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Bacteriological Assessment and Proximate Composition of Bambara Groundnut (*Vigna subterranea*) Flour Sold in Onitsha Metropolis

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ABSTRACT

The study was on Bacteriological Assessment and Proximate Composition of Bambara Groundnut flour Sold in Onitsha Metropolis. Ten representative samples of bambara groundnut flour were aseptically collected from different sellers in open market and analyzed using standard microbiology and biochemical standard methods. The bacteria isolated were S*taphylococcus aureus* spp, *Escherichia coli*, *Bacillus* spp, *Salmonella* spp and *Pseudomonas* spp. The bacterial count ranged from 2.9 x 10^4 cfu/g to 6.0 x 10^4 cfu/g on nutrient agar while that of MacConkey agar ranged from 2.0 x 10^4 cfu/g to 8.0 x 10^2 cfu/g. Sample E recorded the highest protein content (19.0%) while sample H recorded the least protein content (16.89%). The moisture content ranged from (6.20% to 9.00%). The fat content ranged from (5.50% to 7.30%). The carbohydrate content ranged from 58.58% to 66.05% while the ash and fibre contents ranged from (2.98% to 4.80%) and (2.88% to 4.00%) respectively. High bacteriological quality of bambara groundnut flour can be obtained through good hygienic practices.

Key Words: Bambara groundnut, Microbial count, Proximate composition, Onitsha

INTRODUCTION

Legumes are the most sources of macronutrients such as protein, carbohydrates and dietary fibre of many populations, especially in the developing countries [1]. Bambara groundnut (Vigna subterranea) is one of these legumes and is derived from the name of a Mali tube called “Bambara” [2].

Bambara groundnut is a popular crop in Sub-Saharan Africa. It is highly nutritious and plays a vital role in people’s diet especially in the developing countries where the cost of meat and fish is high. The seed contains 63% carbohydrate, 19% protein and 6.5% oil [3].

Varieties of bambara groundnut cultivated include black which is early maturing and small-sized kernels, red which is late maturing type but a good yielder, cream/black eye that have large kernels and the yield is high, cream/brown eye with moderate kernels and good yielder and cream/ no eye that have very small pods and kernels with low yield. Bambara groundnut seeds grow well in a well-drained soil, moderate rainfall and average temperature of 20°C to 28°C. The immature seeds of bambara groundnut can be eaten fresh, boiled, roasted or grilled while the mature seeds are ground into flour and then mixed with oil or butter to form porridge.

Bambara groundnut is one of the most acceptable of all plants and tolerates harsh conditions better than most crops. The seeds are important source of food security because they are high in methionine, an essential amino acid.

MATERIALS AND METHODS

Ten representative samples of bambara groundnut flour were collected aseptically from different sellers in open markets in Onitsha Metropolis and kept in sterile containers prior to analysis. One gram of each sample was dissolved in 9ml of peptone water and diluted using a ten-fold serial dilution. The isolation and identification of bacteria was carried out by the method described by [4]. Zero point one millilitre of each sample suspension was inoculated on appropriate media. The total viable count was calculated using the formula TVC = N/V x D, where TVC = Total Viable Count, V = Volume plated, D = Dilution and N = Mean colony.

The organisms were sub-cultured and characterized using Gram staining, colony morphology, microscopic morphology and biochemical tests. The proximate composition was carried out by the method of Association of Official Analytical Chemists [5]. Protein content was determined by Kjeldahl's apparatus. The moisture content was determined using moisture analyzer and carbohydrate was determined by difference using:

Carbohydrate = 100 – (Protein + Moisture + Ash + Fat)

RESULTS

Table 1 shows the total viable bacterial count of Bambara groundnut flour samples.

Table 2 shows the characteristics of bacterial isolates.

Table 3 shows the proximate composition of Bambara groundnut flour.

Table 1: Total viable bacterial counts of Bambara groundnut flour samples

Sample	Total Bacterial Count (cfu/g)	
	Nutrient agar	**MacConkey agar**
A	4.0×10^4	5.0×10^4
B	3.0×10^2	6.5×10^2
C	5.2×10^2	4.3×10^2
D	6.0×10^4	5.5×10^4
E	5.0×10^2	8.0×10^2
F	5.0×10^2	6.4×10^4
G	3.5×10^4	4.1×10^4
H	2.9×10^4	2.0×10^4
I	3.6×10^4	2.9×10^4
J	4.8×10^4	4.5×10^4

Table 2: Characteristics of Bacterial Isolates

Isolates	Cultural Morphology	Microscopic Morphology	Gram Reaction	Catalase	Citrate	Coagulase	Oxidase	Methyl Red	Nitrate	Indole	Voges Proskauer	Urease	H_2S	Motility	Lactose	Maltose	Glucose	Sucrose	Xylose	Manitol	Sorbitol	Probable organism
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1	On nutrient and MacConkey agar, colonies are large, low convex, rough and oval in shape. Some are irregularly round about 2-3mm in diameter and emit fruity odour and also pigmented (green-yellow, blue-green	Straight and slightly curved rods	-	+	-	-	+	-	+	-	-	+	+	+	-	-	A	-	-	-	-	*Pseudomonas* spp.
2	Colonies are yellowish, moist and have smooth glistering surface on nutrient agar, appears pinkish on MacConkey agar and about 1-2mm in size.	Cocci in grape-like cluster with some singe and paired	+	+	-	+	-	+	+	-	+	+	-	-	A	+	A	A	+ A	A	A	*Staphylococcus* spp
3	Low convex discrete colonies about 0.5-1.0mm in diameter	Spherical cocci in short chains	+	-	-	-	+	-	-	-	-	+	-	-	+	+ A	+ A	+ A	A	-	-	*Streptococcus* spp
4	Colourless to greyish smooth colonies on nutrient agar, rose	Rod shaped																				

	pink, large colonies of MacConkey agar about 2-3mm in diameter		-	+	-	-	-	+	+	+	-	-	+	+	+ A	A	+ A	+ -	A	+ A	-	*Escherichia coli*
5	Colonies are greyish to white circular, moist, convex and transluscent in nutrient agar Pale yellow on MacConkey agar, colourless with black centre on SSA, about 2-3mm in diameter	Rod shaped	-	+	+	-	-	+	+	-	-	-	+	+	+ A	+ A	+ A	A	+ A	+ A	A	*Salmonella* spp
6	Large, greenish, raised, wide-spreading with irregular fingerlike edges and opaque about 2-3mm in diameter	Long straight rods in single, some in pairs	+	+	+	-	+	-	+ -	-	+	-	-	+	-	+ A	+ A	+ A	A	A	A	*Bacillus* spp

Key: A = Acid production, G = Gas production

Table 3: Proximate composition of Bambara groundnut flour samples

Sample	*Moisture(%)*	*Fat(%)*	*Protein(%)*	*Ash(%)*	*Carbohydrate (%)*	*Fibre(%)*
A	7.31	5.80	17.70	4.80	64.25	3.55
B	7.84	5.50	18.40	4.25	63.52	3.40
C	7.40	6.00	17.20	4.75	64.25	2.98
D	7.90	6.40	17.80	4.81	63.00	4.00
E	8.00	7.10	19.00	3.69	59.25	3.80
F	7.50	5.90	18.01	2.98	66.05	3.72
G	6.50	7.30	18.53	3.80	58.58	3.00
H	6.83	5.70	16.89	4.02	62.45	3.75
I	6.20	6.35	17.66	3.76	60.15	3.50
J	6.90	5.78	17.85	4.23	64.40	3.05

DISCUSSION

There is higher bacterial count in samples B, D and E than in their counterpart samples. The high bacterial counts may be as a result of high moisture content and poor handling.

The presence of *Staphyloccus aureus*, *Streptococcus* spp, *Bacillus* spp, *Escherichia coli*, *Salmonella* spp and *Pseudomonas* spp could be as a result of poor hygienic practices by the sellers and handlers who sell the products with unwashed hands and contaminated containers.

The moisture contents are high in virtually all the samples. The high percentage of essential nutrients especially protein and fat (16.89% to 19.00%) and (5.10% to 7.10%) respectively could have resulted in the high bacterial counts since these nutrients support microbial growth.

CONCLUSION AND RECOMMENDATION

The isolation of various bacterial species especially *Escherichia coli*, an indicator organism shows that the samples are contaminated and are therefore unsafe for human consumption. It has been established from this work, that bambara groundnut flour is rich in essential nutrients and can go a long way in enhancing food security. It is therefore recommended that people should consume products of bambara groundnut flour. Handlers and sellers of bambara groundnut flour should be enlightened on good hygienic practices.

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