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A mini-survey of pathogenic bacteria and parasites in *suya* meat vended in Ilishan Remo, Ogun State

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Abstract

In this mini-survey, 20 samples of *suya* (n=14) and condiment (n=6) purchased from three *suya* vendors within Ilishan Remo, Ogun State, between February and March 2018 were assessed for their safety in terms of the presence of pathogenic bacteria and parasites. Bacteriological analysis of the *suya* and condiment samples was carried out on a set of media (MacConkey agar, eosin methylene blue agar, sorbitol MacConkey agar and blood agar) while isolation of parasites was conducted by steeping the samples in normal saline for 1 h followed by a centrifugation mini-step. The resulting residue was stained with Lugol's iodine and scanned microscopically (×40). *Escherichia coli* (including suspected O157:H7 strains), other Enterobacteriaceae and the cysts of *Entamoeba histolytica* were present in the *suya* samples and their condiments. The co-occurrence of pathogenic bacteria and parasites in the investigated samples necessitates intentional efforts towards educating *suya* vendors on proper food handling and good hygiene practices in view of the widespread consumption of *suya*.

Keywords: *Entamoeba histolytica*, *Escherichia coli,* food safety, microbiological safety, public health, *suya.*

Introduction

Meat is a nutritious, protein and vitamin rich food (Campbell-Platt, 1995) consumed worldwide. In Nigeria, it serves as the main animal protein source during meals and can be traditionally processed into different forms e.g. *Tsire-suya* (Igene & Mohammed, 1983; Igene & Abulu, 1984), *kilishi* (Shamsuddeen, 2009), *asun* (Akharaiyi & Isunu, 2015) and *kundi* (Adeyeye, 2016). Of all the aforementioned meat products, *suya* is mostly preferred by the Nigerian populace because of its pleasant taste, affordability and availability. *Suya* is a boneless, traditionally processed ready-to-eat meat (Abdullahi *et al*., 2004; Uzeh *et al*., 2006; Manyi *et al*., 2014) customarily sold and consumed together with pepper, onion, cabbage and tomatoes. It may be served at birthday parties, picnics and commonly sold along the streets (Igene & Mohammed, 1983). *Suya* processing generally involves defatting and slicing the lean meat, spicing the meat followed by roasting on charcoal fire (Alonge & Hiko, 1981; Edema *et al*., 2008) in outdoor environments by vendors who often lack knowledge about good hygiene practices.

Suya vendors often display *suya* meat and its condiments on tray/table tops for long periods, sometimes close to drainage systems, such that they are often exposed to flies that transmit parasites/pathogens into the exposed *suya* meat (Oyeyemi *et al*., 2015). In addition, the cutting knives and tables of the *suya* vendors are usually washed with unsterilized water or even not washed at all before being used to process the *suya* meat. Prior to processing on fire, the *suya* meat is often staked on a 'stick', and most times vendors perform this activity with the unwashed hands; similar to the process during the sale of the finished product to consumers. The aforementioned unhygienic practices among *suya* vendors could predispose the *suya* meat to possible bacterial contamination; however, the microbiological quality of *suya* vended in many remote (rural/semi-urban) communities, including Ilishan Remo, is rarely reported in the literature.

Despite the widespread consumption of *suya* meat in Nigeria, only one study (Manyi *et al*., 2014) reported on the co-occurrence of bacteria and parasite in *suya* sold in a Northern Nigeria state. Other studies focused only on bacteriological safety assessment (Igene & Abulu 1983; Uzeh *et al*., 2006; Ologhobo *et al*., 2010; Egbebi & Seidu, 2011; Enoch & Onukwufor, 2017) or parasitological safety assessment (Dada & Usman, 1978). In view of the dearth of information on the co-occurrence of bacteria and parasites in *suya* vended in South-west Nigeria, and the public health relevance of such data to safeguarding consumer health, this study was conducted to determine the microbiological safety of *suya* meat sold in Ilishan Remo, Ogun State.

Materials and methods

Sampling

Three *suya* vendors were identified within Ilishan Remo community of Ogun State and sampling of *suya* types from the three vendors was based on availability of samples during the study period. Five samples of sticked *suya* each were purchased from two vendors while four samples of unsticked *suya* were purchased from the third vendor. From each vendor, two samples of the *suya* condiments were purchased. Consequently, a total of 14 samples of *suya* and six samples of *suya* condiment were purchased between February and March 2018. The condiment and *suya* samples weighed approximately 20 and 30 g, respectively. Each sample was packaged in nylon bags and transported to the laboratory within 30 mins for immediate analysis.

Microbiological analysis

Bacteriological analysis was performed on the samples by adopting the modified pour-plate method of Goresline *et al*. (1945). The samples of *suya* and condiments were ground separately in an electric blender (Master Chef, China) and 1 g each of the samples was serially diluted in sterile distilled water. After proper homogenization of the dilutions, aliquots of 1 mL were pour-plated in duplicates on Nutrient agar (Lab M, UK) and MacConkey agar (HiMedia, India) plates. The inoculated plates were incubated aerobically at 37 ^{o}C for 24 h. Nutrient agar plates were considered for counting of colonies in order to estimate total viable bacteria count, while MacConkey plates were used as isolation medium for enteric bacteria. The colonies of enteric bacteria were purified on fresh plates of MacConkey and Gram-stained. Pink colonies on MacConkey agar that were Gram-negative after microscopy were purified on Eosin methylene blue (EMB; HiMedia, India) agar plates for the identification of *E. coli* which characteristically shows a metallic green sheen on

EMB. Preliminary identification of suspected *E. coli* O157:H7 was performed on Sorbitol MacConkey agar (SMAC; HiMedia, India). All isolated enteric bacteria were screened for hemolytic potential on blood agar (2.8 g/100 mL Nutrient agar and 5 mL/100 mL human blood free from antibiotics for 60 days) incubated aerobically at 37^{o}C for 24 hs for haemolysis.

Parasite isolation

Three grams of each of the whole *suya* meat and condiment samples were steeped separately in 10 mL of normal saline (Manyi *et al*., 2014) and left to stand for 1 h. Thereafter, the steeped samples were sieved and the filtrate poured into a 15 mL centrifuge tube prior to centrifugation at 2000 rpm for 10 min. After centrifugation, the supernatant was decanted while the sediment was placed on a clean glass slide and stained with Lugol's iodine. Microscopic (×40) examination of stained slides were performed for the identification of eggs and cysts of parasites (Cheesbrough, 1998).

Results and discussion

The results for the bacteria and parasites isolated from the *suya* and their condiment sampled from vendors in Ilishan Remo are shown in Table 1. The total viable bacteria count of bacteria in the samples ranged between 5.5 x 10^4 cfu/g and 1.2 x 10^6 cfu/g. This is higher than the values of 7 x 10^2 cfu/g to 171 x 10^2 cfu/g reported by Uzeh *et al*. (2006) and 0.30 x 10^5 cfu/g to 0.48 x 10^5 cfu/g reported by Egbebi and Seidu (2011) in *suya* from neighboring states in South–west Nigeria. A total of 91 isolates belonging to the Enterobacteriaceae were recovered only from the unsticked *suya*, where the total Enterobacteriaceae count was 9.1 x 10^2 cfu/g. This finding of enteric bacteria occurring in the unsticked *suya* may be due to the practice of *suya* vendors. *Suya* vendors directly touch/hold the unsticked *suya* with unwashed and uncovered hands after heat-processing during the meat-slicing process at sale; this rarely occurs in the case of the sticked *suya*. All the Enterobacteriaceae isolated from the *suya* meat showed gamma haemolysis on blood agar.

Due to the focus of this study, which is to assess the safety of the *suya* samples for human consumption, only *E. coli* known as an indicator of poor food quality was considered for identification in this study. Consequently, only 2(2%) of the isolated enteric bacteria were identified as *E. coli* and these *E. coli* isolates were suspected to be of the O157:H7 serotype due to the characteristic colourless colonies on SMAC agar. The presence of *E. coli* in any food sample or during process chain evaluation indicates poor hygienic and improper processing of food; thus constituting a threat to consumer safety (Dahiru *et al*., 2008; Odonkor and Ampofo, 2013). Although the *E. coli* isolates were non-hemolytic on blood agar, suspicion of their taxonomic status as *E. coli* O157:H7 raises additional concern in view of the threat level of O157:H7 strains in global food safety. These strains are known to cause bloody diarrhea in humans (Besser *et al*., 1993; Ackers *et al*., 1995). The present study adds to the body of evidence on the presence of *E. coli* and O157:H7 serotype in *suya* and roasted beef that have been previously reported in Nigeria (Uzeh *et al*., 2006; Dahiru *et al*., 2008; Enabulele & Uraih, 2009; Manyi *et al*., 2014).

Cyst of *Entamoeba histolytica* was detected in the condiments that are usually applied to the *suya* samples. *Entamoeba histolytica* is commonly vectored by houseflies and causes amoebiasis in humans (Nowak *et al*., 2015). The vending spots for the *suya* samples collected in this study were in close proximity to dirty and poorly managed roadside drainages. Perhaps, houseflies present in the unhygienic outdoor environment where the *suya* samples were processed transported the cysts of the parasite into the condiments; this is in agreement with the report of Oyeyemi *et al*. (2015).

Conclusion

In this study, we have presented data on the presence of *E. coli* and other enteric bacteria in *suya* samples and cyst of *E. histolytica* in the condiments applied to the *suya*. Thus, the co-occurrence of pathogenic bacteria and parasite in the samples calls for concern because these micro-organisms can cause gastrointestinal tract-related diseases. These diseases, although not usually life threatening if diagnosed early and proper medical care is promptly administered, may heighten the combined disease burden in humans leading to further complications. Considering that *E. coli* O157:H7 and *E. histolytica* are commonly associated with poor hygienic practices, efforts should be made to create more awareness on good hygienic practices, proper food handling and processing among *suya* vendors. The public should

also be enlightened about the possible health risks associated with the consumption of contaminated *suya* bearing in mind that consumers could be a great force in the control of foodborne contamination by insisting on good practices among vendors.

Table 1: Bacteria and parasites isolated from 20 samples of *suya* and *suya* condiments in Ilishan Remo, Ogun State.

			Number of colonies (percentage)		
Sample type	TVC[a] (cfu/g)	TEC[b] (cfu/g)	Other Enterobacteriaceae	*E. coli*[c]	Cyst of *Entamoeba histolytica* (hpf/ml[d])
Sticked *suya*	5.5×10^4	-	-	-	-
Condiments (sticked *suya*)	1.2×10^6	-	-	-	$3(0.18 \times 10^6)$
Unsticked *suya*	8.3×10^4	9.1×10^2	89(98)	2(2)	-
Condiments (unsticked *suya*)	1.05×10^5	-	-	-	$2(0.12 \times 10^6)$

[a]Total viable count expressed as colony forming unit per gram.
[b]Total enterobacteriaceace count expressed as colony forming unit per gram.
[c]*Escherichia coli*; all identified *E. coli* in unsticked suya were suspected to be the O157:H7 serotype.
[d]High power field per milliliter.

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