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Microbial Analysis and Antibiogram of Bacteria and Fungi Isolated from Meat Sellers Tables in Dutsin-Ma Metropolis, Katsina State

Wata I. [a*], Abdullahi K. [b] and Umaru Abdulmalik [a]

[a] Medical Unit, Department of Microbiology, Federal University Dutsin-Ma, Katsina State, Nigeria.
[b] Environmental Unit, Department of Microbiology, Federal University Dutsin-Ma, Katsina State, Nigeria.

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

The goal of the research project was to carry out microbiological analysis and antibiogram of bacteria and fungi associated with meat vendor tables in the city of Dutsin-Ma. This study made use of twenty samples in total. Five distinct locations at Wednesday Market and Darawa were chosen, and two samples from each table were taken using swab sticks. For analysis, the samples were then brought to the Federal University of Dutsin-ma microbiology laboratory department. The agars that were initially employed to isolate the bacteria and fungus were MacConkey, nutrient, mannitol salt, bile esculin, salmonella-shigella, eosin methylene blue, and potato dextrose agars. Bacterial species were identified using gram staining and biochemical tests while lactophenol cotton blue staining was used for the identification of fungal species. Bacterial isolates identified include *Escherichia coli, Salmonella species, Klebsiella pneumonia, Bacillus subtilis, Streptococcus species*

**Corresponding author: E-mail: wjohn@fudutsinma.edu.ng;*

*and Staphylococcus aure*us while the fungal isolates are *Aspergillus flavus, A. niger, A. fumigatus, and Oidiodendron griseum.* The antimicrobial susceptibility test findings showed that while some of the bacterial isolates were responsive to certain drugs, others were resistant. The results of this study's investigations therefore demonstrated how heavily polluted meat vendors' tables are with a wide variety of bacteria. This can be explained by the unsanitary procedures used in the meat sale industry as well as other environmental issues. Therefore, it is imperative that the government authorities tasked with these duties make sure that the vendors of these meat products adhere to standard and hygienic procedures. Raising public knowledge of the risks of foodborne illnesses associated with eating raw meats is another important goal of public health awareness campaigns.

Keywords: Antibiogram; bacterial and fungal isolates; hygiene.

1. INTRODUCTION

It is crucial to guarantee the safety and quality of food, especially meat products, in order to protect the public's health. The existence of microbial contamination, which can result in foodborne diseases and financial losses, is a major worry for the food business. The surfaces where meat is handled and sold, such as meat seller tables, are potential sources of microbial contamination. Conducting a microbial analysis of bacteria and fungi isolates from meat seller tables is crucial in assessing the hygiene conditions of these surfaces and understanding the associated risks. By studying the microbial composition and prevalence on these tables, researchers can gain insights into the presence of harmful microorganisms, evaluate the overall cleanliness, and identify potential sources of contamination. A number of bacteria species, including coliforms and listeria can be present in the intestines of some humans and animals, including birds without causing infection [1]. Hence, listeria could be transmitted through water bodies contaminated by abattoir effluent.

Bacteria and fungi are the primary groups of microorganisms found on meat seller tables. Bacteria exhibit diverse characteristics, including both beneficial and harmful species. Harmful bacteria, such as *Salmonella, Escherichia coli, and Staphylococcus aureus,* can cause foodborne illnesses when consumed [2-4]. Fungi, including molds and yeasts, can also grow on these surfaces and may produce toxins that pose health risks. Understanding the microbial diversity and prevalence on meat seller tables is essential for implementing effective control measures to reduce contamination and ensure food safety. By identifying specific microorganisms and their susceptibility to antimicrobial agents, appropriate strategies for sanitation and hygiene can be developed and implemented to minimize the risk of foodborne illnesses.

Fungi are widely distributed in nature and can occur as unicellular yeast or filamentous and, multicellular molds. Despite their wide occurrence, little attention has been given to their presence and significance to the environments (Kirk 2001). In 1980s and 1990s, more cases of health problems caused by fungal contamination.

By gaining insights into the microbial profile of meat seller tables, various stakeholders in the food industry, including regulatory authorities, food producers, and consumers, can make informed decisions regarding food safety practices, inspections, and appropriate interventions to mitigate the risks associated with microbial contamination [5-7].

Microbial analysis of bacteria and fungi isolates specifically from meat seller tables presents a knowledge gap in understanding the associated risks and ensuring the safety and quality of meat. Microbial contamination on meat seller tables can result from inadequate sanitation practices, improper storage of meat, and cross-contamination with other surfaces [8,9]. These factors increase the likelihood of foodborne illnesses among consumers. To effectively manage these risks, a thorough investigation of the microbial contaminants is necessary. Despite the significance of this issue, there is a notable lack of comprehensive research on the microbial profile of bacteria and fungi isolates specifically from meat seller tables. By investigating the extent of contamination, identifying the antibiotics to which the bacteria and fungi are resistant, and assessing their potential for multi-drug resistance.

The microbial analysis of bacteria and fungi isolates from meat seller tables is a topic of significant relevance to the society. The safety of

meat as a perishable food product is a major concern, considering that it can harbor various microorganisms that may pose health risks to consumers.

Foodborne infections are still a major global public health concern, with potentially dire repercussions for susceptible groups. In order to prevent foodborne illnesses and safeguard the public's health, it can be helpful to identify and comprehend the microbiological contaminants present on meat seller tables. Good hygienic practices: This study can offer important new understandings of the procedures meat vendors use to handle and care for their sale surfaces. The study can encourage meat vendors to adopt better methods and reduce the danger of cross-contamination by raising awareness and educating them about potential gaps in sanitation and hygiene protocols.

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out in Katsina State's Dutsin-ma Local Government District. The 2006 census found that there were 169,671 people living in Dutsin-ma LGA, which has an area of 527 square kilometers. The majority of the population in the area is employed by the government and in the farming and herding industries. The majority of the food products that the residents of this area ate were meat products, rice, beans, cereal, and cereal.

2.2 Collection of Samples

Every seller gave their consent for samples to be collected. Twenty samples in all were gathered for this investigation. Samples were gathered from five distinct places at the Darawa micro market and the Dutsin-ma Wednesday market. Two samples from each table in each of the five different locations within each market were obtained using sterile swap sticks. The organisms' viability and sterility were then preserved by submerging the swab sticks in a sterile transit medium (peptone water). After that, the samples were sent right away for examination to Federal University of Dutsin-ma's microbiological laboratory department.

2.3 Media Preparation and Inoculation

All microbiological media were prepared according to manufacturer’s instructions. The media used include Nutrient, MacConkey, Potatoes dextrose, Mannitol salt, Bile esculin, Salmonella-Shigella and Eosin methylene blue agars. Immediately after solidifying, the streak plate method was used in inoculating the samples unto the freshly prepared agar plates. The plates were then incubated for 24hrs and 72hrs for both bacterial and fungal growth respectively. Sub culturing was done in order to obtain pure colonies of the isolates.

2.4 Isolation and Identification of Fungi

Fungal plates were identified using both macroscopic (cultural characteristics) and microscopic identities.

The lacto phenol cotton blue solution procedure [10] was used for the microscopic identification of fungal species. A drop of 70% ethanol was introduced to a grease free glass slide. Using a sterile swap stick, an inoculum of the fungal colonies was obtained and applied to the ethanol drop on the glass slide. Before the ethanol evaporates, one to two drops of the lacto phenol cotton blue solution was added using a dropper or pipette. After that, a sterile, clean coverslip was carefully placed over it, making sure there were no air bubbles. Next, the slide was inspected for fungus spores and structures with the microscope's 40X objective lens.

2.5 Isolation and Identification of Bacteria

2.5.1 Gram staining

A smear was created by emulsifying a colony that was selected from a plate using a grazing loop and a drop of water applied to a clean glass slide. After being heat fixed and allowed to air dry, it was placed on the staining rack to be stained. Crystal violet, the primary stain was added and allowed for one minute. It was then flooded with water. Gram's iodine was added as a mordant for around 30 to 60 seconds in order to allow the crystal violet to permeate the organisms. It was then flooded with water. In order to remove the primary dye, alcohol was added for five to fifteen seconds after which it was also rinsed with water. Finally the counter stain, safranin was added for 60 to 80 seconds, after which it was flooded with water and allowed to dried. A drop of oil immersion was then applied to the stained portion of the slide and was viewed under the oil immersion lens (100X) of the light microscope for various shapes of the bacteria. (Monica, 2018).

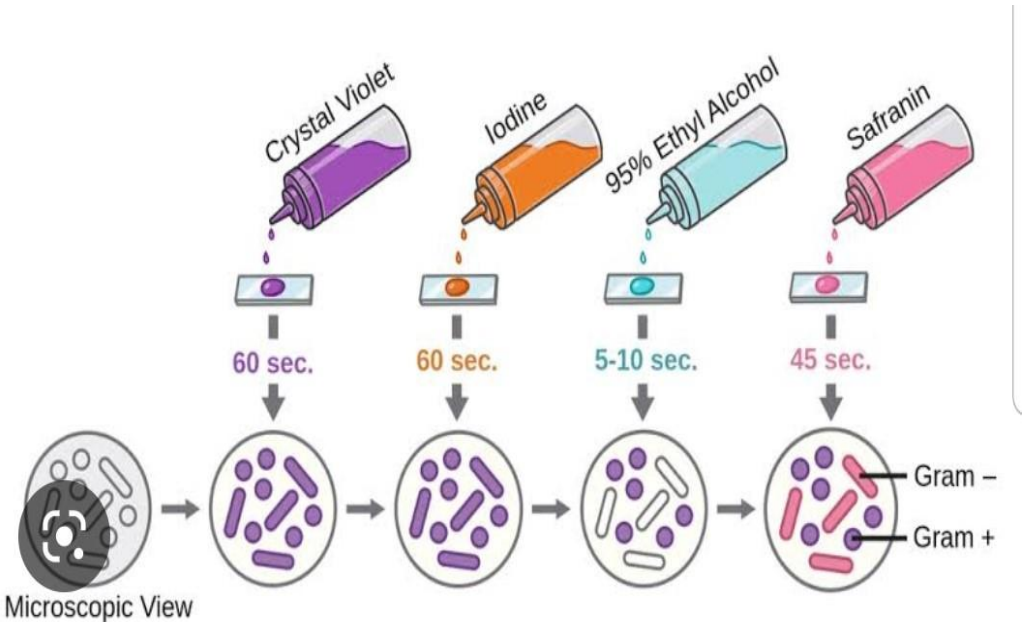

Fig 1. Observation under gram staining

2.5.2 Biochemical tests

Different types of biochemical test were carried out in order to identify the bacterial isolates. The tests procedures were carried out according to methods by Abiola and Oyetayo [11].

2.5.2.1 Oxidase test

A loop-full of oxidase reagent was placed on a filter paper in a petri dish, using plastic wire loop a colony of the organism was smeared across the wetted filter paper. The appearance of deep purple color is indicative of a positive result and no deep purple coloration indicates negative result.

2.5.2.2 Citrate test

Citrate agar is used to test an organism's ability to utilize citrate as a source of energy. When the bacteria metabolize citrate, the ammonium salts are broken down to anomia which increase alkalinity. A Sterile straight wire was used to first streak the slope of already prepared biju bottle with a saline suspension of the test organism and it was then stab in the butt. It was then incubated at 35°C for 24-48 hours. Bright blue coloration shows positive citrate test while no change in color shows negative citrate test.

2.5.2.3 Catalase test

Two drops of hydrogen peroxide was placed on a free grease slide. Then a colony of the organisms was transferred and emulsified in hydrogen peroxide on a clean free grease glass slide. Production of gas bubbles indicates positive reaction and absence of it indicates negative reaction.

2.5.2.4 Urease test

The purpose of a urease test is to find the organisms that can hydrolyze urea and create carbon dioxide and ammonia. By means of an inoculation wire loop, the test organism was injected using sterile procedure into a bijou bottle that held 3 m of sterile Christensen's modified urea broth. The tubes were inspected after three to twelve hours of incubation at 37°C. On the slant, urease production is indicated by a bright pink color when the result is positive and by no bright pink hue when the result is negative.

2.5.2.5 Motility

Motility is used to test an organism ability to move. A sterile hanging drop slide was picked and a Vaseline/ petroleum jelly was applied around the cavity of the slide. A drop of the fresh broth culture of the test organism was placed on the center of Vaseline on the slide. The hanging drop slide was then used to cover the drop of the culture. The preparation was quickly turned so that the drop of the fresh broth was suspended. It was then examined under both low and high power magnification for the presence or absence of motility.

2.5.2.6 Methyl red test (MR)

An overnight culture of the organisms was inoculated into appropriately labeled tubes of MR broth (containing buffered peptone 7g, glucose 5g and dipotassium 5g) by means of inoculation loop. Tube without the inoculum was kept as control. Incubation of both tubes at 37°C for 24 hours followed. After the incubation, 3 drops of 0.04% of MR indicator was added to both tubes including control. It was then mixed and observed.

2.5.2.7 Voges Proskauer test

The test involves inoculating the glucose phosphate broth with the test organism and incubation at 37°C for 48 hours. After incubation, 3 drops of alpha-naphthol was added followed by addition of 1 drop of 40% potassium hydroxide. The reagents were then mix thoroughly and allowed to stand for 30 minutes.

2.5.2.8 Coagulase test

Two drops of citrated plasma was placed on a grease free slide. Then a colony of the organisms was transferred and emulsified on the glass slide. Agglutination or clumping indicates positives and no agglutination or clumping indicates negatives result.

2.5.2.9 Indole test

Indole test screens for the ability of an organism to degrade the amino acid tryptophan and produce indole. The organism was grown in peptone water overnight and 2 drops of Kovac's reagent was added to the overnight peptone water cultured. Red ring colour above the peptone water indicates positive result.

2.6 Antibiotic Susceptibility test

Antibiogram of the test isolates was determined using disc diffusion technique [12]. Each colony of the test isolate was picked with a wire loop and inoculated into nutrient broth and incubated for 3hours. The turbidity of each broth culture was adjusted to correspond to 0.5 McFarland turbidity standards (corresponding to approximately 108cfc/ml). Each standardized broth culture was used to inoculate the surface of the Mueller-Hinton (MH) agar plates and the excess fluid drained into disinfectant jar. The surface of each inoculated plate was allowed to dry. Using a disc dispenser, the antibiotic discs was aseptically placed on the surface of the inoculated agar plates and then incubated for 24hrs at 370C. After incubation, the plates were examined for zones of inhibition round each disc. The diameters of the zones of inhibition were measured with a meter rule and recorded.

3. RESULTS

3.1 Cultural Morphology and Microscopic Characteristics of Fungi Isolates

Results of findings from the investigations carried out on potatoes Dextrose agar showed various colony morphology of different fungal species. Most of the growths on the plates were olive and dark greenish, smooth with white edges and spongy surfaces; others had cottony surfaces with black colorations. The microscopic examination further revealed the presumptive identities of the isolates. Four different fungi species has been isolated in the study sites the most prevalence is *Aspergillus niger* with the percentage of 40% from the ten sample and the less prevalence is *Aspergillus fumigatus* with the percentage of 10% from the ten samples. The results are presented in Table 1.

3.2 Distribution of Bacteria Cultural Characteristics Based on the Media Used

Based on the conditions utilized and the colony characterisation, Table 2 displayed the different distributions of the isolated bacteria. The size, shape, texture, color, and topography were used to interpret the characterisation. Round, creamy, opaque, translucent growths were seen on macConkey agar. The morphology of the colonies on Salmonella-Shigella agar was big, smooth, translucent, round, and had a wet edge.

3.3 Distribution of Bacteria Isolates Based on their Gram Reaction and Biochemical Tests

Microscopic examination and biochemical tests results revealed the gram reaction of the bacteria. The gram positive isolates were three in number and they include *Bacillus subtilis*, *Staphylococcus aureus* and *Streptococcus spp* while gram negative isolates were three which are *Escherichia coli, Salmonella spp* and *Klebsiella pneumonia*. The results are shown in Table 3.

Table 1. Cultural morphology and microscopic characteristics of fungi isolates

Sample code	Colony morphology	Microscopic characteristics	Presumptive isolates
A1	olive green, white edge, and granular surfaces	thick walled, conidospore with hyaline and long, aseptate shape	*Aspergilus flavus*
A2	Black, white edges and spongy surfaces	long conidospore with smooth walled hyaline	*Aspergilus niger*
A3	Dark green, white edges and spongy surfaces	Long and narrow conidospore with wall hyaline	*Aspergilus fumigatus*
A4	Black, white edges and spongy surfaces	long conidospore with smooth walled hyaline	*Aspergilus niger*
A5	cottony surface and brown in coloration	Dark mycellum hyaline, no septation of branches set off from the main hyphae	*Oidiodendron griseum*
W1	olive green, white edge, granular surfaces	thick walled, conidospore with hyaline and long, aseptate shape	*Aspergilus flavus*
W2	Black, white edges and spongy surfaces	long conidospore with smooth walled hyaline	*Aspergilus niger*
W3	Cottony surface and brown in coloration	Dark mycellum hyaline, no septation of branches set off from the main hyphae	*Oidiodendron griseum*
W4	Olive green, white edge, granular surfaces	thick walled, conidospore with hyaline and long, aseptate shape	*Aspergilus flavus*
W5	Black, white edges and spongy surfaces	long conidospore with smooth walled hyaline	*Aspergilus niger*

Key:A1= Sample 1 from Darawa, A2= Sample 2 from Darawa, A3=Sample 3 from Darawa, A4= Sample 4 from Darawa, A5= Sample 5 from Darawa, W1=Sample 1 from Wednesday market, W2=Sample 2 from Wednesday market, W3= Sample 3 from Wednesday market, W4= Sample 4 from Wednesday market, W5= Sample 5 from Wednesday market.

Table 2. Distribution of Bacteria cultural characteristics based on the media used

Media	Colony characterization
Eosin methylene blue agar	Pinpoint, flat, round greenish metallic sheen, smooth, slightly raised and translucent
Nutrient agar	Irregular, creamy, opaque, entire mucoid small, translucent, small, round, white, rough,
Salmonella-Shigella agar	Circular, large, smooth, translucent, grey white, moist, entire edge and opacity
Mannitol Salt agar	Small, round, flat, yellowish, firm, translucent and opaque
Bile eculin agar	Mucoid, smooth, translucent, greyish white, round and large
MacConkey agar	Circular, creamy, opaque, dry, small and translucent

3.4 Results of Antimicrobial Susceptibility Test Pattern for (Gram positive Bacteria)

Table 4 showed the distribution of antimicrobial tests pattern for gram positive bacteria. *Staphylococcus aureus* was susceptible to Ciprofloxacin, Streptomycin, Septrin, and resistance to Pefloxacin, Gentamycin, Ampiclox, Amoxacillin, and Penicillin. *Bacillus species* was resistance to Penicillin, Amoxacillin, Septrin, Pefloxacin and Cefoperazone. Streptococcus species was susceptible to Pefloxacin, Gentamycin.

3.5 Results of Antimicrobial Susceptibility Test Pattern for (Gram negative Bacteria)

Table 5 showed the distribution of antimicrobial tests pattern for gram negative bacteria. *Escherichia coli* was susceptible to Septrin, Ciprofloxacin, Pefloxacin, Tarivid, Streptomycin; Intermediate to Chloramphenicol, Sparfloxacin,

Gentamycin and Resistant to Amoxacillin, Augmentin. *Salmonella species* was susceptible to Sparfloxacin, Ciprofloxacin, Gentamycin and Streptomycin. *Klebsiella pneumonia* is resistance to Chloramphenicol, Sparfloxacin, Ciprofloxacin, Amoxacillin, Augmentin, Pefloxacin and Streptomycin.

Table 3. Distribution of bacteria isolates based on their gram reaction and biochemical tests

Sample	Gram reaction	Oxidase	Citrate	Catalase	Urease	Motility	MR	VP	Coagulase	Indole	IDENTIFIED ORGANISM
A1	-	-	-	+	-	+	+	-	-	+	*Escherichia coli*
A1i	-	-	+	+	-	+	-	+	-	-	*Salmonella spp*
A2	+	-	-	+	-	-	-	+	-	-	*Bacillus subtilis*
A2i	+	-	-	+	+	+	-	-	+	+	*Staphylococcus aureus*
A3	+	+	-	-	-	-	+	-	-	+	*Streptococcus spp*
A3i	+	-	-	+	+	+	-	-	+	+	*Staphylococcus aureus*
A4	-	-	+	+	-	+	+	-	-	-	*Salmonella spp*
A4i	-	-	+	+	-	-	+	-	-	+	*Klebsiella pneumonia*
A5	+	-	-	+	+	+	-	-	+	+	*Staphalococcus aureus*
A5i	+	-	-	+	-	-	-	+	-	-	*Bacillus subtilis*
W1	-	-	+	+	-	+	+	-	-	-	*Salmonella spp*
W1i	-	-	-	+	-	+	+	-	-	+	*Escherichia coli*
W2	+	-	-	+	+	+	-	-	+	+	*Staphlococcus aureus*
W2i	+	+	-	-	-	-	+	-	-	+	*Streptococcus spp*
W3	-	-	+	+	-	-	+	-	-	+	*Klebsiella pneumonia*
W3i	-	-	+	+	-	+	+	-	-	-	*Samonella spp*
W4	+	-	-	+	-	-	-	+	-	-	*Bacillus subtilis*
W4i	+	+	-	-	-	-	+	-	-	+	*Streptococcus spp*
W5	-	-	-	+	-	+	+	-	-	+	*Escherichia coli*
W5i	-	-	+	+	-	+	+	-	-	-	*Salmonella spp*

KEY MR=Methyl red, VR=Voges-Proskauer

Table 4. Results of Antimicrobial susceptibility test pattern for (Gram positive Bacteria)

Isolates/No	CEF	PEN	SXT	CH	CPX	PEF	AM	S	CN
S. aureus	20(S)	2(R)	20(S)	25(S)	24(S)	10(R)	5(R)	19(S)	10(R)
Bacillus spp	4(R)	20(S)	8(R)	20(S)	22(S)	12(R)	6(R)	23(S)	25(S)
Streptococcus spp	20(S)	19(S)	4(R)	24(S)	3(R)	18(S)	6(R)	24(S)	19(S)

Key: 1-12= Resistance (R), 13-17= Intermediate (I), 18> Above Susceptible (S) (CLSI)
CEF= Cefoperazone; PEN= Penicillin; SXT= Septrin; CH= Chloranphenicol
CPX= Ciproflaxacin; PEF= Pefloxacin, AM= Amoxacillin; S= Streptomycin
CN= Gentamycin

Table 5. Results of Antimicrobial susceptibility test pattern for (Gram Negative Bacteria)

Bacteria	SXT	CH	SP	CPX	AM	AU	CN	PEF	OFX	S
Escherichia coli	22(S)	12(I)	18(I)	26(S)	0(R)	0(R)	12(I)	30(S)	26(S)	20(S)
Salmonella spp	0(R)	0(R)	25(S)	30(S)	13(I)	0(R)	20(S)	0(R)	0(R)	22(S)
K. pneumonia	13(I)	0(R)	0(R)	8(R)	0(R)	0(R)	21(S)	0(R)	30(S)	8(R)

Key:SXT=Septrin, CH=Chloramphenicol, SP=Sparfloxacin, CPX=ciprofloxacin, AM=Amoxacillin, AU=Augmentin, CN=gentamycin, PEF=pefloxacin, OFX=Tarivid, S=Streptomycin

4. DISCUSSION

Because of its inherent microflora, processing conditions, and storage conditions, meat is probably one of the most perishable foods. This research's investigations had revealed various microbial contaminants of meat vendors' tables within the study area. *Aspergillus flavus, Aspergillus niger, Aspergillus fumigatus,* and *Oidiodendron griseum* were among the four different fungi isolates that were identified. The presence of these pathogenic fungi isolates is an indication that undercooked meat is not safe to eat because some of the fungi isolated in this study may produce mycotoxins, such as aflatoxin B1, B2, G1, and G2, which could cause food poisoning. The use of soiled or contaminated knives, documents, utensils, water, and serving tables could be the cause of these fungal contaminations. This is consistent with the findings of Bukar et al. [13], who reported that the handler's hands, the utensils, the air, the table surfaces, and even the components, such as the spices, could have been the source of the contaminated organisms in the meat and suya. When consumed by consumers, these fungal isolates have the potential to produce mycotoxins, which can lead to severe health problems.

The results of the investigation also showed that gram positive and negative bacterial contamination was present. *Escherichia coli, Salmonella species,* and *Klebsiella pneumonia* are the gram negative bacteria that were found, whereas *Staphylococcus aureus,* Bacillus, and Streptococcus species are the gram positive bacteria. Table scrapings containing these bacteria suggest that meat that was put on these tables may have become contaminated during the processing. However, the contamination of the tables following the regular daily sales may also be explained by other circumstances, such as unsanitary activities. These results were in line with reports by Edema et al. [14] about the quality and microbiological safety of foodstuffs that were ready to consume in Nigeria. According to research by Kalalou et al. [15], flesh provides a great substrate for the growth of germs. Therefore, because incorrectly handled meat provides germs with nutrients, deterioration may proceed uncontrollably in such meat. Water used in cleaning and processing meat must be microbially contaminated since it can be a source of contamination during washing. The presence of *S. aureus* in the meat samples is a sign that the meat was not handled properly. The existence of Staphylococcus species on raw meat, according to Okonkwo et al. [16]; Iroha et al. [17], is the result of cross-contamination between the raw meat and meat workers, their clothing, and processing equipment. The prevalence of Staphylococcus species provides more evidence. *Staphylococcus aureus* is a significant cause of food poisoning. Furthermore, enterotoxins are produced by certain strains of *Staphylococcus aureus*. Because of its heat stability, staphylococcal enterotoxin can endure thirty minutes of boiling. Within three to four hours after ingesting this toxin, symptoms may appear suddenly and are frequently accompanied by nausea, vomiting, and diarrhea [16]. There may be a high prevalence of staphylococcal food poisoning among meat eaters in the research location. The majority of the isolated bacteria are members of the highly significant enterobacteriaceae family. According to Ercolini et al. [18], meat kept at temperatures as low as 10°C produces slime due to organisms belonging to the Enterobacteriaceae family. Hence therefore, these organisms are frequent colonizer of improperly handed food products and that their presence on meat can be as a result of cross contamination from the animals´ intestine, hides and abattoir environment [19]. Therefore, the results of these studies are consistent with those of Fasanmi et al. [20], who reported that food vendors in Abeokuta Metropolis, Ogun State, Nigeria, had *S. auerus, Bacillus species, E. coli, Pseudomonas species, Saccharomyces species, Rhizopus species, and Aspergillus species* in their palms.

Gram positive and gram negative bacteria displayed varying degrees of resistance and sensitivity to the various antibiotics administered, according to the results of antimicrobial susceptibility testing. The gram-positive bacteria *Staphylococcus aureus* was resistant to amoxicillin, gentamycin, pefloxacin, and ampiclox. The results table indicates that *Escherichia col*i, a gram-negative bacterium, demonstrated resistance to a few additional drugs. Thus, the findings of this investigation are consistent with the work done by Steve et al. in [21]. Their findings showed that meat may become contaminated with feces during slaughter, which could lead to the spread of E. coli that is resistant to antibiotics. This *E. Coli* has the potential to spread resistance to Salmonella or other gut flora in humans. Antibiotic-resistant coliforms have been isolated from carcasses, fresh and cooked meat, raw meat handlers and livestock handlers. Handling of raw market meat by buyers in Nigeria could also lead to contamination of meat

with resistant microorganisms. Veterinary drugs are sold and used without much control in Nigeria. This practice may have created a population of resistant bacteria in the meat animals. Multiple antimicrobial resistance might have happened due to indiscriminate use of antibiotics, chemotherapeutics and or disperse of drug resistant microorganism in the environment (Van de Boogard and Stobberingh, 2000).

The study's statistics showed that Darawa meat locations had lower levels of contamination than Wednesday market meat seller tables, which had the highest levels of contamination. It's interesting to note that this study's results show increased bacterial isolates that were contaminated due to subpar hygiene practices by the butcher shop and meat vendors. There are two main ways that the meat seller tables swab used in this study could get contaminated: primary and secondary sources. Animal secretion and excretion are examples of primary sources of contamination. In contrast, secondary sources of contamination might occur from polluted water and equipment, infected humans, and improper care of animals both before and after slaughter. (Marriot, 2004). There is therefore a certainty that the beef was contaminated at the time when even healthy animals were slaughtered and eviscerated at the abattoir or at the meat retail shops. These notwithstanding, there is also the possibility that:(i) the slaughtered animals may have been contaminated with potential pathogenic and spoilage bacteria that resided in the hide, gastrointestinal and respiratory tract and (ii) the animals slaughtered and eviscerated on the floor had a high risk of bacterial contamination [22]. It suffices to suggest then that the types of microbial contamination and the extent of spoilage of meats depend largely on sanitation procedures and hygienic practices employed during meat handling, processing, transportation, distribution, and storage, which invariably may have damning implications for public health (Ercolini *et al*., 2006).

5. CONCLUSION

The results of the investigation showed that the tables that meat dealers used had both bacteria and fungus on them. The fungi that were isolated included Oidiodendron griseum and three species of *Aspergillus (Aspergillus niger, Aspergillus flavus,* and *Aspergillus fumigatus)*. Three gram negative (Escherichia coli, Klebsiella pneumonia, and Salmonella specie) and three gram positive *(Bacillus subtilis, Streptococcus species,* and *Staphylococcus aureus*) species of bacteria were isolated from the samples. Therefore, the eating of animal products could be harmful to human health if they include these bacteria.

6. RECOMMENDATION

Government should create awareness to the public on the dangers of foodborne illness.

Proper washing and cooking of the meat should be encouraged.

Meat sellers should ensure standard hygiene practices and ethics in the selling of their meat product.

Further research is encouraged to be conducted to discover more microbial contaminates on the meat seller tables

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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