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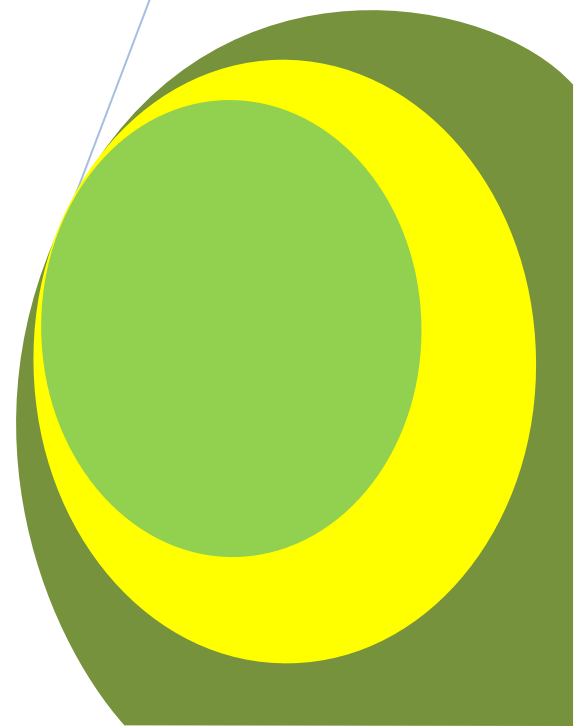
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Environmental Implications of Abattoir Waste Generation and Management in Developing Countries: The Case of Lagos State Abattoir in Agege, Nigeria

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Environmental Implications of Abattoir Waste Generation and Management in Developing Countries: The Case of Lagos State Abattoir in Agege, Nigeria

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ABSTRACT

This study aims at determining the effects of Lagos State Abattoir in Oko-Oba, Agege with consideration to its proximity to the surrounding environment in the study area. The studied jurisdiction of the abattoir was carved out and stratified into four (4) different strata using ArcView 3.2 at an average radius of 0.8 kilometres (800 metres) to the abattoir, with intervals of 200 metres. For the administration of questionnaire, 213 copies of questionnaires were successfully recovered with 51 in the first stratum, 57 in the second, 60 in the third and 45 in the last stratum and thus used in the analysis for this study. The study revealed that the abattoir has polluting effects on its environment and consequently capable of generating negative health effects on its surrounding residents. Also, it is established that the farther the location of the residences to the abattoir, the lesser the degree of the environmental effects of the abattoir and possibly the health effects on the residents and vice-versa. Based on this, the study recommends, among others, adequate provision of necessary facilities for effective waste disposal in the abattoir and control of residential building development close to the abattoir.

Keywords: Waste generation, waste management, Abattoir, Lagos

INTRODUCTION

Urban environment attracts various developmental activities to cater for its incessantly growing population, especially in developing countries. These activities (industries, construction, farming, agricultural processing and manufacturing, among others), in conjunction with their benefits, have negative effects on the urban environment. Of particular concern is animal rearing and processing, an aspect of food consumption and protein supplication. Adeyemo (2002) noted that urbanisation is associated with changes in food consumption pattern and serves as a major driving force influencing the global demand for livestock product. Productions of these livestock for consumption are normally from abattoirs; significant contributors to the deterioration of urban environment (Meadows, 1995).

Abattoirs have been described as premises approved and registered by the controlling authority for inspection and hygienic slaughtering of animals, processing, preservation and storage of meat products for human consumption (Alonge, 1991). Therefore, they are needed primarily to serve the increasing large-scale demand for meat in urban areas. As a result, the production of meat and by-products like leather and skin is associated with livestock waste spills which can be detrimental to humans and the environment if definite precautions are not taken (WHO, 1981). Studies have shown that abattoirs are sources of pollution as they are characterised with highly organic solid and liquid wastes and fat (Alonge, 1991; Adeyemo, 2002; Osibanjo and Adie, 2007). And while the slaughtering of animals results in meat supply and useful by-products like leather and skin, studies have also shown that livestock waste spills can also cause environmental havoc through contamination of air and also surface and ground waters (Meadows, 1995; World Bank, 1998; UNEP, 2000; WRRRC, 2004).

According to UNEP (2000), the environmental effects of abattoir come through abattoir operation and waste disposal. The processes of the operation include bleeding, dressing, hide removal, evisceration or removal of internal organs, carcasses, cutting and boning. All these operations have great potential to generate large quantities of solid wastes and wastewater with a biochemical oxygen demand (BOD) and in many cases; offensive odour occurs (World Bank, 1998). Also, blood, manure, hair, fat, bones and undigested stomach content are among the effluents that are common and peculiar to abattoirs (WRRRC, 2004); their potential to carry diseases has made UNEP (2000) regarded them as industrial wastes.

Pollution arises from activities in meat production as a result of failure in adhering to Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP) (Akinro *et al.*, 2009). Consideration is hardly given to safety practices during animal transport to the abattoir, during slaughter and during dressing (Aniebo *et al.*, 2009; Singh and Neelam, 2011). The poor condition of the abattoir emanates from wastes generated from slaughtering and dressing grounds. They are washed into open drainages or nearby streams untreated and the leach away from the series of decomposition processes of these wastes can introduce enteric pathogens and excess nutrients into surface waters and also percolate into the underlying aquifers to contaminate hand-dug wells (Abiola, 1995; Gauri, 2006; Chukwu, 2008; Bello and Oyedemi, 2009; Adeyemo *et al.*, 2009); especially due to the recalcitrant nature of some contaminants; constituting environmental hazards (Muhirwa *et al.*, 2010; Osemwota, 2010).

The Nigerian livestock industry is not also free from polluting the environment. Abattoirs are littered with non-meat products and wastes that need to be recycled into useful by-products for further agricultural and other industrial uses (Osibanjo and Adie, 2007). Many abattoirs dispose of their effluents directly into streams and rivers without any form of treatment and the slaughtered meat is washed by the same water. According to Chukwu *et al.* (2011), 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, it is very common to see people sinking shallow wells close to them. These shallow wells would draw contaminated water from the surrounding aquifer especially if the radius of influence of the well spans into the abattoir ground (Singh and Neelam, 2011).

Nevertheless, while some of these previous works have discussed and analysed the operational effects of abattoir on different components of the environment such as surface water, ground water and air 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. Likewise, some others with holistic view of the effects of abattoir influent on environment (Akinro *et al.*, 2009; Chukwu *et al.*, 2011; Singh and Neelam, 2011) have not examined the spatial variation of the effects. This spatial variation is based on the proximity of the abattoir to the adjoining land uses. Since abattoirs or slaughterhouses are usually located not far from urban centres to satisfy the yearnings of urban residents for consumption of animal products, their total isolation from other urban land uses is deniable. Therefore, their environmental effects should be studied in relation to their proximity to other urban land uses, especially, the residential areas. Hence, this study aims at determining the environmental effects of Lagos State Abattoir in Oko-Oba, Agege with consideration to its proximity to the surrounding areas in the study area.

MATERIALS AND METHODS

The study area comprises the Lagos State abattoir Oko-Oba and its surrounding area in Agege township. Agege township consists of the whole of Agege and a part of Ifako-Ijaye local government areas in Lagos State. The studied jurisdiction of the abattoir was carved out of the two aforementioned local governments. As such, the surrounding area in the two local governments at an average radius of 0.8 kilometres (800 metres) to the abattoir is considered as the study area. Therefore, the study area includes the abattoir itself and the demarcated studied sphere of influence. The land area housing the abattoir is approximately 11 hectares (Uhakheme, 2006). On this large expanse of land are various buildings and facilities used in the abattoir. These include the administrative building, engineers' offices and workshops, lairages (for cattle assembly), cattle plants (for meat processing), open floor slab and water reservoir. Based on these facilities, the abattoir has the capacity to slaughter and process 1, 600 cattle in 12 hours. It is backed with 2.5 million litres of water, four boreholes, central boiler, chlorine dousing and water treatment system. It also has three generating sets, a chilling room and refrigerated freezers with 1, 600 tonnes capacity (Uhakheme, 2006).

For the purpose of this research, the study area was stratified into four (4) different strata. Using ArcView 3.2, the image of the area was carved out from Google Earth Map and imported to GIS environment. This was further processed for digitisation and stratification to different strata as required by the study (Figure 1). The first stratum comprised the areas below 200m to the abattoir, the second were areas within 200m – 400m from the abattoir, the third stratum consisted of areas within 400m – 600m and the fourth were areas within 600m – 800m from the abattoir.

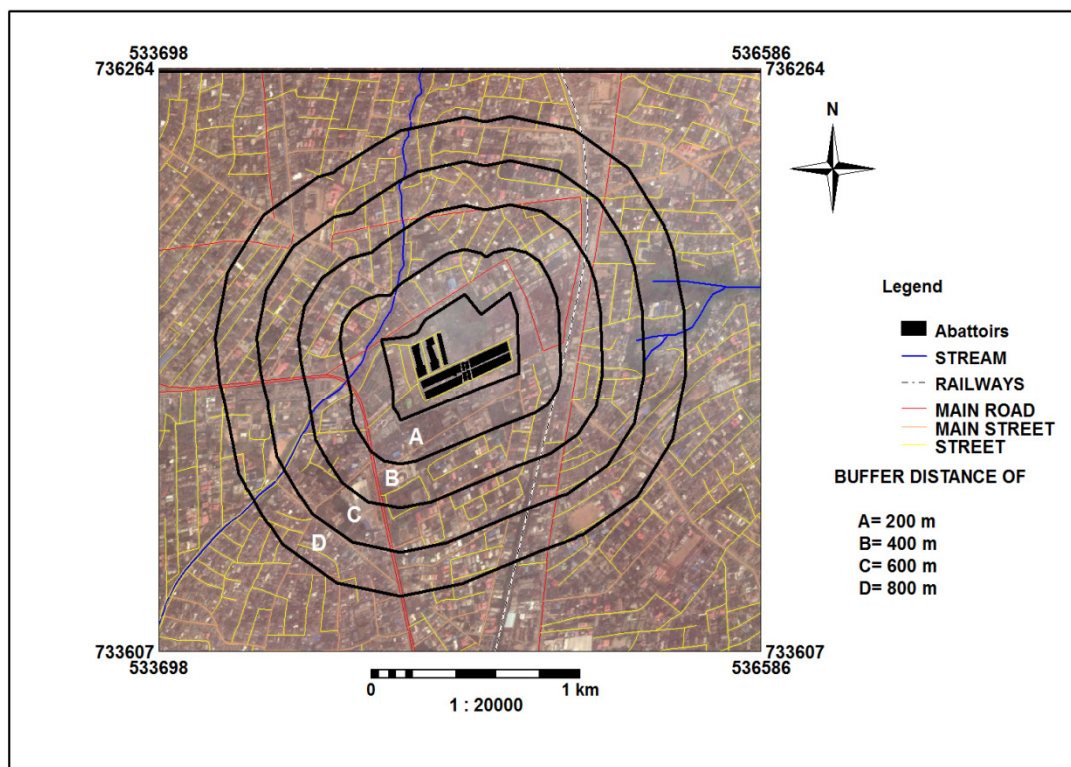


Figure 1: Map Showing Lagos State Abattoir

Source: Google Earth Map 2013

Data for this study were from two sources – primary and secondary. Primary data were sourced from the conduct of oral interview by the researcher and administration of questionnaires. The oral interview was conducted with workers and management of the abattoir, the sellers in and the patrons to the abattoir. Information sourced from these sources was on management of the abattoir and the perception of the sellers and the patrons, including the view of the surrounding residents as regards the environmental condition of the abattoir. Questionnaires were administered on the surrounding residents on their socio-economic characteristics and environmental conditions. The environmental conditions considered for this study is limited to prevalence of insects and rodents, insecticides usage, pollution and time of pollution occurrence. A total number of identified inhabited housing units within the radius of 800 metres to the abattoir were 2, 346 and this form the sample frame for the study. This total comprised 556 houses in the first stratum, 632 in the second, 657 in the third while 501 houses were in the last stratum. The sample size was determined by administering questionnaire on a resident in every 10th building using systematic sampling method. However, out of the 234 copies of questionnaires administered, 213 were recovered and thus used in the analysis for this study. The recovered copies of questionnaire were 51 in in the first stratum, 57 in the second, 60 in the third and 45 in the last stratum.

RESULTS AND DISCUSSION

Socioeconomic Attributes of Residents

The study revealed, as shown in Table 1, that male residents accounted for 60.6% of the total, 91.5% of the residents were aged 50 years and below while 62.4% of them were married have been married before the survey. Further enquiries into the socioeconomic attributes of the residents showed that some of them had secondary education (36.6%) and 57.7 had tertiary education. All these socioeconomic attributes indicated that the residents were capable of giving reliable information on the subject of study.

Table 1: Socioeconomic Attributes of Residents

Variable	Frequency	Percentage	Variable	Frequency	Percentage
Gender Distribution			Average Monthly Income (in Naira)		
Male	129	60.6	Below 10 000	18	8.5
Female	84	39.4	10 000-19000	47	22.1
Total	213	100.0	20 000-29 000	61	28.6
Age Distribution (in years)			31 000-39 000	45	21.1
Below 20	36	16.9	40 000-49 000	24	11.3
20-29	48	22.5	50 000 & above	18	8.5
30-39	69	32.4	Total	213	100.0
40-49	42	19.7	Years Lived in the Area		
50 & above	18	8.5	1-3	64	30.0
Total	213	100.0	4-6	57	26.8
Marital Status			7-9	35	16.4
Single	80	37.6	10-12	27	12.7
Married	94	44.1	Above 12	30	14.1
Widowed/Divorced	39	18.3	Total	213	100.0
Total	213	100.0	Household Size		
Educational Qualification			1-3	67	31.5
Primary	12	5.6	4-6	65	30.5
Secondary	78	36.6	7-9	54	25.3
Tertiary	123	57.7	10-12	27	12.7
Total	213	100.0	Total	213	100.0

Source: Authors' Fieldwork

Specifically, two socioeconomic variables (level of education and income) were examined based on the varying distance of residences to the abattoir. This is because these two variables largely determine the choice of residence of an individual. As presented in Table 2, the focus is on row percentage in order to know specifically the percentages of the residents according to their level of education across the strata. It is discovered that as distance increases from the abattoir there is increase in the educational level of the residents. For instance, it is shown that out of 51 respondents within less than 200 metres to the abattoir, 35.3% had tertiary education, it increased to 47.4% in the second stratum with another increase to 75% in the third and fourth strata. The Chi-square results in this respect ($\chi=44.655$, $p=0.000$) indicate that there is significant relationship between educational levels of the respondents and the distance of their residences to the abattoir. In the same vein, for average monthly income of the residents, it is shown in Table 3 that variation existed in the income of residents across the strata. The Chi-square results ($\chi=24.244$, $p=0.019$) indicate that there is significant relationship between educational levels of the respondents and the distance of their residences to the abattoir.

Table 2: Distance to the Abattoir and Educational Levels of Residents

Distance to the Abattoir	Educational Level of Residents			Total
	Primary	Secondary	Tertiary	
< 200m	0 (.0)	33 (64.7)	18(35.3)	51(100.0)
200-400m	9 (15.8)	21 (36.8)	27(47.4)	57 (100.0)
401-600m	3(5.0)	12(20.0)	45(75.0)	60(100.0)
601-800m	0(.0)	12(26.7)	33(73.3)	45(100.0)
Total	12(5.6)	78(36.6)	123(57.8)	213(100.0)

Source: Authors' Fieldwork

Table 3: Distance to the Abattoir and Average Income of Residents

Distance to the Abattoir	Average Income of Residents (in Naira)				Total
	20 000 & below	21 000-40 000	41 000-60 000	Above 60	
< 200m	17(33.4)	25(49.0)	6(11.8)	3(5.3)	51(100.0)
200-400m	20(35.1)	28(49.1)	3(5.3)	6(11.8)	57(100.0)
401-600m	16(26.7)	35(58.3)	6(10.0)	3(5.3)	60(100.0)
601-800m	12(26.6)	18(40.03)	9(20.0)	6(13.3)	45(100.0)
Total	65(30.5)	106(49.7)	24(11.3)	18(8.5)	213(100.0)

Source: Authors' Fieldwork

Environmental Effects of the Abattoir

Findings on the environmental effects of the abattoir revealed that variation also existed across the strata. From the literature, an environmental effect of abattoir on the surrounding residences is the prevalence of insects and rodents. As shown in Table 4, the prevalence flies, cockroaches, mosquitos and rats was considered for this study. The prevalence was dichotomised into 'few' and 'many' in each case based on distance segmentation. It was discovered that there was a decrease in the rate of prevalence with increase in the distance of the abattoir to the residence of the people. This is further established by the Chi-square results (flies: $\chi=98.330$, $p=0.000$; cockroaches: $\chi=30.960$, $p=0.000$; mosquitos: $\chi=70.488$, $p=0.000$; and rats: $\chi=27.855$, $p=0.001$) establishing that there is a significant relationship between levels of prevalence and distance from the residences to the abattoir.

Table 4: Prevalence of Insects and Rodents

Distance to Abattoir	Prevalence of Insects and Rodents							
	Flies		Cockroaches		Rats		Mosquitos	
	Few	Many	Few	Many	Few	Many	Few	Many
<200m	36(16.9)	15(7.0)	42(19.7)	9(4.2)	17(8.0)	34(16.0)	48(22.5)	3(1.4)
200-400m	51(23.9)	6(2.8)	45(21.1)	12(5.6)	39(18.3)	18(8.5)	54(25.4)	3(1.4)
401-600m	60(28.2)	-	60(28.2)	-	48(22.5)	12(5.6)	48(22.5)	12(5.6)
601-800m	45(21.1)	-	45(21.1)	-	37(17.4)	8(3.7)	45(21.1)	-
Total	192(90.1)	21(9.9)	192(90.1)	21(9.9)	141(66.2)	72(33.8)	195(91.5)	18(8.5)

Source: Authors' Fieldwork

In complement of the findings on prevalence of insects and rodents in the abattoir, are findings on rates of insecticides usage by respondents across the strata in the study area (Table 5). It was discovered that the need to use insecticides by the residents increases with nearness or reduction in the distance of their residences to the abattoir. This is because significant proportion of the residents living close to the abattoir occasionally and regularly used insecticide while those living farther rarely used insecticides. Results of Chi-square test results ($\chi=24.455$, $p=0.018$) show that there is a significant relationship between distance of residence to the abattoir and rate of insecticides usage.

Table 5: Distance to the Abattoir and Rate of Using Insecticides

Distance to the Abattoir	Rate of Using Insecticides				Total
	Never	Rarely	Occasionally	Regularly	
< 200m	0(.0)	6(11.8)	30(58.8)	15(29.4)	51(100.0)
200-400m	3(5.3)	15(26.3)	30(52.6)	9(15.8)	57(100.0)
401-600m	0(.0)	12(20.0)	36(60.0)	12(20.0)	60(100.0)
601-800m	0(.0)	15(33.3)	24(53.3)	6(16.7)	45(100.0)
Total	3(1.4)	48(22.5)	120(56.3)	42(19.7)	213(100.0)

Source: Authors' Fieldwork

Findings on the noticed form of pollution across the strata revealed that almost all the residents within 200 metres (82.4%) to the abattoir experienced noise, bad odour, smoke and water pollution as a result of the operations of the abattoir (see Table 6). The level of this experience also reduced with increase in distance to the abattoir. This is further confirmed by Chi-square test results ($\chi=141.451$, $p=0.000$) indicating that there is a significant difference in the polluting effects of the abattoir across the defined strata in the study area.

Table 6: Distance to the Abattoir and Noticed Form of Pollution

Distance to the Abattoir	Noticed Form of Pollution					Total
	Noise	Bad odour	Smoke	Polluted water	All the above	
< 200m	0(.0)	0(.0)	9(17.6)	0(.0)	42(82.4)	51(100.0)
200-400m	3(5.3)	15(26.3)	3(5.3)	12(21.1)	24(42.1)	57(100.0)
401-600m	0(.0)	9(15.0)	0(.0)	27(45.0)	24(40.0)	60(100.0)
601-800m	0(.0)	16(35.64)	2(4.4)	24(53.3)	3(6.7)	45(100.0)
Total	3(1.4)	40(18.8)	14(6.6)	63(29.6)	93(43.7)	213(100.0)

Source: Authors' Fieldwork

In the same vein is the time when pollution is observed in the area as contained in Table 7. For the residents residing within the distance of less than 200 metres and those within 201 metres to 400 metres, it was discovered that 88.2% and 89.5% of them experienced pollution all the time. However, with increase in distance to the abattoir, the time varies with the residents either experiencing pollution in the morning, afternoon, evening or night. The Chi-square test results ($\chi=117.600$, $p=0.000$) supports this and that indicates that with varying distance of residences to the abattoir, there was variation in the time that the residents experienced pollution.

Table 7: Distance to the Abattoir and Time when Pollution is Observable

Distance to the Abattoir	Time when Pollution is Observable					Total
	Morning	Afternoon	Evening	Night	All the above	
< 200m	0(.0)	0(.0)	6(11.8)	0(.0)	45(88.2)	51(100.0)
200-400m	0(.0)	0(.0)	4(7.0)	2(3.5)	51(89.5)	57(100.0)
401-600m	11(18.3)	1(1.7)	5(8.3)	4(6.7)	39(65.0)	60(100.0)
601-800m	3(6.7)	9(20.0)	13(28.9)	11(24.4)	9(20.0)	45(100.0)
Total	6.6%	4.7%	13.1%	8.0%	67.6%	213(100.0)

Source: Authors' Fieldwork

CONCLUSION AND RECOMMENDATIONS

This study has assessed the environmental effects of Lagos State Abattoir in Oko-Oba, Agege, Lagos State. It is revealed that the abattoir has polluting effects on its environment and consequently capable of generating negative health effects on its surrounding residents in Agege, Lagos State. Nevertheless, the study has established it that the effects vary based on the distance of their residences to the abattoir. That is, the farther the location of the residences to the abattoir, the lesser the degree of the environmental effects of the abattoir and possibly the health effects on the residents and vice-versa. Thus, to make sure that a pleasant environment is ensured in the area and that good health condition of people living near the abattoir is guaranteed, the following recommendations are made:

- The Lagos State and Agege Local Governments, as the owner of the abattoir, should ensure adequate provision of necessary facilities for effective operation of the abattoir and to ensure good disposal of wastes generated in the abattoir;
- Residential building development in the premises of the abattoir or close to its should be highly discouraged as the health of the occupants of the buildings is at risk;
- The various enacted laws on the operation of abattoirs in Lagos State should be adequately enforced without fear or favour and without upholding personal interest of the enforcement agents but the interest of the people by ensuring the public health;
- There should be proper public enlightenment, orientation and re-orientation of the sellers in the abattoir for them to know that the responsibilities for the promotion, protection and maintenance of their health rest on them through the activities of effective environmental management and sanitation;
- The management body of the abattoir should see to adequate environmental protection in the surroundings of the abattoir through effective management of wastes being generated from it.

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