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EVALUATION OF THE ABATTOIR'S OPERATIONAL INFRASTRUCTURE AND SANITATION PROCEDURES IN KANO STATE, NIGERIA

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Abstract

The world's expanding population has contributed to the rise in demand for meals high in protein. This demand is felt more acutely in developing countries such as Nigeria. Everyday, millions of people across the globe depend on protein-rich food like meat supplied from the abattoir. Improper cleanliness and poor facilities in abattoirs can result in microbial contamination of carcasses. Very little information is available on the raw meat handling, sanitation protocols, and hygienic practices adopted in the local slaughterhouse in Kano, Nigeria. An investigation was done to study these parameters. The abattoir is located in the metropolis' Kofar Mazugal and is one of the state's primary meat processing facilities, from which raw meat products are processed and supplied across the state's 44 Local Government Areas, as well as neighboring states. The present study indicated the condition of the slaughterhouse is not up to international standards. Due to the heavy load of slaughtering and the non-adoption of modern technologies, the condition of the slaughterhouse is very filthy. Twenty samples analyzed from the slaughtered animals of the abattoir indicated the presence of *Escherichia coli*, *Staphylococcus aureus*, *Proteus mirabilis*, *Klebsiella pneumoniae*, *Salmonella typhi*, and *Streptococcus pyogenes*. Out of these microbes, the presence of *Staphylococcus aureus* was the most frequent. It was concluded that without adopting modern methods, Kano abattoir not only poses multidimensional health risks for customers but also contributes to environmental pollution. There is an urgent need for the modernization of the Kano abattoir.

Keywords: Kano abattoir, modernization, carcasses, microbial contamination.

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1. INTRODUCTION

According to the UN projection, the expanding global population will be around 9.5 billion by 2050 (Henchion et al. 2017). This will escalate the need for more food production as there will be more mouths to be fed. Everywhere in the world, there is a high need for meat as a staple diet. Especially in underdeveloped countries, meat is a significant source of high-quality dietary protein for a substantial fraction of the world's population (Salter 2018). The bulk of essential amino acids, including the lysine, methionine, and tryptophan that are absent in plant proteins, can be primarily obtained from meat. (Wolfe 2017). Additionally, it is a significant source of vitamins and minerals that are essential for a healthy life (Bafanda et al. 2017). Everyday millions of people across the globe depend on meat supply from abattoirs. An abattoir's goal is to provide hygienically prepared meat by treating animals humanely and employing hygienic methods for slaughtering and dressing (Bello et al. 2015). Over 1.3 million cows are slaughtered each year in Nigeria, where cattle alone contribute nearly 30% of the country's meat consumption. (Akinfenwa 2022).

Slaughterhouses are well-known for polluting the environment through a variety of activities all throughout the world. (Daramola and Olowoporoku 2017). The cattle meat processing sector needs to be modernized globally, especially in Africa. (Adeyemo et al. 2009). Good slaughterhouses, regardless of size, should allow for the slaughter of cattle under controlled hygienic circumstances, strict quality control, and the production of consistently hygienic meat for consumers. Due to the enormous levels of organic waste created by slaughterhouse operations, there are complicated, multifaceted health concerns as well as environmental degradation (Dada et al. 2021). Abattoir activities such as ante mortem inspection, bleeding, slaughtering,

evisceration, post-mortem inspection, and disposal of waste materials are crucial in the supply of healthy meat for human consumption (Lawan et al. 2013). This can only be accomplished by providing enough, standard, and operable facilities, as well as sufficient hygienic conditions and good hygiene methods. (Alhaji 2015).

Infectious diseases that are now present or emerging at the animal-human-ecosystem interface are an increasing public health concern, as are zoonoses and foodborne illnesses of animal origin. Controlling risks in meat production processes and enhancing food safety has been acknowledged as effective technique for preventing these diseases (Agu et al. 2021). Lack of standardized facilities, and noncompliance with good sanitary and hygienic practices in slaughterhouses in developing countries, particularly in Nigeria, have been cited as the primary cause of meat contamination (Uzoigwe 2021). Earlier studies conducted in the abattoirs of Kano (Dandago et al. 2009), and Kaduna (Gali et al. 2020), Nigeria indicated inadequate operational facilities. An effort was made to evaluate the sanitary condition, and hygienic practices prevailing in the Kano abattoir.

2. METHODS

2.1 Study Area

The Kano central abattoir is located in Dala local government, Kano state, Nigeria. The abattoir is owned by Alhaji Aminu Dantata. It is operational since 1963 and was built by the native authority under the premier of Northern Nigeria, Sir Ahmadu Ibrahim Bello the late premier of Northern Nigeria. Kano is within the Sudan savannah region of Nigeria which lies between 11.59°N to 11.922°N and between longitudes 8.75°E to 8.973°E and an altitude of 403m above the sea level. The annual rainfall distribution ranges from 773.4 mm-870 mm per annum, rainfall starts from May to October with a

peak in August. The animal slaughtered comprises cattle, goats, sheep, and camels.

2.2 Study Design

A prospective investigation was conducted in the Kano abattoir to study the operational and hygienic practices that are followed. Meat samples were collected for microbial analysis.

2.3 Period of Study

The slaughterhouse was visited twice during the month of April 2023.

2.4 Assessment of Abattoir Facilities

The operating hours of the slaughterhouse were from 6:00 a.m. to 1:00 p.m. The availability and functional status of the abattoirs' sections, and structures were evaluated. The observed and identified sections and parts were photographed and operations were checked.

2.5 Assessment of Sanitary Practices

The investigation included the following parameters viz. presence of a fencing wall, slaughter area and availability of basic facilities, availability of potable water and its source, presence of toilets and bathrooms, waste disposal system, hygienic procedures followed, use of protective clothing by workers, and the overall environment were all considered in the assessment of the abattoir's sanitary practices.

2.6 Specimen Collection

A total number of 20 meat samples were collected in sterile containers, 4 each from different slaughtered animals i.e., cow, camel, goat, and sheep. Four samples were also collected from condemned beef, the samples were immediately transported to the laboratory for analysis.

2.7 Pre-treatment of Samples

Pieces of meat were blended in a blender. Ten grams (10 g) of each sample were weighed in a weighing balance and were introduced into ninety ml (90 ml) of distilled water and were then blended to homogenize the sample.

2.8 Bacteriological analysis and identification

Identification of bacterial isolates was done based on their cultural, gram stain, and biochemical characteristics. Serial dilution was made for the meat samples in appropriate dilution tubes. One ml of each dilution was taken using a syringe and was placed on nutrient agar using the pour plate method and it was then incubated at 37°C for 24 hours. Developed colonies were then counted to obtain the total colony count. Discrete colonies were purified by subculturing on Macconkey agar, Salmonella Shigella Agar, and Eosin methylene blue agar plates to have the pure isolate (Tauxe 2002). The isolated bacterial colonies were identified based on their morphological, physiological, and biochemical characteristics. These cultures were subjected to various techniques like gram staining and biochemical tests such as indole test, catalase test, Voges-Proskauer test, methyl red test, and citrate utilization test, using Bergey's manual of systematic bacteriology (Haileselassie et al. 2015).

2.9 Statistical Analysis

Data was entered in the Excel spread sheet and was later subjected to ANOVA analysis.

3. RESULTS

The Kano abattoir was built during the early part of the 1960s and is over 60 years old, hence the modern facilities are not in place. Also, the general conditions of the abattoir did not match international standards. Observational and assessment of abattoir facilities revealed that the slaughterhouse is well connected with the

roadways and there is enough space for the movement of people and animals. Even walls were present throughout the building and there was adequate ventilation and illumination. The sloping of the floors was towards the drain; however, the flooring was very old and not smooth. The floor was damaged in many places lead to retention of water. The walls were smooth and simple to clean, but very dirty. Facilities such as lairage, evisceration section, guttery, and tripery section were present. The cold room was present but nonfunctional. Water was stored in the overhead tank and the supply was adequate, more details are summarized in table - 1. On an average 200 cattle, 60 camels, over 700 goats and sheep are slaughtered everyday.

Sanitary practices in the abattoir were not as per the international standard. The abattoir did not have a sanitary section (table -2). The hygienic procedures were carried out manually using a wheelbarrow, disinfectants, water, and brooms. The solid wastes generated daily were dumping on vacant land and used in landfill. Liquid wastes disposal was done manually with brooms into the drainage system which was then routed into a nearby stream. The wastewater and its effluents such as gut contents, blood and urine etc., are directed into the drainage. After each slaughtering session, the grounds, slabs, and floor of the slaughterhouse are cleaned and sanitized (Figure - 1).



Figure 1 - Slaughtering of animals inside the Kano abattoir

Roasted cowhide preparation known as 'Ponmo' or 'Ganda' is very popular in Nigeria. The skin of the animal is first washed, dehaired, partially dried in sun and then processed over flame. The entire process of Ponmo making that was carried out at the Kano abattoir premises was studied. The flame for the fire was

generated by burning wood logs and coal (Figure - 2). The operating condition was not very hygienic in which Ponmo was made, the entire place is full of coal dust, smoke and littered with waste. Huge quantity of blood that are collected from slaughtered animals are sold to poultry feed manufacturers. The hooves and horns of animals are sold to the local vendors.

Flaying section

Absent



Figure 2 - Burning of cattle skin for making of Ponmo

Microbiological study carried out in 20 samples indicated presence of various microbes viz. *Escherichia coli*, *Staphylococcus aureus*, *Proteus mirabilis*, *Klebsiella pneumoniae*, *Salmonella typhi*, and *Streptococcus pyogenes*. The most commonly observed microorganism was *Staphylococcus aureus*, it was observed in 7 out of 20 samples tested. The details of the microbiology studies is given in table - 3. The ANOVA results indicated that there is no significant difference in the presence of microbes between the samples collected from different animals.

Table 1 - Observations on Facilities and Infrastructures

FACILITY	OBSERVATION
Location	<ul style="list-style-type: none"> The abattoir is located in Kasuwar Wambai area, Dala local Government Kano state, Nigeria The slaughterhouse is close to roadways and other modes of transportation
Size	<ul style="list-style-type: none"> There is enough space for movement of people and animals
Constructional materials, walls and floors	<ul style="list-style-type: none"> Even walls were present throughout the building Sloping toward the drains was present The walls and ceiling were smooth and simple to clean
Ventilation	<ul style="list-style-type: none"> Because it was improperly closed, the slaughterhouse has a good ventilation system
Illumination	<ul style="list-style-type: none"> The slaughterhouse was unusually spacious, which provided for enough lighting
Water supply	<ul style="list-style-type: none"> The overhead storage tank and borehole served as the primary sources of water
Sanitary facilities	<ul style="list-style-type: none"> Water was available for washing and cleaning There were brooms and a wheelbarrow available for cleaning
Disposal of waste	<ul style="list-style-type: none"> Done daily by burring or dumping on vacant land
Disposal of liquid waste	<ul style="list-style-type: none"> Disposed daily in nearby drainage
Waste Water channel	<ul style="list-style-type: none"> Cleaned rarely
Cleaning and disinfection of the abattoir	<ul style="list-style-type: none"> Done daily using manual equipment after the slaughtering session are over
Dumping on vacant land or bush	<ul style="list-style-type: none"> Done daily

Table 2 - Assessment of the Abattoir facilities

COMPONENTS OF ABATTOIR	PRESENT/ABSENT FUNCTIONAL/NON-FUNCTIONAL
Lairage	Present and nonfunctional
Slaughter hall/slab	Present and functional
Evisceration section	Present and functional
Meat inspection section	Present and functional
Feet, head and skin section	Present and functional
Gutters and tripery section	Present and functional
Cold room	Present and non-functional
Detained meat section	Absent
Condemned meat section	Absent
Drainage system	Present and functional
Veterinary laboratory	Absent
Water supply	Present and functional
Electricity supply	Present
Sanitation section	Absent
Blood processing section	Absent
Toilets and restrooms	Present and functional
Staff room	Present and functional

Table 3 - Details of Microbiological investigation conducted

Source	Sample number	<i>E. coli</i>	<i>Klebsiella pneumoniae</i>	<i>Staphylococcus aureus</i>	<i>Salmonella typhi</i>	<i>Streptococcus pyogenes</i>	<i>Proteus mirabilis</i>	Remarks
Cow	01		++++	+++				
	02	++			++			
	03				++			
	04		+++	++++				
Goat	01	++++	++					
	02	+++	++					
	03				++			
	04			++		++		
Sheep	01		++	+++				
	02	++						
	03				++			

	04		+++			+++		
Came l	01			++				
	02	++						
	03				+++			
	04					+++		
Disca r-ded Beef	01			+++			++++	
	02	++++						
	03							No growth
	04			++++				

+ Indicate microbial growth pattern

4. DISCUSSION

When the Kano abattoir was constructed in the early 1960s, butchery was not considered a serious industry; however, it had state-of-the-art facilities at that time. But because of cultural and religious practices, the machines were never put to use. Later, when the demand for meat increased, there was tremendous pressure exerted on this abattoir, which lacked facilities for modern slaughterhouses such as mechanical slaughtering and cold storage. Demand was voiced for the construction of an alternative slaughterhouse. The first governor of Kano State, Audu Bako, attempted to shift the abattoir to another location with better facilities, but the butchers refused to relocate to the facility due to a lack of understanding of the long-term benefits. As a result, the Kano abattoir still functions without modern slaughtering facilities (Ngbokai 2021).

The present observational study indicated that some of the facilities present in the Kano abattoir are compliant with the requirements of a standard abattoir; however, it is unfortunate to note that most of them are non-functional. Many of the essential sections, such as the veterinary laboratory, record-keeping section, sanitation section, and blood processing section, were completely missing. Earlier

studies have indicated that many abattoirs in Nigeria are located in residential areas (Gali et al. 2020; Adetunji and Awosanya 2011). This was also the case with the Kano abattoir. When it was constructed, it may have been on the outskirts of the city, but today it is surrounded by residential areas. The slaughter halls were available, but none were divided into sections for proper and hygienic meat processing. An earlier study of Nigerian abattoirs indicated that the lack of proper sterilization facilities, continuous use of a single knife, and carcasses coming in contact with dirty and contaminated floors because of the lack of proper separation areas (Adetunji and Awosanya 2011). All these features were also present in the present study. However, due to the adequate availability of water, the slaughtering areas were cleaned every day, and the carcasses were thoroughly cleaned before they were transported outside. The Kano abattoir's electric supply is provided by the Kano Electricity Distribution Company (KEDCO). A huge amount of solid waste that is generated in the Kano abattoir is carried outside the city and used for land fill. However, there is no provision for biogas generation in the slaughterhouse.

One of the most patronized animal derived product treated as delicacy in most parts of Africa is processed cowhide (Ademola et al. 2022). Which is popularly known as

'Fata' or 'Ganda' in Hausa and 'Ponmo' in Yaruba, in Nigeria (Keta et al. 2020). The processing of Ponmo differs in various places according to the culture. In some places the skin is first boiled and then fried and in other places cowhide is dehaired by singeing in open flame then boiled in hot water (Ademola et al. 2022). High levels of microbial contamination of processed cowhide has been reported (Bosede and Omokaro 2022). Various bacterial species, namely *Staphylococcus aureus*, *Salmonella* spp, *Shigella dysenteriae*, *Escherichia coli*, *Bacillus* spp, *Klebsiella* spp, *Pseudomonas aeruginosa* and *Shigella* spp, has been isolated from Ponmo sold in local market (Keta et al. 2020). This contamination may have been resulted due the handling of the cowhide in unhygienic conditions, contaminated abattoir soils or from the washing done with water stored in unsanitary containers. Though in the present investigation microbial studies of Ponmo was not done; however, the condition in which the preparation is carried out is not very conducive.

The present observational study indicates that although some facilities that meet the standard requirements of an abattoir are present, many are not functional or not being used in accordance with proper operating procedures and hygienic practices. Therefore, the overall condition of the abattoir can be classified as poor or just meeting the criteria. Concerns about the health of many abattoirs in Nigeria have been raised by earlier researchers, who attribute the dilapidated and deplorable state of most abattoirs to the failure to enforce the use of standard facilities and general maintenance (Lawan et al. 2013; Adeyemo 2002). This has led to common microbial contamination of carcasses during processing, manipulation, storage, and distribution, as noted in the present study, which isolated *Escherichia coli*, *Staphylococcus aureus*, *Proteus mirabilis*, *Klebsiella pneumoniae*, *Salmonella typhi*, and *Staphylococcus pyogenes* from the samples collected from the abattoir (Zailani

et al. 2016; Ahmed et al. 2012). Of these, the most frequent observed microbes was *Staphylococcus aureus*, which could be an area of concern. Additionally, the meat inspector service is virtually non-existent, and there is no provision for recording and documenting disease in animals.

The National Agency for Food and Drug Administration and Control (NAFDAC) in Nigeria has established guidelines for the inspection of beef meat, as well as for the handling, processing, and packaging of beef products. Good storage practices (GSP) are essential to maintaining hygiene throughout the storage stages, while good hygiene practices (GHP) specifically ensure the safety and protection of consumers of beef products (Okpala et al. 2021). Despite these guidelines, however, the majority of abattoirs in Nigeria lack basic sanitary procedures, suitable meat inspection facilities, and qualified meat inspectors (Gali et al. 2020; Bello et al. 2015).

The meat industry in Nigeria began its efforts to meet international standards in the early 1960s with the aim of transitioning from traditional local methods to modern methods of meat production. In the early 1970s, Nigeria even exported beef to the United Kingdom and other European countries (Asiodu 2021). However, the industry began to decline in the mid-1980s due to a deterioration in operational standards, sanitation, and socio-economic dynamics, coupled with the lack of active involvement by regulatory authorities. In 1999, the Federal Government of Nigeria passed new laws that granted local government councils the power to establish, maintain, and regulate slaughterhouses. Unfortunately, the new councils lacked the resources and knowledge to implement the required meat hygiene programs, resulting in a further decline in the industry and posing a threat to public health interests (Bello et al. 2015).

5. CONCLUSION

There is an urgent need that all facilities at the Kano abattoir should be overhauled and upgraded, also ensuring strict adherence to proper sanitation. The microbes that were isolated from the various meat samples in the present investigation indicates that the sanitation condition inside the abattoir need drastic improvement. The conditions of abattoirs across Nigeria have not changed in the last few decades, rather there is constant decline in the overall facilities and hygienic environment. There are many reports published time to time pointed at this lacuna (Gali et al. 2020; Dandago et al. 2009; David-West 2002); however, nothing much changed at the ground level. Many reasons can be attributed for this, but the most important aspect is the political will. Public-private partnership and encouraging young entrepreneurship to venture in this arena could be a welcome step for establishment of modern abattoirs. There should be a constant dialogue between the butchers and the government to convince the abattoir workers and abattoir management to embrace modern technology without compromise much on their religious sentiments. The restoration of Nigeria's status as a meat exporter could be a positive outcome of such efforts. It is important to prioritize public health and safety in the meat industry, and proper sanitation and hygiene practices are essential for achieving this goal.

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Conflict of interest: Nil

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