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Microbial Evaluation of Garri Sold In Ijebu Community

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***Abstract**: The sale and distribution of garri in local markets is associated with practices such as display of product in open buckets, bowls and mats at points of sale and the use of bare hands during handling and sales.These unhygienic practices may lead to the microbial contamination of garri . This study was carried out to evaluate the microbial quality of garri soldin Ijebu community. Six garri samples were randomly collected from six retail sellers in three towns of Ijebu-igbo, Ago-Iwoye and Oru Ijebu in Ijebu-North Local Government Area of Ogun State. Samples were serially diluted to 10^{-2} andinoculated by pour plate method onto Nutrient agar, MacConkey agar and Potato-Dextrose agar plates for Total aerobic plate count (TAPC), Coliform count (CC) and Fungal count(FC) respectively. The Coliform counts of garriranged from 3.0 x 10^2 to 3.0 x 10^3CFU/mland Fungal counts ranged from3.0 x 10^3 to 4.0 x 10^3 CFU/ml. The pH ranged content ranged from 4.78 to 4.90. A total number of fourteen (14) bacterial isolates belonging to five genera were isolated. The occurrences wereEscherichia coli (4),Staphylococcusaureus (3), Klebsiella pneumoniae (3), Bacillus spp.(2)and Pseudomonas aeruginosa (2).A total of nine (9) fungal isolates were Aspergillus flavus 1(11.11%), Aspergillus niger 2(22.22%), Penicillium sp. 2(22.22%), Fusarium sp. 1(11.11), Candidaalbican 2(22.22) and molds 1(11.11%). Application of goodmanufacturing practices (GMP) in garri handling post- processing is important.*
***Key words:** Garri samples, Coliform counts, Fungal counts, Contamination and GMP*

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I. Introduction

Garri is the most popular fermented food product madefrom cassava (Mannihot esculenta) and is widelyconsumed as processed by millions of people in West Africa where it forms a significant part of their diet (Edemet al., 2001; Kostinek et al., 2005; Oduro et al., 2000;Ogiehor et al., 2007). It is preferred by urban consumersirrespective of ethnicity and socio-economic class as it is a pre-cooked food product with good flavour (Jekayinfaand Olajide, 2007). The dry form of post processed garrias obtained in markets is commonly consumed withoutfurther cooking (soaked in water) with sugar, smokedfish, roasted groundnuts, cooked cowpea and coconut, and sometimes with milk and beverages ascomplements. It can also be prepared into a stiff paste called 'Eba' by adding the granules into hot water andstirring to make a paste of varied consistency which canbe consumed with local soups or stews of various types by chewing or swallowing in morsels (Asegbeloyin andOnyimonyi, 2007).

Garri processing covers a series of procedures suchas peeling, washing, grating and packing into closely knitbags. A heavy object is placed on top of the bag toexpress some of the juice and the contents of the bag arethen left to undergo spontaneous solid state fermentationfor several days at ambient temperatures (Huch et al.,2008; Ray and Sivakumar, 2009). Fermentation of thegrated tubers helps in product preservation, flavour development, cyanide reduction and changes in functional properties (Akindahunsi et al., 1999). Thefermented pulp is then dried to about 10% moisturecontent by frying at high temperatures which probablyresults in partial dextrinization of starch (Osho andDashiell, 2002), destruction of enzymes and microorganismsand the expulsion of cyanide gas from theproduct (Asegbeloyin and Onyimonyi, 2007; Harbor and Ogundu, 2009).

The fermentation of cassava to produce garri providesan enormous scope for value addition and preserves thisstarchy food in a wide diversity of flavours, aromas andtextures that enrich the human diet (Ray and Sivakumar,2009; Steinkraus, 1997), and helps to ensure distributionand storage of the product without the need for refrigeration. However, post-process problems of garristill persist and include loss of microbial stability and spoilage during storage, distribution and marketing.

In Nigeria, the sale and distribution of garri in local marketsis associated with practices such as display of product inopen buckets, bowls and mats at points of sale and theuse of bare hands during handling and sales. These unhygienic practices, which may lead to microbialcontamination due to deposition of bioaerosols on exposed products, transfer of microbes from dirty handsand utensils and frequent visits by animals and fomites(which may carry infectious agents), can contribute to the post-process problems of this product.

Previous reportshave revealed high bioload and a vast array ofmicroorganisms in market samples of garri (Agbonlahor et al., 1997; Amadi and Adebola, 2008; Ijabadeniyi, 2007;Ogiehor et al., 2007). The microorganisms isolated fromthese market samples include: Bacillus spp.,Pseudomonas spp., Clostridium spp., Salmonella spp.,Klebsiella spp., Aspergillus spp.; Penicillium spp.; Rhizopus spp., Fusarium spp.; Cladosporium spp., etc.

II. Aims and objective of the study

This study is aimed at assessing the microbial quality of garri sold in Ijebu community with a view to enlightening the public on the importance of proper food handling in food safety which will help in reducing or eliminating potential health hazards that could arise as a result of consumption of contaminated garri.

III. Materials And Methods

Study Area

Ijebu North is a Local Government Area in Ogun State, Southwest,Nigeria. It consistsof three main regions, Ijebu-igbo, Ijebu-Oru and Ago-iwoye.

Collection of Samples

A totalof six garrisamples, two from each market were randomly collected from sixretail sellers in three towns ofIjebu-igbo, Ago-Iwoye and Oru Ijebu in Ijebu-North Local Government Area,Ogun state.The samples were well labelled to indicate the name of the market and sample code and stored in sterile polyethylene bags and at ambient temperature to prevent the entrance of spoilage agents before laboratory analysis.

Microbial Analysis

Microbial analysis was carried out according to the method of Ojokoh and Gabriel(2006). 1 g of sample was weighed and crushed to powder with sterile mortar andpestle. It was then placed in a sterile test tube and homogenized with 10 ml of sterile distilled waterto make the stock. Homogenate was serially diluted to 10^{2}, also in sterile distilled water. About 0.1ml aliquot ofappropriate dilutions were inoculated onto Nutrient agar , MacConkey agar and Potato Dextrose agar plates , for total aerobic plate count, coliform count and fungal counts respectively. plates,using the pour plate method.The plates were allowed to set and subsequently incubated at 37^{o}C for 48 h.Potato Dextrose agar(PDA) plates were however incubated at 25^{o}C for 72 h. Atthe end of each incubation period, the culture plates were examined for enumeration and identification of colonies counted.

Enumeration and Identification of microbial Isolates

Colony count at the end of each incubation period was done with digital colony counter, total microbial load was expressed as colony forming units per gram of sample.Pure cultures of isolates obtained by repeated subculturing were stored on slants at 4^{o} C until characterized.Bacterial isolates were characterized one basis of their Gram-stain reaction and biochemical test and the identification was according to Bergey's Manual of Determinative Bacteriology. Fungal isolates were identified based on morphological characteristics and microscopy (Tsuneo,2010).

Determination of pHcontent of garri samples

The pH of the samples was determinedfollowing the method described by Ogiehor and Ikenebomeh (2005). Tengrams of each sample were homogenizedin 10ml of distilled water and the pH ofthe suspension determined using areference glass electrode pH meter.

IV. Results and discussion

Table 1 shows the mean total coliform count of garri samples from the three different markets. The counts ranged from 3.0 x 10^{2} CFU/ml to 3.0 x10^{3} CFU /ml,with Ijb_{2} sample having the highest count and Ag_{1} with no count.This difference in counts may be attributed to difference in food safety adherence or personal hygiene by the food handlers. The result reveals that coliform was present in most of the garri samples at high counts .This generally signifies poor sanitary conditions in the post- process handling of garri via food handlers and the environment .The ICMSF(1996) and the African Organisation for Standardization recommended absence of coliforms in ready to eat foods. The presence of coliforms in most of the garri samples therefore make it of poor quality and unsafe for human consumption.

Fungal counts of garri samples ranged from 3.0 x 10^{2} to 4.0 x10^{2} CFU/ml as shown in Table 1.This count is within acceptable limits. Ready to eat food with plate counts – < 10^{3} are acceptable 1o^{4} to 10^{5} are tolerable ,while count >- 10^{6} unacceptable.

Furthermore,the pH contents of garri samples were of the acidic range with pH values ranging from 4.78 to 4.90 as shown in Table 1.

A total of fourteen(14) bacterial isolates belonging to five genera were isolated in (3) ,Klebsiella pneumoniae(3),Bacillus spp.(2) and pseudomonas aeruginosa(2).The presence of Escherichiacoli and Staphylococcus aureus calls for serious concern considering the fact that garri is sometimes eaten without further cooking coupled with the fact that some strains of these organisms are toxigenic and have been implicated in food- borne intoxication (Oranusi et al.,2007). Staphylococcus aureus and Escherichia coliare of human origin, their presence therefore could be as a result of poor hygienic practices.

Moreso, the frequency of occurrence of isolated organismsis shown in Table 2.It reveals that the garri samples were contaminated by a diverse microbial population, both bacteria and fungi. This is in line with the previous findings of Idowu(2006),Taulo et al.(2008),Orausi et al.(2013)and olopade et al .(2014). The fungi isolated include speciesof Aspergillus ,penicillium, Fusariumand moulds .Moulds are common environmentalcontaminants due to their ability toproduce spores; this could explain theirpresence in garri. They have been implicated in ready to eat foods and inunregulated/ mixed fermentation. Species of Aspergillus, Penicillium and Fusariumare known to produce deleteriousmycotoxins under favourable conditions(Sweeney and Dobson, 1998; Kabak et al., 2006; Oranusi et al., 2013), their presencein garri could therefore be of potential risk to public health.Post- process contamination of garri by diverse microbial population is specifically associated with sieving of products after heat treatment and the spreading of products in the open to airdry, coupled with the practice of leavinggarri open for sales could have accountedfor the diverse microbial population contaminating the product.

The current findings suggest that the current unhygienic yet acceptable mode of sale of garri may pose potential risk for public health .There is need for strict adherence to GMP,which include proper packaging of garri immediately after processing to curtail the level of contamination and thus improve the microbial quality of this basic staple food.

Table 1 Mean total Coliform count, Fungal Count, pH Contents of garri samples (CFU/ml)

Sample Code	Mean total Coliform count	Fungal Count	pH Contents
Ijb 1	2.0×10^3	4.0×10^2	4.81
Ijb 2	3.0×10^3	3.0×10^2	4.90
Or 1	2.7×10^3	3.0×10^2	4.87
Or 2	3.0×10^2	4.0×10^2	4.82
Ag 1	No Growth	4.0×10^2	4.78
Ag 2	2.7×10^3	3.0×10^2	4.81

Decoder
Ijb = Ijebu-Igbo
Or = Oru Ijebu
Ag – Ago-Iwoye

Table 2 Frequency Occurrence of Isolated Organisms

Isolates recovered	Frequency	Percentage (%)
Bacteria		
Escherichia coli	4	28.6%
Staphylococcus aureus	3	21.4%
Klebsiella pneumoniae	3	21.4%
Bacillus spp.	2	14.3%
Pseudomonas aeruginosa	2	14.3%
Total	14	100
Fungi		
Fusarium	1	11.1
Mold	1	11.1
Aspergillus flavus	1	11.1
Aspergillus niger	2	22.22
Penicillium	2	22.22
Candida albicans	2	22.22
Total	9	100%

References

[1]. Ainsworth, R. (2004) Safe, piped water: Managing microbial water quality in pipeddistribution systems. IWA Publishing, London, for the World HealthOrganization, Geneva.International Commission onMicrobiological Specifications forFoods ICMSF 1996 Microorganismsin Foods 5: MicrobiologicalSpecifications of Pathogens.

[2]. Akindahunsi, A. A., Oboh, G. and Oshodi, A. A. (1999) Effect of fermentingcassava with Rhizopus oryzae on the chemical composition of itsflour and garri. Riv. Ital. Delle Sost. Grasse, 76: 437-440.

[3]. Amadi, J. E. and Adebola, M.O. (2008). Effect of moisture content and storageconditions on the storability of garri. Afr. J. Biotechnol. 7(24): 4591-4594.

[4]. Asegbeloyin, J. N. and Onyimonyi, A. E. (2007). The effect of differentprocessing methods on the residual cyanide of 'Gari'. Pak. J. Nutr.6(2): 163-166.

[5]. Azam-Ali, S., Judge, E., Fellows, P. andBattcock, M. (2003). Small-scale foodprocessing. A directory of equipmentand methods.2nd edition.ITDGPublishing.pp: 256.

[6]. Edem, D. O., Ayatse, J. O. I. and Itam, E. H. (2001). Effect of soy proteinsupplementation on the nutritive value of 'gari' (farina) from Manihotesculenta. Food Chem. 75: 57-62.

[7]. Harbor, C. I. and Ogundu, E. C. (2009). Effect of processing on cyanidereduction in different cassava products. Niger. J. Biochem. Mol. Biol.,24(1): 35-37.

[8]. Huch, M., Hanak, A., Specht, I., Dortu, C. M., Thonart, P., Mbugua, S., Holzapfel, W. H., Hertel, C. and Franz, C. M. A. P. (2008). Use of Lactobacillus strains tostart cassava fermentations for Garri production. Int. J. Food Microbiol; 128: 258-267.

[9]. Idowu, O. A.(2006). Oral faecal parasitesand personal hygiene of food handlersin Abeokuta, Nigeria.Africa Health Science, 6:160 164.

[10]. Ijabadeniyi, A. O. (2007). Microbiological safety of garri, lafun and ogiri inAkure metropolis, Nigeria. Afr. J. Biotechnol., 6(22): 2633-2635.

[11]. Jekayinfa, S. O. and Olajide, J. O. (2007). Analysis of energy usage in theproduction of three selected cassava-based foods in Nigeria. J. Food Eng., 82: 217-226.

[12]. Kostinek, M., Specht, I., Edward, V. A., Schillinger, U., Hertel, C., Holzapfel,W. H. and Franz, C. M. A. P (2005). Diversity and technological properties ofpredominant lactic acid bacteria from fermented cassava used for thepreparation of Gari, a traditional African food. System Appl. Microbiol; 28(6): 527-540.

[13]. Oduro, I., Ellis, W. O., Dziedzoave, N.T. and Nimako-Yeboah, K. (2000). Quality ofgarri from selected processing zones in Ghana. Food Control, 11:297-303.

[14]. Ogiehor, I. S., Ikenebomeh, M. J. and Ekundayo, A. O. (2007). The bioload and aflatoxin content of market garri from some selected states insouthern Nigeria: public health significance. Afr. Health Sci; 7(4):223-227

[15]. Olopade,B.K.,Ajala,R.A.and Olorunsa,S.J.(2014).Microbiological quality of fermented cassava(Garri) sold in Ota,Ogun state,NigeriaInt.J.Curr.Microbiol.App.Sci.**3**(3):888-895.

[16]. Oranusi, S., Wesley ,B. and Oguoma, O.I. (2013). Antifungal properties of lacticacid bacteria LAB isolated fromRicinus communis, Pentaclethra macrophylla and Yoghurts. Global Advanced Research Journal of Food Science and Technology 21:01-06.

[17]. Osho, S.M. and Dashiell, K.E. (2002). Theprocessing and acceptability offortified cassava based product garriwith soybean.DiscoveryInnovation.14: 186-191.

[18]. Ray, R. C. and Sivakumar, P. S. (2009). Traditional and novel fermented foodsand beverages from tropical root and tuber crops: review. Int. J. Food Sci. Technol. 44: 1073-1087

[19]. Steinkraus, K. H. (1997). Classification of fermented foods: Worldwidereview of household fermentation technique. Food Control; 8: 311-31.

[20]. Sweeny,M.and Dobson,A.(1998).Mycotoxin production byAspergillus Fusarium andPenicillium species.Int .J. Food Microbiol. 43:141-158.

[21]. Taulo, S., Wetlesen A., Abrahamsen, R.,Mkakosya, R. and Kululanga, G. (2008).Microbiological quality of water,associated management practices andrisks atsource, transport and storagepoints in a rural communnity ofLungwena, Malawi. Africa Journal of Microbiological Research,72: 31-137.

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