BACTERIOLOGICAL QUALITY OF STREET - VENDED ROASTED PLANTAIN IN YENAGOA, BAYELSA STATE, NIGERIA

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ABSTRACT

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Roasted plantain is a ready-to-eat food prepared in the street by food vendors and eaten with oil spices and roasted fish. The microbial safety of food is the basic requirement of its quality. Roasted plantain samples were purchased from ten (10) different locations in Yenagoa, Bayelsa State, Nigeria. Microbial quality was assessed by total viable count (TVC), total coliform count (TCC) and total Staphylococcal count (TSC). Samples were inoculated onto various selective media such as Eosin Methylene Blue (EMB) agar, Salmonella Shigella (SS) agar, and MacConkey (MC) agar and incubated overnight at 37^oC. Only E. coli and Staphylococcus spp. were isolated and identified from the samples. TVC in roasted plantain samples values ranged from 30×10^6 to 136×10^6 cfu per ml, TSC ranged from 12×10^6 to 62×10^6 cfu per ml and TCC values ranged from 11×10^6 to 132×10^6 cfu per ml. The findings showed that street vended roasted plantain are not bacteriologically safe and serves as vehicles for food borne disease transmission and this arise the need for sanitary practices

Keywords: *Microbiological quality, roasted plantain, street -vended food, coliform count, food safety*

INTRODUCTION

Plantain (*Musa sapientum* var *Paradisiacal Linn)* is one of the stable foods widely consumed in the West Africa sub-region, Northern America, Mexico and the Caribbean. In Nigeria, its consumption cuts across the multiethnic group and the various socio-economic classes because of the ease of preparation and consumption. In roasted form (called bole), plantain is eaten with palm oil or groundnut. When boiled, it is eaten with vegetable soup or assorted stew. It is also fried into chips, making it a popular food item among the rich and the poor (Ohenhen *et al.,* 2006). Plantain being a ready to eat food is mostly involved in food borne diseases due to the microbial contamination during processing and preparation. These food borne diseases results from the ingestion of bacteria and their toxins produced by microorganisms in the food and constitute a major public health problem (Duff *et al.,* 2003). In Nigeria today, many urban dwellers obtain a significant portion of their diet from street foods which increase the street food demand in major cities (Pikuda and Ilelaboye, 2009). The safety of these street foods depends upon the interaction of chemical, physical and microbial factors. The traditional processing methods used in the preparation and poor personal hygiene of food handlers, utensils for cooking and serving are some of the main causes of contamination of street vended foods and consequently, are most commonly exposed to various contamination at different stages of handling (Rane, 2011).

The outbreak of various diseases such as cholera, diarrhoea, stomach upset and other infectious diseases, all account for about 40% of death daily in most part of the world in both children and adult (Duff *et al.,* 2003). Most of these food borne diseases can be attributed to contaminated food. Due to the lack of proper knowledge and regulations in street food vending in Nigeria, vendors prepare these foods in an unhygienic conditions (WHO, 2011). Consequently, there is need for hygienic practices in the preparation of foods among vendors in the street and in homes. Although governments are attempting to ensure safety of food supplies, the occurrence of food borne diseases remains a significant health problem in both developing countries and developed countries (Muiunde and Kuria, 2005). Due to the popularity of roasted plantain in Nigeria, there is need to ascertain the bacteriological quality of street vended roasted plantain. The objective of this study was to determine the bacteriological quality of street vended roasted plantain in Yenagoa, Bayelsa State, Nigeria.

MATERIALS AND METHODS

Sample collection

Roasted plantain samples were collected from vendors at ten (10) different locations in Yenagoa, Bayelsa State, including Otiotio, Edepie, Kpansia, Okaka, Okutukutu, Belger park, Opolo Market, Hospital Road, Tombia Market and Etegwe respectively between March and August, 2016.

Sample preparation

Samples were blended using a stomacher (400 Laboratory blender type BA 7021 England). Serial dilutions were prepared, inoculated on selective media and incubated at 37 °C for 24 h. After incubation, colonies were counted using the method of (Fawole and Oso, 2004).

Bacteriological analysis

The bacteriological analysis comprises enumeration of Total viable count (TVC), coliform count (TCC) and Total Staphylococcal count (TSC) for the determination of sanitary quality. Isolation of the samples was performed onto

Plate Count (PC) agar (Oxoid Ltd., England), Mac Conkey (MC) agar (MERCK, Darmstadt, Germany), Eosin Methylene Blue (EMB) agar (Oxoid Ltd, England), Salmonella-Shigella (SS) agar (Oxoid, Basingstoke, and Hampshire, UK, England). Identification of bacteria was performed by morphological and biochemical tests.

Enumeration bacteria from roasted plantain

To determine the Total viable count (TVC), Total Staphylococcal count (TSC) and Total coliform count (TCC), 0.2 ml of each tenfold dilution was transferred and spread on duplicate PCA using a micropipette, for each dilution for the determination of total bacterial count. The diluted samples were spread as quickly as possible on the surface of the plate with sterile glass bit. The plates were kept in an incubator at 37°C for 24 h. After incubation; plates exhibiting 30-300 colonies were counted. The average number of colonies in particular dilution was multiplied by the dilution to obtain the total viable count. The total viable count was calculated according to ISO (1995). The results of the total bacterial count were expressed as the number of colony forming units (CFU) per gram of food samples. Streaking was done onto PCA (Plate Count Agar), MC (MacConkey agar), EMB (Eosin Methylene Blue), SS (Salmonella-Shigella), agar and Incubated at 37°C for   24 h. Sub-culturing was carried out to obtain pure culture. Morphological characterization, Gram's staining and biochemical characterization of the isolates were carried out.

Statistical analysis

The data of total coliform count (TCC) and total *Staphylococcal* count (TSC) of roasted plantain samples were analyzed for statistical significant using ANOVA, and the significant differences between the means were analyzed using Duncan multiple range test (DMRT) using SPSS software for window version 16.0.1 statistical package (SPSS Inc.). Significant difference was considered at $p<0.05$.

RESULTS AND DISCUSSION

Street foods are very much popular in the recent days. Consumption of ready-to-eat street foods is increasing significantly due to its cheap price and taste. Street foods usually do not receive any treatment as a result they are prone to contamination with food borne bacteria that may cause public health hazard. In the present study, total viable count (TVC) of bacteria in roasted plantain sample sold by different vendors in Yenagoa, Bayelsa State ranged from 30×10^6 (cfu ml^{-1}) -136 x 10^6 (cfu ml^{-1}) and the lowest TVC recorded in Hospital Road vendor (30×10^6 cfu ml^{-1}). The results showed by Madueke *et al.* (2014) recorded TVC of different street foods such as fried yam, fried potato, fried plantain, akara, fish and suya of Lokoja in Nigeria ranged from 5.0×10^4 cfug^{-1} (akara) to 2.08×10^7 cfu per g (fish). In the current study, the highest TVC of samples from Opolo Market were higher than that obtained from other locations.

This may be attributed to intense traffic in Opolo market and along the major high ways and roads leading to the market resulting in increased dust formation which constitutes a major source of contamination. This indicates clearly the effect of overcrowding and environmental dust, as bacteria are widely distributed in nature (human, animals, soil, water and food). The contamination may have either occurred during processing or post-processing as a result of poor hygienic conditions, improper handling and storage practice.

Total *Staphyloccal* and *Escherichia coli* count of roasted plantain samples is presented in Table 2. Result showed that roasted plantain samples from all locations were contaminated with pathogenic bacteria; *Escherichia coli* and *Staphylococcus aureus*. This is in line with a study conducted in the street food of cape coast Ghana by (Madueke *et al.,* 2014) where all sampled food tested positive for *Escherichia coli*. However, this is in contrast with the work of Cho *et al.* (2010) who reported that 3% of Korean street foods tested positive for *Escherichia coli*. Result confirmed that there was lack of good sanitary practice and flagged that such contamination could easily give rise to food-borne diseases and cause spoilage of food items. The presence of *E. coli* in the roasted plantain may be attributed to post-processing contamination, faecal contamination and poor hygienic practice of food handlers.

Staphylococcal count in the roasted plantain samples ranged from 12×10^4 to 62×10^4 cfuml^{-1}. This value is higher than those reported by Suneetha *et al.* (2011), the highest *S. aureus* count was found in Otiotio. The presence of *S. aureus* is an indication of contamination from the skin, mouth or nose of food handlers through coughing and sneezing. This contamination can be introduced into the street foods during handling, processing or vending (Sandel and McKillip, 2004). *Staphylococcus aureus* being part of the microflora present on/in several parts of the human body is a good indicator of contamination due to poor personal hygiene practices (Nester *et al,.* 2001). Among the vending locations, samples from Opolo Market were more contaminated with *S. aureus* than samples from the other locations. Observational studies have shown that Opolo Market area is overcrowded with people and vehicular activities. The roasted plantain are usually displayed and sold openly at very dirty surrounding on the road side. This can easily be contaminated by dust, insects, and hands of intending consumers.

Contamination by *E. coli* was higher in roasted plantain samples from Otiotio than in samples from other locations. This could also be attributed particularly to poor hygienic conditions of the premises that may result from, rubbish, sewage and other noxious substances present in the vicinity. In the current study, two different genera of bacteria such as *E. coli* and *Staphylococcus* spp. were identified. Tambekar *et al.,* (2011) isolated *Escherichia coli, Staphylococcus aureus, Klebsiella* sp. and *Pseudomonas* sp. from street vended food *panipuri*. Saxena *et al.,* (2013) documented *E. coli, Staphylococcus aureus, Bacillus cereus, Shigella* and *Salmonella* from street vendend *Golgappa* and *Bhelpuri* sold in Jaipur city of Rajasthan. Nwamaka *et al.,* (2010) stated that *S.*

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epidermidis is a normal flora of the human skin, respiratory tract, urethra, external ear and mouth. Their presences in the food samples were largely due to the unwholesome practices of the food handlers. The isolation of coliform bacteria from roasted plantain sample indicates fecal contamination.

In this study microbiological methods were used to identify bacteria isolated from roasted plantain samples. The results of cultural characteristics, Gram's staining, biochemical tests used to identify *E. coli* and *Staphylococcus* spp. were similar to the findings of (Cheesbrough, 1985). *Salmonella* species was not detected in any of the samples from all locations studied. This is in line with work done on '*Sambusa'* and '*Macaroni'* in Ethiopia (Muleta and Ashenafi, 2001). Usually, it is difficult to predict the association of *Salmonella species* with specific food products. But in some situations the *S. enteritidis*, can be associated with beef, meat, milk poultry and eggs or egg products (Ivana *et al.,* 2009).The absence of *Salmonella species* might be that roasted plantain was used in this study, which does not have animal products.

Table 1: Total viable count (TVC) of roasted plantain collected from different locations

Vendor Location	Total viable count (cfu ml^{-1})
Otiotio	54 x 10^6
Edepie	44 x 10^6
Kpansia	106 x 10^6
Okaka	35 x 10^6
Okutukutu	90 x 10^6
Belger Park	39 x 10^6
Opolo Market	136 x 10^6
Hospital Road	30 x 10^6
Tombia Market	110 x 10^6
Etegwe	80 x 10^6

Table 2: Total *Staphyloccal* and *Escherichacoli* Count of Roasted Plantain

Vendor Location	Total *Staphyloccal* Count (cfu/ml)	Total *Escherichacoli* count (cfu/ml)
Otiotio	28 x 10^6	132 x 10^6
Edepie	12 x 10^6	12 x 10^6
Kpansia	34 x 110^6	34 x 10^6
Okaka	22 x 10^6	32 x 10^6
Okutukutu	52 x 10^6	96 x 10^6
Belger Park	24 x 10^6	32 x 10^6
Opolo Market	62 x 10^6	86 x 10^6
Hospital Road	20 x 10^6	11 x 10^6
Tombia Market	30 x 10^6	35 x 10^6
Etegwe	42 x 10^6	100 x 10^6

Bacterial species isolated from roasted plantain samples were as presented in Table 3. There was significant difference (p>0.5) in staphylococcal count among sample locations. Bacteria load was highest in Otiotio with mean value (60.00) and the least is Edepie with mean value (12.00) was observed in *Staphylococcal* while in Escherichia coli the highest is Otiotio with mean value (130.00) and the lowest is Hospital Road (10.33).

Table 3: Mean values of isolated bacteria from the roasted plantain samples

Vendor Location	Staphylococcal	Escherichia coli
Otiotio	60.00 ± 2.00	130.00± 2.00a
Edepie	12.00 ± 1.00a	11.67 ± 1.53b
Kpansia	32.00 ± 2.00a	31.00 ± 2.65b
Okaka	20.33 ± 1.53	31.33 ± 2.08a
Okutukutu	50.00 ± 2.00a	93.00 ± 3.00a
Belger Park	20.33 ± 3.51a	30.33 ± 1.53b
Opolo Market	24.67 ± 3.06a	84.00 ± 2.00a
Hospital Road	20.00 ± 1.0a	10.33 ±2.08a
Tombia Market	28.67 ± 1.53a	32.67 ±2.52a
Etegwe	42.67 ± 3.06a	101.67 ±4.73b

Values in the same column with different superscript are significantly different at (p<0.05).

Roasted plantain is a popular street food in Bayelsa State and people of all class eat it due to its low cost ratio, easy accessibility and its ready-to-eat nature. As a street-vended food, some are located close to waste disposal points and dusty roads which results in the harboring of food borne bacteria that may cause food borne infection. The bacteria count in all the samples indicates improper handling, processing and cross contamination from utensils such as knife used.

CONCLUSION

The results of this study clearly demonstrated that, street-vended roasted plantains in Yenagoa were contaminated with different pathogenic bacteria. The existence of these bacteria in roasted plantain could induce potential health problems for consumers. Poor personal hygiene, improper handling, storage practice of foods and poor knowledge of food vendors towards food borne disease are the associated risk factors to contamination of street vended roasted plantain in Yenagoa.

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REFERENCES

Cheesbrough, M. 1985. *Medical Laboratory Manual for Tropical Countries.*1st Edition.   Microbiology. English Language Book Society, London. pp: 400-480.

Cho, J. I., Cheung, C.Y., Lee, S. M., Ko, S. I. and Kim, K. H. 2010. Assessment of microbial contamination levels of street-vended foods in Korea, *Journal of Food Safety*, 31: 41- 47.

Duff, S. B., Scott, E. A., Mastilios, M. S., Todd, E. C., Krilov, L. R. G., Eddes A. M. and Acknernam, S. J. 2003. Cost effectiveness of a target disinfection program in household kitchens to prevent food borne illnesses in the United States, Canada and the United Kingdom. *Journal of Food Protection*, 2: 2103-2105.

Fawole, M. O. and Oso, B. A. 2004. *Food Microbiology*, *Laboratory Manual of Microbiology.* Spectrum Books Ltd. ISBN 978-246-032-X.

Ivana, S., Bodgan, A., Judith, I., Tudor, L., Stlian, B., Tanase, A. A., Popescu, N., Caplan, D.M. and Danes, M. 2009. Food microbial contamination - the main danger in the catering type food industry in Romania. *Romanian Biotechnological letters,* 14: 4260-4266.

ICMSF. 1985. *Microorganisms in Foods; Samples for Microbiological Analysis: Principles and Specific Applications.* Recommendation of the International Commission on Microbiological Specification for Foods. Association of Microbiological Societies. University of Toronto Press.

ISO. 1995. Recommendation of Meeting of the Subcommittee, International Organization for standardization on meat and meat products. Iso/tc 36 sc-6. The Netherlands. pp: 10-18.

Madueke, S. N., Awe, S and Jonah, A. I. 2014. Microbiological analysis of street foods along Lokoja-Abuja Express Way, Lokoja. *American Journal of Research Communication,* 2: 196-211.

Muleta, D. and Ashenafi, M. 2001. *Salmonella*, *Shigella* and growth potential of other   food-borne pathogens in Ethiopian street vended foods, *East African Medical Journal*, 78: 576-580.

Muiunde, O. K. and Kuria, E. 2005. Hygience and sanitary practices of vendors of street foods in Nairobi, Kenya, *African Journal of Food, Agricultural developments,* 5:1-15.

Nwamaka, N. T., Chike, A. and Obiajulu, 2010. Role of bacteria isolates in the spoilage of fermented African oil bean seed "ugba*". Pakistan. Journal of Biological Science*, 13: 497-503.

Nester, E. W., Anderson, D. G., Roberts, C. E., Pearsall, N. N. and Nester, M. T. 2001. *Microbiology: A Human Perspective.* 3rd Edition, McGraw-Hill, New York, pp: 815-816.

Ohenhen, R. E., Enweani, I. B., Ogiehor, S. I. and Uwabor, K. 2006. Microorganisms   associated   with   the preparation of plantain pudding in Western Nigeria. *African   Journal of Biotechnology,* 5 (22): 2077-2080.

Pikuda, O. O. and Ilelaboye, N. O. 2009. Proximate compositions of street snacks purchased from selected motor parks in Lagos, *Pakistan Journal of Nutrition,* 8:1657-1660.

Rane, S. 2011. Street vended food in developing world: Hazard Analyses. *Indian Journal of Microbiology*, 51(1):100-106.

Sandel, M. K. and McKillip, J. L. 2004. Virulence and recovery of *Staphylococcus aureus* relevant to the food industry using improvements on traditional approaches. *Food Control*, 15:5–10.

Saxena, G. and Agarwal, M. 2013. Microbial quality assessment of street-vended *GolGappa* and *Bhelpuri* sold in Jaipur City of Rajasthan. *International Journal of   Food and Nutritional Sciences*, 2:71-77.

Suneetha, C. Manjula, K. and Depur, B. 2011. Quality assessment of street foods in   Tirumala. *Asian Journal of Experimental Science,* 2:207-211.

Tambekar, D. H., Kulkarni, R.V., Shirsat, S. D. and Bhadange, D. G. 2011. Bacteriological quality of street vended food *panipuri*: A case study of Amravati City (MS) India. *Bioscience Discovery*, 2: 350-354.

World Health Organization, 2011. Knowledge = Prevention. The five keys to safer food, Food Safety and Zoonoses