



Microbiological Analysis Of Ready-To-Eat Suya Meat Sold In Owo, Ondo State

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ABSTRACT

Suya is a popular spicy meat product in Nigeria. Ready-to-eat suya samples were collected from four popular 'suya spots' serving at least 250 consumers within Owo, Ondo State, Nigeria. Microbiological analysis of the samples was carried out and the isolates were identified as *Staphylococcus aureus*, *Escherichia coli*, *Streptococcus spp.*, and *Pseudomonas spp.* The total viable counts for the samples ranged from 1.4×10^5 to 3.9×10^3 and 1.1×10^5 to 3.2×10^3 on nutrient agar and chocolate agar respectively. *Staphylococcus* and *Pseudomonas* recorded maximum percentage of occurrence. The result revealed that suya sold in the area were microbiologically unsafe and below acceptable standard for human consumption.

Keywords: Suya, meat, *Staphylococcus*, *Escherichia*, *Streptococcus*, *Pseudomonas*

1. INTRODUCTION

Suya is a spicy, barbecued, smoked or roasted meat product. It originated from the Hausa people of Northern Nigeria, where rearing of cattle is an important preoccupation and a major source of livelihood for the people. This leads to the production of ready-to-eat products such as Suya, Kilishi, Balangu and Kundi, which are very popular street foods. Suya is however the most popular as its consumption has extended to other parts of the country (Inyang *et al.*, 2005). In big cities and small towns, Suya vendors have become very prominent with their grill stands becoming very busy from about mid-day until late night. It is gradually making its way into elite circles where it has become a delicacy served at parties.

Suya meat is a boneless lean meat of mutton, beef, goat or chicken meat stacked on sticks, coated with sauces, oiled and then roasted over wood using a fire from charcoal. It is a traditionally processed meat product and is usually not done with strict hygiene condition because they are still done locally, that is, served hot and sold along streets, at clubs, picnics, and restaurants (Igyor and Uma, 2005).

The preparation process is carried out under largely unhygienic conditions and the risk of contamination is very high. The fact that there are sporadic cases of gastroenteritis and symptoms of food infection after consumption of *Suya* indicates that the product indeed constitutes a food safety risk (Oduote and Akinyanju, 2003; Inyang *et al.*, 2005). In developing countries, despite the apparent dearth of sustainable disease surveillance and reporting, it is widely known that cholera; salmonellosis, campylobacteriosis, shigellosis, typhoid, brucellosis, poliomyelitis, and *Escherichia coli* infections are prevalent (FAO/WHO, 2003). Diarrheal diseases are a major cause of morbidity and mortality in children where at the age of five, on average, the children suffer 2 – 3 episodes of diarrhea per year. Even though epidemiological evidence on outbreaks of food borne diseases is scarce, there are indications that foods could be contaminated to unsafe levels at the point of consumption with air flora and other microorganisms from handlers, equipment/utensils and the raw material itself.

Microorganisms grow on meat causing vital, textural and organoleptic changes when they release metabolites (Jackson *et al.*, 2001). The smoke produced has a number of effects including preservative effects resulting from the deposition of organic compounds all present in the smoked product (Suya) (Dineen *et al.*, 1999). A preservative effect is also induced by the surface drying that occurs to the extent of 30% total weight loss in hot smoked product. The phenolic deposit onto the product produces antioxidant effect.

The microbial load in meat and meat product increases as long as growth conditions are favorable. The factor influencing microbial growth includes acidity, pH, temperature, water activity, gaseous requirement, nutrient and competition of microbes for the nutrient. Controlling these factors implies maintaining long shelf life of meat and meat product but proper preservation of meat could be achieved by the combination of two or more preservation methods which includes drying, salting and high temperature (Nester *et al.*, 2001).

This work is aimed at microbiologically (isolating, identifying, and characterizing) analyzing the quality of Suya meat sold in Owo, Ondo State, Nigeria.

MATERIALS AND METHODS

Sample Collection:

Twenty skewers of suya meat were obtained from suya vendors at four popular suya spots in Owo, Ondo State. The samples were immediately wrapped in sterile aluminum foil to prevent contamination and then transported to the laboratory for microbiological analysis.

Pre-treatment of samples

Pieces of suya were removed from skewers and mashed in a sterile laboratory type mortar and pestle. 1g of the mashed suya meat was weighed and ten aseptically introduced into 9ml of sterile distilled water, properly shaken and sieved before a two fold dilution was performed.

Determination of Total Viable count

A two-fold serial dilution was made for the suya meat samples in appropriate dilution tubes. The media of choice were chocolate agar and nutrient agar. 1 ml of each dilution was pipetted and plated on nutrient agar and chocolate agar using the spread-plate method. Incubation was at 37°C for 24 hours. Developed colonies were counted to obtain total viable count to obtain total viable count. Discrete colonies were purified by sub-culturing onto nutrient agar plates and were subsequently identified using standard methods (Buchanan and Gibbons, 1994).

Gram Staining

This is done to differentiate organisms based on the structure of their cell walls as Gram positive (tough outer cell of peptidoglycan), or Gram negative (having two layers of membranes, with a thin layer of peptidoglycan sandwiched between them). Test organisms were heat-fixed on slides and flooded with crystal violet for about 60 seconds and rinsed with water for about 5 seconds. The slides were then flooded with iodine solution for about 60 seconds and rinsed with water. Ethanol was then added as a decolourizer and rinsed with water afterwards. Finally, the slides were flooded with saffranin for about 60 seconds, rinsed with water, blotted dry, and viewed under a microscope. Gram-positive organisms appeared blue/purple under the microscope while Gram-negative organisms appeared red/pink. The cell shapes were also viewed under this procedure.

Motility test

This is a test done to differentiate motile from non-motile organisms. A wire loop was used to inoculate a motility medium by making a stab to the bottom of the tube and afterwards incubated for 24-48 hours. If the organism is motile, the tube will appear cloudy the organisms will spread out of the stab line. Non-motile organisms will grow along the streak line only and the media will not be cloudy.

Catalase Test

This was carried out by putting a drop of hydrogen peroxide on a clean slide. With a sterile inoculating loop, a colony of organism was picked and allowed to be in contact with the hydrogen

peroxide. Presence of bubbles indicates positive reaction while absence of bubbles indicates negative reaction

Oxidase Test

Fresh growth is removed from the agar plate using a non-metallic instrument such as a sterile plastic inoculating loop or a sterile swab or wooden splint. The oxidase test strip is moistened slightly with oxidase reagent and the growth is rubbed into the moistened paper of the strip. If the microbe has cytochrome oxidase, it will add electrons to the reagent, changing it from its colourless appearance to a deep indigo blue in a matter of 10-20 seconds. Waiting any long than this increases the likelihood that the reagent turns blue due to natural chemical changes caused by exposure to air. If the colour does not turn blue within 20 seconds, the test is negative for the presence of oxidase.

Urease Test

Used to determine the ability of an organism to split urea to form ammonia by the action of the enzyme urease. Media used for urease test contains a pH indicator, phenol red, which turns pink at alkaline pH. Urea broth was inoculated with test organism and incubated for 2-5 days. Intense pink/red colour indicates a positive test and yellow or no colour change indicates a negative result.

Methyl Red (MR)-Voges Proskauer(VP) Tests

5 millilitres of Glucose phosphate medium was inoculated with test organism and incubated for 5 days after which one millilitre of the culture was transferred into another tube. Small quantity (2-3 drops) of methyl red was added to the tube. A red colour on the addition of the indicator signified a positive methyl red test while a yellow colour signified a negative result.

To the rest of the glucose phosphate culture, some drops (about 5 drops) of 4% potassium hydroxide (KOH) were added followed by few drops of 5% α -naphthol in ethanol. The test tube was then sealed, shaken and kept in a sloping position. The development of a red colour after about 15 minutes to 1 hour indicated a positive VP test and no colour change indicated a negative result.

Indole Test

Used to determine the ability of an organism to split indole from the amino acid tryptophan using the enzyme tryptophanase. Tryptophan broth was inoculated with test organism and incubated for 24 hours. Drops of Kovacs Reagent were then added to the broth. Formation of a red ring at the surface of the broth signified a positive result.

Starch Hydrolysis

Used to determine the ability of an organism to hydrolyse starch. A single streak of test organism was inoculated on a starch agar plate and incubated at 37°C for 24-48 hours. After incubation, a small amount of iodine was introduced to the plate and rotated gently (iodine is an indicator of starch; in the presence of starch the iodine will turn blue/black). A zone of clearing appears adjacent to the streak line in positive results and no clearing indicates a negative result.

Coagulase Test

This was used to identify *Staphylococcus aureus*, which produces the coagulase enzyme that causes plasma to clot by converting fibrinogen to fibrin.

A drop of sterile distilled water was placed on each end of a sterile slide. A colony of the test organism was emulsified on each spot to make two thick suspensions. A loop-full of plasma was added to one of the suspensions and mixed gently. The slide was examined for clumping or clotting of the organisms within 10 seconds. Plasma was not added to the second suspension, which served as control substance

3. RESULTS

Table 1: Summary of Microorganisms Isolated from the Different Locations In Owo

Location	Isolates	Organisms
Permanent site, Achievers University, Owo	S1-S5	<i>Staphylococcus sp.</i> <i>Streptococcus sp.</i> <i>Escherichia coli</i> <i>Pseudomonas sp.</i>
Fingerprint Hotel, Owo	S6-S10	<i>Staphylococcus sp.</i> <i>Streptococcus sp.</i> <i>Pseudomonas sp.</i>
Rufus Giwa Polytechnic, Owo	S11-S15	<i>Staphylococcus sp.</i> <i>Streptococcus sp.</i> <i>Escherichia coli</i> <i>Pseudomonas sp.</i>
Point 1 Hotel, Owo	S16-S20	<i>Staphylococcus sp.</i> <i>Streptococcus sp.</i> <i>Escherichia coli</i> <i>Pseudomonas sp.</i>

Table 2: Total Viable Counts and Morphology

Sample	Dilution	Nutrient agar Count	Chocolate agar Count	Color	Shape	Edge
A	10 ⁻⁴	3.9 x 10 ³	3.2 x 10 ³	Milk/Yellow	Circular	Irregular
B	10 ⁻⁴	3.2 x 10 ³	2.8 x 10 ³	Milk	Circular	Irregular
C	10 ⁻⁴	3.0 x 10 ³	4.4 x 10 ³	Milk	Circular	Irregular
D	10 ⁻⁴	2.9 x 10 ³	3.2 x 10 ³	Milk	Circular	Irregular

Location

Sample A- Permanent site, Achievers University, Owo

Sample B- Fingerprint Hotel, Owo

Sample C- Rufus Giwa Polytechnic, Owo

Sample D: Point 1 Hotel, Owo

Table 3: Frequency of Occurrence of Isolates

Isolate	Frequency	Percentage%
<i>Staphylococcus</i>	6	35
<i>Escherichia coli</i>	4	15
<i>Pseudomonas</i>	6	35
<i>Streptococcus</i>	4	15

4. DISCUSSION

Meat basically contains all the nutrients for microbial growth and metabolism, making it very susceptible to microbial contamination. In view of the microbial quality of meat and meat products; proper hygiene must be ascertained to ensure safety from infections after consumption of such products and to promote quality assurance.

In this study, the microorganisms isolated include *Staphylococcus species*, *Streptococcus species*, *Escherichia coli* and *Pseudomonas species*. The result was in consonance with the report of Chukwura and Majekwu (2002), which stated that microbiological analysis of meat samples in Awka urban of Anambra State, indicated contamination with various bacterial species including

Staphylococcus aureus, and some enteric bacteria. Gilbert and Harrison, 2001 also affirmed that meat preserved with a certain amounts of salt permit the growth of *Staphylococcus aureus* whereas, the presence of some members of *Enterobacteriaceae* is due to contamination from the intestines of slaughtered animals. The meat also showed presence of *Pseudomonas aeruginosa*, which occurs in soil, vegetation, and surface of plants, animals and humans (Field, 2002). Four organisms were isolated from the suya samples in view of the unhygienic condition of meat handling in Nigeria. The organisms isolated in this study are the organisms usually implicated in meat spoilage and could always be suspected in connection with contamination and spoilage. The presence of *Staphylococcus species* agrees with the report of cross contamination from meat handlers during processing, since it is a normal flora of the skin (Gilbert and Harrison, 2001). Most butchers in Nigeria, lacking knowledge of hygiene, usually carry raw meat on the body and use contaminated water (usually coliform) to wash the raw meat.

5. CONCLUSION AND RECOMMENDATIONS

Organisms capable of endangering human lives were isolated from the suya samples and in numbers that could likely cause severe health problems. The practice of preparation and distribution of suya in open places where there is no emphasis on hygiene standards leads to exaggerated increase in the proliferation of microorganisms especially where the suya sellers are themselves unhygienic. Proper hygiene in the process-line and the processing environment of suya is recommended to prevent the likely detrimental health implications to consumers. Meat sellers and handlers should as often as possible be enlightened on proper animal husbanding, hygienic slaughter, proper meat transportation, sanitation of utensils and equipment, and proper storage of meat. This would help reduce the rate of infections from meat.

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