

Bacteriology of Suya Meat Sold in Bonny Local Government Area, Rivers State, Nigeria.

Original Research Article

ABSTRACT

Background: Suya Meat is obtained from roasted or smoked beef and other boneless parts of an animal usually beef. Suya meat could be contaminated from air, handlers, equipment, water, papers and some kitchen utensils. The sample locations were Tennis Hut, Golf Club, Ama hausa, Hospital Road (Junction), Finima market junction and Akiama between November and December, 2016.

Aim: This study aimed at determining the level of bacterial contamination of roasted Suya meat sold in Bonny Local Government Area.

Materials and Methods: Five (5) different Suya meat samples were collected at random, from different Suya locations in Bonny giving a total of 30 Suya meat samples sampled. Morphological characteristics of colonies were noted after 24 hrs incubation period. Identifications of isolates were carried out using standard methods.

Results: The results show that six genera of bacteria which include *Bacillus cereus*, *Salmonella species*, *Staphylococcus aureus*, *Klebsiella species*, *Enterococcus species* and *Proteus species* were isolated from the Suya meat. The total number of *Bacillus cereus* and *Salmonella species* presence were 10 (34%) and 5(17%) respectively, from the five Suya samples each, across the six Suya stand in Bonny. *Escherichia coli* have no growth. The total of 1(3.4%) and 2 (6.8%) of *Staphylococcus aureus* and *Klebsiella species* respectively were also isolated. A total of 6(20%) and 5(17%) of *Enterococcus species* and *Proteus species* respectively were also isolated. However, the results also shows that Tennis Hut and Golf club have total of 3(9.6%) and 2(6.4%) of different types of microorganisms isolated. Finima, and Akiama have 7(22%) and 6(19%) respectively of the different type of microorganisms isolated.

Conclusion: The study revealed that proper preparation and processing of our Suya meat should be adhered to by law.

Keywords: Bacteriology; Suya; meat; Bonny.

1. INTRODUCTION

Suya Meat is obtained from roasted or smoked beef and other boneless animal usually beef. They are good in taste and rich in protein, vitamin B12, zinc, selenium and phosphorus. They are also rich in niacin, iron and vitamin (pyridoxine). Suya meat is commonly found on most streets as source of food in Nigeria and sub-Sahara Africa [1]. Hence, Suya meat contamination is mostly associated with the exposure on the street. It is easily contaminated with bacteria, microorganisms and parasite.

The meat (Suya meat) is produced from meat part from animals. The fleshy part is roasted and smoked to dry making it attractive to eat and increasing the shelf life of the Suya meat. Therefore, it is necessary to carried out some microbiological quality assessment in order to ascertain their safety for consumption. Suya could be contaminated from air, handlers, equipment, water, papers, some kitchen utensils for example the spoon, trays, knives and sometimes the contamination could be due to nature of the behavioral habits of vendors and the environments [4].

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In the abattoirs during slaughtering, there is the chance of contaminating the meat, with some intestinal flora which is associated with humans, animals and the environment [6]. It is believed that raw consumption of uncooked meat could result to food poisoning. This is possible based on the presence of some bacteria in the meat which has the ability to produce some toxins in human resulting to some pathological condition like diarrhea and vomiting. However, the infectious doses of some common contaminations of meat were still under debate or investigations [8].

Due to the fact that microorganisms could be found everywhere, it is believed that unhygienic preparation of Suya meat could promote the presence of microorganism which could cause infection of the consumer. Therefore, this research will ascertain some possibilities towards recommending ways to reduced possible health hazards that could be associated with the consumption of Suya meat sold in Bonny. This work was aimed at determining the level of bacterial contamination of roasted Suya meat sold in Bonny local government area.

2. MATERIAL AND METHODS

2.1 Study area

This study was conducted within Bonny (Ibani) Local Government Area of Rivers state in the month of November to December, 2016. Bonny is geographically located at latitude 4° 26' N 7° 10' E, with lengthy raining season and short dry season temperature between 25-28°C. It is situated at the southern part of Rivers State. The major occupations of the people living in this area are fishing and farming. The population for this study was drawn from six (6) selected Suya stands namely: Tennis Hut, Golf Club, Finima market Junction, Akima, Ama-Hausa and Hospital Road (junction). A total of thirty (30) samples were collected for the study, five from each Suya stand location at different time and day.

2.2 Sample Collection

All Suya meat samples from each locations was aseptically collected into a labeled sterile container. These were sent to Bonny General Hospital Medical Laboratory section and Department of Medical laboratory Science, Rivers State University, Port Harcourt for analysis. The samples were cultured into various culture media, strictly following the protocol for media inoculation and organism identification guide for bacteriology culture. The materials used include: sterile universal containers, Bijou bottles, sterile disposable wire loops, Petri-dishes, Media, Peptone water, Incubator, Autoclave and Test tubes. The media was prepared according to the manufacturer's instruction. Based on the number of plates, sterilized by autoclaving at 121°C for 15 minutes and dispensed aseptically into disposable Petri- dishes (about 20 ml each) after cooling to about 50°C [2].

2.3 Bacteriology Determination

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The sample was incubated aerobically in the incubator for 24 hours. Sub-culture of the incubated sample was done the following day into various media. The plates were incubated at 37°C for 12 - 24 hrs and examined for bacterial growth, biochemical and Gram staining was also performed [2].

2.4 BIOCHEMICAL TESTS

Number of Isolates	1	2	3	4	5	6
Morphology	Short rods	Short rods	Short rods	Cocci in clusters	Short rods	Short rods
Maltose	+	+	+	+	+	+
Glucose	+	+	+	+	+	+
Gram Staining	-	-	-	+	-	-
Indole	+	-	-	-	-	-
Citrate	-	-	+	-	-	-
Oxidase	+	+	-	-	-	-
Catalase	+	+	+	+	-	+
Coagulase	-	-	-	+	-	-
Urease	+	+	-	-	+	-
Bacteria species	Proteus spp	Enterococcus spp	Klebsiella spp	S. aureus	Salmonella spp	Bacillus cereus

Key: (-) Negative, (+) Positive

2.5 Data Analysis

The data were analyzed statistically using Excel Software.

3. RESULTS

Result shows that from the 30 (thirty) samples of Suya meat brought from six different locations in Bonny Local Government Areas of Rivers state, were all contaminated with different microbes. The microbes isolated were; *Bacillus cereus*, *Salmonella species*, *Staphylococcus aureus*, *Klebsiella species*, *Enterococcus species* and *Proteus species* that were isolated across the six Suya stands are 10 (34%), 5 (17%), 1 (3.4%), 2 (6.8%), 6 (20%) and 5 (17%) respectively, for Tennis Hut, Golf Club, Finima, Akiama, Ama Hausa and Hospital Road.

Table. 1: Total Number of Microorganisms Isolated from Six different Suya Locations in Bonny Local Government Area.

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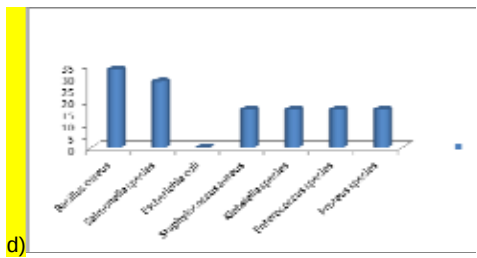
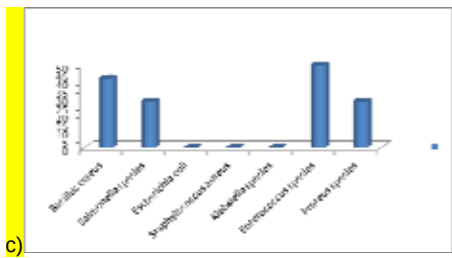
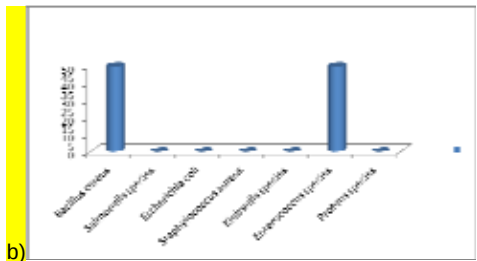
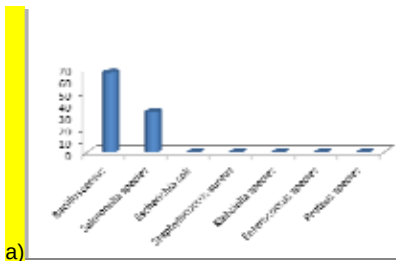
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Organisms Isolated	Tennis Hut (%)	Golf Club (%)	Finima (%)	Akiama (%)	Ama Hausa (%)	Hospital Road (%)	Total (%)
<i>Bacillus cereus</i>	2(66%)	1(50%)	3(42%)	2(33%)	2(25%)	2(40%)	10(34%)
<i>Salmonella</i>	1(33%)	00(00)	2(28%)	00(00)	2(25%)	00(00)	5(17%)
<i>species</i>							
<i>Escherichia coli</i>	00(00)	00(00)	00(00)	00(00)	00(00)	00(00)	00(00)
<i>Staphylococcus aureus</i>	00(00)	00(00)	00(00)	1(16%)	00(00)	00(00)	1(3.4%)
<i>Klebsiella species</i>	00(00)	00(00)	00(00)	1(16%)	00(00)	1(20%)	2(6.8%)
<i>Enterococcus species</i>	00(00)	1(50%)	00(00)	1(16%)	2(25%)	2(40%)	6(20%)
<i>Proteus species</i>	00(00)	00(00)	2(28%)	1(16%)	2(25%)	00(00)	5(17%)
Total	3(9.6%)	2(6.4%)	7(22%)	6(19%)	8(25%)	5(16%)	

*Percentages of Microorganisms Isolated from the Six different Locations; Tennis Hut, Golf Club, Finima, Akiama, Ama Hausa and Hospital Road.



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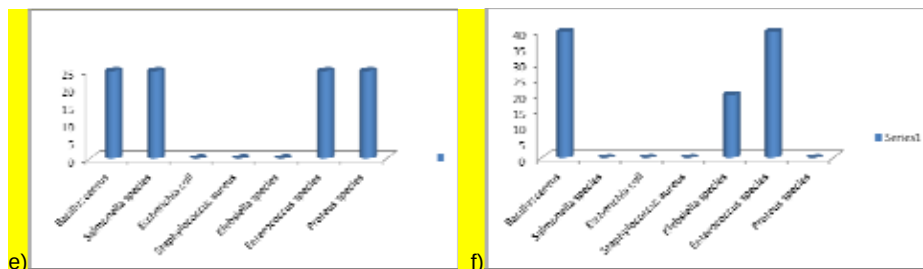


Figure 1. Percentage of organisms isolated from: a) Tennis Hut, b) Golf Club, c) Finima, d) Akiama, e) Ama Hausa, f) Hospital Road

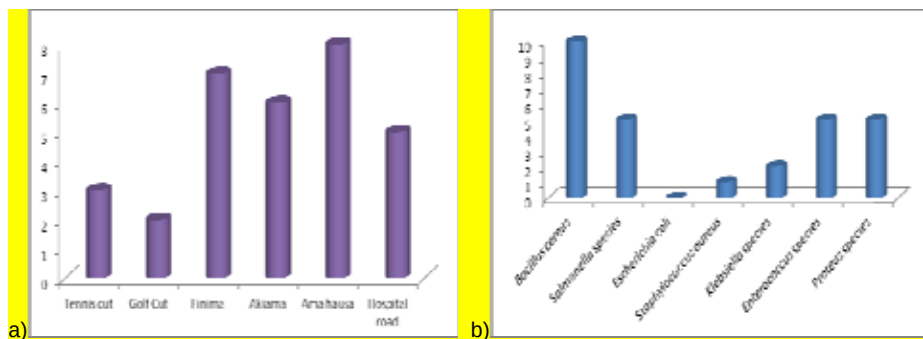


Figure 2. a) Percentage a) organisms isolated from areas, b) Different microorganisms isolated.

4. DISCUSSION

Bacillus cereus and few other microorganisms isolated across the six Suya stands agreed with another work earlier done [5], and the improper establishment of a Hazard Analysis Critical Control Point (HACCP), [10] which is also essential for the control of *Salmonella species*, *Enterococcus species* and *Proteus species*. This method could be used to achieved the potential food safety hazard or could be taken to reduced or totally eliminates the presence of these organisms contained in the meat contaminated from the abattoir personnel or the environment [9].

The Golf Club Suya sample assayed indicates that 1 (50%) was contaminated with *Bacillus cereus* and 1 (50%) of *Enterococcus species*, given a total of 2 (6.4%) of different microorganisms of Suya contamination in Bonny. *Bacillus cereus* can cause two types of illnesses, characterized by diarrhea and vomiting with the aid of their enterotoxins. Although the diarrhea enterotoxin is heat sensitive (could be inactivated by 56°C heat for 5 minutes). But the emetic toxin which induces vomiting is very heat resistant [9]. *Bacillus cereus*, a gram positive, facultative aerobic, spore forming rod which are different from other *Bacillus species* in their biochemical test with their optimum growth temperature of about 30°C to 50°C, pH value of 4.3 to 9.3 and water activity (AW) values of 0.912. *Bacillus cereus* is commonly found in nature for example in the soil and water. The infective dose of *B. cereus* could be more than 10 CFU (gm) of visible cells consumed to cause disease [9].

The result gotten from Finima, shows that 3 (42%) of *Bacillus cereus*, 2 (28%) of *Salmonella species* and 2 (28%) of *Proteus species* were positives given a total of 7 (22%) of different types

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of microbial contaminations. *Salmonella species* could be gotten from uncooked cow meat, or taking raw cow meat that is improper cooked could be harmful to human health [7]. The result from others [5] shows that the isolation of *Salmonella species* from Suya meat sample also agreed with the fact that 2 (28%) of *Salmonella species* contamination can rendered the Suya meat unsafe for consumption [5].

Akiama, also shows 2 (33%) of *B. cereus*, *Staphylococcus aureus* 1 (16%), *Klebsiella species* 1 (16%), *Enterococcus species* 1 (16%) and *Proteus species* 1 (16%) given a total number of 6 (19%) different microorganisms, confirming previous work [5]. The presence of *Staphylococcus aureus* in Suya meat from Akiama indicates possible infection of consumers of the suya within Akiama. It also can produce toxins which are heat resistant and cannot be destroyed through cooking. It is commonly contracted through food workers. An individual with weakened immune systems may also be vulnerable to it toxins [8]. Because *Staphylococcus aureus* are commonly found on the skin, hair, nose and human throats, the bacteria could be found in up to 25% of healthy individual and are more common with those individual that has nose, skin, eye and throat infections [7]. Ama Hausa results show contamination of Suya meat of 2 (25%) *Bacillus cereus*, *Salmonella species* 2 (25%), *Enterococcus species* 2 (25%) and *Proteus species* 2 (25%) given a total of 8 (25%) of different microorganisms contamination in Bonny.

Suya meat collected from Hospital road shows that *Bacillus cereus* has 2 (40%), *Klebsiella species* shows 1 (20%) and *Enterococcus species* 2 (40%) positive out of the total of 5 (16%) of different microorganisms in Suya meat from Hospital road in Bonny Local Government area. The presence of *Proteus species* agreed with the fact that, it is commonly found in the human intestinal tract as part of normal flora, and it is also found in multiple environmental habitats, it is a gram-negative bacillus which also colonized both the skin and oral mucosa. *Bacillus cereus* with total of 10 (34%) was isolated across the six Suya stand in Bonny making it the highest among other microorganism found from the Suya sample. This agreed [10], that *B. cereus* has the ability to produce spores which can also germinate if the temperature is lowed, make it to be temperature tolerance.

Salmonella species and *Staphylococcus aureus* with the total of 5 (17%) and 1 (3.4%) respectively were isolated. Both organisms could also cause poison to human when consumed in their high infective dose. This also agreed [3], with the saying that their infective dose could be as little as 1.0 nanogram of the toxin per gram of food or meat to produce illness. Ingestion of 1-5 microgram of the toxin has been shown to be associated with many outbreaks of diseases [3]. *Klebsiella species*, *Enterococcus species* and *Proteus species* have total of 2 (6.8%), 6 (20%) and 5 (17%) respectively isolated from the six different Suya stand in Bonny local government area. But the infectious dose of *Klebsiella species* is still unknown and it is found widely through nature in soil and water so there is that likelihood that Suya contaminated with *Klebsiella species* could be from soil or water source, human skin and mouth [3]. *Escherichia coli* were negative across the six Suya meat stand in Bonny, with the use of Chromagen 0157 media for isolation and differentiation and there was no growth noticed.

4. CONCLUSION

In a way to reduce or total elimination *Bacillus cereus* organisms which also have contributed to some resistance observed in hospitals. The authority appointed to oversee the proper preparation of our abattoir meats and Suya processing should adhere to required principle, by law. Also the need to stored perishable food like the Suya meat within the temperature "danger zone" at the range of 50°C to 60°C should be encouraged. Suya meat should be reheated to about 75°C before eating. Studies have also shown that food handles especially Suya meat handless can also serve as a source of infection and the hand contact with the Suya represent the means by which the contamination may occur.

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4. RECOMMENDATIONS

Hazard Analysis and Critical Control Point (HACCP) which represents a systematic preventive approach to food safety should be encouraged. Effective measures should be in place in order to avoid cross contamination between raw and cooked foods. Regular hand washing practice with soap and a running tap water and lowering of finger nails thoroughly before cooking and serving the public with Suya meat should be encouraged. Employee with wounds or skin infection are strictly prohibit from Suya handling in Bonny local government areas. Routine environmental sanitations practice, educational symposiums and disinfection of equipment used in Suya meat processing in Bonny should be encouraged.

COMPETING INTERESTS

Authors have declared no competing interests.

AUTHORS' CONTRIBUTIONS

KFE designed the study, performed the experiment and statistical analysis, and wrote the protocol. MTP wrote the first draft of the manuscript. WGN managed the analyses of the study. TJG managed the literature searches. All authors read and approved the final manuscript.

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