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Microbiological evaluation of Suya (dried smoked meat) sold in Ado and Akure, South West Nigeria

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ABSTRACT

Ready to eat suya (dried smoked meat) samples were collected from suya processors in four different locations within Ado-Ekiti and Akure, two state capitals in South West, Nigeria. Studies on the microbiological quality of suya was carried out. The moisture contents ranged from 47.80 to 50.00% (Ado) and 46.50 to 52.01% (Akure). The bacteria counts for the samples were 0.30 – 0.4 × 10^5cfu/g (Ado) and 0.3 – 0.85 × 10^5cfu/g (Akure) while fungi counts; ranged from 0.10 – 0.2 × 10^5cfu /g (Ado) and 0.10 – 0.22 × 10^5cfu/g (Akure). Fifteen (15) general of microflora were isolated, characterized and identified. The isolated were eight (8) bacteria, four (4) molds and three (3) yeast. The following species recorded maximum percentage occurrence; Staphylococcus, coliforms and Aspergillus spp. The isolation of probable potential pathogens from suya samples analyzed is of public health significance.

INTRODUCTION

Traditionally, processed meat products are produced and consumed in different countries throughout the world (Vilar,*et. al*., 2000). Suya is a spicy, traditional stick meat product that is commonly produced by the Hausas in Northern Nigeria from beef (Alonge and Hiko 1981). Where rearing of cattles is an important pre – occupation and major source of livelihood for the people (Edema, *et. al*., 2008). This leads to the production of ready – to – eat beef products such as suya, kilishi, balangu and kundi. suya is however the most popular as its consumption has extended to other part of the country (Inyang *et. al*., 2005).

It is produced from boneless meat, hung on stick and spiced with peanut cake, salt, vegetable oil and other flavourings followed by roasting around a glowing charcoal fire (Abdullahi, *et. al*., 2004). Even though meat from freshly slaughtered, healthy animals is supposed to have no, or

very low microbial populations, laboratory evidence suggests that they could be contaminated to an unsafe level at the point of consumption (Umoh, 2001). The fact that there are sporadic cases of gastroenteritis and symptoms of food infection after consumptionof suya indicate the products indeed constitute a food safety risk (Odusote and Akinyanju, 2003; Inyang, *et. al*., 2005). Microbiological quality of suya sold in Akure and Ado-Ekiti State capitals of Ondo and Ekiti States respectively was investigated and reported upon.

MATERIALS AND METHODS

Sampling procedure

Samples of suya used in this study were obtained from four suya spots at four locations in Ado and Akure capitals of Ekiti and Ondo States respectively in South-western Nigeria and a total of 32 samples were collected. Four replicate samples were collected from each location. From each of the sites, ready – to – eat suya samples were purchased and transported to the laboratory in sterile bags packed in insulated containers with ice packs. Analyses were carried out within 6hours after sampling. Where immediate microbiological evaluation was to be delayed, the samples were refrigerated at 4°C and analyzed within 24hour of collection (Abdullahi *et. al*., 2004). All experimental determinations were made in triplicate.

Microbiological analyses

The total viable counts were carried out using Nutrient agar (Oxoid Ltd., Basing Stoke Hants England). Enumeration of fungal counts (Yeast / Mould) was on acidified potato dextrose agar (PDA, Oxoid, UK). In serial dilution preparation, 10.0g of sample was aseptically transferred into 90.0ml of diluted water and homogenized by vortex. Subsequent serial dilutions up to10^{-5} were made (Kalalou *et. Al*., 2004). The enumeration of micro organisms in the samples was by the pour plate technique. At the end of the incubation, resultant microbial colonies (bacteria and fungi) were counted.

Discrete bacterial colonies on Nutrient agar (NA) were sub-cultured onto freshly prepared nutrient agar plate by streaking. Fresh PDA plates were used to subculture fungi. Stock culture of the isolates were developed on slants and stored at 10°C with transfers at intervals of 14days (Ojokoh, 2006). Isolates were identified by cultural and morphological characteristics as well as biochemical tests such as the catalase, coagulase amongst others in accordance with the methods of (Cheesbrough 2000).

Determination of moisture content of suya

The moisture content of the suya samples was determined by the methods of AOAC (2004) on dry weight basis.

Statistical analyses

The data generated were subjected to statistical analyses using SPSS 16.0 for windows. Means were separated by Duncan's Multiple range tests (Steel and Torrie, 1980).

RESULTS

Table 1: Microbial counts (10^5 cfu / g) and moisture contents of suya samples from selected locations in Ado-Ekiti

Location	Moisture content (%)	Bacteria	Fungi (yeast and molds)
A	47.8^{c}	0.32^{a}	0.14^{b}
B	49.4^{b}	0.48^{b}	0.11^{a}
C	50.2^{ab}	0.30^{a}	0.18^{c}
D	51.0^{a}	0.45^{b}	0.20^{cd}

Mean followed by different superscripts within columns are different ($P \leq 0.05$)

Table 2: Microbial counts (10^5 cfu / g) and moisture contents of suya samples from selected locations in Akure

Location	Moisture content (%)	Bacteria	Fungi (yeast and molds)
J	52.01^{b}	0.60^{b}	0.15^{b}
K	57.00^{a}	0.85^{a}	0.13^{bc}
L	46.50^{c}	0.50^{c}	0.22^{a}
M	50.12^{bc}	0.31^{d}	0.10^{c}

Mean followed by different superscripts within columns are different ($P \leq 0.05$)

Table 3: Micro organisms isolated from Ado-Ekiti samples

Location	Bacteria	Mold	Yeast
A	*Staphylococcus* spp. *E. coli* *Bacillus* spp. *Salmonella* spp.	*Aspergillus* spp. *Rizopus* spp. *Penicillium* spp.	*Rhodotorula* spp. *Saccharomyces* spp.
B	*Klebsiella* spp. *Bacillus* spp. *Pseudomonas* spp. *Staphylococcus* spp.	*Mucor* spp *Aspergillus* spp	*Saccharomyces* spp
C	*Salmonella* spp. *E. coli* *Streplococcus* spp *Bacillus* spp *Staphylococcus* spp	*Rhizopus* spp. *Penicillium* spp *Aspergillus* spp	
D	*Pseudomonas* spp *Slaphylococcus* spp *Klebsiella* spp *Proteus* spp	*Mucor* spp *Aspergillus* spp	*Saccharomyces* spp

The moisture contents of suya samples evaluated in this study ranged from 47.80 to 51.00% and 46.50 to 57.00% for Ado and Akure respectively as presented in Table 1 and 2. The total viable counts in samples of suya from both towns are presented in Table 1 and 2. the minimum counts obtained from the samples were 0.3×10^5 bacteria, fungi: 0.11×10^5 recorded for Ado samples while 0.31×10^5 fungi were recorded for Akure samples.

Bacteria general isolated were four each for all the samples from both towns with exception of samples from locations C and K that had five and three each respectively as shown in Table 3 and 4.

Table 4: Micro organisms isolated from Akure samples

Location	Bacteria	Mold	Yeast
J	*E. coli* spp *Staphylococcus* spp *Bacillus* spp *Streplococcus* spp	*Aspergillus* spp *Mucor* spp	*Candida* spp
K	*Pseudomonas* spp *Klebsiella* spp *Staphylococcus* spp	*Aspergillus* spp *Mucor* spp *Rhizopus* spp	*Rhodotorula* *Saccharomyces* spp
L	*Proteus* spp *Salmonella* spp *Staphylococcus* spp *Streptococcus* spp	*Penicillium* spp *Mucor* spp *Aspergillus* spp	*Saccharomyces* spp
M	*Salmonella* spp *Klebsiella* spp *Pseudomonas* spp *Staphylococcus* spp	*Aspergillus* spp *Rhizopus* spp *Mucor* spp	*Candida* spp *Rhodotorula* spp

The species of mold identified were four while yeast were three. The occurrence of different types of micro organisms in the suya samples analyzed indicated 100% for both *Stapholococcus* and *Aspergillus* species as shown in Table 3 and 4.

DISCUSSION

The moisture contents of suya samples varied from one location to other. The reason for the observed significant differences in moisture contents among the locations is unknown. Bacteria counts for samples from Ado ranged from 0.30 to 0.48 × 10^5 (cfu/g) and 0.31 to 0.85 × 10^5 (cfu/g) from Akure samples. Edema *et. al*., (2008) recorded values for aerobic mesophiles counts in suya samples in the range of 0.07 to 2.22 × 10^5 (cfu/g). The value recorded in this study is within the range of those of Edema *et. al*., (2008) but more than 10^4c fu/g reported by (Osho 2004). However, these values place the suya samples examined in this work in the acceptable but not satisfactory range under the Public Health Laboratory Service guidelines for the bacteriological quality of ready-to-eat foods samples at the point of sale (PHLS, 2000).

E. coli, *Salmonella* spp. and *Klebsiella* spp. all coliforms which were isolated from all the samples and the presence of *Bacillus* spp in some rendered the samples unsatisfactory according to (PHLS 2000). The level of presence of these organisms in food has been described as index of food hygiene (Adesokan *et. al*., 2008; Jay, 1978).

The presence of *Staphylococcus* spp. in all the samples could be from nose where it is commonly found, hands, skin and clothing of handlers, since suya processors were found to be illiterate men without formal training in food preparation which is necessary and important for hygienic handling of foods (FAO, 1999). *Streptococcus* spp, *proteus* spp and *Pseudomonas* species were also isolated, an observation in agreement with the findings of (Edema, *et. al.*, 2008). Three species of yeasts were identified: *Candida*, *Saccheromyces* and *Rhodotorula* while molds found were *Aspergillus* spp, *Mucor* spp, *Penicillium* spp and *Rhizopus* spp. It should also be noted that some species of *Asperigillus* are known to produce powerful mycotoxins which are harmful to man, thus their occurrence in suya is undesirable. The presence of molds could have come from

contaminated spices used and wrapping with contaminated wrap before serving (Shamsudeen and Oyeyi, 2008). Edema *et. al*., (2008) found that suya are kept at ambient temperature and the re-heating temperature of less than 70°C is not sufficient to destroy all the vegetative cells and heat resistant spores of bacteria especially if the meat is heavily contaminated with enteric bacteria (Bryan, 1988).

There is need for monitoring of this nutrition products by educating processors and consumers on good sanitary practices during processing displaying and sale of the products and the possible danger of contaminated products.

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