

IDENTIFICATION AND CHARACTERIZATION OF BACTERIA ASSOCIATED WITH HAWKED SUYA MEAT FROM IBARAPA LOCAL GOVERNMENT AREA

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Abstract

Meat nutritions with high moisture content and neutral pH is a good culture medium for most micro-organisms (bacteria, yeast and moulds) and as such, classified among perishable foods whose contamination with spoilage organisms are almost unavoidable. This study focused on identification and characterization of bacteria associated with hawked suya meat. Meat samples were purchased from three suya hawkers from the study areas and cooled in refrigerator for 24hours. Standard method of analysis was used for the isolation, identification and biochemical characterization of bacterial isolates. The bacterial isolates obtained from the suya meat sampled were Staphylococcus aureus, Shigella flexneri, Samollena tyhi, Escherichia coli, Pseudomonas aeruginosa and Proteus vulgaris. Prevalence of bacterial isolated in relation to all the retail outlets was highest for E.coli with 26.3%, followed by S.typhi (24.8%) occurrence, S.aureus(21.1%), P.aeruginosa (13.9%) flexneri (7.23%) and P.vulgaris (6.6%) with the lowest value of occurrence. However, suya meat constitutes a great source of protein which is needed for body building and repair of worn-out tissue in human, adequate steps must be taken to prevent contamination and spoilage by microorganisms. Hence, improvement in the microbial quality of suya meat is very important.

Keywords: Characterization; Hawked Suya meat; Suya meat; Bacteria

Introduction

Most commonly consumed meat is specifically identified by the animals from which they are obtained; beef (meat from cattle), veal (meat from calf), pork (meat from pigs), mutton (meat from sheep). Meat plays an important role in human diet by contributing to both macro and micro nutrients that are required for growth and health maintenance (Vilar *et al.*, 2000). Meat can be prepared by different methods such as cooking, boiling, frying or roasting. It can also be processed into different forms that are easier and convenient for consumers, these include canned beef, hot dogs, sausages, cured meat, suya, bacon. Traditionally, processed meat products are consumed in different parts of the world (Vilar *et al.*, 2000).

Meat is composed of water, protein, fat and other water-soluble organic material. Muscles proteins are either soluble in water or in concentrated salt solutions. Fat in meat can be either adipose tissue used by the animal to store energy and consisting of true fats (esters of glycerol with fatty acids), or intra muscular fat (which contains considerable constituents such as cholesterol). Meat is an important source of amino acids (the building blocks of

proteins), minerals, vitamins and energy (Moon, 2006).

Suya is popularly consumed spicy, barbecued, smoked or roasted meat product that originated from the Northern Nigeria where rearing of cattle is an important preoccupation and a major source of livelihood for the people (Edema *et al.*, 2008). Suya can be prepared from ram, beef or chicken and also from offal's such as liver, kidney and gizzard. There are three main types of Suya; Tsire, Kilishi and Balangu (Omojola *et al.*, 2004).

Its production process involves thinly slicing of raw boneless meat, staking into skewers marination with various spices such as ginger, garlic, salt, pepper, black pepper. The spiced skewered beef is then coated with a mixture of groundnut paste, sprinkled with vegetable oil and barbecued over coal fire before serving or packaging it. It is reheated for a given time, re-spiced with the addition of a spices and garnished with thinly sliced onion rings, cabbage and tomato ball (Abdullahi *et al.*, 2004; Jonathan *et al.*, 2016).

Suya has become a popular street delicacy on several countries, particularly those in West Africa. It is consumed as a snack and frequently served in hotels,

bars, restaurants and in homes (Inyang *et al.*, 2006). Like any other meat product, it serves as an excellent supply of high-quality protein, vitamins and mineral. It is a street-vended food which provides a source of cheap, convenient and often nutritious menu and creates opportunity for self-employment (Mead, 2004).

The humid tropical environment encourages the breeding of flies which swarm and perch on meat displayed for sale. These constitute a major nuisance and can aid the spread of disease agents of significant public health importance (Okoli *et al.*, 2006). The fact that, there are sporadic cases of gastroenteritis and symptoms of food infection after consumption of suya, indicate that the product indeed constitutes a food safety risk (Odusote and Akinyanju 2003). Other sources of contaminations can be linked to the meat handlers and packing materials as well as cross processing contaminations (Hassan *et al.*, 2014; Odey *et al.*, 2013).

Hence, this study will enable the suya handlers to be aware of various pathogens infection transmitted through the meat as well as good knowledge of safe food handling practices by keeping high food temperature that will inhibits the growth of bacteria and using suitable preservation such as salt and sugar. Therefore, this study explored different characterization and Identification of Bacteria associated with Hawked Suya meat from Ibarapa Local Government Area.

Materials and methods

Sample collection

Suya were purchased from suya hawkers from three different area of Ibarapa Local Government Area, Oyo State (Igboora, Igangan and Idere). The samples were bought and wrapped in the usual packaging materials. The samples were placed in a well labelled zip lock bag and transported in a cooler containing ice block and taken to the laboratory where the microbiological

analysis were carried out after 3 to 6 hours of purchase and after 24hours of storage in the refrigerator.

Enumeration of microorganisms

Sample (25g) of the suya was homogenized with 225ml of sterile peptone water in a laboratory blender for 1 minutes and serially diluted to 10^{-5} in the same diluent following the procedure described by Harrigan (2008). Representative colonies from various enumeration plates were sub cultured by streak plating into their respective fresh agar plates and incubated at 37°C for 24 to 48 hours.

Characterization of colony

Isolated organisms from the different plates were characterized by their colony morphology (colony shape, appearance, colour, edge, elevation) and gram staining (Harrigan, 2008).

Biochemical test

Catalase and coagulase test were done according to the methods of Cheesebrough (2000). A colony of the sub-cultured bacterial was inoculated into few drops of hydrogen peroxide solution on a slide and observed the bubbling of gas for positive catalase test. For coagulase test, a colony of the sub cultured organisms was emulsified with drop of diction water at the end of a slide to make a thick suspension. The slide was examined for clumping of the bacteria within 10 seconds. Gram staining was performed for all isolated colonies according to the standard procedure (Adams and Moss, 1999; Uzeh *et al.*, 2006; Igyor and Umar, 2005).

Statistical analysis

Data collected were subjected to Analysis of variance (ANOVA): general linear model (GLM) using IBM SPSS software for windows version 23.0 (Amrmonk, Ny:IBM corps.). Statistical difference was established at ($p \leq 0.005$).

Results and discussion

Table 1: Percentage of bacteria isolated from suya samples (%)

Bacteria isolates	Bacteria in suya samples (%)
<i>Staphylococcus aureus</i>	21.1
<i>Shigella Flexneri</i>	7.23
<i>Proteus vulgaris</i>	6.6
<i>Samonella typhi</i>	24.8
<i>Escherihcia coli</i>	26.3
<i>Pseudomonas aeruginosa</i>	13.9

The percentage of each bacteria isolated in suya samples collected from suya meat vendors from

different locations was shown in table 1. The percentage of occurrence was highest for Escherichia

coli with 26.3% followed by *Salmonella typhi* (24.8%), *Staphylo coccus aureau* (21.1%); *Pseudomonas aeruginosa* (13.9%) and *Shihel*

flexneric (7.23%) while *Proteus vulgaris* had the lowest occurrence (6.6%).

Table 2: Bacterial Load of the Suya Sample ($\times 10^5$ cfu/g)

Sample Location	TAC	TCC
S ₁	198	150
S ₂	200	180
S ₃	170	100

Key: S₁ = Suya sample purchased at Igboora

S₂ = Suya sample purchased at Igangan

S₃ = Suya sample purchased at Idere

TAC = Total Aerobic Count

TCC = Total Coliform Count

From table 2, the total aerobic plate count (TAC) for each of the suya vendor locations was as follows; Sample Location (S₁) (198×10^5); S₂ (200×10^5) and S₃ (170×10^5). Sample location 2 had the highest total aerobic count value (cfu/g). Also, the total coliform

count was also shown in the table above, in which, the mean for coliform plate count (cfu/g) was 150×10^5 for S₁, S₂ (180×10^5) and S₃ (100×10^5). Sample location (S₂) from Igangan had the highest total coliform count.

Table 3: Biochemical Identification of Bacterial isolates.

Isolate codes	Motility	Methyl red	H ₂ S	citrate	catalase	oxidase	coagulase	mannitol	Gram reaction	glycose	fructose	Probable bacteria
S ₁	-	±	-	±	+	-	±	+	±cocci rod	+	+	<i>S.aureas</i> <i>S.fleneri</i>
S ₂	+	+	±	±	+	-	-	-	-rod	+	-	<i>S.typhi</i> <i>E.coli</i>
S ₃	+	+	+	+	+	-	-	-	-rod	+	±	<i>P.aeruginosas</i> <i>P.vulgaris</i>

Key: Present (+); Absent (-)

S₁ = Suya sample purchased at Igboora

S₂ = Suya sample purchased at Igangan

S₃ = Suya sample purchased at Idere

Table 3, result of biochemical evaluation carried out on suya meat samples purchased from vendors showed the gram reaction, catalase, oxidase, mannitol, motility, H₂S and fructose.

Prevalence occurrence of bacteria in relation to all the retail outlets is highest for *E.coli* with 26.3% which probably may arise from the use of non-portable in collaboration with the findings of Igyor *et al.* (2005) that contamination occur from various sources notably the present states of abattoir, slaughter house, slaughter procedure and practices may give rise to heavily contaminated meat.

The increase level of bacteria load observed in this study (*Samonella typhi* 24.8% and *Staphylo coccus aureus* 21.1%) could also be as a result of continuous flies contact with the product (suya meat), so also dust particles from heavily contaminated atmosphere around market places and motor parks. The observed

trend this is in agreement with the report of Umoh (2004) that contamination from aerial spores carried in the air comes from meat handlers during processing, since it is normal flora of the skin.

Another source of contamination could be the retailer themselves as most are dressed in filthy clothes and the location plays a significant role as most samples analysed were sold in market places, along road sides, near refuse dump and motor park where meat products are easily contaminated directly or indirectly.

From the result, mean aerobic plate count for 'suya' samples is higher and this may be due to the additional contamination arising from the environment or poor handling of the spices during preparation, this is in line with Umoh, 2004 findings who stated that contamination of meat product could arise from spice and use of contaminated utensils and spice may also be heavily loaded with microorganism which serve as good source of contamination of meat products.

However, an important factor which significantly contributes to the great increase in the coliform count is the location of the retail outlet which are basically motor packs or railway station where suya meat can be easily contaminated by aerial spores or bacterial spores carried in the air and several other insects such as flies, which are uncountable at such sites. This result is in agreement with Egbegi and Seidu (2011) work, who stated that one of the major sources of

Plate 1a: Appearance of *Staphylococcus aureus* on Nutrient agar



Plate 1b: Appearance of *Shigella flexneri* on Nutrient agar



contamination arise from the handlers during preparation and display of meat produce for sale. The results were also in accordance with the report of Chukwura and Majekwu, (2002) who stated that microbiological analysis of meat samples in Awkwa, Anambra state, indicating contamination of meat samples with various bacterial species including *Staphylococcus aureus* and some enteric bacteria.

Plate 1c: Appearance of *Proteus vulgaris* on MacConkey agar



Plate 1d: Appearance of *Salmonella typhi* on MacConkey agar



Plate 1e: Appearance of *Escherichia coli* on Nutrient agar

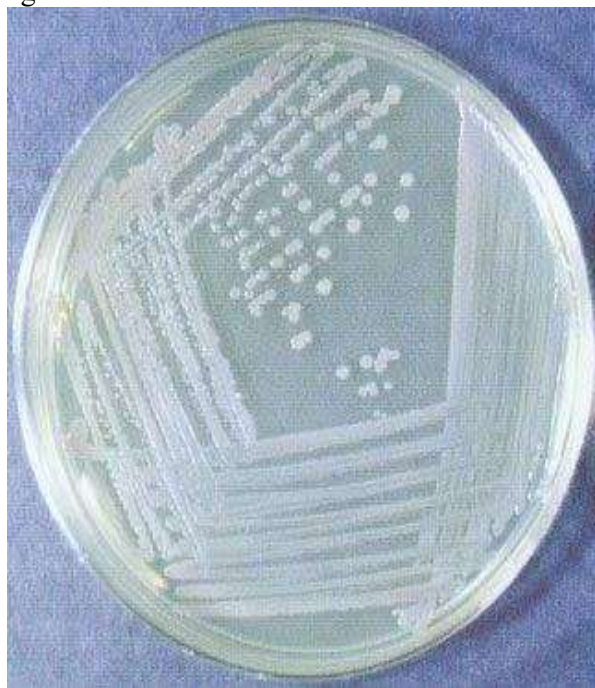


Plate 1f: Appearance of *Pseudomonas aeruginosa* on Nutrient agar



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Conclusion and Recommendation

However, suya meat constitutes a great source of protein needed for body building and repairs of worn-out tissues in human, adequate steps must be taken to prevent contamination and spoilage by microorganism as detected in the course of this study. The microbes isolated from the suya meat indicated that standard preparation and preservation have not improved over the years and facilities for preparation are not sterile. Quality control unit should be established in meat processing industries in Nigeria and Hazard Analysis Critical Control Point (HACCP) concept should be applicable to the processing and rendering of meat and suya meat beef products.

Proper animal husbandry, hygienic slaughter, adequate meat inspection, proper meat transportation, sanitation of utensils and equipment, portable drinking water and proper storage of meat should be employed to reduce microbial contamination.

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