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Bacteriological Assessment of Cassava Products in Makurdi Markets, Guinea savanna, Nigeria

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Abstract

Bacteriological assessment of cassava products was carried out in three different main markets'' modern, wadata and Wurukum markets all in Makurdi Benue State to determine bacterial contamination. The "garri" and cassava chip samples were subjected to the pour method to determine the number of colonies and their densities, thus the extent of contamination and analysis of faecal indicators using presumptive, confirmatory and completed tests. Fine major bacteria isolated were *Escherichia coli. Aerobacter aerogenes Salmonella species, Streptococcus faecalis* and *Staphylococcus aureus.* In all the three markets, contamination of cassava chips and garri by E. coli was significantly ($P<0.05$) higher (30.8%) followed by salmonella species (24.8%). The higher percentage occurrence of E. coli in those cassava products may give an indication of faecal contamination of those products during processing or handling. More so, the highest occurrence of bacteria in "garri" and cassava chips from Wurukum and Wadata markets may be attributed to the poor sanitary condition of the markets and probably because of the processing methods and materials used in producing those products and poor west disposal and management system.

Keywords: Bacteriological; Cassava-Products; Contamination; Guinea-Savanna; Nigeria

Introduction

Cassava (Mamihot esculenta Crantz) is a dicotyledonous perennial plant, belonging to the family of rubber plants with white latex following out of its wounded stem and leaf stalks; botanically, it is of the Euphorbiceace family. It is also a woody shrub with an edible root with an average height of one meter. It first originated from Brazil and some parts of Central America [1]. It is known by different names in different part of the world. Spanish Speaking countries of North America, Europe and Africa call it Cassava, while English speaking countries of South Asia call it "tapioca," and it is referred to as "mandioca" in Brazil. In the middle belt region of Nigeria Benue in particularly, the Tiv call it "Logo", the Idomas call it "oila" and the Igede call it "Tarrkum" (personal communication).

Cassava roots are processed into different products according to local customs and preferences. The products derived are high energy foods of excellent quality. Cassava, is however affected by fungi, bacterial, virtual and virus like and mycoplasmic agent [2]. The environment in which cassava root products stay when it is been processed (or not processed) goes a long way in contributing to the contamination of the root product. Contamination of this food can be traced to the hands and garments of handlers and utensil used in processing. The method of drying chips on bare floor or road exposes chips to air borne micro-organisms, and this type of contamination (air-borne) is deadly on quality and shelf life of cassava [3]. The contamination of cassava and it product can arise during processing of the product by employing unhygienic methods, use of contaminated utensils, dust and activities of domestic animals [4]. Thus, the objectives of this papers is to determined the bacterial species and their load in two cassava products; garri and cassava chips from three major markets in Makurdi metropolis, guinea savanna, Nigeria and to compare the bacterial load of the products from those markets and hence the possible sources of contamination.

Material and Methods

Collection of Samples

Samples were collected from three (3) main markets in Makurdi metropolis Modern, Wurukum & Wadata markets. Fifteen (15) samples each of cassava chips and garri were collected from each market in sterile polyethene bags and were taken to the laboratory for bacteriological analysis. This gives us

a total of forty five samples each of cassava chip and garri.

Bacteriological Analysis of Cassava Products

Poor Plate Method: Using a sterile pipette, serial dilutions of I ml of solution from washed cassava product were put into semi solid nutrient agar and mixed immediately, by a sideways shaking and circular movements for some seconds to ensure complete dispersal of inoculums. Plates are allowed to set and incubated at 370C for 24-48 hours. The plate with the most countable clear colonies were counted and multiplied by the dilution factor to give the total number of undiluted washings of the product.

Presumptive Tests: 1.0g of each sample of garri and cassava chips were washed in 9ml of sterile water with 1ml each of the washing inoculated into the lactose broth. The tubes were incubated for 24 to 48 hours. Formation of gas was considered a positive presumptive test.

Confirmatory Test: Samples were streaked into plates of special indicator agar EMBA and inoculated for 24 hours at 370C. This follows the method of [5].

Completed Test: Index colonies from confirmatory tests were inoculated into lactose broth using sterile wire loop. Production of gas in the broth upon incubation shows a positive completed test. Developing colonies were gram stained; negative rods confirmed a positive test as presented by [6].

Catalase Test: A drop of hydrogen peroxide was dropped on a glass slide. A bit of colony was removed with a wire loop and touched on the drop of hydrogen peroxide. Building and frothing indicates positive test. For gram staining, a drop of water was put on a clean slide (glass) using a wire loop. A representative colony was emulsified on it and smeared properly. The smear was air dried and fixed by passing it through a flame. Crystal violet was applied for I minute and then rinsed. Lugols iodine was applied and allowed to stand I minute and then rinsed with water. Several changes of acetone alcohol were applied until no more colours were seen to come off the preparation. Safranin solution was applied and allowed to stand for 10 seconds and rinsed with water. It was blotted dry using a filter paper. A drop of immersion oil was placed on the slide and viewed under the microscope [7]. Gram-positive bacteria stained violet and gram negative bacteria stained red or pink.

Results and Discussion

The results obtained during the research reveals that both cassava chips and garri obtained from all the major markets were found to be highly contaminated with some forms of bacteria.This could be attributed to the fact that, most of the cassava chips produced is usually spread to dry by the road side on a bare floor and in the process dust bearing microbes raised by moving vehicles and passersby settle on the chips as reported by [3].

More so, the processing methods of these cassava chips may also contribute to the significant high percentage of their bacterial load, this is because of the doubtful sources of water, unhygienic environment and materials used in processing. The relative lower bacterial load in "garri" as compared to that of the cassava chips could also be due to the fact the that "garri" was subjected to high temperature treatment during frying thus destroying and inhibiting most bacteria. However, during air-drying and bagging, contamination may still take place. This was similarly reported by [8,9]. In all the three markets, contamination of the cassava chips and garri by E*scherichia Coli* was significantly (PL 0.05) high (30.8%) followed by *Salmonella species* (24.8%). The higher percentage occurrence of E. coli in those cassava products may give an indication of fecal contamination of those products during processing. Also the percentage occurrence of *Salmonella Species* in those products may expose consumers of the product to typhoid fever. The highest occurrence of bacteria in garri and cassava chips from Wurukum and Wadata markets may be attributed to the poor sanitary condition of the markets. However, this was in line with the findings of [10,11](Tables 1-3).

Table 1: Standard Plate Count of Bacterial Isolates from Cassava Product in the Three Major Markets in Makurdi Benue State.

Market	Bacterial Plate Cassava Chips	Mean Count from Cassava Product Garri	Total Mean Count
Modern Market	4.68×10^4	4.24×10^4	4.46×10^4
Wadata Market	3.19×10^5	4.15×10^4	3.67×10^5
Wurukum Market	6.01×10^4	4.12×10^4	4.07×10^4

Table 2: Distribution of Bacterial Isolates in Cassava Product in the Three Major Markets in Makurdi Benue State, Nigeria.

Market CassavaProductsTotal (%)	Bacterial Isolates and their Frequency				
	E.col.	Strep.f.	Aero.a	Sal.sp.	Stap.a
Modern CassavaMarketchip25(16.8)	8	3	1	8	4
Garri 20(13.4)	8	5	1	4	2
WadataCassavaMarketchip 21(14.1)	7	3	4	4	3
Garri 30(20.1)	9	3	6	4	8
Wurukum CassavaMarketchip28(18.8)	7	3	3	11	4
Garri 25(16.8)	6	5	4	6	4
Total (%)	46(30.8)	22(14.8)	19(12.8)	37(24.8)	25(16.8)

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Abbreviations: E. co: E. coli; Strep. f: = Streptococcus faacalis; Aero. A: Aerobacter aergoenes; Sal. Sp: Salmonella spepcies; Stap. al: Staphylococcus aureus

Table 3: Prevalence of Bacterial Isolates in the Three Major Markets in Makurdi Nigeria.

Market	Bacterial Isolates and their Frequency					
	E.col	Strep.f.	Aero.a	Sal. sp.	Stap. a.	Total (%)
Modern Market	8	1	3	2	6	20(267)
Wadata	9	6	4	8	3	30(40.0)
Wurukum	6	6	4	4	5	25(33.3)
Total (%)	23	13	11	14	14	75

Abbreviations: E. co: E. coli; Strep. f: Streptococcus faacalis; Aero. A: Aerobacter aergoenes; Sal. Sp: Salmonella spepcies; Stap. al: Staphylococcus aureus

Conclusion

The data analysis obtained during this research had shown that the cassava products obtained from the three major markets in Makurdi Benue State, Nigeria are not safe for human consumption in their current state. This may be because of the poor sanitary conditions of these markets and probably because of the unhygienic state of the processing methods and materials used in producing those products.

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