



Microbial Assessment of Slaughter Slabs at the Central Slaughterhouse of Ado Ekiti

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study was aimed at assessing the presence of microbes in the selected slaughter slabs in order to inform the Animal scientists, Public health workers, Butchers and Meat vendors to know the risk pose to human health with contaminated meat.

A total of 50 sterile swab sticks were used to collect the samples from five abattoir slaughter slab surfaces in Ado-Ekiti central abattoir with ten swab samples from each slaughter slab. After collection the samples were immediately transported to laboratory for microbiological studies. Trypticase-soya-agar (TSA) was used as medium for the samples, while chloramphenicol was used in replacement to trophic bacteria and Sabouraud-glucose-agar (SGA) for fungi. The incubation of Petri dishes were set at 37°C for 48 – 72hrs while daily observation of the cultures were carried out with the use of stereoscopic microscope for the presence of fungal mycelium and or bacterial colonies. The results revealed that bacterial count mean value was 1.83×10^5 CFU/ml and fungal count mean value was 0.59×10^5 CFU/ml. A total of eight strains of bacteria comprises of gram positive and gram negative bacteria from all the samples were isolated, *Staphylococcus aureus* had the highest percentage of occurrences (33%), followed by *Escherichia coli* (26%), *Pseudomonas aeruginosa* (19%), while other prevalence bacteria have 5% each. In the fungi samples, isolation of four strains were carried out, from all the total fungal count, *Aspergillus flavus* had the highest number of occurrence with approximately 40%, *Penicillium* spp had 28%, and 8% occurrence for the lowest fungal count. It is shown in the study that the meat has higher contamination potential from the slaughter slab surfaces. With the result shown, contamination rate could be attributed to poor sanitation level, and proper measure and attention was not given to hygienic practices in the

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Central abattoir in Ado Ekiti. This then called for butchers education on the importance of practicing good hygiene, handling of meat with modern techniques and encouragement of good sanitation in the abattoirs.

Keywords: Abattoir; slaughter slabs; bacterial; fungi; sanitation.

1. INTRODUCTION

According to WHO [1], revealed that Africa is embattled with food borne diseases as a result of poor handling of food, weak monitoring, unhygienic sanitation practices, lack of food safety advocacy, and poor regulatory systems coupled with insufficient financial resources to purchase appropriate equipment as well as lack of proper orientation for food handlers. There are different food sources meant for human consumption, but the one that pose serious threat to human health is from animal origin which could only be mitigated through proper food hygiene. In different countries, there are diseases associated with food borne which poses serious health challenges [2]. As stated by Yousuf et al. [3], the sources of animal products especially meats and fish are said to be at high risk with presence of pathogen contents, the natural toxins, with some other contaminants. Edema et al. (2005) stated that the present world as described by Food and Agricultural Organization (FAO) and the World Health Organization is faced with widespread of health related problems which can be attributed to food contamination and that it has caused reduction in economic productivity.

Slaughter slab is a facility which is made up of concrete slab and metal roof designated for the purpose of animal slaughtering and dressing of meat approved solely and licensed for human consumption [4]. In Nigeria, slaughter houses are located in different places both public and private owned used in meat processing. Meat vendors purchase meat from any of these processing centres to sell to the consumers. Different issues such as lack of proper hygiene, poor sanitation could arise in slaughtering and dressing facilities which may pose a challenge to national productivity [5,6].

Lack of accurate data relating to occurrence of food borne is higher in most developing countries such as Africa compared to developed countries. As stated by Govindarajan [7], one of the good source of animal protein is meat which various consumers expects to purchase an hygienic and wholesome products which would not pose threat

to their health. There is so much concern and threat to health when meat procured from an unhygienic source is consumed, this could cause reduction in meat quality as well [6,8].

There are various means at which meat could be contaminated ranging from working surfaces, use of equipment, handling of the meat during processing etc. [9]. The use of quality water could play a vital role in determining if meat contamination will either be increased or reduced during meat processing. Meat processing is easily subjected to microbial contamination due to poor hygienic control, unclean immediate environment of the abattoir, and other activities carried out can serve as contamination sources to the meat processed [10,11]. It was observed that there is no available data to use in comparing the assessment of food borne diseases, food safety practice as well as microbial load of slaughter slabs in Ado Ekiti Central abattoir. Lack of this data could prevent the government to intervene and provide accurate measure to mitigate against problems caused by meat contamination on public health, hence the present work was designed to determine the load of microbial contamination and pathogenic organisms present in Ado Ekiti Central abattoir slaughter slabs.

2. MATERIALS AND METHODS

2.1 Study Area

The microbial assessment was carried out from December 2021 to January 2022 in Ado-Ekiti central abattoir, Ekiti State, South West Nigeria.

2.2 Study Design

A cross sectional study design was employed whereby a simple random sampling of slaughter slabs surfaces was carried out. Samples from slaughter slabs surfaces from abattoir were invariably collected aseptically, processed and analysed accordingly.

2.3 Sample Collection

A total of 50 samples were collected from Ado Ekiti central abattoir using sterile swab sticks.

The samples were collected from five abattoir slaughter slabs surfaces with ten swab samples taken from each slaughter slab. After collection the samples were immediately transported within 6 hours of collection to the laboratory for microbiological studies. Microbial quality analysis were carried out on the samples according to FAO [12]. At the screen house of the Microbiology Unit of the Department of Science Laboratory Technology of Federal Polytechnic, Ado- Ekiti, Ekiti State located in the South West Nigeria. The ambient temperature fluctuated between 25-31⁰ C during the period of the experiment.

2.4 Microbial Counts

Placement of the samples were done on trypticase-soya-agar (TSA), while chloramphenicol was used to supplement fungi (trophic bacteria and Sabouraud-glucose-agar) (SGA). The incubation process for Petri dishes were set at 37⁰ C with time interval of 48 - 72 hrs while the presence of bacterial colonies and/ fungal mycelium were daily observed on the cultures with the aid of stereoscopic microscope. The manufacturer's specification was followed in preparation of the media with given instructions and directions after the media has been weighed out. Total microbial counts was subjected to serial dilution method.

2.5 Identification of Microbes

In order to identify the microbes, the incubation process carried out on the Plates were set at 37⁰C with time period of 24 - 48 hours. While to derive isolates of pure culture, the discrete colonies were further sub-cultured aseptically into fresh agar plates. The resulting growth of the Pure isolates were later stored for further identification of bacteria at 4⁰ C. A macroscopical examination (Olympus light microscope, Germany) was carefully carried out on discrete colonies subjected to agar nutrient in order to obtain distinct shape, size, colour, and consistency that have cultural characteristics. The standard procedures were followed strictly with Gram staining as also the biochemical tests used as described by Oyeleke & Managa [13]. Morphological and biochemical methods as stated by Lennette et al., [14] and Jolt et al., [15] were used to isolate the resulting growth from the pure isolates. For each occurrence of bacterium and fungus identified, number of occurrence were taken with number of percentage of occurrence. Incubating one or two of the un-

inoculated plates confirmed the sterility for each tested batch medium while inoculated tests were also carried out. Subsequently, in order to show that there was no bacterial growth, un-inoculated plates were intermittently examined.

2.6 Statistical Analysis

All the results of the laboratory investigations were subjected to analysis of variance (ANOVA) according to the standard procedure described by Steel and Torrie [16]. Duncan multiple range test was used to compare means found to be statistically significant ($p < 0.05$) as described by Obi (1990).

3. RESULTS AND DISCUSSION

The mean value of the bacterial count from all the samples varies from 1.37×10^5 to 2.25×10^5 CFU/ml while the mean value for fungal count varies from 0.38×10^5 to 0.88×10^5 CFU/ml with a significant difference ($P < 0.05$). The mean total microbial count for all the samples was 2.42×10^5 CFU/ml (Table 1). The highest and lowest microbial counts were observed in Slaughter slab 1 (2.80×10^5 CFU/ml) and Slaughter slab 5 (1.90×10^5 CFU/ml) respectively.

A total of eight strains of bacteria comprises of gram positive and gram negative bacteria were isolated from all the samples with *Staphylococcus aureus* had the highest percentage of occurrences (33%), followed by *Escherichia coli* (26%), *Pseudomonas aeruginosa* (19%). However, others prevalence were *Bacillus* species, *Vibrio cholerae*, *Proteus mirabilis*, *Shigella dysenteriae* and *Klebsiella pneumonia* having the least percentage of occurrence with 5% each. A total of four strains of fungi were isolated from the samples with *Aspergillus flavus* being the most frequently occurring fungi accounting for approximately 40% of the total fungal count followed by the *Penicillium* species 28% (Table 3). The least frequently occurring fungi in the study was *Rhizopus* species accounting for 8% of the total fungal count in the study.

3.1 Discussion

The total microbial counts observed in this study ranged between 1.90×10^5 and 2.80×10^5 CFU/ml these values exceed the FAO/WHO (2004) standard limit of 1.0×10^5 CFU/ml for food products and water. This poses a serious public health concern to the consumers of these meats and is an indicator of the level of hygienic

Table 1. Mean values of microbial load of slaughter slabs in Ado-Ekiti central abattoir

Slaughter slab	Bacterial count (CFU/ml)	Fungal count (CFU/ml)	Total microbial count (CFU/ml)
Slab 1	1.92×10^5	0.88×10^5	2.80×10^5
Slab 2	2.08×10^5	0.52×10^5	2.60×10^5
Slab 3	1.37×10^5	0.70×10^5	2.07×10^5
Slab 4	2.25×10^5	0.47×10^5	2.72×10^5
Slab 5	1.52×10^5	0.38×10^5	1.90×10^5
Total	9.14×10^5	2.95×10^5	12.09×10^5
Mean	1.83×10^5	0.59×10^5	2.42×10^5

Table 2. Number of individual bacterium encountered in the samples

Bacterium	No of occurrence	Percentage
<i>Staphylococcus aureus</i>	14	33%
<i>Escherichia coli</i>	11	26%
<i>Pseudomonas aeruginosa</i>	8	19%
<i>Klebsiella pneumonia</i>	2	5%
<i>Bacillus sp</i>	2	5%
<i>Shigella dysenteriae</i>	2	5%
<i>Vibrio cholerae</i>	2	5%
<i>Proteus mirabilis</i>	2	5%
Total	43	100

Table 3. Number of individual fungus encountered in the samples

Fungus	Number of occurrence	Percentage of total number (%)
<i>Aspergillus flavus</i>	10	40
<i>Aspergillus niger</i>	6	24
<i>Penicillium species</i>	7	28
<i>Rhizopus sp,</i>	2	8.0
Total	25	100

practices at the slaughter slab in Ado-Ekiti central abattoir. The total mean bacterial load of 12.09×10^5 CFU/ml obtained from the slaughter slabs in this study was higher than the value reported by Fasanmi et al. [17] "which is 5.54 CFU/ml from meat sellers' tables from various markets in Ibadan, Nigeria. The Hazard Analysis Critical Control Point (HACCP) concept is used to identify microbiological vulnerable points in the food production process and processing, and to determine the most appropriate methods of control to be applied. Usually such methods include improved handling techniques, sanitation, monitoring of temperature and more intensive supervision" [18]. "The microbiological safety of food is achieved by ensuring the absence of pathogenic microorganisms and by all means preventing their multiplication" [19]. The highest total microbial counts was observed in slaughter slab 1 at 2.80×10^5 CFU/ml and lowest total microbial counts was observed in slaughter slab 5 at 1.90×10^5 CFU/ml this is an indication that the slaughter slab 1 is easily accessed by the

butchers and many animals are slaughtered and dressed on the slab which tends to increase the rate at which microorganisms were growing there since meat contains sufficient nutrient needed to support the growth of microorganisms (Magnus, 1981). "The high microbial load obtained from the slaughter slab is an indication of inadequate cleaning and poor or absence of sterilization of the slaughter slab, which are usually washed with water only. The presence of bacterial pathogens in meat contact surfaces may contribute to the contamination of meat" [20].

In this study *Staphylococcus aureus* had the highest percentage of occurrences (33%), followed by *Escherichia coli* (26%), *Pseudomonas aeruginosa* (19%). However, others prevalence were *Bacillus sp*, *Vibrio cholerae*, *Proteus mirabilis*, *Shigella dysenteriae* and *Klebsiella pneumonia* having the least percentage of occurrence with frequency of 5% each. The bacterial contaminants of samples in the study were *Staphylococcus aureus*,

Escherichia coli and *Pseudomonas aeruginosa*. Similar bacterial contaminants have been reported by other workers in foods, water and environmental samples [21,22,23,24]. "Biological contaminants such as bacteria, viruses, fungi, protozoa and helminthes constitute the major cause of food-borne diseases with varying degrees of severity, ranging from mild indisposition to chronic or life-threatening illness, or both. In developing countries, such contaminants are responsible for food borne diseases such as cholera, campylobacteriosis, *E. coli* gastroenteritis, salmonellosis, shigellosis, brucellosis, amoebiasis and poliomyelitis" (Edema et al. 2005).

Staphylococcus species was the predominant isolate (33%) followed by *Escherichia coli* (26%) and this is in close agreement to previous reports by [24] (Okonko et al., 2009) "where they isolated almost similar organisms from meat, sea-foods and other ready to eat food stuffs. The higher rate of contamination of meat with these organisms is an indication of deplorable state of poor hygienic and sanitary practices employed right from the abattoir".

Aspergillus flavus being the most frequently occurring fungi isolated from the samples which accounted for approximately 40% of the total fungal count followed by the *Penicillium* species 28% (Table 3). The least frequently occurring fungi in the study was *Rhizopus* species accounting for 8% of the total fungal count in the study. The findings of this study is in conformity with that of Bankole et al. (2005) who reported "the presence of *S. auerus*, *Bacillus* species, *E. coli*, *Pseudomonas* species, *Sacchromyces* species, *Rhizopus* species and *Aspergillus* species in the working surfaces in abattoirs and palms of meat vendors in Abeokuta Metropolis, Ogun State, Nigeria".

4. CONCLUSION

"The high microbial load on the processing facility surfaces in this study underscores the poor level of personnel hygiene and poor sanitation at the abattoir. Based on the bacteria isolated and bacterial load on different surfaces in the abattoirs, meat could be contaminated by contact with contaminated surfaces and equipment in the abattoirs to pose public health hazards" [20]. Thus to safeguard the public against the risks of food borne infections, there is need to frequently educate butchers and meat vendors on the adverse effects of meat contamination on public health and they should

also be educated on practicing good sanitation and meat handling techniques in the abattoirs. However, the meat vendors/retailers should observe strict hygienic measures such as daily washing of their slabs before and after dressing of carcasses. This should be followed by a consistent sanitization of working spaces and equipment used in the dressing of carcasses meant for public consumption. Nevertheless, the public must be enlightened on the need to properly cook meat before eating them.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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