An Assessment of Microbial Contamination of Bush Meat Sold at Different Locations along Warri/Benin Express Way in Nigeria

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Abstract:- The research examined the microbial count loads of bush meat sold at different locations along Warri to Benin Express way in Nigeria. An inclusive sampling method was used to purposively select nine locations along the Warri to Benin Express way where bush meats such as antelope, Grass cutters and Monkeys were routinely sold to commuters and locals in the area. Samples of smoked bush meat were purchased from locations (Adeji Junction, Oviri Court Junction, Amukpe Junction, Mosogar Old Garage Junction , Jesse Junction, Ovade Junction , Ologbo old park , Koko Junction , Elume junction respectively), and transported to the laboratory using sterile plastic bags. Fastidious growth of organism suspected to be present in the bush meat was determined via standard nutrient broth inoculation for twenty four hours. Sabrose agar, Macconkey, Potatoes dextrose agar, Blood agarand Chocolate agar sub-cultures of sample broth were developed from the initial broth. Several Biochemical analyses(e.g. indole citrate, urease and oxidase tests) of isolates were carried out to identify and classify microbes present in the bush meats. The findings reveal the bushmeat samples had high microbial viable counts. Bacteria counts ranged from 1.72×10^6 to 9.46×10^6 cfu/g. The identified bacteria isolates include: Staphylococcus aureus, Providencia freundii, Staphylococcus epidermilis, Proteus mirabilis, Proteus vulgaris, Streptococcus feacalis, ,and Escherichia coli.The bacteria Staphylococcus epidermidis was seen in bush meat from most of the study locations. Bush meats from Jesse Junction and Adeji Junction show the most and least microbial count respectively. Fungi were not detected in the bush meats. This might be attributed to the way the bush meats were preserved by the vendors. At ($P>0.05$) there was no significant difference in microbial counts among types of bush meat and also among the locations of sales along Warri-Benin Express way. The observed microbial counts load in this study is huge. This may be a result of lack of appropriate health agency checking the sales of bush meat at various locations along Warri to Benin Express way in Nigeria. Meat vendors and butchers should also be well educated on the potential negative health impacts resulting from poor personal and environmental hygiene. The study recommends that Consumers of Bush meats should take into consideration the risk associated with the potential contamination of the meat with microorganisms, and the conditions under which the meat was handled, sold and prepared as food or part of food.

Keywords:- Bacteria, Bush Meat, Microbial Count, Food Contamination.

I. INTRODUCTION

For many Nigerians, meat is the chief source of protein in their diet. In Nigeria, locals do refer to Bush meat generally as meat from the wild forest and that can be consumed by humans. Thus, meats of wild life origins are termed bush meat. They are prepared in local delicacies using the smoked, salted or fresh forms of the meat. Most retailers of the bush meat sell them as smoked bush meat, or fresh bush meats. InNigeria, approximately a quarter of the populace relies exclusively on resources of animal protein from bush meat. For many it is first choice when presented with other sources of protein such as fish and beef etc.

There is a high demand for bush meats in restaurants and food outlets in Nigeria. Hunters now get higher prices for the bush meat. The hunters also do employ different methods of hunting bush meats which include bush burning and use of supplicated arms.

Around the country sides in Nigeria, bush meat is sold in to commuters and traders in meat products at popular junctions andparks at road sides. This causes potential exposure of the meat to the sun and dust. Microbial contamination from dust and the environment becomes a possibility.

In the recent past, hunters as well as bush meat vendors had exploited the opportunities to also sell bush meat along major high ways in Nigeria. Commuters and locals have been noted to stop at roadsides, major junctions and makeshift kiosk in order to purchase fresh or smoked bush meats from sellers.

There are consequences, however of increased interactions between humans and wildlife[1]. Bush meat hunting and consumption creates this bridge between wild life and humans. It had been reported that this had led to increases chances of zoonotic transmission of diseases from animal hosts to humans [2].

II. MATERIALS AND METHOD

➢ *Sampling methods*

The study carried out survey of nine locations along Warri to Benin Express way where bush meats are routinely (daily) put for sale to commuters and locals

➢ *Sample collections*

Twenty-seven samples of smoked bush meat were procured from nine different selected locations (Adeji Junction, Oviri Court Junction, Amukpe Junction, Mosogar Old Garage Junction , Jesse Junction, Ovade Junction , Ologbo old park , Koko Junction , Elume junction)respectively all along Warri to Benin Express way.Each species of Bush meat samples were taken to the laboratory in sterilized plastic bags for proper analysis. The researchers collected all bush neat samples within 72 hours from the selected locations.

➢ *Microbial analysis*

Preparation of the samples involved slicing of the bush meat into pieces.They were then inoculated into anutrient broth fora day (24 hours). This process facilitates the potential growth of the fastidious organism. Mac-conkey, Blood agar, Chocolate agar, Sabrose agar and Potatoes dextrose agar cultures were prepared from bush meat broth after a day's interval.Further inoculation was allowed for a day at 37^0c. Subsequently, the isolates recovered were subjected to several tests. These include gram staining and biochemical analysis (coagulase, catalase, indole citrate, urease, and glucose). The outcome was employed in the identificationof the bacteria specie in the bush meat samples.

➢ *Statistical analysis*

Analysis of variance (ANOVA), and a randomized complete block design (RCBD) was use in the analysis of findings from the research.Significant differencesbetween samplemeans were determined with the Duncan's multiple range tests.

III. RESULTS AND DISCUSSION

The Bacteria type isolated from the bush meat is shown in Table 1. In summary, the most prevalent or common bacterial observed to be present in the bush meat samples were*Staphylococcus epidermidis* and *Proteus mirabilis*.Observed, followed by the bacteria Escherichia coli was the third most common in the selected locations in the study area.

Table 1: Bacteria type isolated from the bush meat

s/no.	Site along Benin-Warri road	Bush meat type	Microorganism shape	Isolated bacteria
1	Ologbo old park	Antelope	Cocci	Streptococcus feacalis
		Grasscutters	Cocci	Staphylococcus aureus
		Monkeys	Cocci	Staphylococcus epidermidis
2	Elume junction	Antelope	Cocci	Staphylococcus epidermidis
		Grasscutters	Bacilli	Escherichia coli
		Monkeys	Bacilli	Proteus mirabilis
3	Koko Junction	Antelope	Cocci	Staphylococcus epidermidis
		Grasscutters	Cocci	Staphylococcus aureus
		Monkeys	Bacilli	Proteus mirabilis
4	Ovade Junction	Antelope	Cocci	Staphylococcus epidermidis
		Grasscutters	Bacilli	Providencia freundii
5	Jesse Junction	Antelope	Cocci	Staphylococcus epidermidis
		Grasscutters	Bacilli	Proteus mirabilis
		Monkeys	Bacilli	Escherichia coli
6	Mosogar Old Garage Junction	Antelope	Cocci	Staphylococcus epidermidis
		Grasscutters	Bacilli	Proteus mirabilis
		Monkeys	Bacilli	Proteus mirabilis
7	Amukpe Junction	Antelope	Cocci	Staphylococcus epidermidis
		Grasscutters	Bacilli	Proteus vulgaris
		Monkeys	Bacilli	Proteus mirabilis
8	Adeji Junction	Antelope	Cocci	Staphylococcus epidermidis
		Grasscutters	Bacilli	Proteus mirabilis
		Monkeys	Cocci	Staphylococcus epidermidis
9	Oviri Court Junction	Antelope	Cocci	Staphylococcus epidermidis
		Grasscutters	Bacilli	Proteus vulgaris
		Monkeys	Bacilli	Proteus vulgaris

➢ *Isolated bacteria load (CFU/ML)*

The highest bacterial and lowest bacterial count load are observed from bush meat samples obtained atAmukpe Junctionand Adeji Junctionrespectively(Table 2). The results also revealed that antelope has the highest bacterial count load while the Monkeys has the lowest bacterial count load.

Table 2: isolated bacteria load summary (Cfu/g)

Location	Bush meat type			Total	Mean
	Antelope	Grasscutters	Monkeys		
Elume junction	27×10^5	25×10^5	30×10^4	5.50×10^6	1.83×10^{6a}
Ologbo old park	23×10^5	28×10^5	23×10^4	5.33×10^6	1.78×10^{6a}
Koko Junction	32×10^5	22×10^5	27×10^4	5.67×10^6	1.89×10^{6a}
Ovade Junction	32×10^5	22×10^5	27×10^4	5.67×10^6	1.89×10^{6a}
Mosogar Old Garage Junction	24×10^6	27×10^5	24×10^4	2.67×10^7	8.96×10^{6a}
Jesse Junction	29×10^5	29×10^5	26×10^5	8.40×10^6	2.80×10^{6a}
Amukpe Junction	26×10^5	22×10^6	29×10^5	2.84×10^7	9.47×10^{6a}
Oviri Court Junction	28×10^5	21×10^4	28×10^5	5.31×10^6	1.77×10^{6a}
Adeji Junction	25×10^5	24×10^5	28×10^5	5.15×10^6	1.72×10^{6a}

- The Means with the same superscripts are not significantly different at $P < 0.05$ for DMRT.

The bacteria Staphylococcus epidermidiswas the most common isolate identified in the bush meat. Ithad been known to causesurinary infectionand. Conjunctivitis. Another bacteria found in the bush meat samples at some locations was.*Proteus mirabilis.*This specie of bacteriacan cause several illnesses to humans such a kidney stonedisease [3].

Bush meats samples at Adeji, Oviri court junctions, Amukpe,Ovade, Koko, Mosogar Old Garage Junctions, Escherichia coli,*Staphylococcu aureus, Providencia* freundii, and Proteus vulgaris, *Streptococcus feacalis*were isolated.[4] in another related study identifiedsimilar bacteria found in bush meat samples from locations in this study. Their research noted that these bacteria are pathogenic. At Elume junction. *Escherichia coli*wereisolated from the anteleope samples and *Proteus mirabilis*from the monkey samples. This bacteria specie*(Escherichia coli)* had been responsible for most reportedfaecal contamination. This point to poor or lack of proper hygiene by the handlers of the bush meat during preparation for sales or having them as smoked meat.[5] had reported thatfermented as well as smoked bush meats prepared in dirty conditions are potentially sources of diseases. These diseases include tuberculosis, measles, rabies etc.

At Koko Junction the Antelope samples was found to contain Staphylococcus epidermidis and the Grasscutters sample had *Staphylococcus aureus*contamination. The bush meat had no Fungi in any of the locations. Moisture is often needed by fungi to grow[6].The smoked fish moisture content may be below that that causes fungal growth to thrive [7]

Table 2 presents themicrobial counts mean values. The results show that the bush meats samples had significantly high microbial viable counts. Bacteria counts ranged from 1.72×10^6 to 9.46×10^6 cfu/g. These values suggest that the sampled bush meat fall within those safe to be consumed as food. The premise for such deductions is indicated in the microbial load requirements in meat product.Relatively, the total viable microbial count of less than half a million is satisfactory. Microbial count of 500,000 to < 10,000,000 in meatis acceptable and passable. Microbial count of ten million and more is considered as unsatisfactory[8][9]

The presence of high microbial loads might be due to bush meat handling methods, cleanliness of the handling area, management as well as the personal cleanliness of the meat vendors. There is need for public health education for the meat handlers. Members of the public along major highways in Nigeria such as the Warri- Benin expressway need to ensure meat vendors are neat and the environments the meat is sold in hygienic enough.

Bush meat samples fromJesse Junction andAdeji Junctionlocation has the highest and least bacterial count load respectively. Result from this study revealed that antelope has the highest bacterial count load and this is in agreement withsimilar findings of [4]. The Monkey samples had the lowest bacterial count load.

All the bacterial isolated in this study are potentially pathogens.Statistically, therewas no significant difference $(P > 0.05)$ in terms of bacterial load between the locations and also between types of bush meats respectively. This is in agreement with what was reported by [4] but differs from of [9] who stated that the factors that affect microbial growth in meat is include intrinsic environmental conditions.

Microbial growths on food items including smoked bush meats are usually facilitated by inappropriatepreservation procedures or methods[10].Thus smoking of the meat by the handlers or vendors under poorhygienic conditions may encourage microbial contaminations. [11]made similar observations in their study and did reportpoor hygieneand handling associated with smoked productsresult in high microbial load counts.

Bacteriological quality of food is important parameter for assessing food safety[12]. [13]conducted a related study in Nigeria, and employed this parameter in confirming food safety. The study noted that high bacterial counts do make such foods a potential source of infection. Proper hygiene is therefore necessarywhen handling meat and meat products.

IV. CONCLUSION

There are noted high viable counts in all the locations under the study. This is observed across the various locations in the study area. Thiscan potentially causenegative impact on consumers' health. It is therefore imperative for persons patronizing the bush meat vendors along the highways in Nigeria to be more careful and ensure that they examine the status and appearance and general conditions of the meat before purchase or consumption.

One of the good ways of preserving raw food including meat and meat product is smoking[14]. Smoked meat has potentially increased shelf life. Smoked meat also experience reduction in rate of spoilage[10}. It helps in inhibiting the microbial activities in the smoked meat. Poorly smoked meat however will deteriorate as a result of microbial activities not inhibited adequately.

Health education is needed to enlighten the local hunters as well as bush meat vendors about potential zoonotic contaminations from wild animals. The ministry of health in Nigeria should ensure that food hygiene and quality is maintained. Health and Nutritional related campaigns should be made to inform and educate the rural dwellers, commuters in the highways aboutthe spread of infectious disease from wild animal sources. This will ensure that only safe, healthy foodssuch as clean and microbes free bushmeat is made accessible to the Nigerian public for consumption.

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