

Full Length Research Paper

Bacteriological quality of garri sold in Owerri open markets, Imo state, Nigeria

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Garri as popularly known in Nigeria is a general food consumed by most people in Nigeria. It could be eaten by reconstituting it with hot water, stirred to form a thick paste and eaten with soup or stew. It could also be taken dried or mixed with cold water and sugar/milk, as a snack. As a part of check mating the public health risk associated with this general dependence of the population on garri, the bacteriological quality of garri sold in Owerri open market was examined with the aim of investigating the bacterial contamination of garri due to exposure in the market as well as establish the hygienic statue of garri taken as snacks by many Nigeria. To achieve this, a total of one hundred and ten (110) garri samples were collected from Eke-ukwu market, relief market, Eke-Mmegbu market, Orji market, IMSU gate market and some local garri processing factories within Oweri metropolis to serve as control. The samples were analyzed bacteriologically for viable heterotrophic bacteria and coliform bacteria counts on Nutrient and MacConkey agar respectively, using pour plate method. The mean value results from all the markets revealed high bacterial contamination, except from the factory. The resultant data were analyzed statistically using Chi-square to determine if there is a significant difference between the five markets. When calculated, the value of the five markets was 35.75 while the tabulated was 11.07. This implies that there was a significant difference between the five markets. Identified bacteria included: *Staphylococcus aureus*, *Staphylococcus epidenmidis*, *Bacilus cerus*, *Escherichia coli* and *Klebsiella aerogenes*. Isolation of these bacteria is a sign of danger, hence, Imo State government is advised to take measures such as making environmental sanitation a priority project in the state to save the lives of the citizens.

Key words: Market, sample, snack, organism, contamination, Owerri.

INTRODUCTION

“Garri” as popularly known in Nigeria is a staple food for most Nigerians. It is prepared by fermenting grated fresh cassava (*Manihot esculenta* (rantz) roots. This cassava originated from tropical America and is cultivated today in all tropical regions of the World (Scolt et al., 2000). It could be eaten, by reconstituting with hot water, stirred

to form a thick paste and eaten with soup or stew and could be eaten dried or mixed with cold water and sugar-/milk, taken as a snack (Nweke, 1988).

In Nigeria, the sales and distribution of garri in local markets is associated with practice such as displaying of the products in open buckets, bowls and mats at points of

sales and the use of bare hands during handling and sales. These unhygienic practices, may lead to microbial contamination due to deposition of bioaerosols on exposed products (Amadi and Adebola, 2008).

There are many factors that could result to food contamination. Trickett (1992), listed his own sources of contamination. According to him, the larger the surface area of the food exposed, the higher the load of micro organism, as well as the greater availability of oxygen for the metabolic activities of aerosol organisms.

Microorganism, especially bacteria vary from species to species in nutritional requirement (Asegbeloyin and Onyimonyi, 2007). Their presence in food at any stage, depend on the nutritional status of the food at that stage, temperature, water content, pH as well as the nature of the organism. The bacteria that cause food poisoning have a similar nutritional requirement with that of human (Baine, 2000). He also states that food poisoning could have been minimized, if the food producers and processors are trained in safe – food – handling and consumers are better advised in the choice of food.

Microorganism associated with food exposed to environment are *Salmonella* Typhi which was incriminated in *Salmonella* food poisoning outbreak in Germany and Great Britain in 1988 and 1971 respectively (Tietjen and Fung, 1980), *Shigella flaxner* associated with food contaminated with fecal materials. Others include: *Bacillus cerus*, *pseudomonas* spp.; *clostridium* spp.; *Klebsiella* spp.; and *S. aureus* (Nkanga and Nduka, 1980; Ijebadeniyi, 2007). In Nigeria, it has become a common practice to eat garri raw or as snacks especially among students who resort to it as faster alternative to preparation of cooked food, without considering the bacteriological implication. This work therefore is aimed at investigating the bacterial contamination of garri due to exposure in the market, as well as to establish the hygiene status of garri taken as snacks by many Nigerians.

MATERIALS AND METHODS

Sample collection

Garri samples used for this study were purchased randomly on two spaced time points between the month of January and November 2012 from sellers in five selective open markets: Eke-ukwu, Relief, Eke-Mmegbu, Orji and IMSU gate, as well as from different local garri processing factory within the locality to serve as control. A total of one hundred and ten (110) samples were obtained, twenty (20) samples from each market and ten from factories. The samples were collected into sterile polyethylene bags, using standard procedure and were transported to the microbiology laboratory of the Department of Medical Laboratory Science, Imo State

University, Owerri for analysis within 3 h of collection.

Preparation of samples

Ten (10) grams proportion of each sample was aseptically weighed after thorough mixing, transferred into a sterile 500 ml beaker containing 90 ml of peptone water and allowed to soak for 5 min with occasional stirring using sterile glass rod. The supernatant was decanted into another sterile beaker and 10 fold serial dilutions of the sample supernatant were prepared by transferring successively 1 ml aliquot of the supernatant into 9 ml of sterile distilled water up to 10^{-3} dilutions (Osoagbaka, 1996).

Cultivation of samples

0.1 ml aliquot of each dilution was plated on nutrient agar (Biotec) for total viable heterotrophic bacterial counts and MacConkey agar (Biotec) for total coliform counts by pour plate method. The plates were incubated at 30°C for 24 h. At the end the incubation period, discrete colonies were enumerated and expressed as log of colony – forming units per gram (log CFU/g) of sample.

Representative bacterial colonies obtained after incubation were purified by subculturing on nutrient agar using the streak method. The purity of isolates was determined using the Gram's stain reaction. The purified isolates were then characterized and identified using their colonial morphologies and biochemical characteristics as described by Cheesbrough (2000) and with reference to the bergey's Manual of Determinative Bacteriology (Holt et al., 1994).

Statistical analysis

Chi-square statistical method was adopted to determine if there is a significant difference between the five markets.

RESULTS

Table 1 shows the prevalence of Bacterial contamination distribution among the different market samples; relief market recorded 100% contamination, followed by Eke-Ukwu (90%) and IMSU gate with the least contamination of 75%. Table 2 shows specific sites of bacterial contaminants. This indicates that *Staphylococcus aureus* was the predominant isolate, while *E. coli* was isolated from four out of the five markets. *B.cereus* and *Staphylococcus epidemidis* were isolated from three different market each and *Klebsiella aerogenes* was isolated from only one market.

Figure 1 shows the rate of occurrence of the different isolate. *S. saprophyticus* occurred in 35 representing 37% occurrence, *E. coli* in 24 (25.5%), *B. cereus* 18(19.2%), *K. aerogenes* 10 (10.6%) and *S. epidemidis* 7

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Table 1. Prevalence of Bacterial contamination of different market samples.

Parameter	Eke ukwu	Relief	Eke mmegbu	Orji	Imsu gate	Control factory	Row total
No of Samples collected	20(21.11)	20 (22.22)	20 (20.00)	20 (20.56)	20 (19.44)	10 (6.67)	110
No of Samples that yielded growth	18 (16.89)	20 (17.78)	16 (16.00)	17 (16.44)	15 (15.56)	2 (5.33)	88
Coloumn total	38	40	36	37	35	12	198

The value of the five markets =35.75. The value of tabulated =11.07.

Table 2. Specific sites of Bacterial contaminants.

Bacterial isolates	Eke-Ukwu	Relief	Eke Mmegbu	Orji	IMSU Gate	Factory (control)
<i>Staphylococcus aureus</i>	+	+	+	+	+	+
<i>Staphylococcus epidermdis</i>	+	+	-	-	-	-
<i>Bacillus cerus</i>	+	-	-	+	+	+
<i>Escherichia coli</i>	+	+	+	+	-	-
<i>Klebsiella aeroganes</i>	-	-	+	+	-	-

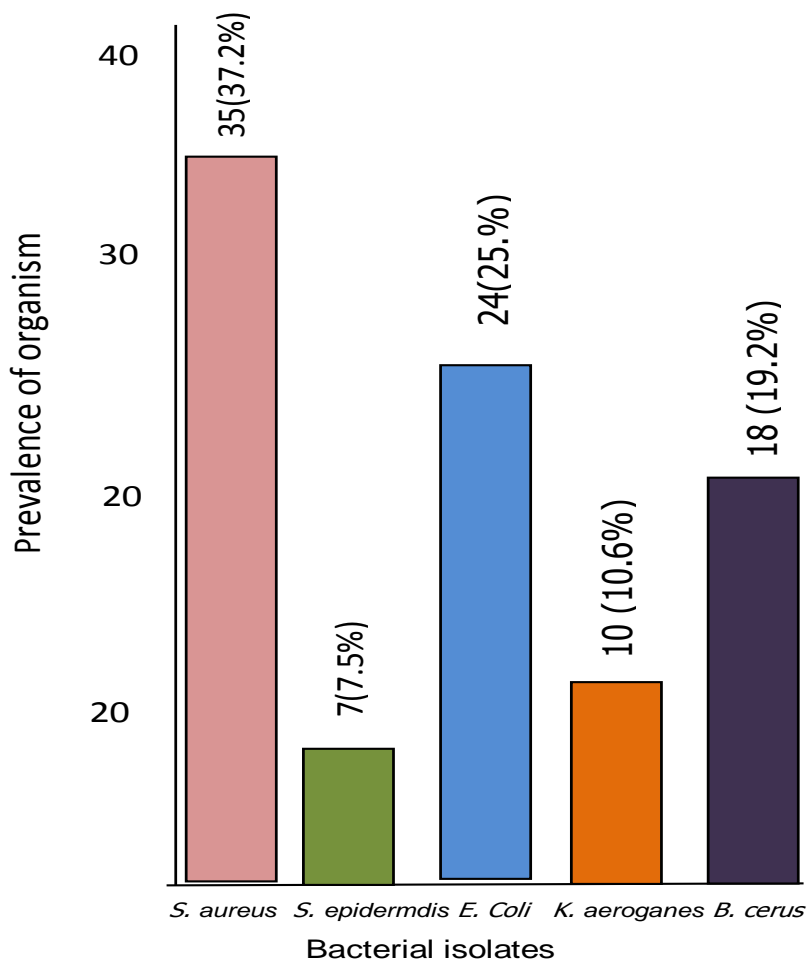


Figure 1. Chat representation of the occurrence of different isolates.

(97.5%). The heterotrophic count when compared with the control showed a statistical significant increase at $P > 0.05$.

DISCUSSION

In addition to death and ill health caused by food poisoning, individuals, families, health care system and society, as well as commercial enterprises incur tremendous economic loss. These losses include, loss of income due to the cost of medical care, the cost of investigating food contamination outbreaks, loss of income due to closure of business, legal costs and fine (Baine, 2000). Hence taking "Garri" dry as snacks or with cold water is exposure to health risk due to the microbial status.

This study reveals high prevalence of bacterial contamination of samples from different markets, when compared with that of control. Relief market has the highest prevalence of 100%. This may be attributed to dirty environment associated with these markets. Indiscriminate dumping of refuse is a common practice around these markets. This is in agreement with the results of Trickett (1992) who listed his own sources of food contamination among other factors to include, dust, and waste products from the environment.

The 20% prevalence recorded against the control can be attributed to the unskilled nature of the garri producers who introduce contaminants to their products, especially during the cooling and packaging phase of their production. This corroborates the reports of Baine (2000) who states that food poisoning could have been reduced if the food producers and processors are educated and trained in safe food handling and consumers are better advised in their choice of food.

The coliform count of IMSU gate when compared with that of control showed significant difference against other markets. This decrease can be attributed to the fact that IMSU gate market is not a large market, rather a mini market and so does not accommodate large population. Refuse disposal in this market is more properly managed than what is obtainable in other markets. The major source of contamination in this market is likely to be from the sellers and the aerosols. This supports the observation of Mankee et al. (2003) who states that the vendors can be carriers of pathogens like *E. coli*, *Salmonella*, *Shigella*, *Campylobacter* and *S. aureus*, who eventually transfer these food borne hazards to consumers.

The distribution of the organism varied from the different markets. Eke – Ukwu market is located at the heart of the town with great number of people coming in for marketing purpose. Relief market though not completely at the heart of the town, harbours many refuse dumps, gutters and water logged areas containing stagnant water from sewages, hence, recorded more contamination than others. This corroborates Almeida, (1994) who attributes

the variation in distribution of organisms to environmental condition and practice of the food handlers. From the result of this work, *Staphylococcus* spp. (*S. epidermidis* and *S. aureus*) had the highest rate of occurrence with a total of 44.7% (37.2 and 7.5 respectively). They might have found their way into the garri through carriers, since the organisms are found around the nose, throats, hands and clottings of these carriers (Cheesbrough, 2000).

The isolation of *E. coli* and *K. aerogenes* from some of the markets, though, below infection causing value (*E. coli*: $\geq 1.0 \times 10^6$ and *Klebsiella aerogenes* $\geq 5.9 \times 10^3$) (Solberg et al., 1976) indicates recent faecal contamination which can be attributed to the refuse dumps as well as the stagnant waters from sewages seen around some of these markets. This is in agreement with the results of Dike- Ndudim et al. (2014) who attribute the isolation of the same organisms from smoked fish sold in Owerri to faecal contamination of water sources in Owerri.

The result of this study has proven that "Garri" which were sold in Owerri markets are highly contaminated with pathogenic organism. Although, the coliform (CFU/G) fall below the value that can result to infection, this implies that, increase intake of garri as snacks among people of Owerri may lead to a disease condition such as gastro enteritis.

We therefore suggest that the state government establishes standard garri processing industries to be managed by trained personnel in food handling, to reduce contamination due to poor handling. Also, environmental sanitation should be taken as a priority project to reduce food-borne disease. Finally, residents of the state should be educated on the dangers of food poisoning to enhance personal hygiene.

Conflict of interest

Authors did not declare any conflict of interest.

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