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Evaluation of Medically-Important Bacteria in Selected Abattoirs in Ilorin Kwara State Nigeria

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Abstract: Bacteria encountered in red meat are of great concern to public health from the standpoint of food spoilage and food-borne diseases. It is imperative that meat processed and produced from slaughterhouses for consumption has the lowest possible level of bacterial contamination. This study assessed the medically-important bacteria in four abattoirs within Ilorin, Kwara State, Nigeria. Ipata slaughterhouse, Mandate slaughterhouse, Oja-titun slaughterhouse and Kilanko slaughterhouse were purposively selected for the study. The meat water, abattoir floor and butchering tables were sampled for each slaughterhouse. Total Viable Bacterial Count (TVC) and Total Coliform Count (TC) were determined using standard microbiological methods. Isolates were identified based on colonial, morphological and biochemical characterizations. The TVC ranged from 3.47 x 10 to 7.72 x 10 CFU/mL/g/cm^2 while the TCC ranged from 1.10 ± 0.22-3.47 ± 2.71 $\log_{10}$Cfu/ml/g/cm^2) and (6.92 ± 0.12 - 1.10 ± 0.11 $\log_{10}$Cfu/ml/g/cm^2) respectively. Preliminary Biochemical tests performed on all pure cultures obtained revealed the probable identification of the following species: *Enterococcus, Staphylococcus, Klebsiella, Escherichia coli, Bacillus, Salmonella, Proteus* and *Pseudomonas*. This study concluded that bacterial contamination of raw meat and abattoir environment in Ilorin exceeded the internationally accepted levels for sanitary practices in abattoirs.

Key words: Abattoir · Bacteria · Coliform · Meat · Butchering Table

INTRODUCTION

An abattoir (also called a slaughterhouse) is a facility where animals are killed and processed into meat for food. The animals commonly slaughtered for food are cattle (for beef and veal), sheep (for lamb and mutton), pig (for pork), horse (for horsemeat), goat (for chevon) and fowl, largely chickens, turkeys and ducks, for poultry meat [1].

Meat as an essential source of protein is needed for growth. Tissues from healthy animals are normally sterile, but can be contaminated by microorganisms from the exterior of the animal and its intestinal tract during slaughter, dressing and cutting [2]. Contamination of meat is a continuous possibility from the moment of bleeding until consumption. Nabawy*et al*. [3] reported that during slaughter operations, in particular during skinning, scalding, evisceration, dressing, transport and meat cutting a smaller or high number of the bacteria can be found on carcasses as a contaminant from alimentary tracts of birds, water, working tables, draining boards, utensils and poultry handlers.

In the abattoir itself, there aremany potential sources of contamination of meat by microorganisms; these include the animalhide and hair; soil adhering thereto, the contents of the gastrointestinal tract (if inadvertently releasedduring dressing operations); airborne contamination; aqueous sources (the water used for washing the carcass, or for cleaning the floors and equipment); the instruments used in dressing (knives, saws, cleavers and hooks); various vessels and receptacles; and the personnel [4].

Studies have revealed that abattoirs in developing countries have an unhygienic environment and detected the presence of pathogens that are known causes of diarrheal diseases and a possible hazard to human health in the abattoir waste and water contaminated by abattoir waste [4, 5]. Many of the microorganisms isolated from meat samples are highly pathogenic and cause various diseases.The consumption of meat containing various pathogens has shown to be problematic [6].

The safety of meat has been at the forefront of societal concerns in recent years and indications exist that

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challenges to meat safety will continue in the future. Major meat safety issues and related challenges include the need to control traditional as well as ‘‘new emerging, ’’ or ‘‘evolving’’ hazardous microorganisms, which may be of increased virulence and low infectious doses, or of resistance to antibiotics or food related stresses [7]. According to Bello and Oyedemi [8], medical experts have associated some diseases with abattoir activities which include pneumonia, diarrhea, typhoid fever, asthma, wool sorter diseases and respiratory diseases. This study was aimed at assessing the medically-important bacteria in popular abattoirs within Ilorin, Kwara State, Nigeria.

MATERIALS AND METHODS

Sample and Sampling Procedure: Four popular abattoirs were purposively selected for this study. These were Ipata slaughterhouse, Mandate slaughterhouse, Oja-titun slaughterhouse and Kilanko slaughterhouse in Ilorin, kwara State, Nigeria.

Meat (beef), water, Butchering tables and abattoir floor were sampled from each slaughterhouse. Meat samples were collected in an individual sterile plastic bag while water samples were collected into sterile sample bottles. Butchering tables and abattoir floor samples were collected by rubbing swab stick on the sites continuously for 30 seconds and transferred to a sterile screw-capped test tube containing 10 ml of sterile 0.1% peptone water. The samples were transported to the laboratory for immediate analyses.

Isolation and Identification of Bacteria: Ten gram each of the meat samples were mixed with 90 mL sterile peptone water and shaken properly. The swab samples were vortexed for 30 seconds for uniformity of the mixture. These and the water samples were then serially diluted six-fold. Using the spread plate method, 0.1 mL diluents was inoculated from each sample on sterile Plate Count Agar (PCA), MacConkey Agar, Eosin Methylene Blue Agar (EMBA), Mannitol Salt Agar (MSA), Blood Agar (BA) and Salmonella-Shigella Agar (SSA).

The inoculated plates were incubated at 37°C for 24-72 hours. Distinct colonies were counted and sub-cultured appropriately to obtain pure cultures. The Total Coliform Counts (TCC) and Total Viable Bacterial Count (TVC) were recorded as colony forming unit (CFU/mL/g/cm^2). The isolates were characterized based on their colonial, morphological and biochemical characteristics with reference to Bergey’s manual and Cheesbrough [9].

RESULTS

Fig. 1 and 2 show the Total Viable Counts (TVC) and Total Coliform Counts (TCC) of meat, Butchering table, Abattoir floor and Water samples. In Oja-titun, TVC were higher on meat samples and lowest on table samples while the TCC were also higher on meat samples but lowest on water samples.In Ipata, the trend is different. Water samples had the highest TVC and lowest on table samples. This is similar to the trend observed in the TVC

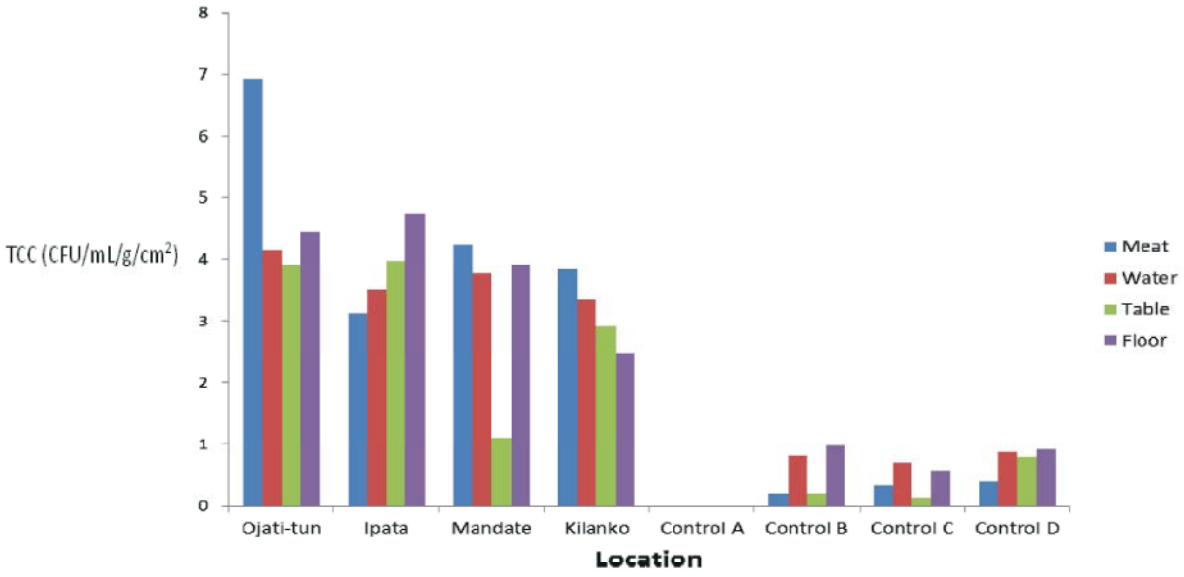

Fig. 1: Mean Total Coliform Counts of meat, Butchering table, Abattoir floor, water and control samples

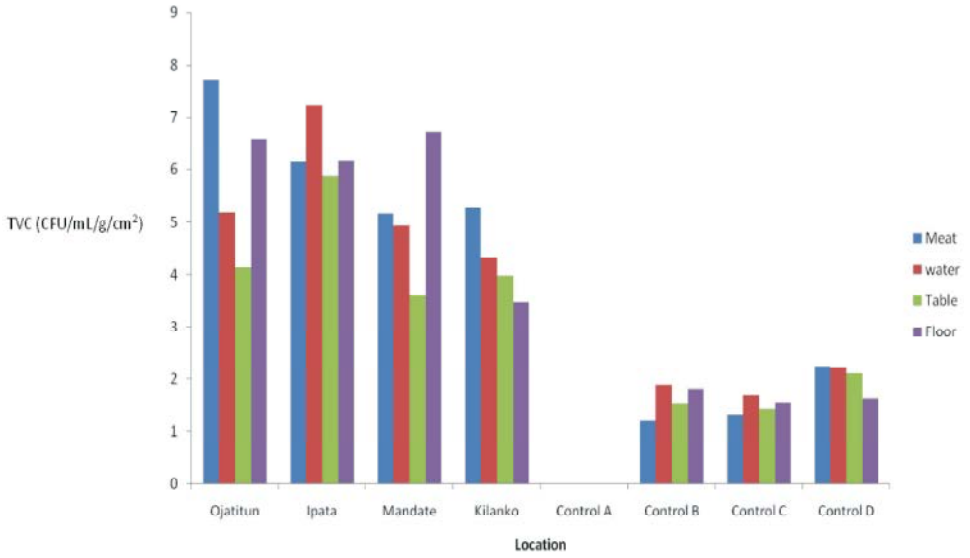

Fig. 2: Mean Total Viable Counts of meat, Butchering table, Abattoir floor, water and control samples

Table 1: Bacteria species isolated from each of the sample types collected from Ipata

	Meat	Water	Abattoir floor	Table
Bacillus spp.	+	-	-	-
Escherichia coli	+	+	-	+
Klebsiella spp.	-	-	-	-
Enterococcus spp.	-	-	-	-
Proteus spp.	-	-	-	-
Pseudomonas spp.	+	+	+	+
Salmonella spp.	-	-	-	-
Staphylococcus spp.	+	-	+	+

KEY: + = Present
- = Absent

Table 2: Bacteria species isolated from each of the sample types Collected from

Mandate	Meat	Water	Abattoir floor	Table
Bacillus spp.	-	-	-	-
Escherichia coli	+	+	+	-
Klebsiella spp.	+	-		+
Enterococcus spp.	-	-	-	-
Proteus spp.	+	-	+	-
Pseudomonas spp	+	-	-	-
Salmonella spp.	+	+	+	+
Staphylococcus spp.	+	-	+	+

KEY: + = Present
- = Absent

Table 3: Bacteria species isolated from each of the sample types Collected from

Kilanko	Meat	Water	Abattoir floor	Table
Bacillus spp.	-	-	-	-
Escherichia coli	+	+	+	+
Klebsiella spp.	-	-	-	-
Enterococcus spp.	+	+	-	-
Proteus spp.	-	-	-	-
Pseudomonas spp	+	-	+	-
Salmonella spp.	-	-	-	-
Staphylococcus spp.	+	-	+	+

KEY: + = Present
- = Absent

Table 4: Bacteria species isolated from each of the sample types Collected from Ojatitun

	Meat	Water	Abattoir floor	Table
Bacillus spp.	-	-	-	-
Escherichia coli	+	+	+	+
Klebsiella spp.	+	+	+	+
Enterococcus spp.	+	+	+	-
Proteus spp.	+	-	+	+
Pseudomonas spp	+	+	-	+
Salmonella spp.	-	-	-	-
Staphylococcus spp.	+	-	+	+

KEY: + = Present
- = Absent

on table samples collected from Oja-titun. The TCC were higher on floor samples and lowest on the meat samples, this shows a dissimilar trend observed in the TCC in Oja-titun. In Mandate, the TVC were higher on floor samples and lowest on table samples while the TCC showed a higher count on meat samples and a lower count on table samples. In Kilanko, a higher TVC were observed on meat samples and lower on floor samples. The TCC in Kilanko had a similar trend, the higher counts were observed also on meat samples and lower on floor samples.

A total of one hundred and six (106) bacterial isolates comprising five different genera of Gram negative bacteria and three different genera of Gram positive bacteria were isolated in this study from the four abattoirs sampled. This showed that all the selected abattoirs contributed equally to the microbial diversity reported in this study. Tables 1-4 show the occurrence of the bacterial isolates in the slaughterhouses.

DISCUSSION

The findings of this study showed that there were heavy microbial load in beef carcasses in the sampled abattoirs. However all water samples and environmental facilities sampled had higher bacterial load values as demonstrated by Total Viable Counts and Total Coliforms Counts levels that exceeded to what was proposed by Agbodaze *et al*. [10] who found that if the Total Plate count was less than 5.0 log CFU and coliforms count are less than 3.5log CFU the meat could be classified as having low risk as far as transmission of pathogenic bacteria to consumers is concerned.

This study is in agreement with the results of some previous researches and that conditions in Nigerian abattoirs and meat markets are very poor [11, 12]. All the bacterial counts obtained from meat samples in this study were higher than the internationally accepted level i.e. 10^5cfu/g (The Prevention of Food Adulteration Act and Rules) [13]. Higher microbial count observed in the meat samples may be due to improper handling and processing employed in these slaughterhouses.

Adetunji and Awosanya [14] reported that portable water was an essential requirement in the quality assurances of meat produced at the abattoir. Presence or high level of microbial count in the water in abattoir suggested a possible contamination by bacteria. The findings of this work showed that the source of water in all the abattoirs was highly contaminated with *E. coli* and are not in conformity with the recommended zero *E. coli* counts in water used for washing carcasses, which is required to meet the drinking water standard [13].

The report of Adeyemo *et al*. [15] in the same vein agrees with the findings of this work that meat safety and environmental sanitation measures at Bodija (Ibadan) abattoir were grossly inadequate thereby giving room for contamination and exposure of humans to pathogens. Furthermore, the differences in theconstruction of these abattoirs played a crucial part to theireventual selection. The abattoirs are local abattoirs as slaughtering of animals was done manually (not mechanically) on slaughtering pavement.

The most prevalent bacteria isolated in this study were Coliforms and *S. aureus* which is in agreement with Mekonnen *et al*. [16] where the major bacterial pathogens isolated were *S. aureus, E. coli* and *B. cereus*. The predominant bacteria isolated were *Escherichia coli*, *Staphylococcus spp., Pseudomonas aeruginosa, Enterococcus spp., Proteus vulgaris, Klebsiellapneumoniae Salmonella spp.* and *Bacillus spp.,* Microorganisms isolated from fresh meat samples in this study have been earlier found in foods, environment and other places and their pattern is similar to previous reports by Ali *et al.* [17].

This is also similar to that reported by Itah *et al.* [18], where they observed in Uyo abattoir (Nigeria), that *Staphylococcus aureus, Escherichia coli, Bacillus cereus, Staphylococcus epidermidis, Micrococcus*

roseus, Bacillus subtilis and species of *Streptococcus, Klebsiella, Pseudomonas* and *Salmonella* were isolated from meatsamples.

CONCLUSIONS

The findings of this study have shown the poor microbiological quality of meat sold in the abattoirs in Ilorin and has provided public health information regarding the study area.This study concluded that bacterial contamination of raw meat and other parameters from abattoirs in Ilorin washigh exceeding the recommended standard and internationally accepted levels for sanitary practices.

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