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Perceived Environmental Implication of Abattoir Waste Generation and Management in Akinyele Slaughtering House, Oyo State

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ABSTRACT

Slaughtering of animals results in meat supply and useful by–products like leather and skin, however, livestock waste spills can also cause environmental havoc through contamination of surface and ground waters. Management of wastes in most slaughtering houses poses challenge to their immediate environment. An investigative survey approach was carried out to evaluate the environmental implication of wastes generation and management in Akinyele slaughtering house in Oyo state. Akinyele slaughtering house was purposively selected for the study while thirty copies of structured questionnaire were administered and retrieved among randomly selected slaughtering house worker in the study area. Data obtained was analyzed using descriptive statistics. The survey shows that majority (96.7%) of workers in the slaughtering house were male with those in their active age been 66.7%. Most of them (56.6%)had maximum of primary school education. Not fewer than 60% of the slaughtering house's workers revealed non availability of necessary facilities like sick bay, refuse disposal bay, incinerator and proper drainage. All respondents (100%) agreed that they manually remove waste by scraping with spade or usually sweep and wash the waste into open drainage (93.3%), and without any treatment (86.6%). Study further shows that 56.7% of the respondents agreed that their waste disposal methods constitute a threat to the environment while 50% of the respondents disagreed that the way of disposing waste in their slaughtering house can constitute a barrier to free flow of water as about 48.4% of the respondents disagreed that their unhealthy way of disposing waste can lead to outbreak of disease in the neighborhood. the values of turbidity (5.01± 0.10), P^H (6.48± 0.02), temperature (27.52± 0.8), TSS (0.67± 0.02) and TDS (613.44± 12.34) on Wednesdays were not significantly different from the values obtained on Fridays while the values of dissolved oxygen (DO) 6.30 ± 0.14 and biochemical oxygen demand (BOD) 7.05± 0.25were significantly different on both days. It was however concluded that waste management in the slaughtering house constitute a big threat to the environment and that regular education of the slaughtering house workers is very important and that the relevant bodies should ensure proper disposal of the slaughtering house wastes and that relocation of slaughtering houses from the residential areas should be considered when necessary.

Keywords: Environment, slaughtering house, wastes, management.

Introduction

Meat from ruminants constitutes the major source of protein in the developing countries. With growing nature of the developing nations, the need to meet the ever growing demand for meat comes with its challenging of handling the wastes generated during the slaughtering of livestock. Waste generation at

Nigerian slaughter houses poses a serious threat to the environment because of poor handling practices which result into adverse impact on land, air and water. In a typical Nigerian abattoir, the surrounding land is often marshy due to improper channeling of wastewater arising from the dressing of the slaughtered animals and washings at the Lairage (Omole and Ogbiye, 2013).

Blood constitutes the major dissolved pollutants in abattoir wastewater and has the highest Chemical Oxygen Demand (COD) of any effluent from abattoir operations. If the blood from a single cow carcass is allowed to discharge directly into a sewer line, the effluent load would be equivalent to the total sewage produced by 50 people on average day (Aniebo *et al*., 2009). Whereas the recommended limit of COD in treated wastewater before discharge into surface water bodies is put at 125 mg/L (Environment Canada, EC, 1998), bovine blood and paunch contents are oftentimes washed away without any form of treatment into nearby streams.

According to Longe and Omole, (2008) this constitutes very strong organic load for surface water bodies. The effect of this is the depletion of dissolved oxygen (DO) content of the surface water body and the attendant imbalance and/or loss of aquatic life. Improper management and supervision of abattoir activities remain the major sources of risk to public health in South Western Nigeria as abattoir wastes contain several pathogenic organism (Sangodoyin and Agbawhe, 1992). There is no special waste disposal system or treatment, dung is piled up and waste water containing blood and dung are discharged into a nearby stream without treatment. These result into pollution of surface and underground water especially of the abattoir and residents in the abattoir vicinity. Chukwu *et al.*, (2011) reported also that all the abattoirs they visited use nearby streams and ponds as means of discharging these wastes slurry thereby giving rise to offensive odor, contribute to the organic and nutrients loads of the streams leading to eutrophication. The action was found to be unhygienic, uneconomical and dangerous to human health.

Adeyemi and Adeyemo (2007) reported that waste management at the Bodija abattoir is aesthetically unappealing, environmentally unsustainable and also makes the meat processed and offered for sale unwholesome. This is what is obtainable in most of the slaughtering houses in Nigeria. Chukwu *et al.*, (2011), stated further that little interest has been shown to the effects of wastes from abattoirs to the environment. They further stated that due to low awareness of the effects of abattoirs wastes, it is very common to see people sinking shallow wells close to them.

Nevertheless, while some of these previous works have discussed and analyzed the operational effects of abattoir on different components of the environment differently (Osibanjo and Adie, 2007; Raheem and Morenikeji, 2008; Hunter *et al.*, 2009; Muhirwa *et al.*,, 2010), they have not looked at them in holistic manner in their studies.

There is therefore urgent need to reduce or completely avoid ground water pollution and the associated human health risks in meat slaughtering operations in Nigeria. This study was however carried out to examine the socio-economic characteristics of slaughtering house operators in Akinyele slaughtering house, identified the various waste management practices in the selected abattoir, assess the level of facilities available for animal slaughtering in the study area. The

study also aims at making necessary recommendation for safe slaughtering house waste management.

Methodology

The study was carried out in Ibadan, the capital city of Oyo State, and Nigeria6. It is located on geographic grid reference longitude 3° 54'E, latitude 7° 31'N with a population of over 3 million people (National Census, 2006) and having Federal, State and Local Government participation in meat processing hygiene and inspection. Akinyele, one of the major slaughtering houses in Ibadan was purposively used for this study.

Study population of this study consists of the abattoir operators in the study area. Primary data for the study was obtained using a well-structured questionnaire which was designed for the slaughtering house users to obtain information on available facilities in the slaughtering house, average number of animals killed per day, operation and activities, waste disposal methods employed, and other slaughtering house management issues. Thirty respondents were randomly sampled for this study and investigator collected the questionnaires on the spot to ensure that all questionnaires were properly filled and collected. Data obtained from the questionnaires was analyzed using descriptive statistics.

The second study was conducted where well water samples located within 0-250m radius along each of the two abattoir premises were collected and analyzed for physical and chemical properties which included Temperature, Turbidity, pH, Dissolved oxygen (D.O), Total suspended solid (T.S.S), and Biochemical Oxygen Demand (B.O.D), also the levels of the following metals in the water samples was determined: copper, iron, zinc and lead. In addition to this, total microbial count and identification was done.

A total of three well samples were used as there were only three wells within the range of study. Well water samples were collected in 500ml PVC plastic containers previously cleaned by washing in non-ionic detergent, rinsed with tap water and later soaked in 10% HNO_3 for 24 hours and finally rinsed with deionized water prior to usage. For Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD] testing, samples were collected in 150 ml bottles. During sampling, sample bottles were rinsed with sampled water three times and then filled to the brim. To ensure that changes in sample properties did not occur while in transit to the laboratory, the bottles were placed in a cooler box, and appropriate preservation methods were applied.

The samples were labeled and transported to the laboratory. Samples were collected two times a week (Wednesdays and Fridays) for a period of three weeks. Parameters like temperature and P^H were done on the spot of sample collection. Temperature was measured with the aid of mercury in bulb thermometer while the P^H was measured with a P^H meter. Physico-chemical parameters such as biochemical oxygen demand (BOD), dissolved oxygen (DO), total suspended solids (TSS), were used to determine the water quality and pollution effects from abattoir wastes. All chemical tests were done based on standard methods of American Public Health Association (APHA, 1998). Data collected through the survey were analyzed using descriptive analysis.

Results and discussion

Table 1: Demographic status of slaughtering house operators

Variable	Frequency/ % (n=30)
Age (yrs)	
20-40	20(66.70)
41-60	10(33.30)
Above 60	0.00(0.00)
Gender	
Male	29(96.70)
Female	1(3.30)
Marital status	
Single	0.00(0.00)
Married	30(100.00)
Religion	
Christian	0.00(0.00)
Islam	30(100.00)
Household size	
1-5	12(40.00)
6-10	14(46.70)
11-15	4(13.30)
Educational level	
No formal education	13(43.30)
Primary education	17(56.60)
Secondary education	0.00(0.00)
Adult education	0.00(0.00)

***Percentage in parenthesis.**

Table 1 above revealed that 66.7% of the operators were between the ages of 20-40 years. This result clearly contradicted the non-documented belief that abattoir workers and meat sellers are majorly elderly people. Also 96.7% were males while the remaining 3.3% were females. This was close to the report of Otolorin *et al.*, (2015) who reported 100% abattoir workers to be male. The result shows that this profession is dominated by males, this might not be unconnected with the nature of the job and the general belief that the trade is for men. Result also shows that 56.8% of the respondents had only primary education.

Table 2: Number of cattle slaughtered per day at Akinyele slaughtering house

Number of animals	Frequency (n=30)
60-120	30(100.00)
121-180	0.00(0.00)
181-240	0.00(0.00)
Above 240	0.00(0.00)
Total	30(100.00)

***Percentage in parenthesis.**

Result from table 2 above shows that in Akinyele cattle market, all the respondents (100%) agree that a range 61- 120 cattle are slaughtered per day at the market. This shows that fewer cattle are slaughtered at Akinyele slaughtering house than expected following the reports of Osibanjo and Adie (2007). This result may be subjective as most of the traders usually have fear of disclosing the true picture of their performance for the fear of taxation. This enormous number of cattle being slaughtered daily implies that much waste and waste water are being released into the neighboring environment and may be hazardous to the environment.

Table 3: Available facilities in Akinyele slaughtering house

Variables	Frequency/(%)	
	Yes	No
Water closet	8(26.70)	22(73.30)
Incinerators	5(16.7)	25(83.30)
Refuse disposal bay	4(13.30)	26(86.70)
Lairage	25(83.30)	5(16.7)
Proper drainage	7(23.30)	23(76.7)
Sick bay	19(63.30)	11(36.70)
Slaughter unit	29(96.70)	1(3.30)
Dressing unit	17(56.70)	13(43.30)

***Percentage in parenthesis.**

Table 3 above showed that higher proportion (60%, 85%, 66.7% and 60%) of the respondents submitted that there is no refuse disposal bay, incinerator, proper drainage and sick bay, respectively in the abattoir. This explored the different facilities available in the abattoir and ascertained that there has not been any improvement on the findings of Adetunji and Awosanya (2011) who reported that the state of some abattoirs in Nigeria is such that encourages unsanitary practices as they are usually without modern waste disposal facilities. This condition will present the abattoir operation as a threat to the society despite the service they render.

Table 4: Type of waste generated in the Akinyele slaughtering house

Waste	Frequency n=30	
	Yes	No
Fat	13(43.30)	17(56.70)
Blood	21(70.00)	9(30.00)
Bone	23(76.70)	7(23.30)
Hoof and horns	24(80.00)	6(20.00)
Feacal material	19(63.30)	11(36.70)
Rumen and gut content	24(80.00)	6(20.00)
Foetus	21(70.00)	9(30.00)
Wastewater	23(76.70)	7(23.30)
Slurry liquids	24(80.00)	6(20.00)

***Percentage in parenthesis.**

The result in table 4 above shows wastes generated in the abattoir with the answer 'yes' having the majority. High percentage (> 60%) of the respondents agreed that blood (70.0%), bone (76.7%), hoof and horn (80.0%), feacal material (63.3%), rumen contents (80.0%), foetus (70.0%), wastewater (76.7%) and slurry liquid (80.0%) are parts of the wastes produced in the study area. This result is in agreement with the reports of Itodo and Awulu (1999) who identified all the products mentioned above as waste generated in various abattoirs across the Country. It is important to know that where any of these waste products are poorly managed they constitute great threat to ground water in the immediate environment.

Table 5: Method of waste removal at Akinyele slaughtering house

Method of waste removal	Frequency (%)n=30	
	Yes	No
Manual scraping with spade	30(100)	0(0.00)
Sweeping and washing into open drainage	28(93.3)	2(6.7)
Mechanical scraping	1(3.3)	29(96.7)
Hydraulic flushing	2(6.7)	28(93.3)

***Percentage in parenthesis.**

Table 5 shows that all respondents (100%) agreed that they usually employ manual form of waste removal by scraping with spade with majority (93.3%) usually sweep and wash the waste into open drainage. This is in line with the findings of Adelegan (2002) who reported that animal blood is released untreated into the flowing stream while the consumable parts of the slaughtered animals are washed directly into the flowing water in many developing nations. Result further shows that majority of the respondents (96.7%) agreed that they do not use mechanical scraping and 93.3% confirmed not using hydraulic

flushing. This result thus shows that our abattoir operators are yet to adopt modern method of removing abattoir waste.

Table 6: Method of treating abattoir waste at Akinyele slaughtering house

Waste treatment methods	Frequency (%)n=30
No treatment	26(86.6)
Chemical treatment	4(13.3)
Burning	0(0.0)
Chemical treatment and burning	0(0.0)

***Percentage in parenthesis.**

Since majority of the respondents (86.6%) agreed that they do not treat their wastes (table 6), it implies that most abattoirs in this country do not treat their waste in any way before disposing it off. This agrees with the findings by Omole and Ogbiye (2013) who submitted that most of the operators in abattoir do not have idea of any treatment for wastes before disposal. Dung is piled up and waste water containing blood and dung are discharged into a nearby stream without treatment. This results into pollution of surface and underground water especially of the abattoir and residential area around the abattoir vicinity. Bones and hooves collected in the abattoir are burnt at the abattoir site causing smoke and air pollution in the environment.

Table 7: Disposal of wastes at Akinyele slaughtering house

Disposal methods	Frequency (%)(n=30)
Disposal in the nearby river	23(76.7)
Burning	3(10.0)
Disposal at the dump site	4(13.3)
Total	30(100.0)

***Percentage in parenthesis.**

Table 7 shows that at Akinyele abattoir, majority of the respondents (76.7%) usually dump the waste into nearby river while 13.3% dispose abattoir wastes at the dump site in the abattoir. Dung is piled up and waste water containing blood and dung are discharged into a nearby stream without treatment. This results into pollution of surface and underground water especially of the abattoir and residents in the abattoir vicinity. This result is also in line with previous findings (Weobong, 2001; Adelegan, 2002). These methods of waste disposal are dangerous for the quality of both ground and surface water in the abattoir environment.

Table 8: Perception of slaughtering house workers at Akinyele on waste disposal methods

Items	SA	A	U	D	SD
My waste disposal method constitutes a threat to the environment	13(21.7)	34(56.7)	5(8.5)	7(11.7)	1(1.7)
My waste disposal method is a source of pollution to a nearby well water	7(11.7)	5(8.5)	10(16.7)	29(48.3)	9(15)
My waste disposal method is a source	10(16.7)	5(8.5)	14(23.3)	28(46.7)	3(5.0)

of pollution to play grounds in the neighborhood					
My waste disposal method constitutes a barrier to the free flow of water in nearby stream	8(13.3)	7(11.7)	8(13.3)	30(50.0)	7(11.7)
My waste disposal method can lead to outbreak of disease in the neighborhood	15(25)	10(16.7)	6(10)	18(30)	11(18.4)

***Percentage in parenthesis.**

KEY: SA- Strongly agree A-Agree U-Undecided D- Disagree SD-Strongly disagree

Table 8 shows that 56.7% of total respondents agreed that their waste disposal methods constitute a threat to the environment while 50% of the total respondents disagreed that the way of disposing waste in their abattoirs can constitute a barrier to free flow of water. In addition, 48.4% of the respondents disagreed that their unhealthy way of disposing slaughtering house waste can lead to outbreak of disease in the neighborhood. This is in agreement with the discovery of Umubyeyi (2008) who studied environmental impact of abattoirs on water bodies in Kigali city. When this result is closely examined, it was discovered that majority of the respondents' responses may not be unconnected with the fact that most of them have low level of education and hence, may not fully appreciate the consequence of improper waste disposal habits on the immediate environment.

Table 9: Constraint to waste utilization in Akinyele slaughtering House

Constraint	Frequency (%) n=30	
	Yes	No
Lack of utilization skill	26(86.7)	4(13.3)
Irritation and labor scarcity	26(86.7)	4(13.3)
Lack of vehicle and transportation cost	22(73.3)	8(26.7)
Difficulty to burn during rainy season	17(56.7)	13(43.3)
High cost of pit and chemical	9(30)	21(70)

***Percentage in parenthesis.**

Table 9 shows that no fewer than 73.3% of the total respondents identified lack of knowledge and skill required as well as transportation cost as a constraint to waste utilization but 86.7% opined irritation and labor scarcity are part of the constraint responsible for their inability to utilize waste. Omole and Ogbiye (2013) submitted that most of the operators in abattoir do not have knowledge of any treatment or usage for wastes before disposal. However, 56.7% identified difficulty to burn the waste during rainy season as major constraints. Meanwhile, only 30% identified high cost of pit and

chemicals as constraints. The implication of this result is that inability to utilize waste is the reason abattoir waste is poorly managed in this part of the world.

Table 10: Effect of abattoir operation on a particular day of the week on the utility water of the residents around Akinyele Slaughtering house

Values and constituents	Wednesdays	Fridays
P^H range	6.48± 0.02	6.52± 0.02
Temp(^{0}C)	27.52± 0.8	27.70± 0.8
TDS (mg/l)	613.44± 12.34	527.89± 12.34
TSS(mg/l)	0.67± 0.02	0.61± 0.02
Turbidity(mg/l)	5.01± 0.10	4.57± 0.10
DO(mg/l)	6.30 ± 0.14^a	4.25 ± 0.14^b
BOD(mg/l)	7.05 ± 0.25^a	2.30 ± 0.25^b
Cu(ppm)	0.00± 0	0.00± 0
Fe(ppm)	0.031± 0.01	0.016± 0.01
Zn(ppm)	0.86± 0.02	0.83± 0.02
Pb(ppm)	0.00± 0	0.00± 0
Total aerobic count(cfu/ml)	2.8×10^{6a}	1.4×10^{6b}
Total coliform count(cfu/ml)	1.1×10^{6a}	3.7×10^{4b}

Mean with the same superscript on the same row are not significantly different.
TSS= Total Soluble Solid, TDS = Total Dissolvable Solid

The result from table 10 shows that the values of turbidity (5.01± 0.10), P^H (6.48± 0.02), temperature (27.52± 0.8), TSS (0.67± 0.02) and TDS (613.44± 12.34) on Wednesdays were not significantly different from the values obtained on Fridays while the values of dissolved oxygen (DO) 6.30 ± 0.14 and biochemical oxygen demand (BOD) 7.05± 0.25were significantly different on both days. The implication of this result is that the dissolved oxygen content and biochemical oxygen demand (BOD) which both have to do with the quality of the water have higher values on Wednesday as compared with Friday. Since BOD indicates the amount of putrescible organic matter present in water, it implies that the level of pollution on Wednesdays is higher than that of Fridays. This might make the cost of treating such water to be higher. Also, it may also mean and implies that less oxygen is available for aquatic life in the water on Wednesdays as compared with Fridays for the number of water bodies sampled. This is in line with the report of Umubyeyi, (2008) who reported Lower DO usually after the effluent is discharged into the water.

Conclusion and Recommendations

The results of this study shows that the workers as well as the residents around Akinyele slaughtering house are under threat if the present habit of discharging untreated slaughtering house wastes continues. Residents living in slaughtering house vicinity may in no distant time begin to experience severe consequences of pollutants from abattoir activities located in their neighborhood.

In view of the fact that the slaughtering house is located in the heart of the town and that the discharge of untreated abattoir wastes may continue unabated, ensuring that health of the

dwellers around the slaughtering house is guaranteed will necessitate that the management body of the abattoir enforce adequate environmental protection laws in the slaughtering house. Immediate steps is however necessary to put in place machinery that will enable treatment of the abattoir wastes before they are disposed while alternative uses of the slaughtering house wastes such as in biogas should be encouraged. Furthermore, public awareness and enlightenment on possible effect of pollution from slaughtering house wastes should be made on regular basis by relevant agencies.

Above all, Portable water should be provided for the slaughtering house operators and the dwellers around the slaughtering house while efforts should be made to commence activity towards the relocation of the abattoir to location away from residential areas.

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