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THEME  
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## ISOLATION AND IDENTIFICATION OF MICROORGANISMS FROM MEAT SAMPLES OBTAINED FROM DIFFERENT AREAS IN JOS METROPOLIS

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### ABSTRACT

*Meat deterioration is a global problem and one of the leading causes of food wastage and substantial economic loss. It is associated with different environmental factors like poor handling and conducive decay factors like high moisture content, conducive microbial growth, temperature, and favourable acidity for microbial growth. The present study was designed to find out the microbial species associated with decayed meat samples in the Jos metropolis. Meat samples were collected from different locations in Jos metropolis at guided random and it included nine samples of raw beef, twenty-seven processed samples which were made of Kilishi, Suya and Minced meat. They were subjected to microbial isolation experiments which were plated out on Potato Dextrose Agar and Nutrient Agar media. The samples were also subjected to ecological determination with a pH range of 6.14 to 6.81 while percentage moisture content was highest in minced meat (57.47%). A total of 21 species of microorganisms were isolated from the meat samples. The isolates included 9 bacteria, 11 fungal and one yeast species. Among the test samples, minced meat showed the highest bacterial load while Kilishi showed the highest number of fungi and some of these isolated organisms are of public health importance.*

**Keywords:** Raw beef, processed samples, microbial species, ecological determination, bacterial load.

### INTRODUCTION

Rich nutrient matrix meat is the first-choice source of animal protein for many people all over the world (Heinz & Hautzinger, 2007). It is an ideal culture medium for the growth of different types of microorganisms including bacteria and fungi. The initial microbial population on meat depends on the physiological state of the animal at the moment it is slaughtered and on the level of environmental contamination in the slaughterhouse and areas in which subsequent handling of the meat is performed, including the level of hygiene of employees, the tools, water used and equipment used for the meat processing ((Nychas, Skandamis, Tassou, & Koutsoumanis, 2008). The nature and level of microbial contamination in meat have important consequences concerning public health, storage life and the type of spoilage of meat (Gracey & Collins, 1994). Meat, like any food, can also transmit certain diseases, but good hygienic practices, complete cooking and avoiding recontamination reduces this possibility.

This work investigates the species of microorganisms associated with meat samples in Jos metropolis and therefore determines its safety for human consumption.

### MATERIALS AND METHODS

A total of 36 meat samples comprising of 9 raw beef and 27 processed samples which were made of Kilishi, Suya and Minced meat; were aseptically collected from abattoirs, retail shops and malls in three different areas of Jos metropolis at guided random and were taken to the laboratory for the assessment of microbial content and other physiochemical analyses. The serial dilution and Warcup's soil dilution plate method as modified by Ogbonna & Pugh, (1982) was employed for bacteria and fungi respectively. The microbial isolates were examined under the research microscope for their morphological details and were appropriately identified. The various results obtained on ecological determination were subjected to statistical analyses with the aid of one-way ANOVA.

### RESULTS

The pH range and percentage moisture content of the meat samples are presented in Table 1 while the microbial species isolated from the meat samples are presented in Table 2. Among the test samples, minced meat showed the highest bacterial load while Kilishi showed the highest number of fungi, the details of the



results are presented in Figures 1, 2, 3 and 4. Also, the microbial isolates present before and after the decay of the experimental meat samples are presented in Table 3.

### DISCUSSION

Kilishi and Suya were similar but significantly different from minced and raw meat in their pH analysis while in the percentage moisture content, only Kilishi was significantly different from the other meat samples.

**Table 1. The mean meat ecological analyses are given on the table below**

SAMPLES	pH	MOISTURE CONTENT (%)
KLISHI	6.50±0.23 <sup>a</sup>	25.04±5.97 <sup>b</sup>
SUYA	6.81±0.16 <sup>a</sup>	47.40±3.76 <sup>ab</sup>
MINCED	6.16±0.13 <sup>b</sup>	57.47±7.39 <sup>a</sup>
RAW MEAT	6.14±0.17 <sup>b</sup>	56.25±1.57 <sup>a</sup>

Values expressed as mean ± Standard deviation at P < 0.05.

**Table 2: Microbial Isolates from the Dry and Fresh Meat Samples**

Microbial isolates	Meat samples				Total
	Kilishi (Dry)	Suya	Minced (Fresh)	Raw beef	
<b>Bacterial isolates</b>					
<i>Bacillus cereus</i>	+ <sup>a</sup>	+	+	+	4
<i>B. lentus</i>	+	+	+	-	3
<i>Enterobacter cloacae</i>	-	+	+	+	3
<i>Escherichia coli</i>	+	+	+	+	4
<i>Klebsiella pneumoniae</i>	+	-	+	-	2
<i>Proteus mirabilis</i>	-	+	+	-	2
<i>Staphylococcus aureus</i>	+	+	+	+	4
<i>S. intermedius</i>	-	-	+	-	1
<i>S. simulans</i>	+	-	+	-	2
<b>Fungal isolates</b>					
<i>Alternaria alternata</i>	+	+	-	-	2
<i>Aspergillus flavus</i>	+	+	-	-	2
<i>A.fumigatus</i>	+	-	-	+	2
<i>A. niger</i>	+	+	+	+	4
<i>A.ochraceus</i>	+	-	-	-	1
<i>A.oryzae</i>	+	-	-	-	1
<i>A.terreus</i>	-	-	+	+	2
<i>Fusarium oxysporum</i>	+	+	+	+	4
<i>Mucor pusillus</i>	+	+	+	-	3
<i>Penicillium chrysogenum</i>	+	+	-	+	3
<i>Rhizopus microsporus</i>	+	+	-	-	2
<b>Yeast Isolate</b>					
<i>Candida spp</i>	+	+	+	+	4
<b>TOTAL</b>	17	14	14	10	55
% Moisture content	25.04	47.40	57.47	56.25	
Mean pH range	6.50	6.81	6.16	6.14	

+ <sup>a</sup> = Present, - = Absent.

The pH of the raw and minced meat was the lowest with the highest percentage moisture content. The results revealed that the different meat samples showed heterogeneity in ecological parameters. The pH range from 6.14 to 6.50 indicates that the meat samples are slightly acidic and the organism thriving in them are



neutrophils and it is in line with (Ismail, 2017) and (Feiner, 2006) who in their findings revealed that reduced pH reduced the growth of bacteria in minced and fresh meat and as the pH approaches 5.88 and 6.2, there is an increase in bacteria count. Fungal communities unlike the bacteria exhibit a wider range of pH for optimal growth (Rousk *et al.*, 2010), ranging from 5 to 9 pH units and the pH results of this study falls within the range. *S. aureus* were the only organisms present in each of the various experimental meat samples, these could be as a result of them constituting in the normal skin flora of the animal (Odeyemi, Alegbeleye, Strateva, & Stratev, 2020). Fungi are common contaminants of meat and meat products. They either cause decay or produce mycotoxins, making the infected meat dangerous for consumption. (Odeyemi, Alegbeleye, Strateva, & Stratev, 2020). *A. niger*, *F. oxysporum* and *Candida spp* were the only organisms present in each of the various experimental meat samples, this could be attributed to *A. niger* mostly found in bovine carcasses and yeast being able to grow in foods with high sugar and organic acid contents or with low water activity and low pH (Odeyemi, Alegbeleye, Strateva, & Stratev, 2020).

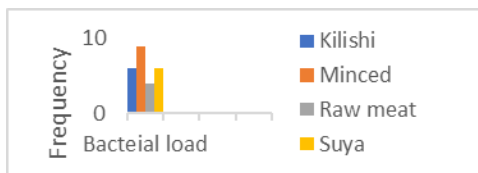


Fig.1



Fig. 3

Total bacterial load (Fig. 1) and Total number of fungi (Fig. 3) from the deteriorated experimental meat samples

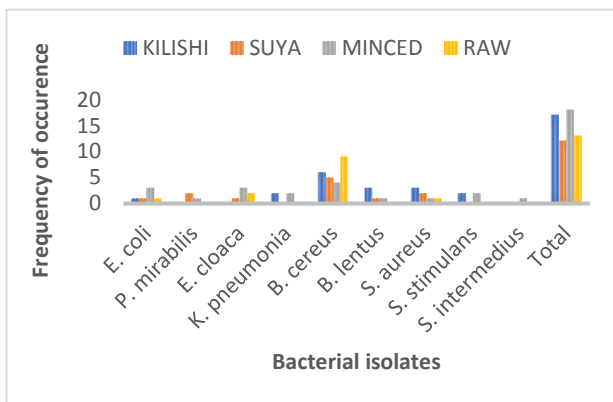


Fig.2

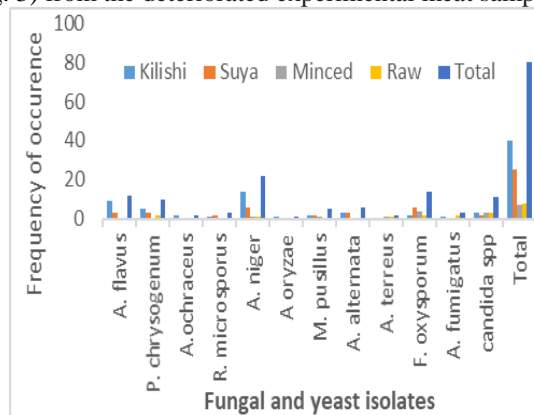


Fig.4

Species of bacteria (Fig.2), fungi and yeast (Fig.4) associated with deteriorated experimental meat samples.

From the bacteria isolated, *B. cereus* had the highest frequency of occurrence while *S. intermedius* had the least. Minced meat was the only test sample that has all the isolated organisms present among the bacteria isolates. This could be due to the nature, processing method of the test sample and high moisture content which is significantly higher than other test samples. Also, from the fungi isolates, *A. niger* had the highest frequency of occurrence while *A. oryzae* had the least. Kilishi had the highest number of fungi among the test samples; this could be attributed to the high exposure of the product to aerial fungal spores and handling with contaminated hands during packaging and storage. Nychas, Skandamis, Tassou, & Koutsoumanis, (2008) reported that the initial microbial population on meat is dependent on the physiological state of the animal and the level of environmental contamination in the meat processing stages.

Microbial isolates present before the decay of meat samples are in the table above and the presence of these organisms could be due to pre-slaughter handling of the animal or the products during processing, since the intestinal tract and skin of these animals are the main sources of these organisms (Dave & Ghaly, 2011). Microbial isolates found after the decay of meat samples are in the table above and most of these organisms found are of public health importance, which could result in some food-borne diseases when ingested such as abdominal cramps, nausea, vomiting and diarrhoea among others, the result of which could be fatal

**Table 3: Microbial Isolates from both Decayed and Non-Decayed Meat Samples**

Microbial isolates	ND <sup>a</sup>	D	TOTAL
Bacterial isolates			
<i>Bacillus cereus</i>	+ <sup>b</sup>	+	2
<i>B. lentus</i>	+	+	2
<i>Enterobacter cloacae</i>	+	+	2
<i>Escherichia coli</i>	+	+	2
<i>Klebsiella pneumoniae</i>	-	+	1
<i>Proteus mirabilis</i>	-	+	1
<i>Staphylococcus aureus</i>	+	+	2
<i>S. intermedius</i>	-	+	1
<i>S. simulans</i>	-	+	1
Fungal isolates			
<i>Alternaria alternata</i>	-	+	1
<i>Aspergillus flavus</i>	-	+	1
<i>A.fumigatus</i>	-	+	1
<i>A. niger</i>	+	+	2
<i>A.ochraceus</i>	-	+	1
<i>A.oryzae</i>	-	+	1
<i>A.terreus</i>	-	+	1
<i>Fusarium oxysporum</i>	-	+	1
<i>Mucor pusillus</i>	+	+	2
<i>Penicillium chrysogenum</i>	+	+	2
<i>Rhizopus microspores</i>	-	+	1
Yeast isolate			
<i>Candida spp</i>	+	+	2
<b>TOTAL</b>	<b>21</b>	<b>20</b>	<b>29</b>

ND<sup>a</sup> = Non decayed meat samples, D= Decayed meat samples, +<sup>b</sup> = Present, - = Absent

### CONCLUSION AND RECOMMENDATION.

The present study revealed that meat and meat products are heavily contaminated with microorganisms; of which some are of public health importance. It is therefore imperative that basic training and hygienic practices be incorporated in abattoirs, shopping malls and retail meat outlets to ensure food safety.

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