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Effects of Abattoir Waste Management Practices on Environmental Quality and Implications for Health Service Delivery in Kwara State, Nigeria

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Abstract

Background: Poor waste management practices in abattoirs pose significant environmental and public health risks, particularly in low- and middle-income countries. These risks may increase the burden of communicable diseases and place additional pressure on already constrained health systems. This study assessed waste management practices at Owode Market Abattoir and examined their implications for environmental quality and health service delivery in Offa, Kwara State, Nigeria.

Methods: A descriptive cross-sectional study was conducted among 120 respondents, including butchers, abattoir workers, waste handlers, and nearby residents. Data were collected using structured questionnaires and an observation checklist. Descriptive statistics were used to summarize waste management practices and perceived environmental health impacts. Associations between waste practices and environmental outcomes were explored using chi-square analysis at a significance level of $p < 0.05$.

Results: The majority of respondents reported unsafe waste disposal practices, including direct discharge of effluents into water bodies (53.3%) and open dumping (45.8%). Solid waste was the most commonly generated waste type (54.1%), followed by liquid waste (32.0%). Water pollution was identified as the predominant environmental impact (59.2%). Limited availability of waste treatment facilities and weak enforcement of environmental regulations were key contributing factors. Respondents also reported increased occurrence of sanitation-related illnesses and greater reliance on local health facilities.

Conclusion: Inadequate abattoir waste management practices contribute significantly to environmental degradation and may increase the burden on local health services. Strengthening regulatory enforcement, improving waste management infrastructure, and integrating environmental health interventions into primary healthcare systems are essential for reducing disease risk and improving health outcomes.

Introduction

Abattoirs play a critical role in food systems by ensuring the supply of meat for human consumption and supporting local economies. However, their operations generate substantial quantities of waste, including blood, wastewater, animal tissues, and solid residues. When inadequately managed, these wastes pose serious environmental and public health risks, particularly in low- and middle-income countries where regulatory enforcement and waste treatment infrastructure are often limited [1].

Poor abattoir waste management has been widely associated with environmental contamination of water bodies, soil, and air. Untreated effluents discharged into drainage systems or nearby rivers can introduce pathogenic microorganisms and toxic substances into the environment, increasing the risk of waterborne and foodborne diseases such as cholera, typhoid fever, and gastroenteritis [2–4]. In addition,

improper disposal of organic waste creates favorable conditions for vectors such as flies and rodents, further facilitating the transmission of infectious diseases within surrounding communities [5].

Beyond environmental contamination, the public health implications of poor abattoir sanitation extend to increased demand for healthcare services. Exposure to contaminated water, poor sanitation, and unhygienic environmental conditions can lead to a higher incidence of diarrheal diseases, respiratory infections, and skin conditions. These health outcomes contribute to increased healthcare utilization, higher treatment costs, and additional strain on already resource-constrained health systems in developing settings [6, 7].

In Nigeria, rapid urbanization and growing demand for animal protein have led to the expansion of slaughterhouse activities, often without corresponding improvements in waste management infrastructure. Several studies have reported that abattoir wastes are frequently discharged untreated into open drains and surrounding environments, contributing to environmental degradation and adverse health outcomes [8–10]. Despite existing environmental sanitation policies, enforcement remains weak, and many abattoirs operate without adequate waste treatment facilities or monitoring mechanisms [11].

From a health services perspective, environmental risk factors such as poor sanitation and waste mismanagement are important determinants of disease burden and healthcare demand. The resulting increase in preventable illnesses places additional pressure on primary healthcare systems, particularly in semi-urban and rural areas where resources are limited [7, 12]. Integrating environmental health interventions into health service planning is therefore essential for reducing disease incidence and improving overall health system efficiency.

Although previous studies have documented the environmental impacts of abattoir waste in various parts of Nigeria, there is limited evidence linking these practices to health service implications at the community level, particularly in semi-urban settings such as Offa in Kwara State. Understanding this relationship is important for informing policy decisions, improving environmental health practices, and strengthening healthcare delivery systems.

Therefore, this study aimed to assess waste management practices at Owode Market Abattoir and examine their effects on environmental quality and implications for health service delivery in Offa, Kwara State, Nigeria. The findings are expected to provide evidence to support improved environmental sanitation policies, targeted public health interventions, and more efficient allocation of healthcare resources.

Methods

Study Design

This study employed a descriptive cross-sectional design to assess abattoir waste management practices and their effects on environmental quality, as well as their implications for health service

delivery in Offa, Kwara State, Nigeria.

Study Area

The study was conducted at Owode Market Abattoir located in Offa Local Government Area of Kwara State, Nigeria. Offa is a semi-urban community characterized by active commercial activities, including livestock trading and meat processing. The abattoir serves as a major slaughter facility for surrounding communities and generates considerable quantities of solid and liquid waste. Its proximity to residential settlements and drainage channels makes it an appropriate setting for evaluating environmental contamination and associated public health risks.

Study Population

The study population comprised individuals who were directly or indirectly exposed to abattoir activities. These included butchers, abattoir workers, waste handlers, sanitation workers, and residents living in close proximity to the abattoir. These groups were considered appropriate for the study because of their increased likelihood of exposure to environmental hazards associated with abattoir waste.

Sample Size Determination

The sample size for the study was determined using the Yamane formula for finite populations, expressed as:

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[
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$$
n = \frac{N}{1 + N(e)^2}
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]
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where n represents the required sample size, N denotes the estimated population size, and e represents the margin of error, set at 0.05. Based on an estimated population of 170 individuals across the identified study groups, a minimum sample size of 119 was obtained. This value was rounded up to 120 respondents to improve adequacy and account for possible non-response.

Sampling Technique

A combination of purposive and simple random sampling techniques was employed in selecting study participants. Purposive sampling was used to identify individuals directly involved in abattoir operations, such as butchers, abattoir workers, and waste handlers, due to their relevance to waste generation and

management practices. Subsequently, simple random sampling was applied to select residents living near the abattoir in order to reduce selection bias and enhance the representativeness of the sample.

Data Collection Instruments and Procedure

A structured questionnaire was developed specifically for this study by the researchers based on a review of relevant literature on abattoir waste management practices, environmental health risks, and public health implications. The questionnaire was reviewed by experts in environmental health/public health for content validity. The English-language version of the questionnaire used for data collection is provided as Supplementary File 1. In addition, an observation checklist was used to assess on-site environmental conditions, including waste storage practices, drainage systems, presence of waste treatment facilities, and overall environmental cleanliness. Direct observation enabled verification of reported practices and provided complementary data to the questionnaire responses.

Validity and Reliability of Instruments

Content validity of the questionnaire was established through expert review by professionals in environmental health and public health. A pilot study was conducted among 15 respondents in a similar setting outside the study area to assess clarity, consistency, and reliability of the instrument. Feedback obtained from the pilot study informed necessary revisions prior to the main data collection.

Operational Definitions

For the purpose of this study, poor waste management practices were defined as unsafe disposal methods such as open dumping, direct discharge of untreated effluents into water bodies, and absence of waste segregation. Environmental health impact referred to observable or reported effects including water pollution, soil contamination, air pollution, and odor nuisance. Health service implication was defined as increased occurrence of sanitation-related illnesses and reported utilization of healthcare services among affected populations.

Data Analysis

Data collected were coded and entered into the Statistical Package for the Social Sciences (SPSS) version 25 for analysis. Descriptive statistics, including frequencies and percentages, were used to summarize the data. Inferential analysis was conducted using the chi-square test to examine associations between waste management practices and environmental health outcomes. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval for the study was obtained from the Nigerian Navy College of Health Sciences Research Ethics Committee. Permission was also obtained from the management of Owode Market Abattoir prior to data collection. Participation was voluntary, and informed consent was obtained from all respondents.

Confidentiality and anonymity were strictly maintained, and participants were informed of their right to withdraw from the study at any stage without any consequences.

Results

Response Rate

A total of 120 questionnaires were administered and all were successfully completed and returned, resulting in a response rate of 100%. This high response rate enhances the reliability and representativeness of the study findings.

Socio-Demographic Characteristics of Respondents

Table 1 presents the socio-demographic characteristics of respondents involved in the study.

Table 1
Socio-Demographic Characteristics of Respondents (N = 120)

Variable	Category	Frequency (n)	Percentage (%)
Sex	Male	65	54.2
	Female	55	45.8
Age Group	21–35 years	94	78.3
	36–50 years	14	11.7
	Above 50 years	12	10.0
Marital Status	Single	77	64.2
	Married	35	29.2
	Divorced	4	3.3
	Widowed	4	3.3
Educational Level	No formal education	5	4.2
	Primary education	5	4.2
	Secondary education	56	46.7
	Tertiary education	54	45.0

Narrative Description

The socio-demographic characteristics of the respondents are presented in Table 1. The majority of respondents were male (54.2%), while females accounted for 45.8%. Most participants were within the

age group of 21–35 years (78.3%), followed by those aged 36–50 years (11.7%) and those above 50 years (10.0%).

In terms of marital status, 64.2% of respondents were single, 29.2% were married, while divorced and widowed individuals each accounted for 3.3%. Regarding educational level, the majority of respondents had secondary education (46.7%) and tertiary education (45.0%), whereas only a small proportion had primary education or no formal education (4.2% each).

Occupational Distribution of Respondents

Table 2: Present the Occupational Distribution of Respondents participated in the study.

Table 2
Occupational Distribution of Respondents

Occupation	Frequency	Percentage (%)
Abattoir Workers	57	47.5
Butchers	36	30.0
Waste Managers	8	6.7
Others	19	15.8

Narrative Description

The occupational distribution of respondents is shown in Table 2. Abattoir workers constituted the largest proportion (47.5%), followed by butchers (30.0%). Waste handlers accounted for 6.7% of respondents, while 15.8% were engaged in other occupations. The relatively low proportion of waste handlers suggests limited personnel dedicated specifically to waste management within the abattoir.

Types of Waste Generated

Table 3: Shows the different types of Waste Generated in Abattoir.

Table 3
Types of Waste Generated

Waste Type	Frequency	Percentage (%)
Solid Waste	65	54.1
Liquid Waste	38	32.0
Gaseous Waste	17	14.0

Narrative Description

As presented in Table 3, solid waste was the most commonly generated type of waste (54.1%), followed by liquid waste (32.0%) and gaseous waste (14.0%). The predominance of solid waste reflects the nature

of abattoir activities, which generate materials such as bones, hides, and other animal remains.

Waste Management Practices

Table 4: Present the Waste Management Practices in the Abattoir.

Table 4
Waste Management Practices at the Abattoir

Waste Management Method	Strongly Agree	Agree	Disagree	Strongly Disagree
Direct discharge into water bodies	64 (53.3%)	20 (16.7%)	21 (17.5%)	15 (12.5%)
Open dumping	55 (45.8%)	20 (16.7%)	30 (25.0%)	15 (12.5%)
Recycling	50 (41.7%)	30 (25.0%)	25 (20.8%)	15 (12.5%)
Incineration	35 (29.2%)	20 (16.7%)	25 (20.8%)	40 (33.3%)

Narrative Description

Table 4 summarizes the waste management practices reported by respondents. A substantial proportion of respondents indicated that waste is disposed of through direct discharge into water bodies, with 53.3% strongly agreeing and 16.7% agreeing. Open dumping was also widely practiced, with 45.8% strongly agreeing and 16.7% agreeing.

In contrast, environmentally safer practices such as recycling and incineration were less commonly reported. While 41.7% strongly agreed that recycling occurs, a notable proportion of respondents either disagreed or strongly disagreed. Similarly, incineration was the least practiced method, with 33.3% of respondents strongly disagreeing with its use. These findings indicate a reliance on unsafe and environmentally harmful waste disposal methods.

Environmental Impact of Abattoir Waste

Table 5: Depict the Environmental Impact of Abattoir Waste

Table 5
Environmental Impact of Abattoir Waste

Environmental Impact	Frequency	Percentage (%)
Water Pollution	71	59.2
Soil Contamination	25	20.8
Odor Nuisance	15	12.5
Air Pollution	9	7.5

Narrative Description

The environmental impacts associated with abattoir waste are presented in Table 5. Water pollution was identified as the most significant environmental problem, reported by 59.2% of respondents. Soil contamination accounted for 20.8%, while odor nuisance and air pollution were reported by 12.5% and 7.5% of respondents, respectively.

These findings highlight the substantial environmental burden associated with poor waste management practices and suggest potential implications for public health and healthcare demand in the surrounding community.

Revised discussion section (with additional citations)

Building on these findings, the predominance of solid waste observed in this study further reinforces concerns regarding inadequate waste handling systems in abattoir settings. Similar observations have been reported in Nigeria, where solid waste such as bones, tissues, and animal remains constitute the bulk of abattoir by-products due to slaughtering activities and limited mechanization [13]. Poor handling and disposal of these materials contribute to environmental degradation and provide breeding grounds for vectors, thereby increasing the risk of zoonotic and enteric infections [14].

In addition, the documented impact of abattoir waste on water and soil quality is consistent with previous environmental assessments. Studies have demonstrated that abattoir effluents significantly alter soil physicochemical properties and introduce harmful contaminants into surrounding ecosystems [15]. This environmental degradation has direct implications for public health, particularly in communities that rely on untreated water sources for domestic and agricultural use. Exposure to contaminated water has been strongly associated with increased incidence of diarrheal diseases and other environmentally mediated conditions [16].

The widespread discharge of untreated effluents into water bodies observed in this study is particularly concerning from a health systems perspective. Evidence indicates that inadequate water, sanitation, and hygiene (WASH) conditions contribute substantially to the global burden of disease, especially in low- and middle-income countries [17]. Poor water quality has been consistently linked to outbreaks of cholera, typhoid fever, and other gastrointestinal infections, which remain major causes of morbidity and

mortality [18]. These conditions increase healthcare utilization, strain limited health system resources, and reduce overall population productivity.

Furthermore, the limited adoption of sustainable waste management practices such as incineration and recycling reflects systemic gaps in environmental health governance. Previous studies in Nigeria have highlighted inadequate infrastructure, weak regulatory enforcement, and poor institutional coordination as key barriers to effective waste management in abattoirs [19]. This aligns with broader evidence from developing countries, where ineffective policy implementation and limited financial resources hinder environmental sanitation efforts [20].

Importantly, the findings also highlight the role of knowledge and behavior in shaping waste management practices. Studies have shown that low levels of awareness and inadequate training among abattoir workers contribute significantly to unsafe waste disposal practices [21]. Strengthening health education and promoting behavioral change interventions are therefore critical components of improving environmental sanitation in such settings. From a health services research perspective, the implications of poor abattoir waste management extend beyond environmental contamination to increased disease burden and healthcare demand. Environmental risk factors such as unsafe water and poor sanitation are major contributors to preventable diseases, which place additional pressure on already constrained health systems [22]. Integrating environmental health interventions into primary healthcare services can improve disease prevention, reduce healthcare costs, and enhance overall system efficiency [23].

Moreover, these findings are consistent with global policy frameworks that emphasize the importance of environmental determinants of health. The Sustainable Development Goals, particularly those related to health and sanitation, underscore the need for improved waste management systems as a pathway to better health outcomes and sustainable development [24].

Overall, this study adds to existing evidence that improving waste management practices in abattoir settings is essential for reducing environmental hazards, preventing disease transmission, and strengthening health systems in resource-limited contexts.

CONCLUSION

This study assessed waste management practices and their implications for environmental quality and public health at Owode Market Abattoir in Offa, Kwara State, Nigeria. The findings show that unsafe disposal practices, particularly open dumping and the discharge of untreated effluents into nearby water bodies, remain widespread. These practices significantly contribute to environmental contamination, including water pollution and soil degradation, and create conditions that facilitate the spread of infectious diseases.

The predominance of solid waste, coupled with the limited use of appropriate treatment methods such as recycling and controlled incineration, highlights substantial gaps in infrastructure and operational

capacity. These challenges are further compounded by weak enforcement of environmental regulations and insufficient coordination among responsible agencies. As a result, the burden of environmentally related diseases is likely to increase, placing additional pressure on already constrained health services. Evidence has consistently shown that poor water, sanitation, and hygiene conditions contribute significantly to disease burden and healthcare demand in low- and middle-income countries [15–18, 22].

Overall, the study underscores that improving abattoir waste management is both an environmental necessity and a public health priority. Addressing these challenges will not only reduce disease risks but also contribute to strengthening health system performance and improving the quality of life in affected communities.

RECOMMENDATIONS

Improving waste management practices at the abattoir should begin with the introduction of basic, low-cost sanitation measures that can be implemented immediately within existing resource constraints. This includes establishing designated points for waste collection and ensuring routine removal of waste to prevent accumulation. Simple drainage adjustments to limit the direct discharge of effluents into nearby water bodies would also significantly reduce environmental contamination and associated health risks.

Strengthening regulatory oversight is equally important. Local environmental health authorities should adopt consistent inspection routines combined with on-site guidance to encourage compliance with safe waste disposal practices. A supportive enforcement approach, rather than purely punitive measures, is more likely to improve adherence in informal or semi-regulated settings.

In addition, targeted training of abattoir workers should be prioritized to improve awareness of the health risks associated with poor waste management and to promote safer handling practices. Such training can be delivered through existing public health structures and does not require substantial financial investment.

Together, these practical and context-sensitive actions provide a realistic pathway for reducing environmental hazards, lowering disease risk, and improving overall public health outcomes in the study area.

Abbreviations

Package for the Social Sciences APC
Article Processing Charge
WHO
World Health Organization
FAO
Food and Agriculture Organization

UNEP
United Nations Environment Programme
LGA
Local Government Area
SPSS
Statistical

Declarations

Ethics Approval and Consent to Participate

Ethical approval for this study was approved by the Nigerian Navy College of Health Sciences Research Ethics Committee. Permission was also obtained from the management of Owode Market Abattoir, Offa, Kwara State, Nigeria. The study was conducted in accordance with the ethical principles. All participants provided was voluntary and informed, consent was obtained from all respondents before the administration of questionnaires. Respondents were assured of confidentiality and anonymity, and their information was used strictly for research purposes.

Consent for Publication

Clinical trial number: Not applicable.

Availability of Data and Materials

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Competing Interests

The author declares that there are no competing interests regarding the publication of this paper.

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Authors' Contributions

The author was responsible for the conception and design of the study, data collection, data analysis, interpretation of results, and preparation of the manuscript. The author read and approved the final manuscript.

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