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N PAKISTAN JOURNAL OF
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Bacterial Contamination of Tsire-Suya, a Nigerian Meat Product

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Abstract: Samples of raw meat prior to roasting, and tsire-suya were analyzed bacteriologically for total viable, coliform, staphylococcal counts and the presence of *Pseudomonas aeruginosa*, *Bacillus cereus*, *Staphylococcus aureus* and *Escherichia coli*. The sensitivity of the bacterial isolates to some antibiotics and spices was evaluated. The total viable count varied from $20x10^2$ to $289x10^2$ cfu/g for the raw meat and $7x10^2$ to $171x10^2$ cfu/g for the tsire-suya. The coliform count was $4x10^2$ to $71x10^2$ cfu/g for the raw meat and $1x10^2$ to $42x10^2$ for the tsire-suya while the staphylococcal count ranged from $1x10^2$ to $60x10^2$ cfu/g for the raw meat and $1x10^2$ to $12x10^2$ cfu/g for tsire-suya. From results obtained, bacterial count was higher in raw meat than in tsire-suya. *P. aeruginosa*, *B. cereus*, *S. aureus*, and *E. coli*, were isolated from the raw meat and tsire-suya. The isolates were sensitive to some of the antibiotics and spices tested. However, *E. coli* was only sensitive to gentamicin. While *P. aeruginosa* on the other hand was resistant to *Afromomum melegueta*, *Piper quinense* and *Capsicum fructescens*, the three spices tested for this study. The incidence of the isolated bacteria in tsire-suya, a ready-to-eat meat product in Nigeria is of health significance.

Key words: Antibiotics, bacterial count, coliform count, raw meat, staphylococcal count, spices, tsire-suya

Introduction
Suya is a popular, traditionally processed, ready to eat Nigerian meat product, which may be served or sold along streets, in club houses, at picnics, parties, restaurants and within institutions (Igene and Mohammed, 1983). It is a mass consumer fast food. Its preparation and sales along streets are usually not done under strict hygienic condition because they are still done locally.

Tsire is a type of suya. Tsire is roasted boneless meat of either mutton, beef, or goat that is cooked around a glowing fire in which the meat pieces are stacked on wooden sticks and spiced with peanut cake, spices, vegetable oil, salt or other flavourings (Alonge and Hikko, 1981). The prepared tsire when being sold are usually packaged in newspapers and sometimes in cellophane or nylon bags. Most of the stages of tsire preparation, materials used in its preparation and packaging, the handlers and the surrounding environment can serve as source of contaminants to the meat product.

The objective of this research therefore are to assess the incidence of some bacteria vis-à-vis *Pseudomonas aeruginosa*, *Escherichia coli*, *Bacillus cereus* and *Staphylococcus aureus*, evaluate total bacterial, staphylococcal, and coliform counts in tsire-suya as well as determine the effect of antibiotics and spices on the isolated bacteria.

Materials and Methods
Collection of samples: Raw meat prior to roasting, and tsire-suya samples were collected from five locations in Lagos State, University of Lagos (Location 1), Bariga (Location 2), Allen Avenue roundabout, Ikeja (Location 3), Barracks gate, Sabo (Location 4), and UTC Supermarket ground, Surulere (Location 5). From each location, five samples were aseptically collected taken to the laboratory and analyzed without delay.

Isolation and identification of bacteria: A one in ten serial dilution was made for each raw meat and tsire sample. From appropriate dilution tubes 1 ml each was pipetted and plated on nutrient agar, MacConkey agar and mannitol salt agar using the spread plate method. Incubation was at 37^0C for 24 hr. Developed colonies were counted to obtain total viable, coliform, and staphylococcal counts respectively. Isolated colonies were purified to obtain pure cultures which were subsequently identified using standard methods (Buchanan and Gibbons, 1974), for the presence of *Pseudomonas aeruginosa*, *Bacillus cereus*, *Staphylococcus aureus*, and *Escherichia coli*.

Sensitivity test of bacterial isolates to antibiotics: The disk diffusion method was used. Commercial antibiotics disks of known concentration were placed on Mueller Hinton agar previously seeded with the bacterial isolates. The plates were seeded at 37^0C for 24 hr. Plates were examined for zones of inhibition around the antibiotics disks, and measured.

Extraction of spices: The spices (*Afromomum melegueta*, *Piper quinense*, and *Capsicum fructescens*) were extracted using 95% ethanol. Twenty grammes of each spices was ground into powder form in a clean

mortar. This was suspended in 100 ml of 95% ethanol, stirred, left to stand with occasional stirring for 2 hr, and then filtered through cheese cloth into sterile bottles.

Sensitivity test of bacterial isolates to spices: The disk diffusion method was also used. Disks (6 mm in diameter) were made from Whatman No. 1 filter paper and impregnated with extracts from spices. The disks were placed on Muller Hinton agar previously inoculated with the bacterial isolates and incubated at 37°C for 24 hr. Developed zones of inhibition were measured. The 95% ethanol was used for the control experiment.

Results

Pseudomonas aeruginosa, Bacillus cereus, Staphylococcus aureus and *Escherichia coli* were isolated from both raw meat and tsire-suya. The total viable bacterial count varied from 20 x 10^2 to 289 x 10^2 cfu/g for the raw meat, and 7 x 10^2 to 171 x 10^2 cfu/g for the tsire-suya (Fig.1). The coliform count varied from 4 x 10^2 to 71 x 10^2 cfu/g for raw meat and 1x 10^2 to 42 x 10^2 cfu/g for tsire-suya (Fig. 2), while the staphylococcus count varied from 1 x 10^2 to 60 x 10^2 cfu/g for raw meat and 1 x 10^2 to 12 x 10^2 cfu/g for tsire-suya as shown in Fig. 3. In all cases, the bacterial count was higher in raw meat than in tsire-suya.

Each of the isolates was sensitive to some of the antibiotics tested as shown in Table 1.

Sensitivity of the bacteria to some spices was also observed; however, *Pseudomonas aeruginosa* was resistant to all the spices (Table 2).

Discussion

The analysis of the bacterial counts of the raw meat and tsire-suya samples indicated variations between both samples. Higher bacterial counts were obtained from the raw meat than the tsire-suya. This may be due to the effect of heat on the bacteria during the preparation of tsire-suya.

According to Pace (1975) and Solberg *et al.* (1986), bacterial count exceeding 10^5/g or coliform count higher than 10^2/g in delicatessen food products are indicative of dangerous contamination. In this study, the total bacterial count for the tsire-suya ranged from 7 x 10^2 to 171 x 10^2 cfu/g, for coliform count it was 1 x 10^2 to 42 x 10^2 cfu/g while the staphylococcal count ranged from 1 x 10^2 to 12 x 10^2 cfu/g. With these results, there may be cause for concern, especially with the coliform count. The incidence of *Escherichia coli* may be as a result of poor hygiene since tsire-suya is popularly sold along streets. *S. aureus* and *B. cereus* have been known to be implicated in food borne illness. *S. aureus* have been reported in the nose and throat of food handlers (Omoregbe and Igbinovia, 1992) and in more than 50% of healthy humans (Bergdoll, 1990). However, this organism may have occurred in tsire-suya as a post-
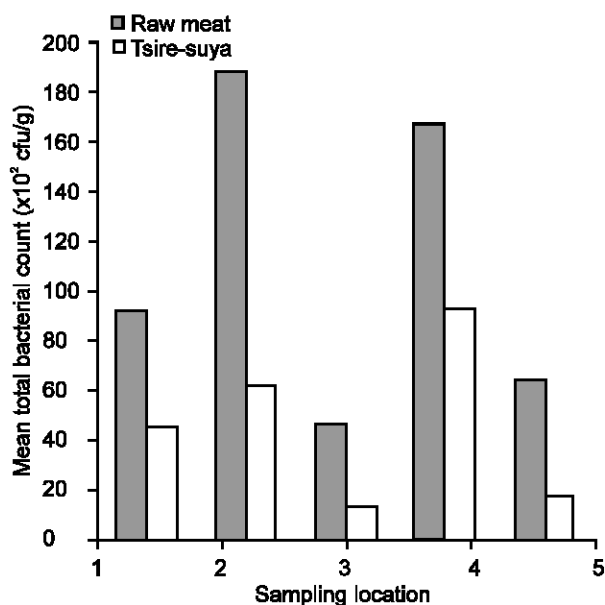

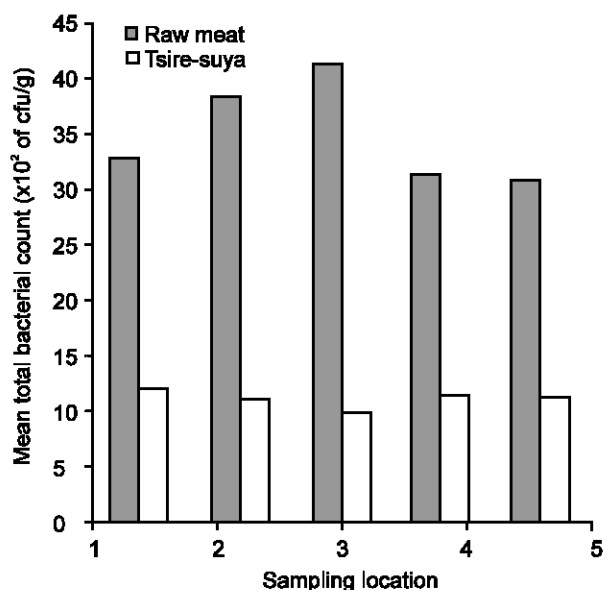Fig. 1: Comparison between total bacterial population of raw meat and tsire-suya

Fig. 2: Comparison between coliform population of raw meat and tsire-suya

processing contaminant or as a result of poor processing. *B. cereus* is a spore former; it can be found in the air and even spices. The spores are heat resistant. These may account for its occurrence in tsire-suya.

P. aeruginosa being widely spread in nature and especially in soil, water and on plants, can easily contaminate suya since it is usually exposed. Sometimes the spices used in suya preparation may have introduced *P. aeruginosa* into the suya.

Table 1: Antibacterial activity of some antibiotics against the isolates

Microorganisms	Zones of inhibition (mm)				
	CIP	OFL	ERY	GEN	STR
Pseudomonas aeruginosa	22	34	-	-	-
Staphylococcus aureus	25	24	14	-	9
Escherichia coli	-	-	-	13	-
Bacillus cereus	21	36	14	13	-

Key: CIP: Ciprofloxacin. OFL: Ofloxacin. ERY: Erythromycin. GEN: Gentamycin. STR: Streptomycin. - : No zone of inhibition

Table 2: Antibacterial activity of some spices against the isolates

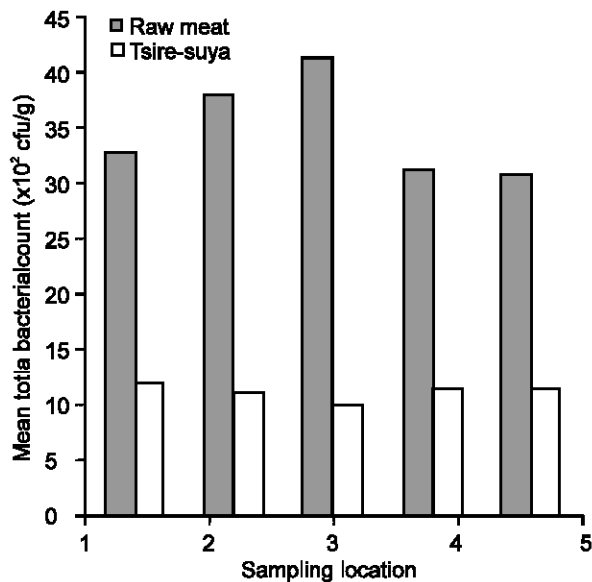| Microorganisms	Zones of inhibition (mm)			
	Afromomum melegueta	*Piper quineense*	*Capsicum fructescens*	95% ethanol
Pseudomonas aeruginosa	-	-	-	-
Staphylococcus aureus	19	15	14	10
Escherichia coli	20	16	18	16
Bacillus cereus	13	17	12	10

Key: - : No zone of inhibition

Fig. 3: Comparison between staphylococcal population of raw meat and tsire-suya

E. coli was the most resistant to the antibiotics used in this study. It was however sensitive to gentamicin. Okeke *et al.* (2000) reported on the antibiotic resistance of *E. coli* isolated from Nigerian students. *B. cereus* was the most sensitive to the antibiotics of the four isolates investigated. It was sensitive to ciprofloxacin, ofloxacin, erythromycin and gentamicin (Table 1). *B. cereus*, *E. coli* and *S. aureus* were sensitive to *Afromomum* melegueta, Piper *quineense* and *Capsicum fructescens*. However, they differ in their rate of sensitivity to the spices. *P. aeruginosa* was resistant to all the spices. This is of great concern to us considering the role of *P. aeruginosa* in the spoilage of meat and the tsire-suya that is being investigated in this study is a meat product.

The sensitivity of the bacterial isolates to the antibiotics was different from that obtained from the spices. Many factors may have been responsible for this. For instance, the concentration of the antibiotics would have been different from that of the crude extract of spices. The efficiency of the extracting solvent in the total extraction of the active ingredients from the spices can be in doubt. However, results obtained from the spices are encouraging when compared to those obtained from the antibiotics.

We will like to state therefore, that the continuous use of these spices in suya preparation is highly recommended not only for their flavouring attributes, but also for their possible health benefits.

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