IDENTIFICATION AND PREVALENCE OF DIFFERENT SPECIES OF BACTERIA IN ABATTOIR AND RETAIL MEAT OUTLETS IN OSUN STATE

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ABSTRACT
This study was carried out to identify the level of prevalence of different species of microbes in abattoir and retail meat outlets in Osun State. Two abattoir and retail meat outlets were selected from the study area. Swabs of meat tables, knives and clothes and samples of water and meat from different parts were collected for microbiological analysis. The bacteria identified were Escherichia coli 1, Staphylococcus aureus, Clostridium perfringes, Pseudomonas aero, Hatniaalvei, Proteus vulgarius, Stenotrophomonasentericaspp, Bacillus huringiensis, Lactobacillus bulgaricus, Yersinia enterocolitica, Micrococcus lutus, Serratiamarcenscens and Bacillussubtilis. It was observed that highestbacteria species identified in Osogbo were found on knives ($2\times10^4 CFU/cm^2$), water($2\times10^4 CFU/ml$), tables($2\times10^4 CFU/cm^2$), clothes($4\times10^4 CFU/cm^2$)and meat ($2\times10^4 CFU/g$).In |Ila-Orangun, the highest bacteria were found on knives ($4\times10^4 CFU/cm^2$) and clothes($4\times10^4 CFU/cm^2$). At Ede, the highest bacteria were found on water ($3\times10^4 CFU/ml$), tables ($3\times10^4 CFU/cm^2$)and clothes ($3\times10^4 CFU/cm$).In Iwo abattoir, the highest was found on knives($4\times10^4 CFU/cm^2$) and in Ilesa, the highest bacteria were found on water ($4\times10^4 CFU/ml$) while Ile-Ife had highest bacteria on knives($4\times10^4 CFU/cm^2$),water ($4\times10^4 CFU/ml$), and clothes($4\times10^4 CFU/cm^2$). Since the highest percentage of population of the State consume the beef produced in abattoir and retail meat outlets, there is need for the sensitization campaign by both Federal and State Ministries of Health about the public health risk of heavy bacterial load present in the meat offered for sale in the study area
Keywords: Contamination, Bacteria, Hygiene, Beef, Abattoir, Prevalence

INTRODUCTION

The consumption of beef in Osun State increased in parallel with human population. This increase had led to compromise in adherence to food safety standard in the State (Sulley, 2012). Most abattoirs and retail meat outlets facilities, equipment and tools are old, outdated, and substandard and dilapidated Introduction of microbes in the abattoir start from the use of unsterilized knives for slaughtering, wearing of dirty aprons or clothes, eviscerating on unwashed tables during processing (Sulley, 2012). Contamination occurs by introduction of microorganism on the meat surfaces in almost every operation performed during processing (Warris, 2010). A great diversity of microbes affects fresh meat generally and their extent depends on PH, composition, texture and storage temperature and means of transportation (Fakolade *et al*., 2017). Thus, to reduce the levels of microbial contamination, good sanitation is required in the abattoirs or processing room, since microbes affects the shelf life and overall acceptability of meat products whether fresh or processed (Bello and Oyedemi, 2009).

MATERIALS AND METHODS

This study was carried out in 6selected abattoirs and retail meat outlets from across some selected from across Osun State. The State is situated in the Western part of Nigeria and lies on latitude 8º to the North and longitude 6º to the South. Then it is marked by longitude 4º to the West and longitude 5º to the East The surface swabs from abattoirs and retail meat outlets knives, tables and clothes were collected aseptically using sterile moistened cotton wool swabs by rubbing firmly over the predetermined surface area using parallel stroke lines and slow rotation with respectively chosen template surface area to be swabbed. 500g of raw meat samples were collected from different parts of the carcass and immediately transported to laboratory in a cool box for biochemical analysis. Sample of water used in the abattoir was collected with sterile bottles, labeled, placed in a cool iced box and transported immediately to the laboratory for further biochemical analysis.

Statistical Analysis

The data generated from this study were analyzed using descriptive statistics which comprises of percentages and frequency.

RESULTS AND DISCUSSION

The bacteria identified from across the 6 abattoirs and retail meat outlets is presented in **Table 1**..Our results showed that bacterial levels reported were presented decreasing order: *Escherichia coli 1, <Staphylococcus aureus, Salmonella enterica spp <Serratia marcenscens,<Proteus vulgaricus,<Bacillus huringiensis<,Hatnia alvei,Stenotrophomonas maltophila,Shigella,< Bacillus subtillis,< Yersinia enterocolitica,<Clostridium*

perfringes,< Pseudomonas aero, <Lactobacillus bulgaricus < Micrococcus lutus. It was observed that the abattoir environments encouraged the contamination of beef by microbes because the sites were dirty and rules of personal hygiene were not strictly adhered to. Pathogenic microorganisms associated with meat contaminations include *Escherichiacoli, Listeria monocytogenes, Salmonella spp. and Campylobacter spp* .Reports of Ogunnusi and Dahunsi (2014) stated that microbial contamination of meat and its products in Oyo, Oyo State involves pathogens such as *E. coli and Salmonella spp.*

In **Table 2**, it was observed that *E. coli* and *Staphylococcus aureus* was the predominant bacteria reported in Osogbo through the result and they were found on knives, clothes and tables. This result is in support of earlier published work of (Joseph et al, (2021) who reported that contamination of meat products occurs during slaughtering and after slaughtering in the abattoir. Besides, it was also reported that direct contact with the cattle faeces and viscera during evisceration exposed meat to cross-contamination (Adeyemi, 2012). It is worthy of note that cleaning and disinfection of the meat processing areas as well as maintaining good hygienic practices among the meat handlers are pivotal in minimizing the risk of microbial contamination (Fakolade *et al*., 2017).

Table 1: Species of Bacteria Identified Six Abattoirs and Retail Meat Outlets in Osun State

Bacteria	Number of Isolates	Percentage (%)
Escherichia coli 1	33	40.00
Staphylococcus aureus	10	12.04
Salmonella enterica sp.	7	8.43
Serratiamarcenscens	6	7.22
Proteus vulgaricus	5	6.02
Bacillus huringiensis	4	4.81
Shigella	3	3.61
Hatniaalvei	3	3.61
Stenotrophomonasmaltophila	3	3.61
Bacillus subtilis	3	3.61
Yersinia enterocolitica	2	2.40
Clostridium perfringes	1	1.20
Pseudomonas aero	1	1.20
Lactobacillus bulgaricus	1	1.20
Micrococcus lutus	1	1.20
Total	**83**	**100.00**

Escherichia coli, Staphylococcus aureus and Bacillus huringiensis were found on swabs of tools and samples collected in Ila-Orangun. This result confirms the work of Warris (2010) who ascertained that carcass could become contaminated with microbes during the process of hides removal, evisceration and cutting when using unsterilized tools and facilities. The most common general of meat spoilage bacteria found are *Staphylococcus, Bacillus, Campylobacter, Clostridium, Listeria, Salmonella, lactic acid bacteria, Pseudomonas spp., Acinetobacter spp., and Moraxella spp.* They caused discoloration, bad odours, and slime on meat surfaces (Bello and Oyedemi, 2009). **Table 3** below shows that *Escherichia coli 1 and Serratia marcenscens* were predominant bacteria in abattoirs and meat retail outlets in Ede. The presence of these microbes could be connected with the hygienic situation of the abattoir and retail meat outlets. According to work of Soyiri *et al*. (2008), these species of bacteria that present in abattoir were as a result of personal and environmental hygiene that were poor because of the equipment/tools used for processing that were not washed and sterilized. Joseph et *al*. (2021) reported the possible source of contamination arising from the cutting knives, intestinal contents, chopping boards, hides, meat handlers, containers, vehicles for transporting carcasses and the meat selling environment. Bacteria identified in Iwo were predominant *Escherichia coli and Staphylococcus aureus.* They were found on knives, clothes, tables, meat and water. Ahmed and Karanis, (2020) confirmed this when they reported that unhygienic tables, knives and clothes encouraged the contamination of meat through bacteria. Ogunnusi and Dahunsi (2014) reported that contamination of meat by resistant strains of *S. aureus and E. coli* during slaughtering process dramatically have been increased indicating, secondary contamination from the environment of slaughter houses.

Bacteria identified in Ilesa and Ile-Ife abattoirs and meat retail outlets are presented in **Table 4**, the predominant bacteria identified in Ilesa was Escherichia *coli*. It was found on knives, clothes, tables, meat and water. This result is in support of the work of Fasanmi *et al*. (2010) who reported that bacteria were abundant in abattoirs where personal and environmental hygiene were poor and the tools used for processing were not washed and sterilized. With inadequate slaughtering and disposal facilities attracting flies, domestic animals, wild carnivores and rodent, abattoir or slaughtering house become among the important sources of microbial contamination. The study

of Sulley . (2012) revealed that the workers' hands and their equipment were among the main sources of meat contamination. In Ile-Ife,the predominant bacteria identified were *Escherichia coli, Proteus vulgaricus and Salmonella enterica spp.* They were found on knives, clothes, tables, meat and water. The result obtained from this work is in support of earlier work of Sulley (2012) who reported that introduction of microbes in the abattoir start from the use of unsterilized knives for slaughtering, wearing of dirty aprons or clothes, eviscerating on unwashed tables during processing .Pre-slaughtering conditions like feeding and housing including spreadable contaminations from skin and faeces, contents of digestive system, and contaminated water are sources of *Staphylococcus, Escherichia and Bacillus cereus* (Ahmed and karanis,2020).

Table 2: Bacteria Species Identified at Osogbo and Ila-Orangun Abattoirs and Retail Meat Outlets Respectively (Osun Central Senatorial District)

Type of Bacteria	I_1	I_2	II_1	II_2	III_1	III_2	IV_1	IV_2	V_1	V_2
Escherichia coli	2	2	0	1	0	0	0	1	0	1
Staphylococcus aureus	0	0	1	1	0	1	0	1	0	1
Shigella	0	0	0	0	2	0	0	0	0	0
Hatniaalvei	0	0	0	0	0	0	1	0	2	0
Proteus vulgaricus	0	0	0	0	0	0	1	0	0	0
Bacillus huringiensis	0	1	0	0	0	1	0	1	0	0
Total	**2**	**3**	**1**	**2**	**2**	**2**	**2**	**3**	**2**	**2**

Key: I = knife, II = water, III = table, IV = clothes, V = meat

Table 3: Bacteria Species Identified at Ede and Iwo Abattoirs and Retail Meat Outlets Respectively (Osun West Senatorial District)

Type of Bacteria	I_1	I_2	II_1	II_2	III_1	III_2	IV_1	IV_2	V_1	V_2
Escherichia coli	11		1	0	1	2	2	3	2	1
Staphylococcus aureus	0	1	0	0	0	1	0	0	0	0
Shigella	0	0	0	0	0	0	0	0	0	1
Salmonella enteric spp	0	0	0	0	0	0	0	0	0	1
Bacillus huringiensis	0	1	0	0	0	0	0	0	0	0
Lactobacillus bulgaricus	0	0	0	1	0	0	0	0	0	0
Yersinia enterocolitica	0	0	0	2	0	0	0	0	0	0
Bacillus subtilis	0	1	0	0	0	0	0	0	0	0
Seratiamarcenscens	1	0	2	0	2	0	1	0	0	0
Total	**2**	**4**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**

Key: I = knife, II = water, III = table, IV = clothes, V = mea

Table 4: Bacteria Species Identified at Ilesa and Ile-Ife Abattoirs and Retail Meat Outlets (Osun East Senatorial District)

Type of Bacteria	I_1	I_2	II_1	II_2	III_1	III_2	IV_1	IV_2	V_1	V_2
Escherichia coli	1	2	1	3	0	1	0	1	1	2
Staphylococcus aureus	0	0	1	0	0	0	2	0	0	0
Clostridium perfringes	0	0	0	0	1	0	0	0	0	0
Proteus vulgaricus	0	1	0	0	0	1	0	2	0	0
Stenotrophomonasmaltophila	1	0	0	0	1	0	1	0	0	0
Salmonella enterica spp	0	1	1	1	0	2	0	1	0	0
Micocccoccuslutus	0	0	1	0	0	0	0	0	0	0
Total	**2**	**4**	**4**	**4**	**2**	**4**	**34**		**1**	**2**

Key: I = knife, II = water, III = table, IV = clothes, V = meat

CONCLUSION

The results obtained from this study showed that beef was produced and processed under unhygienic and dilapidated facilities, old building including unsterilized tools and equipment, unkempt environment which gave rise to multiplication of microbes that caused meat contamination can led to food poisoning and food borne diseases. Therefore, in order to protect the health of the workers and public against the risk of food borne disease and to produce wholesome beef, there is a need for intervention of Government at all levels and private organizations to advocate for good hygiene and sanitary practices, good meat handling procedures, modern equipment, tools and facilities, training and workshop for the meat producers, handlers and other stakeholders in the sector.

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