ABSTRACT

The sanitary conditions of a food processing facility play a vital role in the safety and quality of its final products. This study assessed the hygiene practices and sanitary conditions of the Gbagi Community Slaughterhouse in Ibadan, Nigeria, to identify the factors hindering sanitation and meat hygiene at the facility, and provide recommendations for improvement. The study was conducted using a combination of observation and surveys as the data collection technique. The activities taking place in the slaughterhouse were observed for two weeks during which certain practices were documented textually and pictorially. Twelve key informants comprising butchers, cleaners, buyers, and people in the neighborhood were purposively recruited as study participants and were interviewed, using open-ended questions about the sanitation and hygiene practices at the facility. All obtained data were analyzed qualitatively by thematic content analysis. Study results showed poor waste management practices, inadequate ante- and post-mortem veterinary inspection of slaughtered animals, the absence of requisite slaughterhouse infrastructure, and the unhygienic behaviors of slaughterhouse personnel. The sanitary and hygiene practices of the Gbagi Community Slaughterhouse environment fall below the required standards for food processing operations and hence, poses a risk to food safety and public health. An integrated involvement of relevant arms of government is needed at the state and local levels for sanitary enforcement, provision of critical waste management infrastructure at the Gbagi slaughterhouse, and education of slaughterhouse personnel, so as to prevent microbial food contamination and safeguard public health.

Keywords: Hygiene practices, Microbial food contamination, Public health, Slaughterhouse, Waste management
INTRODUCTION

A slaughterhouse is a small facility licensed for slaughtering food animals on a small scale to meet the dietary needs of a smaller community (Fasanmi et al., 2018). The term “slaughterhouse” is sometimes used synonymously with the word, “abattoir”. Slaughterhouses carry out large-scale slaughter operations and are very common in developed regions of the world such as Asia, Europe, and America. However, developing regions such as Africa often rely on slaughterslabs and illegal slaughterhouses for meat production (Dada, 2020).

Currently, Nigeria has only three registered and legal abattoirs, located in Borno, Lagos, and Nassarawa States (VCN, 2015). However, thousands of other slaughterhouses and illegal abattoirs are operating all across the country without restrictions. These slaughterhouses and illegal abattoirs operate without inspections from the regulatory bodies, hence their production activities are characterized by poor sanitation and adequate hygiene practices (Nwanta et al., 2008).

Allowing slaughter slabs and abattoirs to operate without regular inspections directly violates subsection 1(e) of the fourth schedule of the Nigerian 1999 constitution which states that "one of the main functions of Local Government Councils will be to establish, maintain and regulate the activities of slaughterhouses, slaughterslabs, motor parks, markets, and public conveniences" (FRN, 1999). Despite these laws, thousands of slaughterhouses continue to operate without routine inspections by relevant authorities. In the absence of a proper surveillance network to ensure proper operation and management of slaughterhouses in Nigeria, most of these illegal facilities have made poor management practices the norm, and their slaughtering activities, meat processing procedures, and waste management have been far from sanitary or hygienic (Olowoporoku, 2016; Ribah et al., 2021).

Several empirical pieces of evidence have emphasized the poor management practices among slaughterhouses in different parts of Nigeria. For instance, Olowoporoku (2016) reported that selected slaughterhouses in Osogbo, southwestern Nigeria, show extremely poor sanitation as all the wastes from the slaughterhouse are disposed off in open lands right beside the slaughterhouse where cows are slaughtered and meat is processed. Akpan et al. (2020) also reported that due to the absence of waste management facilities in a major abattoir in Abeokuta also in southwestern Nigeria, wastewater from slaughterhouse activities was being discharged into a nearby receiving water body. Similar reports have been documented in Northern Nigeria. For instance, Bello et al. (2015) conducted an extensive study across 17 slaughterhouses in Northern Nigeria and reported a total absence of operational facilities such as potable water, drainage system, waste disposal system, lairage, or hoisting facilities. The study also reported a total absence of good hygienic practices as there was a lack of animal inspection before slaughter, and a lack of meat inspection before commercial supply, and the meat was often conveyed out of the slaughterhouse using unhygienic transport methods.

This poor level of sanitation and hygiene that has become the norm among slaughterhouses in Nigeria can have far-reaching effects on the workers, people living around the slaughterhouse as well as people consuming the meats produced in these slaughterhouses. Some of these impacts have also been documented in the literature by previous studies. For instance, a study by Iyaji et al. (2018) reported a 33% and 39% prevalence of Fasciola gigantica and Dicrocoelium dentriticum parasites in bile samples from cattle in slaughterhouses in Kogi State, Central Nigeria. A study by Ukpong et al. (2013) showed that the poor waste disposal management practiced by slaughterhouses in Uyo, Southern Nigeria, affected groundwater resources in the area by increasing the concentration of toxic chemicals, suspended solids, and coliform bacteria in the water, hence posing a threat to inhabitants in the area.
In addition to breeding infectious pathogens and corrupting water quality, the unsanitary management of slaughterhouses across Nigeria has been reported to degrade air and surface water quality (Olayinka et al., 2013), increase human exposure to the pathogen and waterborne diseases such as cholera, typhoid fever, dysentery, diarrhea, and giardiasis (Aworh et al., 2013). It also generates highly offensive odors, hence inconveniencing people living close to the slaughterhouses (Edet, 2022).

In a bid to provide solutions to this problem, it is expedient to conduct empirical investigations across several slaughterhouses in Nigeria to understand the perspective of butchers and slaughterhouse workers concerning the conditions of their slaughterhouses. This will help the academic community to understand the reasons why slaughterhouses have remained in such a horrible state, although the Nigerian constitution empowers local government councils to maintain and regulate the activities of these slaughterhouses. It is against this backdrop that this study will assess the environmental sanitation and hygiene situation of a slaughterhouse located in one of the largest markets in Ibadan, southwestern, Nigeria.

**METHODOLOGY**

**Study Area.**
The study area is Gbagi market located in Akinyele Local Government Area in Ibadan North, Oyo State, Nigeria. The study area lies on longitude 3° 57ˈ 18̈E and latitude 7° 27ˈ 38̈N. The Gbagi community slaughterhouse is located in the New Gbagi market which is one of the largest markets in southwestern Nigeria.

**Study Design**
A descriptive cross-sectional study design was adopted for this study. Data were collected through observational checklist and surveys. By conducting an exhaustive tour of the facility for two weeks, the state of sanitation and hygiene of the study area was visually inspected and observations were appropriately documented in textual and pictorial formats. All necessary facilities such as the waste management system, water supply system, preservation rooms, meat processing area, and meat transport systems were all visually inspected to evaluate the level of hygiene and sanitation in the slaughterhouse.

Also, a survey was conducted using structured questionnaires containing open-ended questions. The respondents of this survey were recruited using a purposive sampling technique. A total of 21 respondents were purposively selected including butchers, consumers, and people living close to the abattoir. All the participants were recruited during the two weeks of observation conducted at the study area. The structured questionnaires were administered to participants immediately after the recruitment of each participant. The respondents were guided on how to provide answers to the questions in an interview format and translations were provided for those who were less proficient in reading and communicating in English language. Results obtained from the observational checklist and interviews were subjected to content and thematic analysis.

**Ethical Considerations**
This study was kept ethical by ensuring that the ethics code of research involving human participants are not violated. First, the researchers obtained the permission of the Gbagi slaughterhouse management before proceeding with the study. The management of the abattoir sanctioned a two-week observational study and did not restrict the researchers from data collection in any form. Also, the study was made as convenient as possible for all the study participants by...
ensuring that adequate guidance and support were provided for them while filling out the questionnaires. Confidentiality was also assured throughout the course of the study as none of the study participants were identified by their names.

RESULTS

Facilities at the Gbagi Community Slaughterhouse.

Based on the results of the observations, the Gbagi community slaughterhouse has four sections namely: the singeing section, the flaying section, the meat processing area, and the triery section. Cows ready for slaughter are taken to the flaying section where they are slaughtered and then to the singeing section where the hairs are removed by light burning and washing, then passed to the meat processing for cutting and deboning. The slaughterhouse lacks a cold room facility for the preservation of meat. The slaughter area sometimes also serves as the meat processing area, and meat parts are moved from the processing area by workers via dragging on the floors or hoisting on the shoulder. Meat is moved to the buyers almost immediately after the processing is completed. The slaughterhouse lacks lairage facilities and animals brought in are slaughtered almost immediately without any ante-mortem examination. The floors of the facility were made of concrete, with the walls unplastered. The roof was in bad condition and could barely cover half of the entire facility.

The facility also lacks a toilet and hand washing facilities. The facility has a running water system (Plate 1) and an artesian well (Plate 2) serving as a backup in case the running water is unavailable as a result of power loss or other mechanical faults. The artesian well is sited and predominantly utilized in the meat guttery and triery section.

Sanitary and Hygiene Practices

The sanitation and hygiene situation of the Gbagi Community Slaughterhouse was poor. Animals marked for slaughter are not subjected to routine antemortem inspection for possible lesions or disease symptoms. On two occasions, moribund animals were slaughtered without inspection. Cleaning operations are carried out by cleaners in the facility using scrubs, detergent, broom, and water to wash the concrete floors in the slaughterhouse. Running water supplied by a tap from a nearby borehole is used for washing the carcass, post-singeing. However, the containers used for water collection and storage were seen to be dirty and unwashed. The open flaying section attracted wild birds, flies, rodents, and other potential disease vectors as shown in Plate 4. The waste dump is sited near the slaughterhouse. In addition, the slaughterhouse workers were seen handling meat with bare hands, clad in inappropriate apparel. On one occasion, a butcher was sighted coughing repeatedly and spitting on the slaughter floor.

When the workers were asked about how they prevent meat contamination, most of them stated that meat cannot be contaminated, hence they do not have any particular way of preventing meat contamination. One of the respondents is quoted below:

“Our meat cannot be contaminated. No one has ever complained about sickness after eating meat from here. Be careful with the questions you are asking me”.

Another respondent stated:

“Let me just tell you the truth: you can’t stop birds, rodents, and flies from entering this place, unless you build it like a proper housing and put doors and windows. For now, it is open and nothing can be done”.

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Notwithstanding, some of the workers replied that they prevented meat contamination by frequently washing of slaughter and meat processing floor with water and detergents.

**Waste Management**

First-hand observation showed that parts of the facility lacked cover and drainages for the disposal of blood and wastewater. Also, the dumpsite used for the solid waste disposal is open and poorly managed, ensuring that rainwater flushes the solid wastes and other debris into a large nearby drainage. Wastewater from the slaughter activities is discharged directly into a large drainage without any form of prior treatment. Solid wastes from the slaughterhouse and surrounding residences block the flow of this drainage. Some of the respondents also stated that some of the expressed blood from slaughtered animals are collected into containers. The women who collect the blood said they re-sell to farmers who incorporate it into feeds for fish and livestock. However, large volumes of the blood are always emptied into small channels shown in Plate 4 and flushed out of the facility. Often, the channels become stagnant as shown in Plate 5, and produce bad odors that create an inconducive atmosphere within and outside the slaughterhouse. One of the respondents living within the neighborhood was quoted as follows:

“The waste management of this slaughterhouse is too poor. I am afraid for my children and family every day, as we live close to the stench. Fecal wastes and pieces of tissues are all dumped into this open and static gutter over there; they smell and ooze bad odours here. This attracts numerous rats and flies which can lead to health risks for us living in this place”.

Unlike liquid wastes, solid wastes such as bones, horns, tissues, hoofs, intestines, faecal matter, and skin trimmings are swept, gathered, and often disposed into a dumpsite that is less than 300 meters away from the meat processing areas. The land area of the facility is insufficient, hence there is no space to locate the dumpsite farther away from the slaughterhouse.
Remnants of the solid wastes (after rain run-off action) are left in the dump sites until the dry season when they are burned. Solid wastes such as bones and horns are kept separately for people who come around to buy them for the production of bone meals. Fecal matter produced by the animals is sometimes packed with a heap of other solid wastes to be disposed off on the dumpsites - and is sometimes dumped into the large drainage.

Knowledge and Perception of Slaughterhouse Personnel

All of the workers interviewed agreed that the hygiene and sanitation of the Gbagi slaughterhouse are good enough at the moment. The majority of the workers believed that the same way they carry out their meat processing at the Gbagi Slaughterhouse is the same way it is done all across Nigeria, so there is nothing wrong with their facility or meat production routine. Some of them also believed that the way they handle the meat at the slaughterhouse does not affect the quality of the meat as long as it is well-cooked before consumption. One of the participants is quoted below:

“Meat is meat, it does not matter how you handle it. What matters is for you to cook it very well, it will kill all the contamination”.

Another participant was quoted saying:

“Well, I don’t know. I think it’s the same in most places. It is God that is protecting us from any of these hazards”

However, three workers agreed that the current practices at the slaughterhouse were not hygienic and therefore should be improved.

When queried about the slaughterhouse’s most pressing needs, the responses of the participants were very much different. However, a relatively large proportion (69%) of the respondents believed that the slaughterhouse needs a better waste management system. One of the participants was quoted saying:

“We need a better waste management system, like government trucks coming to pack our wastes every day or every week”.

Plate 2: Feral birds feeding on residual wastes on an open slaughter floor
Another respondent also mentioned that the slaughterhouse needs an incinerator with which they can burn their waste during rainy or dry seasons, to reduce the smell that comes with stagnant drainage and filled dumpsites. A fair proportion of the study participants mentioned water supply as the slaughterhouse most pressing need. These respondents believe that the facility needs a big tank to store water as well as a powerful power plant to ensure 24hrs supply of water at the facility. Some other respondents believe that the facility should be reconstructed or at least renovated. In this regard one of the respondents was quoted below:

"We need the government to come and re-construct this place. The main problem I am seeing is waste disposal. Flies can come from there and perch on the meat. Big rats also live and run around that big stagnant gutter"

Some of the respondents also believed that the slaughterhouse should be relocated to a place with a larger land area, while some believed that the facility needs a good cold room to serve as a preservation room for processed meats. One of the respondents agreed that what the slaughterhouse needs is a large loan from the government which can enable them to bring in more animals for slaughter to meet the people's demand for meat.

**DISCUSSION**

Based on the observation and survey results, the Gbagi Slaughterhouse lacks the appropriate facilities required to run a sanitary and hygienic slaughterhouse. Lairage (a resting house for animals) is a very important facility in a slaughterhouse because it helps animals to rest, recover, and get examined for potential lesions or diseases before they are slaughtered, hence improving the meat quality of such animals (Fasanmi *et al.*, 2018). Despite its importance, the Gbagi abattoir lacked a lairage facility and animals are slaughtered almost immediately they get to the slaughterhouse. The absence of functional lairage facilities and the practice of slaughtering animals without giving them a resting period is a very common practice among slaughterhouses in Nigeria and has been extensively reported in previous studies such as Omotosho *et al.* (2016); Gali *et al.* (2020); Njoga *et al.* (2021). Also lacking in this slaughterhouse is a storage and preservation facility, hence making processed meat highly prone to spoilage if not pushed into the market within 8-12 hours post-slaughter. Meat spoilage can lead to economic losses for animal owners, as buyers tend to reject meat with signs of spoilage, characterized by foul odour, presence of large number of flies, change in colour and loss of consistency. Additionally, consumption of such meat can predispose the public to diseases caused by
spoilage bacteria such as *Salmonella* spp., *Escherichia coli*, *Shigella* spp., *Pseudomonas* spp. and *Lactobacillus* spp. (EFSA, 2016).

With an average of 10 animals slaughtered per day, no veterinary personnel for antemortem and post-mortem inspection on the slaughtered animals were sighted. Slaughtering of animals without antemortem tests violates the operational code of abattoirs and slaughterhouses as it can facilitate the spread of zoonotic diseases, pathogenic microbes, and other toxins (Sattar *et al.*, 2023). In addition to the absence of antemortem and post-mortem tests, general sanitation is inadequate. Although the facility is frequently swept and washed by the workers, wastes are disposed of in dumpsites very close to the meat processing room. Also, liquid wastes such as wastewater and blood are disposed off in stagnant drainages near the meat processing room. The stagnant drainage attracts all sorts of vermin such as rodents, worms, and insects which can contaminate the meats processed in the slaughterhouse. Workers show unhygienic attitudes such as lack of protective equipments or clothings, handling meat with unclean hands, spitting in the meat processing areas, carrying meat on their stained clothes, pouring wastewater into stagnant drainages, and collecting water in very dirty containers. All these unsanitary behaviors have been shown to predispose meat and meat products to contamination by harmful microorganisms (Bersisa *et al.*, 2019).

The findings from this study align with reports by researchers on other slaughterhouses in Nigeria. For instance, Adeolu *et al.* (2019) reported unsanitary practices such as the absence of routine antemortem and post-mortem tests and a poor waste management system in Karu abattoir, Northern Nigeria. Similarly, Edet (2022) reported significant deficiencies in the hygiene of three slaughterhouses located in Ijebu Ode, Southwestern Nigeria. This chronic problem of poor hygiene and sanitation among slaughterhouses in Nigeria can be attributed to several factors. First is the perception of butchers concerning meat contamination. Most slaughterhouse workers are ignorant about the consequences of their unsanitary behaviors. The survey conducted in this study showed that most workers of the Gbagi slaughterhouse believe that meat cannot be contaminated and some believe that cooking is capable of removing any form of pathogen or microorganism on the meat. This ignorance influences their attitude, hence they pay little attention to the proper sanitation and hygiene of the slaughterhouse. This position has also been emphasized in earlier studies (Ismaila *et al.*, 2015; Ekanem *et al.*, 2020).

**CONCLUSION**

This study establishes the unhygienic environment and operations at the Gbagi Community Slaughterhouse. Poor waste management compromises water and air quality, and the unsanitary habits and attitudes of workers further question the safety of their meat products. The findings of this study suggest potential meat contamination and environmental degradation through the discharge of untreated slaughter wastes into the environment. Also, further studies are needed to fully establish the hazards and quantify the risk of exposure of workers, consumers community residents to potential pathogens associated with Gbagi Community slaughterhouse wastes and activities.

**RECOMMENDATIONS**

Based on the findings from this study, the following were recommended:

The government at state and local level should improve the facilities at the slaughterhouse. Alternatively, the facility should be shut down and relocated to a more spacious environment with requisite infrastructure such as a waste treatment plant, lairage, cold room, changing room, meat processing room with rails, toilets and bathrooms, offices,
and meat display area. Also, butchers and other personnel should be subjected to hygiene and sanitation training sponsored by the government. This will correct the ignorant belief among butchers that meat cannot be contaminated or spread diseases. Sequel to this, the slaughterhouse should be provided with a permanent veterinarian and or meat inspection officer who will conduct routine antemortem and post-mortem inspections at the facility.

Generally, the low number of government-approved abattoirs in Nigeria can be attributed as a major reason for the widespread operation of illegal slaughterhouses in Nigeria. To solve this problem, the federal state and local governments in Nigeria must ensure that every Local Government Area (LGA) in Nigeria has at least one government-approved abattoir based on population and meat demand in the area. This will allow the government to shut down illegal slaughterhouses without compromising the adequate supply of meat in any region. This will also ensure that abattoirs have up-to-date facilities such as functional lairage, cold rooms, and hand washing facilities amongst others. Asides from the government, slaughterhouse workers and the general public have important roles in tackling the poor sanitation and hygiene of slaughterhouses. Slaughterhouse workers should be made comply with standard regulations guiding hygiene and sanitation in slaughterhouses in Nigeria. This can be ensured through extensive training of workers and providing them with basic materials such as boots, hand gloves, head covers, and overall uniforms. To complement, the efforts of the government and slaughterhouse workers, the general public also has to adopt the practice of not patronizing any illegal or unsanitary slaughterhouses around them. This can be achieved through strict government policies and extensive public awareness to discourage the operations of illegal and unsanitary slaughterhouses across Nigeria.

LIMITATION OF THE STUDY
This study was limited by the lack of cooperation of many Gbagi slaughterhouse personnel, meat vendors and other relevant stakeholders in being interviewed or served questionnaires by the researchers. Hence a limited number of participants were involved in this study, which affected the researchers' ability to obtain quantitative data.

CONFLICTS OF INTEREST
The authors declare that there are no conflicts of interest.

REFERENCES


