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Amino Acids Profile of Locally and Laboratory Produced Bam-Bara Nut Condiment

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ABSTRACT
Amino acids profile of locally and laboratory produced bambara groundnut (*Vigna subterranea L (Verd)c* condiment: inoculated and un-inoculated samples were analyzed using different methods. The amino acids investigated showed that acidic amino acids (aspartic and glutamic acids) were most abundant in all the samples more specifically un-inoculated sample, with value of 21.64-22.02g/100g protein for aspartic acids and 4.84-14.16g/100 protein for glutamic acid the most abundant essential amino acids were leucine, lysine, valine, isoleucine and phenylalanine and were more concentrated in inoculated sample. The inoculated sample was rich in all the amino acids than un-inoculated except glutamic acid and serine and also cystine which has the same concentration with un-inoculated sample. The total acidic amino acids (26.86-36.25g/100protein) in the entire sample were greater than the basic amino acids (11.28-12.47g/100g protein). It is evident that these products have played a major role in the food habits of communities in the rural regions serving not only as a nutritious non-meat proteins substitute but also as condiments and flavouring agents in soups.
Keywords: Bambara nut, condiment, amino acid, inoculated and un-inoculated

INTRODUCTION

The Bambara groundnut, or round beans, is widespread in Africa where it is known by various names, according to different local language: for instance, among the Akan tribes of Cote d'Ivoire, it is commonly named Clo-Nglo, in Hausa tribe of Nigeria it was named "Kwaruru", Boro (yoroba), bambara bean, nyimo bean, congo goober, earth pea, ground bean, or hog peanut. While in literature the name Bambara ground nut is preferred. Is a member of the family *fabaceae*, the plant originated in West Africa (the Bambara people are in southern Mali, Guinea, Burkina Faso and Senegal) (Murevanhema and jideani, 2013).

A condiment is a substance applied to food in the form of a source, powder, spread or anything similar, to enhance or improve the flavor. Fermentation is one of the oldest methods of food preservation known to man. In Nigeria and most African countries, condiments such as fermented locust bean (Iru), fermented melon seed (Ogiri), fermented bambara seed (Daddawa), fermented cotton seed (Ogiri) and fermented pigeon pea were widely used to season food. The production of condiment is largely on a traditional small-scale, household basis under highly variable conditions contact with appropriate microorganisms at the ambient temperature of the topics. The completion of fermentation is indicated by the formation of mucilage and overtones of ammonia produced as a result of the breakdown of amino acids during the fermentation (Omafuvbe *et al*., 2000). Condiments are also known to contribute to the calorie and protein intake and are generously added to soups as low-cost meat substitute by low- income families in parts of Nigeria.

Amino acids are monomers of proteins linked together by peptide bonds. Proteins are essential nutrients for human body. There are nine essential amino acids which humans obtain from their diet in order to prevent malnutrition. These include phenyl alanine, valine, threonine, tyroptophan, methionine, leucine, isoleucine, lysine and histidine (Young, 1994). However, humans are able to

synthesize in the body five dispensable amino acids which are alanine, aspartic acid, asparagine, glutamic acid and serine. The six conditionally amino acids that their synthesis can be limited under special conditions especially in the severe catabolic distress are arginine, cysteine, glycine, glutamine, proline and tyrosine (DIR, 2006). Humans need the essential amino acids in certain ratios for proper body nutrition. Both plant and animal foods contain protein which may provide all essential amino acids or may not. This paper aimed at determining amino acids profile of the condiments produced from Bambara nut (un-inoculated condiment and inoculated condiment).

MATERIALS AND METHODS

Sample collection and processing

One kilo gram (1kg) of *Vigna subterranean* seeds were purchased from a local market in Sokoto, Sokoto State, Nigeria. The sample was taken to the Usman Danfodio University Sokoto (UDUS), Department of Biology, and Botany unit, herbarium laboratory which was identified and authenticated and given the vouchers number as (ANS. 0301) and was then aseptically transferred to the microbiology laboratory of the Sokoto State University, for further analysis.

Local Production of Bambara nut condiment (*daddawa*)

The process was done according to (Odunfa, 1981).The raw seeds were pre-processed before the real production steps. The pre-processing consists of a selection by manually sorting. The seeds were winnowed to eliminate stones and other impurities and repeatedly washed with water (2 to 3 times). The water cleaning step is in fact a sorting by gravity in the sense that immature seeds and spoiled seeds as well as other light impurities were float while heavy impurities (stones, sand) were deposited as sediment.

Steeping

In this step the cleaned seeds were soaked in water at room temperature which were leaved overnight, thus softened the seeds.

Cooking

After the initial cleaning process and soaking, the seeds were cooked for 2 hour in a pressure cooker. The seeds were well-cooked until become soft and easily crushed with fingers.

Sieving

The cooked seeds were sieved and drained the cooking water and then allowed to cool.

Dehulling

The cooked seeds were dehulled (removing of the seeds hull (cover) with fingers after cooling.

Pounding

After dehulling step, the seeds were pounded in a pestle and mortar and rapped with polyethylene bag for fermentation.

Fermentation

The rapped pounded seeds were kept in a container to ferment naturally (spontaneously) for three days. During the fermentation the microorganisms used the nutritional component of the seeds converting them in to product that contribute to the chemicals composition and taste of the condiments. At the end of the fermentation, the ammonia-like flavor condiment was dried in an open sun and will be repeatedly turned to form balls and enable a good drying for 2 to 3 days according to the intensity of sunshine.

Laboratory Production of Bambara Nut Condiment

The method of Fadahunsi and Olubunmi (2009) was adopted. 200g of *Vigna subterranea* seeds were weighed using electric weighing balance. The seeds ware washed and stepped in 500ml of distilled water for 18h, the seeds were then transferred in to pressure cooker containing 400ml of distilled water, which were boiled with hot plate for about 90 min until soft, this were sieved and allow to cool for 15 min, dehulled (removing of the seeds coat) and transferred to a sterile mortar followed by mashing in to pulp, the mashed nut were sterilized with autoclave, after sterilization the mashed nuts were aseptically inoculated with the starter cultures, wrapped in a polyethylene bag and kept in a air tight container, incubated at 37^0C for 72h.

Amino Acids Analysis

About 1g of each samples was weighed in to the extraction thimble and fat extracted with chloroform/methanol (2:1 v/v) using a soxhlet extraction apparatus as described by AOAC (2005). The extraction lasted for 5-6 h. 0.3861g of the defatted samples was weighed in to glass ampoule. 7ml

of 6 NH_4Cl was added and oxygen was expelled by passing nitrogen in to the ampoule (this is to avoid possible oxidation of some amino acids during hydrolysis e.g methionine and cystine).The glass ampoule was then sealed with Bunsen burner flame and put in an oven at 105^0C for 22 hours. The ampoule was allowed to cool before broken open at the tip and the content was filtered to remove the humid. The filtrate was then evaporated to dryness using rotary evaporator. The residue was dissolved with 5ml acetate buffer (pH 2.0) in plastic specimen bottles, which were kept in the freezer.

Loading of the Hydrolysate in to the Analyzer

The amount loaded was 60 microliter of the filtrate in acetate buffer. Hydrolysate was loaded in to the cartridge of the analyzer. The analyzer was designed to separate and analyze free acidic, neutral, and basic amino acids of the hydrolysate (AOAC, 2005).

RESULTS AND DISCUSSION

The amino acids composition of dehulled un-inoculated and inoculated samples displayed in Table 1 indicated higher content of Aspartic acid followed by glycine leucine, lysine and glutamic acid, these are the most abundant amino acids found which are in closed agreement with Adeyeye, (2011); Olaofe and Akintayo (2000) and Aremu *et al., (*2006), who had observed that aspartic acid and glutamic acid were the most abundant in legumes and nuts. glycine, leucine and lysine content were also abundant in this report. It also indicated the higher content of aspartic acid, leucine, lysine and glycine in inoculated sample much more high than the un-inoculated sample, this indicated that the starter cultures has a positive effect in the production of bambara nut condiment as well as in the increase of the amino acids (protein) content of bambara nut condiment.

The concentration in g/100g protein of essential and non essential amino acids composition of inoculated and un-inoculated bambara nut condiment were showed in the Table 2 in which the essential amino acids are better enhance and have high concentration in inoculated sample compare to un-inoculated. Table 3 displayed the concentration of total essential amino acids (TEAA) of (32.67 and 36.20g/100g crude protein in the un-inoculated and inoculated samples, these were almost closed to the value of egg reference protein (56.6g/100g cp) (Paul *et al.*, 1976). the TEAA in the present report were comparable to that of egg (50%) (FAO/WHO, 1990). 46.1% reported for *prosopis africana* (Aremu *et al*., 2006) and 43.6% reported for p*igeon pea* flour (Oshodi *et al.,* 1993). Total non essential amino acids (*58.78* and 62.80g/100cp), Total acidic amino acids: The acidic amino acids in the two samples (26.86 and 36.25g/100g cp) were found to be greater than basic the amino acids (11.28 and 12.47g/100g cp), this showed that the sample protein were probably acidic in nature. Total neutral amino acids (*42.07* and 57.50g/100cp), total aromatic amino acids (6.86 and 7.8g/100g cp) for un-inoculated and inoculated samples respectively were fairly the same with suggested (6.8g/100g cp) for ideal infant protein (FAO/WHO/UNU, 1985). The total sulphur containing amino acids in the samples (2.65g/100g cp and 2.86g/100g cp) were lower than the 5.8g/100g cp recommended for infants (FAO/WHO/UNU, 1985). , it also indicated that the concentration of must amino acids are high in inoculated than un-inoculated samples which signify that the exogenous fermentation organisms (starter cultures) inoculated in the sample are better in the process of fermentation of bambara nut than natural fermentation organisms present in the samples.

Table 1: Amino acid composition in Bambara nut condiment

Amino acids	Inoculated sample	Un-inoculated sample
	Conc: g/100g protein	Conc: g/100g protein
1. Leucine	6.01	5.72
2. lysine	5.83	5.30
3. Isoleucine	3.93	3.27
4. Phenylalanine	3.99	3.55
5. Tryphtophan	0.89	0.73
6. Valine	4.74	4.33
7. Methionine	1.17	0.96
8. Threonine	3.00	2.83
9. Histidine	2.17	1.85
10. Arginine	4.47	4.13
11. Tyrosine	2.92	2.58
12. Cystine	1.69	1.69
13. Alanine	4.78	4.55
14. Glutamic acid	4.84	14.16
15. Glycine	15.68	3.61
16. Serine	3.73	3.78
17. Aspartic acid	22.02	21.64

Table 2: Essential and non essential amino acid content in Bambara nut condiment

Amino acids	Inoculated sample	Un-inoculated sample
Essential amino acids	Conc: g/100g protein	Conc: g/100g protein
1. Leucine	6.01	5.72
2. lysine	5.83	5.30
3. Isoleucine	3.93	3.27
4. Phenylalanine	3.99	3.55
5. Tryphtophan	0.89	0.73
6. Valine	4.74	4.33
7. Methionine	1.17	0.96
8. Threonine	3.00	2.83
9. Histidine	2.17	1.85
10. Arginine	4.47	4.13
Non essential amino acids		
1. Proline	4.97	4.47
2. Tyrosine	2.92	2.58
3. Cystine	1.69	1.69
4. Alanine	4.78	4.55
5. Glutamic acid	4.84	14.16
6. Glycine	15.68	3.61
7. Serine	3.73	3.78
8. Aspartic acid	22.02	21.64

Table 3: concentration in g/100g crude protein in Bambara nut condiment

Classes of amino acids	Concentration/100g crude protein	
	Inoculated sample	Un-inoculated sample
Essential amino acids	36.20	32.67
Non essential amino acids	62.80	58.78
Acidic amino acids	26.86	36.25
Basic amino acids	12.47	11.28
Neutral amino acids	57.5	42.07
Aromatic amino acids	7.8	6.86
Sulfur containing amino acids	2.86	2.65

CONCLUSION

Investigation of the amino acids concentration of the samples: inoculated and un-inoculated condiment of Bambara groundnut showed that it is very rich in acidic amino acid (aspartic and glutamic acid) especially aspartic acid. All the amino acids were more concentrated in inoculated than un-inoculated sample except glutamic acid and serine and also cystine which has the same concentration. All the amino acids were better enhancing in inoculated compared to un-inoculated. Generally the concentration of non essential amino acid was fairly above that of total essential amino acid. the essential amino acid concentration were high in inoculated than un-inoculated, the amino acids scores based on whole hen's egg, based on provisional essential amino acids and based on requirement for child in the samples also showed that the inoculated sample is better than un-inoculated. Generally Bambara groundnut is a good source of protein and can be used as a food supplement.

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