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BACTERIOLOGICAL QUALITY OF SUYA MEAT SOLD IN ALIADE TOWN, GWER EAST LOCAL GOVERNMENT AREA OF BENUE STATE, NIGERIA

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ABSTRACT

This study aimed at assessing the bacteriological quality of suya sold in Aliade town, Gwer East LGA of Benue State, Nigeria. A total number of 52 samples were collected from vendors within the Aliade Town: Austoma, Basenat, Kings Resort and Main Market (13 samples in each location). Sample preparation and microbial identification followed standard microbiological and biochemical procedures. The data obtained were subjected to appropriate descriptive and inferential statistics (Chi square test and one way ANOVA) at 95% confidence limits using the SPSS software. A total of seven (7) species of bacteria were identified from all suya samples. *Salmonella* spp, *Staphylococcus aureus* and *Escherichia coli* were present in all samples. Occurrence of contaminant type was highest at Basenat and King;s resort, with 6 species of bacteria isolated from the samples. Frequency of contaminants was homogenous in each of the location and between locations (P>0.05). The contamination rate of suya in the study was 14.2%. *Staphylococcus aureus* was the leading contaminant (21.1%) followed by *Salmonella* spp (19.2%), *Psuedomonas* spp (17.3%) and *Bacillus* spp (13.4%) as given in. There was no significant difference in the distribution of bacteria species (P=0.89, P>0.05). This study thus raises question on the safety of suya consumption in the study area. The given report is crucial to stakeholders in the health sector and the consumers of suya products.

Keywords: Bacteria, Contaminants, Suya meat, Quality, Consumers

1 INTRODUCTION

In the world today, traditionally processed meat products are consumed in different countries, amongst which is the meat delicacy called "suya" (Vilar *et al*., 2000). Meats are processed in Nigerian into ready-to-eat snack products such as Suya, Tsire, Balangu, Dambun-nama and Kilishi. Meats are the most perishable of all important foods and this is as a result of their chemical composition. Suya is a spicy, barbecued, smoked, roasted meat or traditional stick meat product that is commonly produced by the Hausas in Northern Nigeria from beef (Alonge and Hiko, 1981). Suya is a boneless lean meat stacked on sticks, coated with sauces, oiled and then roasted over wood using a fire from charcoal. Suya is however the most popular as its consumption has extended to other parts of the country (Inyang *et al*., 2005). Bacteria are the most abundant, versatile and oldest organisms on earth and they exist everywhere in nature including soil, air, water and the foods we eat (Samuel *et al*., 2015). When bacteria have nutrients (food), moisture, time and favorable temperatures, they grow rapidly increasing in numbers to the point where some can cause illness (Doulgeraki *et al*., 2012; Doulgeraki and Nychas, 2013). Meat and meat products provide excellent growth media for a variety of microflora (bacteria, yeasts and molds) some of which are pathogens (Jay *et al*., 2005). The intestinal tract and the skin of the animal are the main sources of these microorganisms.

Poor environmental sanitation and poor hygiene are largely responsible for much of the contamination, particularly among food handlers accounts for the contamination of foods while improper storage leads to multiplication of bacteria in food (Ogbonna *et al.*, 2012). For the purpose of this study we are considering tsire suya. In the resource-poor tropical countries of the world, particularly in the sub-saharan Africa, foods are often preserved at ambient temperatures long before consumption, improperly handled by food vendors, and sold in streets in the dirty unhygienic environment. Most suya vendors have limited education and therefore, lack knowledge on proper handling of suya and on the effects of improper handling with reference to transmission of food-borne bacteria. The conditions described above prevail in Aliade, a rural town in Benue state Nigeria. It is with this background that the bacteriological quality of suya sold in Aliade town, Gwer East was undertaken in order to provide useful information to the general public, health organizations, consumers and sellers of the meat.

2 MATERIALS AND METHODS

Study Area

Aliade is a town in Gwer East Local Government Area of Benue State, Nigeria. The town is about 60 kilometers from Makurdi the State Capital, located between latitude 7.3°N and longitude 8.94°E with a population of 10, 292 people. Aliade lies in the Savannah region of Nigeria with a typical savannah vegetation and climate (BSG, 2018).

Sample Collection and Preservation

A total number of 52 samples were collected for this study from popular vendors within the Aliade Town: Austoma, Basenat, Kings Resort and Main Market (13 samples in each location). This collection was repeated each week for 3weeks. The samples were collected between 6:00pm to 9:00pm when suya meat was mostly prepared and patronized. The samples were then preserved in a refrigerator at a temperature of 4°C prior to microbiological analysis.

Sample Preparation, Microbiological and Biochemical Analyses

Exactly 5g of the samples was each introduced into 10ml of peptone water and incubated for 24hours at 37°C. A portion of the sample was transferred into MacConkey agar using a sterile wire loop and incubated at 37°C for 24hours (Egbebi and Seidu, 2011). The agar plates were examined for bacterial growth. Growth characteristics and other colonial morphology of the samples were carefully observed. Different colonies on the MacConkey agar plates were picked carefully and Gram stained (Chukwura and Mojekwu, 2002). Other biochemical tests were carried out to identify bacterial colonies. Catalase test was used to differentiate those bacteria that produced the enzyme catalase such as *Staphylococci* from the catalase producing bacteria such as *Streptococci*. Coagulase test was done to identify *Staphylococcus aureus* which produces the enzyme coagulase from other stains of *Staphylococci*. The oxidase test was used to assist the identification of organisms that produced the enzyme Cytochrome oxidase. Indole test was carried out on bacteria species to determine the ability of the organism to convert Tryptophan into indole. Citrate utilization test was used to identify entrobacteria using Simmon's Citrate agar (Chukwura and Mojekwu, 2002; Cheesbrough, 2006).

Statistical Analysis

The data obtained were subjected to appropriate descriptive and inferential statistics (Chi square test and one way ANOVA) at 95% confidence limits using the SPSS software

3 RESULTS AND DISCUSSIONS

A total of seven (7) species of bacteria were identified from all suya samples based on biochemical analysis (Table 1). They were: *Escherichia coli, Staphylococcus aureus, Bacillus* spp, *Klebsiella* spp, *Pseudomonas* spp, *Salmonella* spp and *Proteus* spp. Analysis further revealed the presence of *Salmonella* spp, *Staphylococcus aureus* and *Escherichia coli* in all study locations.

Table 1: Biochemical characteristics of bacteria isolates.

Isolates	Gram Stain	Colour	Shape	Catalase	Oxidase	Coagulate	Indole	Citrate	TSI	Glucose	Lactose	Sucrose	H_2S gas
***Salmonella* spp**	-	Pk	R	-	-	-	-	-	+	-	-	+	+
***Pseudomonas* spp**	-	Pk	R	-	+	-	-	-	+	-	-	-	+
Staphylococcus aureus	+	Pu	C	+	-	+	-	-	+	+	+	-	+
***Proteus* spp**	-	Pk	R	-	-	-	-	d	+	+	+	+	d
Escherichia coli	-	Pk	R	+	-	-	+	-	+	+	+	-	-
***Bacillus* spp**	-	Pk	R	+	-	-	-	-	+	+	+	-	-
***Klebsiella* spp**	-	Pk	R	-	-	-	-	+	+	+	+	-	+

Key : + = positive, - = negative, Pu=purple, Pk=pink, R=rod, C=cocci, TSI = Triple Sugar Ion, H_2S = Hydrogen Sulphide, d = different strain gives different reaction.

Five bacterial species were isolated from the samples from Austoma. *Salmonella* spp (7.6%) and *Pseudomonas* spp (5.7%) were the dominant species occurring in 4 and 3 of the isolates respectively. Six species of bacteria were identified from the samples obtained from Base-Nat location, *Staphylococcus aureus* and and *Bacillus* spp had the highest percentage contamination 3(5.7%) Six bacterial isolates were identified from the samples from king's Resort. *Staphylococcus aureus*, *Bacillus* spp and *E.coli* gave the highest frequency of contamination, 3(5.7%) each. From the Main Market location, five (5) bacterial species were identified but *Salmonella* and *Pseudomonas* spp gave the highest frequency of contamination, 4(7.6%) each. Frequency of contaminants was homogenous in each of the location and between locations (P>0.05). The contamination rate of suya in the study was 14.2%. *Staphylococcus aureus* was the leading contaminant (21.1%) followed by *Salmonella* spp (19.2%), *Psuedomonas* spp (17.3%) and *Bacillus* spp (13.4%) as given in Table 3. There was no significant difference in the distribution of bacteria species (P=0.89, P>0.05).

Table 2: Distribution of isolates on roasted meat(suya) in Aliade town.

Location	No Examined	No Positive (%)	Isolates.
Austoma	13	4(7.6%)	*Salmonella* spp
		3(5.7%)	*Psuedomonas* spp
		2(3.8%)	*Staphylococcus aureus*
		2(3.8%)	*Proteus* spp
		2(3.8%)	*Escherichia coli*
Base-Nat	13	3(5.7%)	*Bacillus* spp
		2(3.8%)	*Escherichia coli*
		2(3.8%)	*Klebsiella* spp
		3(5.7%)	*Staphylococcus aureus*
		2(3.8%)	*Psuedomonas* spp
		1(1.9%)	*Salmonella* spp
King's resort	13	3(5.7%)	*Escherichia coli*
		3(5.7%)	*Bacillus* spp
		2(3.8%)	*Proteus* spp
		1(1.9%)	*klebsiella* spp
		3(5.7%)	*Staphylococcus aureus*
		1(1.9%)	*Salmonella* spp
Main market	13	4(7.6%)	*Psuedomonas* spp
		1(1.9%)	*Escherichia coli*
		4(7.6%)	*Salmonella* spp
		3(5.7%)	*Staphylococcus aureus*
		1(1.9%)	*Bacillus* spp

Table 3: Overall rate of suya contamination in the study area

Isolates	No Positive (%)
Staphylococcus aureus	11(21.1%)
Salmonella spp	10(19.2%)
Psuedomonas spp	9(17.3%)
Escherichia coli	8(15.3%)
Bacillus spp	7(13.4%)
Proteus spp	4(7.6%)
Klebsiella spp	3(5.7%)
Mean contaminant	**7.4 (14.2%)**

P>0.05

4 DISCUSSION.

From the results obtained, contamination rate of suya in Aliade was high from the point of view of disease epidemiology. Results were similar to those obtained in other places within Nigeria. All the bacteria species reported in this study were previously isolated in suya sold across the six geopolitical zones of Nigeria. For instance, Chukwura and Mojekwu (2002) isolated *Bacillus* spp and *Staphylococcus aureus* from the suya meat samples collected from different suya spots in Awka Ibom. Uzeh *et al* (2006) also isolated *Pseudomonas* spp, *Bacillus cereus* and *Staphylococcus aureus* from tsire-suya, a Nigerian

meat product. Abdullahi *et al*. (2006) isolated *Bacillus* spp and *Staphylococcus aureus* from a popular roasted meat (tsire) in Zaria, Nigeria while Enem and Onyekwodiri (2009) also isolated spp of *Staphylococcus, Streptococcus, Escherichia coli* and *Bacillus* from the suya samples from Nsukka, Enugu State, Nigeria. Manyi *et al*. (2014) isolated *Escherichia coli, Staphylococcus aureus, Klebsiella sp, Streptococcus sp, Bacillus* spp and *Pseudomonas* spp from Suya (roasted beef) sold in Makurdi, Benue State, Nigeria.

The percentage distribution of the bacterial isolates in the Suya samples in this study showed that *Staphylococcus aureus* was most frequently isolated (21.1%) while *Klebsiella* spp had the least percentage distribution (5.7%). The incidence of *Staphylococcus* spp. observed in this study is commonly found in hands, skin and clothing. In fact, most of those involved in the processing and sale of suya are usually illiterates without formal training on food preparation which is necessary in the hygienic handling of foods (Okonko *et al*., 2013; Onuoro *et al*., 2015). The presence of these bacteria in the meat product is hazardous to public health particularly *Escherichia coli, Bacillus* and *Staphylococcus aureus* (Samuel *et al*., 2015). These organisms are known to produce potent enterotoxins and the ingestion of food containing these toxins can cause a sudden onset of illness within three to four hours, with nausea, vomiting and diarrhea as the major symptoms (Samuel *et al*., 2015). The existence of these organisms in the Suya samples is attributed to the filthy environment, poor personal hygiene of the processors and retailers, the use of contaminated utensils during processing, use of contaminated materials for packaging, activities of flies as well as the addition of spices and seasonings after processing,

Staphylococcus spp and *Bacillis* spp are abundant in the nose and throat as well as the skin of humans as potential opportunistic pathogens. *Bacillus cereus* is a spore former. It can be found in the air and even in the spices and the spores are heat resistant (Ray, 2004). This may have accounted for its occurrence in the Suya samples. *Pseudommas aeruginosa* is widely spread in nature especially in the soil, water, on plants and even in the spices used in Suya preparation and it can easily contaminate Suya meat (Samuel *et al*., 2015).

The observed microbial contamination in suya samples analysed in this study is in line with reports by Inyang *et al*. (2005) that suya meats have microbial contaminants. This study thus raises question on the safety of suya consumption in the study area based on the varieties and loads of contaminants reported. There is therefore need to enlighten the producers, retailers and consumers of suya meat on the importance of good environmental and personal hygiene, to avoid possible outbreak of food poisoning and or food borne infections due to the consumption of contaminated suyameat if appropriate quality control measures are not put in place.

5 CONCLUSION

A total of seven (7) species of bacteria were identified from all suya samples. *Salmonella* spp, *Staphylococcus aureus* and *Escherichia coli* were present in all samples. Occurrence of contaminant type was highest at Basenat and King;s resort, with 6 species of bacteria isolated from the samples. Frequency of contaminants was homogenous in each of the location and between locations ($P>0.05$). The contamination rate of suya in the study was 14.2%. *Staphylococcus aureus* was the leading contaminant (21.1%) followed by *Salmonella* spp (19.2%), *Psuedomonas* spp (17.3%) and *Bacillus* spp (13.4%) as given in. There was no significant difference in the distribution of bacteria species ($P=0.89$, $P>0.05$). This study thus raises question on the safety of suya consumption in the study area. The given report is crucial to stakeholders in the health sector and the consumers of suya products.

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