SURVEY OF BACTERIAL AND FUNGAL CONTAMINATION ON BEEF SUYA SOLD IN JOS AND ENVIRONS

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Abstract
A survey was carried out to determine the bacterial and fungal contaminants associated with beef suya sold in Jos and environs. A total number of 20 (twenty) suya samples were collected randomly from major suya selling spots in Jos and environs and analyzed for bacterial and fungal contaminants. The following bacteria were detected: *Salmonella species* (18.84%), *Klebsiella species* (8.70%), *Escherichia coli* (13.04%), *Enterobacter* (10.14%), *Staphylococcus species*(7.25%), *Streptococcus species* (5.80%), and *Serratia* (11.59%). Fungi detected were *Candida albicans* (68.97%), *Aspergillius species* (13.79%), *Absidia species* (13.79%), and *Cunnighamella species* (3.45%). On the basis of location in respect to bacteria isolates, Secretariat junction and Aguldi junction had the highest bacteria isolates of 8.70% each, West of Mine, Kugiya, Miango, had 7.25%, each while Terminus, Apata and K-Vom market had 5.80% each. Zarmaganda, Angwan Doki, Gyel, Old Airport Junction, Bauchi Road, Abatoir and British America junction 2.9% each, while the lowest bacteria prevalence was Vom club which had 1.45%. Distribution of fungal isolates showed that K-Vom market had the highest percentage of 10.34%, Faringada, Terminus, Bauchi road, Anguldi, Kugiya, Miango, and Zarmaganda junction had 6.90% each while Vom club ,Angwandoki, Rayfield , Gyel, Old airport junction, Secretariat junction, Apata, Abattoir, Bauchi road, West of mine,Gangare and Gada biyu had the lowest percentage of 3.45% each. All the samples collected had bacteria and fungi contamination. It was concluded that the beef suya sold in Jos and its environs are contaminated with bacteria and fungal. This constitutes a public health problem.

Introduction

The growing microbial contamination of food is of global public health significant as it results into various food borne diseases. Scallan, *et al.* (2011) reported an estimated food – borne disease to be about 48 million diseases with about 325,000 hospitalizations and 5,000 deaths annually in United State. In the United Kingdom, Gormley, *et al.* (2011) reported about 2429 food- borne out breaks in England from 1992 to 2008 mostly caused by bacterial pathogens of which the vero cytotoxin producing *Escherichia coli* has increasing contribution. Reliable statistics on food borne diseases are available in developing countries like Nigeria due to poor or non-existent reporting systems (Ifeadike *et al.,* 2012).

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 pre-occupation 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 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 midday until late at night. It is gradually making its way into elite circles where it has become a delicacy served at parties.

According to Abdullahi (2004), *suya* is prepared basically from boneless meat of animals. The preparation process carried out under largely unhygienic conditions and the risk of contamination is very high. It is widely known that cholera, salmonellosis, campylobacteriosis, shigellosis, typhoid, brucellosis, poliomyelitis and *Escherichiacoli* infections (Entero-pathogenic) infection are prevalent (FAO/WHO, 2003).

Diarrhoeal diseases are a major cause of morbidity and mortality in children were 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 disease 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 (Edema *et al.,* 2008).

The aim of this study was to screen suya samples in Jos and environs in order to determine the bacterial and fungal contaminants associated with them.

Materials and Methods

The materials used for this study are autoclave, roasted chicken part, incubator, Durham tube, hot air oven, petri dishes, wire loop, bunsen burner, microscope, disposable hand gloves, polythene bag, cotton wool, needle and syringe, spatula, metler balance, universal bottles, glass slide, slide cover, refrigerator, EDTA bottle, measuring cylinder, masking tape, distil water. The culture media used are blood agar, MacConkey agar (mck) and potatoe – dextrose agar

Sterilization Techniques
All wares used were thoroughly washed with detergents, rinsed with clean water and dried. Glass wares were wrapped in aluminium foil paper, put into a canister and sterilized in the oven at 170ºC for 1 hour. All media and diluents used were sterilized by autoclaving at 121ºC for 15minutes. Except otherwise stated.

Sample Collection
Samples were collected within Jos and its environs. The sites where samples were collected include the following: Farin Gada, Gada Biu, Taminus, Gangare, West of mine, British American junction, Abatoir, Bauchi Road, Apata, Secretariat junction, Anguldi, Kugiya Junction, Airport junction, Gyel Bukuru junction, Rayfield, K-Vom Market, Vom club, Miango Junction, Angwan Doki and Zarmaganda junction.
The samples (*suya*) were collected at random from the settlements indicated above.. Sterile polythene bags and disposable gloves were used in collection of the samples from the point of purchase and brousght to the laboratory as soon as possible in readiness for use on the following day. A total number of 20 samples were collected.

Laboratory Examination of Samples
One gram (1g) of each of the processed meat was weighed by the use of a gallon hamp mettler into a sterile mortar and mashed with pestle for 15-20 minutes. After which it was added into 9mls of phosphate buffered peptone water and shaken thoroughly to obtain a homogenous solution and incubated at 37ºC for 24hours.

Detection and Characterization of Bacteria
Gram's staining
A smear of each bacterial isolate was prepared using a drop of sterile water on a clean grease-free slide. The smear was air dried and then heat-fixed by passing it over flame 2-3 times. It was then flooded with Crystal violet for about 30-60 seconds, drained and rinsed with water. It was yet flooded with Lugol's iodine which was left for seconds, and the slide was rinsed gently with water, and drained off .The slide was then flooded with acetone alcohol until the slide appeared free of violet stain. It was then rinsed with water and flooded with neutral red for 30seconds after which it was drained, with water and blotted dry. Microscopic observation was done under the oil immersion objectives lens. Gram positive bacteria stained purpled while gram negative stained red (Tortora *et al.,* 1982).

Motility Test
Hanging drop method was used in which one loop fill of a smooth suspension of isolates was applied and placed on a clean slip then the edges of the cover slip was applied with the Vaseline. A cavity slide was then inverted over the cover slip; the preparation was then examined under x40 objective lens for evidence of motility (Cheesbrough, 2003).

Catalase Test
A smooth suspension of each isolate was prepared on a glass slide and three drops of 30% Hydrogen peroxide (H_2O_2) were added. A positive result was shown by immediate effectiveness of the mixture (Cheesbrough, 2003).

Indole Test
Peptone water was incubated with the isolated organisms and incubated at 37ºC for 24hours and 0.5ml of Kovac's reagent was added. The mixture was examined after one minute for the development of a Resepink colour at the peptone water culture Kovac's reagent interphase (Cheesbrough, 2003).

Citrate Test
Slants of Simean's citrate agar was inoculated with isolate from pure stock culture and incubated at 37ºC for 24hrs. Blue colour and streak of growth indicted a positive result while negative result was shown by the retention of the original green colour and absence of growth observed (Cheesbrough, 2003).

Methyl Red Test
Peptone sugar broth in test tubes was incubated with isolates at 37ºC for 24hrs. After this, 5 drops of methyl red reagent were added to 5ml of culture and the reaction was indicated by the brigade red colour of the broth while a yellow colour indicated a negative result (Cheesbrough, 2003).

Detection and Characterization of Fungi
The Fungi were identified using the lactophenol cotton blue technique (Cheesbrough, 2003). A drop of lactophenol cotton blue was placed on clean grease free.A straight wire loop was used to pick the organism colony and teased on the drop. A cover slip was placed on the lactophenol cotton blue and examined under ×40 objective lens to check for the structure of the organism (Cheesbrough, 2003).

RESULTS

Table 1: Prevalence of bacteria Contaminants in Suya Samples

BACTERIA	SUYA SAMPLES	PREVALENCE (%)
Salmonella species	13	18.84%
Klebsiella species	6	8.70%
Escherichia coli	9	13.04%
Enterobacterspecie	7	10.14%
Staphylococcus species	5	7.25%
Streptococcus species	4	5.80%
Bacillus species	3	4.35%
Shigella species	14	20.29%
Serratia specie	8	11.59%
Total	69	100%

The table above shows the prevalence of each bacteria species in the *suya* samples. *Shigellaspecies*had the highest percentage of 20.29% followed closely by *Salmonellaspecies*18.84% while *Streptococcusspecies* had the lowest percentage of 5.80% on the *suya*samples.

TABLE 2: FUNGI CONTAMINANTS ON SUYASAMPLES

FUNGI	TOTAL	PREVALENCE (%)
Candida albicans	20	68.97%
Aspergillus spp	4	13.79%
Absida	4	13.79%
Cunnighamella	1	3.45%
Total	29	100%

The table above shows the prevalence of each fungal isolates in percentage, on *suya* samples *Candidaalbicans* had the highest percentage of 68.97% followed closely by *Aspergillus* and *Absida* 13.79% each while *Cunnighamella* had the lowest percentage of 7.67% on the *suya* samples.

Discussion / Conclusion

Suya used for the purpose of this experiment were purchased at different location on different days. Bacteria species identified include *Salmonella species, Klebsiella species*, *Escherichia coli, Enterobacter species, Staphylococcus species, Streptococcus species, Bacillus species, Shigella and Serratia* while fungi include *Candida albicans, Aspergillus species, Absidia species*and *Cunnighamella species* were isolated from the *suya* samples (Table 1). Bacteria such as *Staphylococcus aureus, Escherichia coli, Bacillus cereus*, *Streptococcus pyogens, Salmonella typhi, Klebsiella, Enterobacter and Shigella* are of public health importance as they have been incriminated in various diseases of man such as gastroenteritis. These findings agree with the earlier publications of FAO/WHO, (2003) which stated that in developing countries such as Nigeria, cholera, salmonellosis, brucellosis, shigellosis, and colibacillosis are prevalent due to the feeding habit of people.

The prevalence of bacterial contamination was highest in Secretariat junction and Anguldi had the highest (8.70%) each, while Vom club (1.45%) had the lowest prevalence percentage of bacterial contamination (Table1). This could be attributed to the level of contaminations in the area which may be contributed majorly by vehicular traffic which is higher in those ares with higher contaminations (Secretariat junction and Angle D). This is in agreement with Kachenko and Singh (2006) who stated that vehicular traffic could lead to food contamination. The prevalence of fungi isolate in respect to location was presented in table 2. K-Vom market had the highest fungi isolate (10.34%) while Gada Biu had the lowest prevalence of 3.45% each. Variation in the result could be due to the materials and different treatments/processes used by the producers and sellers of the suya. This is in line with the findings of Igene *et al.* (2009) which stated that the quality of *suya* produced by the processors varies from one producer to another due to lack of standard and method of preparation that would ensure consistent product quality. FAO (1990) also observed that most of the sellers had no training in food preparation which is necessary and important for hygienic handling of foods. The results also confirmed that *suya* samples were contaminated with bacteria. This is in agreement with Ologhobo, *et al.* (2010) who stated that suya meats may have surface contamination from flies, dust, formites, the butchers, the meat vendor

and or buyers. It could also be due to salt, oil, groundnut cake, ginger and contaminated utensils used. These bacteria and fungi isolated could cause disease(s) in individuals who consume the suya.

Suya from different locations varied in microbial load. This could be the variation in spice and packaging method used in their processing which may be potential sources of microorganisms. It could also be because of unhygienic contact of the suya with buyers.

It is concluded that suya meat sold in Jos and environs are contaminated with bacteria and fungi.This is a potential source of health hazard especially to immunocompromised individuals who may also patronize the suya.

Recommendations

The study recommends that suya vendors and meat sellers should adopt good hygienic practice. The vendors should also not allow everyone to contaminate suya by touching and should cover their products properly.

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