Ayetoro, Ogun State, Nigeria. The temperature range for the Control soils recorded in this work is in agreement with 27.33 – 29.00°C reported by Rabah et al. (2010) for soils from a different part of Southern Nigeria.

The pH values for the two abattoir soils and their Controls recorded in this work were 7.7-8.5 and 8.1-8.3, respectively. This parameter was determined because pH (acidity or alkalinity) plays a great role in determining nutrient availability and the species of microorganism in soil (Daniel et al., 2021; Sawyerr et al., 2019). The results indicated that all the soils (abattoir and Control) studied were alkaline in nature, with their Control soils showing higher alkalinity than the abattoir soils. However, the obtained ranges reported in this work are higher than the 6.22 -7.44 reported by Chukwu & Anuchi, 2016; Rabah et al., 2010) but are consistent with 7.3 to 9.6 obtained by Sawyerr et al. (2019) in abattoir soils, though with slight differences. Also, the observation of higher pH obtained from control soils than from the abattoir soil obtained in this work is in line with the findings of Ayeni et al., (2024). This could be attributed to biodegradable waste materials in the studied abattoir soils, which may lead to reduced anaerobic activities in these soils (Edori & Iyama, 2017). Consequently, the pH of soils impacted by abattoir wastes could be affected considerably. For phosphorus, both abattoir soils recorded higher phosphorus content than the Control soils. This result also agrees with the report of Okwakpam et al., (2022). This could be explained by the higher pH (less acidity) values. The range of phosphorus obtained in this study is consistent with the reported 2.3 – 3.7mgkg-1 by Daniel et al. (2021), though lower than the 0.005-0.007 mg kg-1 reported by Rabah et al. (2010) for abattoir soils obtained from Sokoto State, Nigeria. The findings of both sampled sites recorded higher content of phosphate than the control site. Although the values are within the permissible limit of the World Health Organization limits, if the concentration exceeds the acceptable limits, it restricts the uptake of nitrogen (Oh, Nelson, Hesterberg & Niedziela, 2016). Although phosphorus is needed in soil by plants as a component of the complex nucleic acid structure of plants, it regulates protein synthesis in plants. However, excess phosphorus in soil usually causes plants to mature too rapidly, in addition to reducing Zn, Cu, and Fe availability in soil. Excess phosphorus in soil can become a point source of pollution, because the excess not utilized by plants is washed away by runoffs into ponds, lakes, and rivers.
Though phosphorus promotes plant growth in soils, inadequate phosphorus content, plants will suffer, as the growth of crops will be stunted, leaves may change color to purple, and there will be a delayed time to flowering and development of new shoots (Edori & Iyama, 2017).

Nitrate levels varied significantly, with the highest concentration recorded in slaughtering areas in Mgboshmini. Nitrate levels were considerably higher in locations where bones were stacked and animals were slaughtered compared to control sites. High nitrate levels may be due to contamination from urine, blood, and decomposing animal matter, which are rich in nitrogenous compounds. Elevated soil nitrate concentrations pose environmental risks, particularly groundwater contamination through leaching, which can lead to methemoglobinemia (blue baby syndrome) in infants and increased risks of waterborne diseases (Elemile et al., 2019; Oladipo et al., 2022). Similar findings are reported in studies by (Elemile et al., 2019), who reported excessive nitrate levels in soil and groundwater near abattoirs, suggesting improper waste disposal as a primary cause. High total nitrogen content of the soil enhances microbial proliferation and promotes plant growth (Daniel et al., 2021). Total organic carbon (TOC) results indicated ranges of 6.05 -15.6% for the abattoir soils and 0.26 -1.40% for the Control soils. The Control soils recorded lower TOC than the abattoir soils. This could be a result of higher organic matter levels in abattoir soil. This observation corroborates the reports of Iwu et al. (2022). Results obtained for the studied abattoir soils in this study are lower than 6.1-7.6% reported by Ediene & Iren, (2017) for abattoir soil from Calabar Metropolis, Cross River State, Nigeria, but higher than 12.68-

30.02% reported by Edori & Iyama (2017). The differences in the reported values of total organic carbon and those earlier reported for abattoir soils may be due to the rate of decomposition and composting of animal wastes such as dung, body parts, blood, bones, etc. (Chukwu & Anuchi, 2016; Rabah et al., 2010; Sawyerr et al., 2019). Organic carbon content in soil plays a vital role in soil development, fertility, and moisture availability in soil. The results indicate that abattoir activities significantly alter soil physicochemical properties, with potential negative impacts on the environment.

5. CONCLUSION

The study showed that, there is no proper strategy put in place for the management and treatment of abattoir waste within the study area. The current disposal method utilized in the abattoir were unsatisfactory. The establishment and management of abattoirs and waste management are supposed to be a social service by the various tiers of government in Nigeria especially because of its health implication to the general public.

The physicochemical analysis of soil samples taken from locations near abattoirs showed significant changes in soil properties due to waste accumulation. Elevated levels of phosphate, nitrate, and total organic carbon (TOC) in areas associated with abattoir activities underscore the necessity for improved waste management strategies. These measures are essential to prevent environmental pollution and maintain soil health.

It is therefore important to set up regulatory standards to monitor abattoir activities in order to maintain a healthy environment by promoting good hygienic and safe environmental practices in areas dealing with animal slaughtering and processing.

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