Assessment of the safety of 'suya' condiment vended in three communities in Rivers State, Nigeria.

ABSTRACT

Aims: The essence of this research was to assess the microbiological quality of suya condiments/spices sold at different points in Obio/Akpor (Choba and Rumuepirikom) and Ikwerre (Aluu) Local Government Areas, Rivers State and reduction of microbial load using home microwave oven.
Study design: Completely randomized design with two replications and average values calculated.
Place and Duration of Study: Food and Industrial Microbiology Laboratory, University of Port and Emadavistic Medical and Research Laboratory, Osaks House, East-West road Port Harcourt for three months.
Methodology: Twelve (12) samples of already formulated suya condiments/spices were sampled from twelve different suya vendors at Choba, Rumuepirikom, and Aluu. Standard methods were used for the microbiological analyses and microbial inactivation using home microwave oven.
Results: The total plate counts (log10 CFU/g) for the samples ranged from 5.35 to 6.29, 5.67 to 6.09, and 5.88 to 6.36 for samples collected from Choba, Rumuepirikom and Aluu respectively. The isolated bacteria on the basis of cultural, physiological and biochemical characteristics were identified as: *Staphylococcus* spp. (44.4%), *Salmonella* spp. (11.1%), *Bacillus* spp. (35.2%), *Shigella* sp. (1.9%), *Enterobacter* sp. (3.7%) and *Streptococcus* sp. (3.7%) from all three locations. A decrease in the microbial load was noted as exposure time increased from 0 to 60 s.
Conclusion: In all, suya condiments collected for this study were contaminated with bacteria of public health significance which suggest the need for microbial inactivation and an improvement in hygiene practice during processing and storage.

Keywords: Condiment, gastroenteritis, meat, spices, suya

1. INTRODUCTION

Suya is a popular, traditionally processed, ready-to-eat boneless lean meat of mutton, beef, goat or chicken meat served or sold along the streets, in club houses, at picnics, parties, restaurants and within institutions often prepared by coating with spiced sauces and vegetable oil, and then roasted over wire gauze using fire from charcoal [1, 2]. It originated from Hausa people of Northern Nigeria, Sub-Saharan Africa, where rearing of cattle is a major preoccupation and source of livelihood for the people [3, 4].

Suya condiment is a combination of ground Nigeria indigenous spices and condiments added to the meat before and after it has been processed with the addition of sliced onions that gives suya its unique desired taste. The ingredients used for Suya condiment vary

according to personal and regional preferences for taste, which comprises of but not limited to red pepper (*Capsicum* spp), white pepper (*Piper guinensis*), clove (*Allium sativum*), ginger (*Zingiber officinate*), African nutmeg (*Monodora myristica*), brown pepper (*Xylopia aethiopica*), curry, salt, maggi seasoning, peanut cake and monosodium glutamate [5, 6, 7, 8].

Spices like other food substances, may be contaminated by bacteria, fungi and even some insects during harvesting, processing, transportation and storage in the exporting countries. The predominant flora is generally composed of aerobic spore and non spore forming bacteria, indicator organisms and some pathogens may also be found [9]. Studies have shown that spices used in suya preparation may contain high population of bacteria and fungi which may be viable even at the time of marketing [10] and in formulated ready-to-eat suya condiment/spices [11], confirming the sporadic cases of gastroenteritis and symptoms of food borne infection after consumption of suya which make this product (suya) a food safety risk [12, 13, 14, 15], often resulting in the development of antibiotic resistance organisms if these infections are not properly treated [16].

Microwaves are a form of electromagnetic radiation employed especially to produce rapid heating effects known to inactivate bacteria and yeasts, namely: *Escherichia coli*, *Streptococcus faecalis*, *Staphyloccocus aureus*, *Bacillus subtilis* spores, *Salmonella* sp., *Lactobacillus plantarum*, *Listeria* spp., *Saccharomyces cerevisiae* and *Clostridium perfringens* [17, 18, 19].

According to Price and Schweigert, [20], unless spices are treated to reduce their microbial content, they may add high numbers and undesirable kind of organisms to food in which they are used. It is for this reason therefore, this research was set up with the aim of investigating the microbiological quality of the ready-to-eat suya spices vended in Obio/Akpor and Ikwerre LGAs, Rivers State and the reduction of the microbial load using home microwave oven.

2. MATERIAL AND METHODS

2.1 Source of Sample

Samples of ready-to-eat suya condiment composed of ginger, garlic, West African black pepper, hot pepper, groundnut and maggi were purchased from suya vendors from Obio/Akpor (Choba and Rumuepirikom) and Ikwerre (Aluu) Local Government Areas, Rivers State. The twelve (12) samples purchased at different occasions were taken to the laboratory immediately and analyzed.

2.2 Isolation procedures

Sample preparation was carried out according to the method described by Ogbonna *et al*. [21]. Twenty-five grams of condiments were dissolved in 225ml of peptone water. The mixture was shaken vigorously for proper mixing, followed by a 10-fold serial dilution and plating of 0.1ml of appropriate dilutions on selected media (Nutrient agar, eosin methylene blue agar, mannitol salt agar and *Salmonella/Shigella* agar). All inoculated plates were incubated at 29±2°C for 24-28 h [22, 23]. Distinct colonies were purified on freshly prepared Nutrient agar and stored pending identification.

2.3 Identification of Isolated bacteria

The isolated bacteria were identified conventionally on the bases of the cultural morphology, physiological and biochemical characteristics (Gram's reaction, spore staining, motility, oxidase test, catalase test, indole test, methyl red, Voges Proskauer, citrate utilization test, coagulase, triple sugar iron agar test, sugar fermentation) and compared with Bergey's Manual of Determinative Bacteriology [24].

2.4 Effects of micro-wave on bacterial count

Composite samples (11g) of ready-to-eat 'suya' condiment in separate sterile Petri dishes were placed in a home microwave oven, 2450 MHz - 750W (AKAI, model: MWO20A-AC928ARW 28L) and samples withdrawn at interval (0, 15, 30, 45, 60 s) for enumerated in duplicate on Nutrient agar after a 10-fold serial dilution. The resulting colonies after incubation at room temperature for 18-24h were counted and expressed in CFU/g [25].

3. RESULTS AND DISCUSSION

Spices and herbs powder are known to be significant source of microorganisms, due to high microbial contamination caused by poor sanitary conditions along the production chain [25]. The bacteria counts on the selected agar plates are presented in Table 1. The aerobic plate counts (log_{10}CFU/g) ranged from 6.20 to 6.35, 5.67 to 6.36 and 5.88 to 6.36 for ready-to-eat suya condiments from Choba, Rumuepirkom and Aluu respectively. The observed aerobic plate (APC) counts were comparable to counts of 3.45 to 6.16 log_{10}CFU/g in suya condiments and 3.07 to 5.71 log_{10}CFU/g in dried spices reported by Odu and Akwasiam [23] and Dababneh, [25] respectively. The average APC and Staphylococcal counts of 8.47 and 7.24 log_{10}CFU/g respectively from similar spice mix for preparation of kilishi were higher than the counts of this study [26]. The International Commission on Microbiological Specifications for Foods (ICMSF) allows maximum limits of 10^6 CFU of total aerobic mesophilic bacteria; 10^4 CFU of coliforms and, 10^3 CFU of *Escherichia coli* and *Clostridium perfringens* per g of spice [27]. According to the specification above, the results of the total aerobic mesophilic bacteria count (4.7×10^5 to 2.31×10^6 CFU/g) of this study is considered satisfaction with the regulation of the ICMSF which allows maximum limits of 10^6 CFU/g though on the high side.

Table 1. Bacteria counts on the selected agar

Location	Range of bacteria (log_{10}CFU/g)			
	APC	SC	CC	SalC
Aluu	5.88 - 6.36	3.73 - 3.75	-	-
Choba	6.20 - 6.35	3.92 - 5.70	4.31 - 5.47	3.78 - 8.00
Rumuepiricom	5.67 - 6.36	-	-	-

APC=aerobic plate count; SC=*Staphylococcus* count, CC= coliform count and SalC= *Salmonella* count.

The isolated bacteria on the basis of cultural, physiological and biochemical characteristics were identified as: *Staphylococcus* spp. (44.4%), *Salmonella* spp. (11.1%), *Bacillus* spp. (35.2%), *Shigella* sp. (1.9%), *Enterobacter* sp. (3.7%) and *Streptococcus* sp. (3.7%) from all three locations. Some of the bacteria isolated in this study have been previously reported in 'suya' condiments [11, 23, 26, 28] and spices and spice products [29, 30, 31]. The high level of contamination by *Staphylococcus* may not be unconnected with poor handling during and after processing.

The distribution of the isolates according to location is presented in Figure 1. The samples from Choba were the most contaminated, followed by samples from Rumuepirikom and

lastly samples from Aluu. The condiments from Choba were the most contaminated and unsafe for consumption.

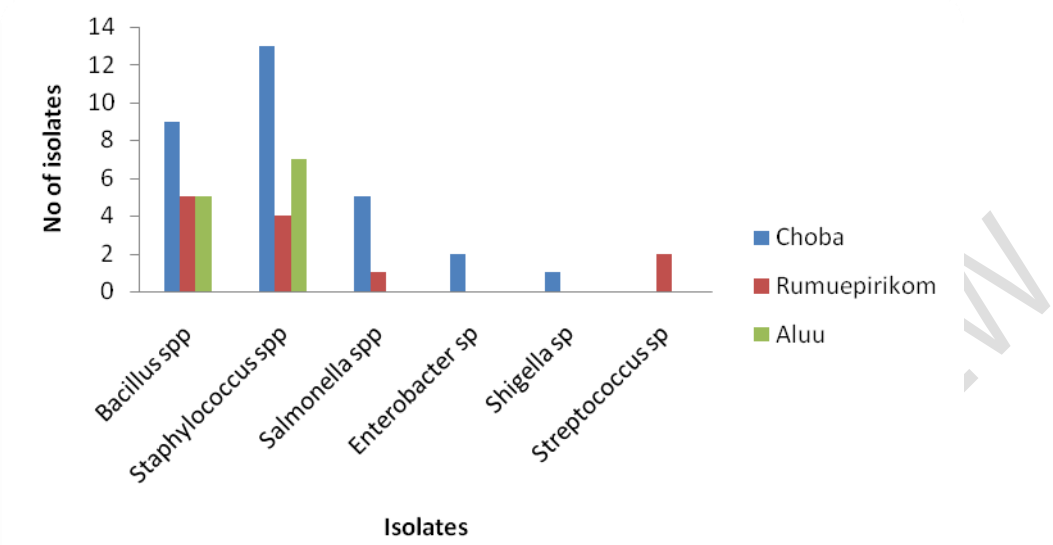

Figure 1. Distribution of isolated bacterial according to location

Spice ingredients are thought to have some antimicrobial activities; but do not have a marked bacteriostatic effect in the concentrations used in meat products and they may even serve as source of contamination of processed product [32, 33]. Occurrence of microorganisms that are potentially pathogenic in spices used in suya preparation is considered as major cause of gastrointestinal disturbances resulting from the consumption of suya in Nigeria [13]. According to Price and Schweigert, [20], unless spices are treated to reduce their microbial content, they may add high numbers and undesirable kind of organisms to food in which they are used.

In general, a decrease in the microbial load was noted as exposure time increased from 0 to 60 s (Figure 2). A considerable linear reduction slope was obtained at 15 s exposure followed by a lower and semi constant rate from 15 to 30 s and 30 to 60s respectively, consistent with the report of Dababneh [25]. This same trend was previously reported by Gedikli, *et al*. [34] that a rapid inactivation of suspension of *Escherichia coli* ATCC 25922, *Bacillus cereus* NRRL 3711 and *Staphylococcus aureus* ATCC 25923 occurred in the first 60 sec by microwave, after which period there was no considerable change observed in the amount of viable cell and it fixed as the optimum contact time. They also stated that maximum destruction level occurred in a short time, which was the trend between 0 and 15s in this study. The predominance of *Bacillus* spp in the plates kept till 60s is not unconnected with the presence of spores, which according to Park *et al*. [35] were totally eradicated in the work with kitchen sponges, scrubbing pads and syringes only after 4min of irradiation; whereas, coliforms and *Escherichia coli* were totally inactivated after 30 s and bacterial phage MS2 within 1 to 2 min.

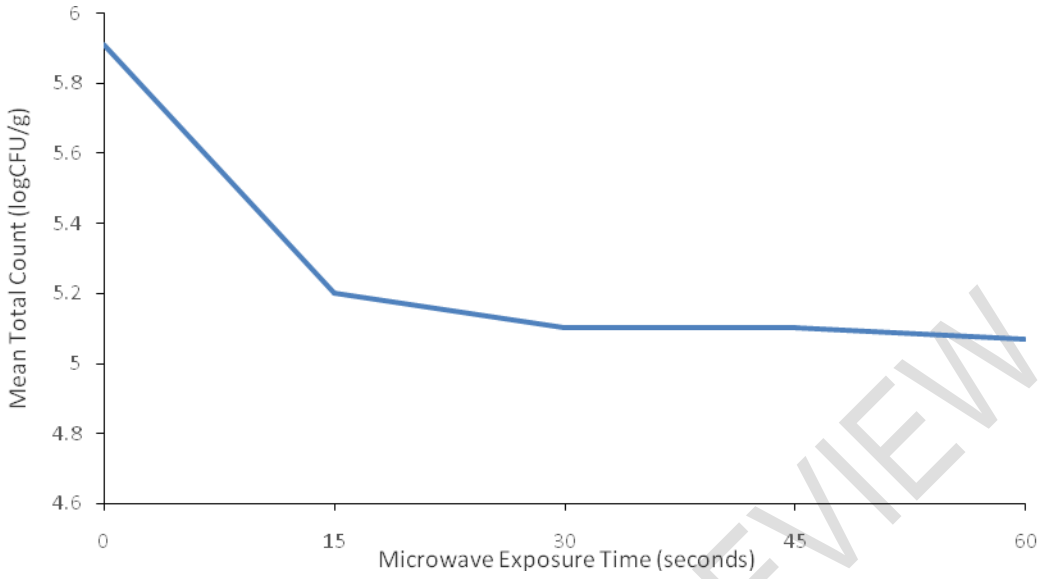

FIG. 2. Graphical Presentation showing mean total count and microwave exposure

4. CONCLUSION

The level of contamination of the analyzed ready-to-eat 'suya' condiment, though within the acceptable limits, is worrisome because of the presence of bacteria of public health significance. A combination of improved hygienic processing practices and microwaving of samples will in no doubt improve the safety of 'suya' condiments.

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