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Amino Acids Profile of Powdered Fermented Maize Meal (Ogi) Fortified With Powdered Unfermented Locust Bean Seeds (Pakia Biglobosa).

[1]Makanjuola, [2]Olakunle Moses
Department Of Food Technology, Federal Polytechnic, P.M.B 50, Ilaro. Ogun State, Nigeria.
Corresponding Author: Makanjuola

Abstract: *The study was conducted to evaluate theaminoacids profile of powdered fermented maize meal (ogi) fortified with powdered unfermented locust bean with a view of increasing the nutritional status of ogi, being a wholly carbohydrate food. Blends of ogi and locust bean powders were prepared in the ratio 100:0, 90:10, 80:20, 70:30 and 60:40. A total number of eighteen (18) amino acids were analyzed using standard methods. The results of the analysis showed that there was gradual increase in the levels of lysine and tryptophan, the two limiting amino acids in cereals (maize) as the substitution levels increases. The lysine content in all the samples ranged from 0.5mg/100g – 190.40mg/100g while tryptophan varied between 0.15mg/100g – 11.2mg/100g. Glutamic acid showed the highest amino acids both at control (100% ogi) and at 40% substitution. Generally, all the amino acids evaluated showed increased levels as the substitution levels with powdered unfermented locust bean increase, hence there are significant differences (P≤0.5) at all levels of determinations. Therefore, fortifying ogi with powdered unfermented locust bean serves to increase the biological value of ogi as well as providing cheap source of plant protein.*

Keywords*: Amino acid, Maize meal (Ogi), Locust bean, Fortification, Profile.*

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I. Introduction

The cereal grains are the staple foods of the peoples of the tropics, providing them with about 75% of their total caloric intake and 67% of their total protein intake [1]. In sub-sahara Africa, maize in a staple food for an estimated 50% of the population and it remains the most important agriculture crop for over 70 million families worldwide [2]. Maize is used as human food in the form of tortillas, porridge, popcorn, and bar barbecues and as forage and silage for animals. It is also a good source of vitamins [3,4,], fibre [5], oil [6].Weaning food [7], porridges [8] and ethanol [2,9]. According to [10,11], Maize is a complete food and a diet based on white maize may be deficient in calcium, vitamin A, B, B12, E, and K Folate, Riboflavin, Pantothenic, Acid, Niacin, Potassium and Iron. Maize is also limiting in lysine and low in tryptophan, amino acid. Maize, however constitutes about 90% of the cereals consumed in southern Nigeria [12]. The grain is often processed into a fermented product known as ogi and is consumed in many parts of west Africa.

The lowest bean is made up of 39%-47% of protein, 31% -40% oil, 11.7%-15.4% of carbohydrate [13]. Unfermented locust bean contains (up to 48%) amount of carbohydrate, much available reducing sugars. During ogi manufacture, nutrients including the available proteins and minerals are lost from the grain thereby affecting nutritional quality adversely. A number of studies have been carried out to improve the nutritional value of ogi. A reduction in protein loss was achieved by using an improved wet milling techniques [14] while no nutrient loses occurred during production from high lysine corn using an improved method [15]. Similarly, the protein content of ogi was increased by the blends of cashew nuts, African locust bean and sesame oil meals [13]. However, the present work aims at fortifying ogi meal with powdered unfermented locust bean at different substitution levels and determining the amino acid profile of the substituted meals

II. Material And Method

Diseased free dry maize (white variety) grains and raw unfermented locust beans were purchased from Sayedero, a local market in Ilaro, Yewa south local government area, Ogun state, Nigeria and transported in jute sacs to the laboratories of department of Food Technology, Federal Polytechnic, Ilaro, Ogun state Nigeria for subsequent preparation and analyses.

Preparation Of Ogi From Maize Grains.

Ogi (maize meal) was produce using the method described by [16]. Maize grains were soaked in potable warm water for 48 hours to soften the kernel and loosen the endosperm. The soft grains were then milled using attrition milling machine. The slurry obtained after milling operation was allowed to pass though sieves and the suspension was left to stand for 1 hour for the ogi to settle. The supernatant was decanted, and the ogi collected was dried in a cabinet dryer at 100^0C for 1 hour, allowed to cool and milled into fine powder.

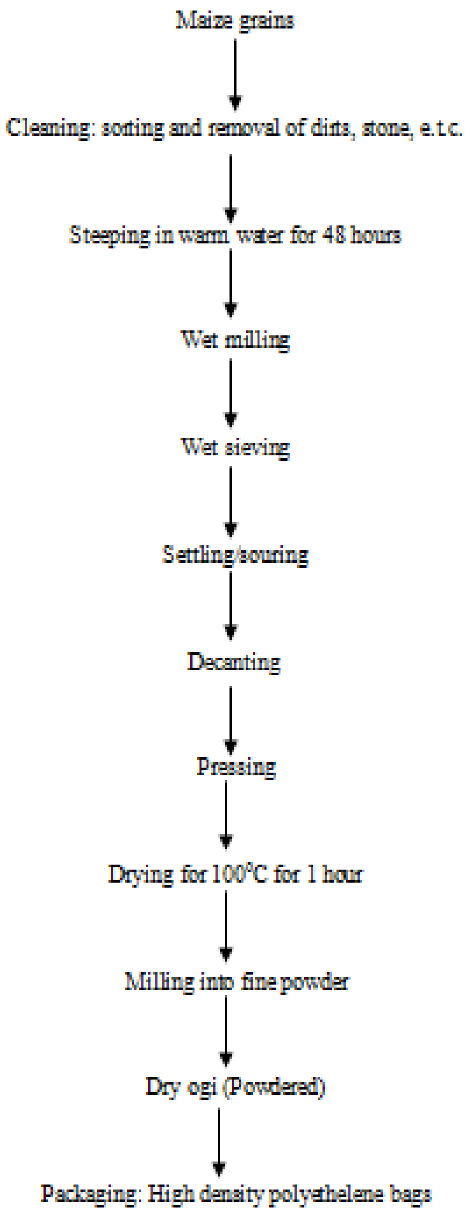

Fig1: Flow chart of the production of ogi powder.

Preparation Of Powdered Unfermented Locust Bean

Diseased free raw African locust beans were boiled for 12 hours to soften the firmly attached seed coats and further soaked in the boiling water for another 12 hours. Excess water was drained of and the seeds were dehulled by slightly pounding the seed with a large wooden mortar and pestle. Further removal of the seed coat was achieved by rubbing the cotyledons between the palms of the hand and washing with clean water. The cotyledons were then soaked for another 6 hours, the hot water was drained off and the cotyledons were then dried in a cabinet dryer, cooled, milled using milling machine and sieved to produce powdered unfermented locust bean machine and sieved to produce unfermented locust bean powder.

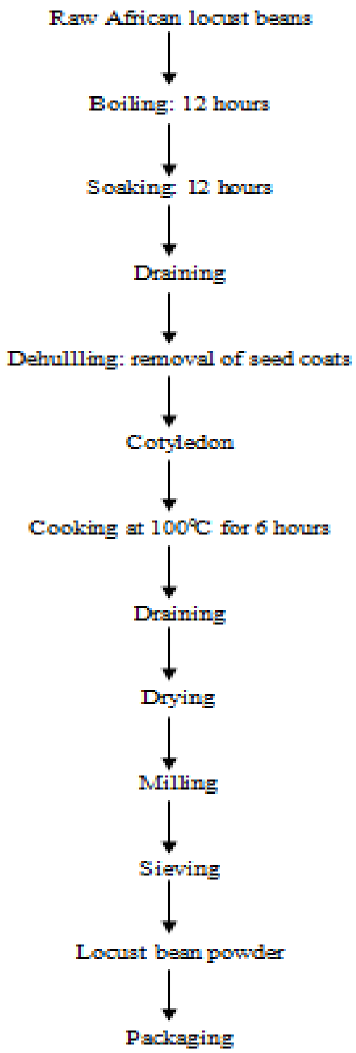

FIg2: flow chart of the production of unfermented locust bean powder

Formulations of different blends of fortified ogi (maize meals with unfermented locust bean powder)
A: 100% powdered ogi + 0% powdered locust bean (control)
B: 90% powdered ogi + 10% powdered locust bean
C: 80% powdered ogi + 20% powered locust bean
D: 70% powdered ogi + 30% powdered locust bean
E: 60% powdered ogi + 30% powdered locust bean

Amino acid analysis.

The amino acid profiling of both control and fortified samples were determined according to the methods described by [14] as reported by [18]. It involved the use of High Performance Liquid Chromatography (HPLC) specifically the Technion TSM (Techno Sequential Multisamples) analyser for amino acid. The samples were dried to constant weight and defatted. A known weight of the defatted sample was hydrolyzed under vacuum with 7ml of 6 N HCL in a sealed pyrex tube at 105^0C for 22 hours. Immediately after cooling, it was diluted with 5ml of acetate buffer (pH 2.0) and 5 to 10µl was loaded into cartridge of Technicom Sequential Multisample Amino acid Analyzer (TSM). The absorbance of the mixture was monitored continuously in a calorimeter, the signals were magnified and traced on two pen recorder using a linear char to develop a chromatograph. The area under the pen was calculated as the concentration of each amino acid. The determinations were done in triplicates.

Statistical analysis: The data generated were subjected to statistical analysis using univariate analysis of variance and significant treatments of means were separated by the Multiple Range Test of Duncan's according to the procedure stated in SPSS Package (SPSS for window 2001) [19].

Table 1. Amino Acid Profiling of Blends of Powdered Ogi with Powdered Unfermented Locust Bean (mg/100g)

	SAMPLES				
PARAMETERS	A	B	C	D	E
Lysine	0.53 ± 0.13^{e}	$47.97^{d} \pm 0.01$	$65.77^{c} \pm 0.09$	$142.87^{b} \pm 0.05$	$190 \pm .40^{a} \pm 0.08$
Histidine	$0.28^{e} \pm 0.01$	$14.59^{d} \pm 0.03$	$29.07^{c} \pm 0.05$	$43.30^{b} \pm 0.23$	$57.65^{c} \pm 0.00$
Arginine	$0.67^{e} \pm 0.01$	$31.88^{d} \pm 0.09$	63.00 ± 0.00	$94.40^{b} \pm 0.14$	$125.42^{a} \pm 0.14$
Aspartic acid	1.12 ± 0.02^{e}	$77.37^{b} \pm 0.10$	$153.40^{e} \pm 0.00$	$229.48^{b} \pm 0.14$	$125.42^{a} \pm 0.14$
Threonine	$2.13^{e} \pm 0.10$	$24.93^{d} \pm 0.02$	$49.90^{e} \pm 0.00$	$70.85^{b} \pm 0.04$	$93.90^{a} \pm 0.10$
Serine	$0.73 \pm 0.0.02^{e}$	$33.75^{d} \pm 0.04$	$66.80^{c} \pm 0.00$	$99.90^{b} \pm 0.00$	$132.92^{c} \pm 0.23$
Glutamic acid	5.70 ± 0.00^{e}	$138.08^{d} \pm 0.44$	$269.57^{c} \pm 0.05$	$401.50^{b} \pm 0.00$	$533.92^{a} \pm 0.01$
Proline	$0.73^{e} \pm 0.02$	$93.25^{d} \pm 0.11$	$184.28^{c} \pm 0.93$	$278.13^{b} \pm 0.09$	$370.43^{a} \pm 0.02$
Glysine	$0.46^{e} \pm 0.01$	$39.80^{d} \pm 0.01$	$73.80^{c} \pm 3.75$	$118.30^{b} \pm 0.06$	$157.79^{a} \pm 0.01$
Alanine	$0.80^{e} \pm 0.01$	$36.38^{d} \pm 0.01$	$71.90^{c} \pm 0.02$	$107.40^{b} \pm 0.06$	$143.40^{a} \pm 0.33$
Cystine	$0.72^{e} \pm 0.02$	$10.64^{d} \pm 0.01$	$20.60^{c} \pm 0.00$	$30.57^{b} \pm 0.01$	$65.3^{a} \pm 0.10$
Valine	0.85 ± 0.10^{c}	$57.63^{d} \pm 0.02$	$114.45^{c} \pm 0.04$	171.28 ± 0.02^{b}	$228.27^{a} \pm 0.33$
Methionine	$0.91^{e} \pm 0.01$	$7.10^{d} \pm 0.00$	$13.20^{c} \pm 0.00$	$25.62^{b} \pm 0.02$	$37.50^{a} \pm 0.09$
Isoleucine	$2.53^{e} \pm 0.00$	$22.32^{d} \pm 0.02$	$42.00^{c} \pm 0.00$	$61.80^{b} \pm 0.00$	$95.33^{a} \pm 0.09$
Leucine	$1.20^{e} \pm 0.01$	$8.72^{d} \pm 0.05$	$16.27^{c} \pm 0.02$	$25.93^{b} \pm 0.13$	$46.50^{a} \pm 0.00$
Tyrosine	$0.45^{e} \pm 0.01$	$38.52^{d} \pm 0.02$	$76.58^{c} \pm 0.08$	$114.73^{b} \pm 0.09$	$139.59^{a} \pm 9.41$
Phenylalanine	$35.1^{e} \pm 0.01$	$46.40^{d} \pm 0.08$	$89.10^{e} \pm 0.08$	$131.90^{b} \pm 0.00$	$174.70^{a} \pm 0.00$
Tryptophan	0.15 ± 0.06^{d}	$3.20^{d} \pm 0.00$	$6.13^{c} \pm 0.05$	$9.50^{b} \pm 0.00$	11.2 ± 0.02

Means ± standard deviation of triplicate determinations.
Values with different superscript in the same raw are significant different ($P < 0.05$)
Note
A= 100% powdered ogi, B = 90% powdered ogi + 10% unfermented powdered locust bean, C=80% powdered ogi + 20% unfermented powered locust bean, D= 70% powdered ogi + 30% unfermented powdered locust bean, E= 60% powdered ogi + 40% unfermented powdered locust bean.

III. Discussion

The results of the amino acid determinations are as shown in Table 1. A total number of eighteen (18) amino acids were detectable in the samples during analyses. Lysine, an essential amino acid lacking in cereals such as maize ranged from 0.53mg/100g-190mg/100g in all samples. It was observed that 100% powdered ogi (maize meal) had the least lysine content of 0.53mg/100g. Also, another essential amino acid lacking in maize, tryptophan ranged from 0.15mg/100g-11.2mg/100g for all the samples under investigation. When considered as a whole, the protein in maize is still low in lysine, very low in tryptophan, bus reasonably fair in sulphur constraining amino acids [1]. There was progressive increase in the amount of both lysine and tryptophan as the level of substitution of the powdered ogi with powdered unfermented locust bean. Of all the amino acids determined, glutamine had the highest values and varied between 5.70mg/100g (control) to 533.00mg/100g (60%:40% substitution). Maize grains are excessively high in aromatic amino acids [1].

Notable amino acids with high values as seen in the table are Arginine (125.42mg/100g), Aspartic acid (305.70mg/100g), Serine (132.92mg/100g), Proline (370.43mg/100g), Glycine (157.29mg/100g), Alanine (143.40mg/100g), Valine (228.27mg/100g) Thyrosine (139.59mg/100g); Phenylalanine (174.70mg/100g). These high contents of amino acids occurred at 60%:40% fortification. Other amino acids such as Histidine ranged from 0.28mg/100g – 57.65mg/100g, Threonine varied between 2.13mg/100g-93.90mg/100g, Cystine ranged from 0.72mg/100g to 65.30mg/100, Methionine ranged from 0.91mg/100g to 37.50mg/100g, Isoleucine varied between 2.53mg/100g – 95.33mg/100g while leusine ranged from 1.20mg/100g-46.50mg/100g. Fortification of maize with powdered unfermented locust bean increased the protein content as well as protein quality essentially lacking in cereals grains (essential amino acid profile.) [20].

The results obtained are in agreement with a precious work [21] who reported that fortification of wheat flour (cereals) with soy protein increased protein quality by improving amino acid profile. Most cereals are also low in essential minerals such as calcium, potassium, iron and zinc, and blending with legumes rich in proteins and essential amino acids has been previously reported [22]. However, he general trends as shown in the research work revealed that increasing levels of powdered unfermented locust bean in the blends led to increasing the amount of amino acids present.

IV. Conclusion

This study has revealed that the use of powdered unfermented locust bean as fortifying agent in ogi (maize meal) improved the quantity and quality of protein in cereal based food thereby increasing the corresponding essential and non essential amino acid in the various blends at different substitution level. Therefore, fortification of ogi with powdered unfermented locust bean increases the biological value of ogi and will reduce over dependence on animal protein since legumes offers a cheap source of protein for the teeming and poor populace who could not afford the cost of animal protein.

References

[1]. I Ihekoronye and P.O Ngoddy, Integrated Food Science and Technology for the Tropics. Vol 1 Macmillian Publishes London (1985): 236-244.

[2]. S.H Abiose and A.V Ikujenlola, Comparison of Chemical Composition, Functional Preparation and Amino Acids Composition of Quality Protein Maize and Common maize. (Zea may L). African Journal of Food Science and Technology 5 (3), 20014:81-89.

[3]. B. Zhang, D. Cuil, M. Liu, H.Gong, Y. Haung and F.Han, Corn Porous Starch: Preparation , Characterization and adsorption property international journal of Biology macromolecules 50:2012:250-256.

[4]. P.R Warman and K.A Havard, Yield, vitamin, mineral contents fo Organicelly converntionally grown potatoes sweet corn. Agric, Ecosystem, Environment 68:1998:207-216.

[5]. P.T.S. Pandya and R. Srinivasan, effect of H using super critical ammer Mill Retention Screen Size on Fiber Separation from Corn Flour Using the Elusieve Process, Indus crop Production 35:2012:37-43

[6]. L.M Comin, F. Temelli and M.D.A Saldana, Impregnation of Flour Oil in Pregelationized corn starch using super critical Co_2. Journal of supercritical fluids, 61:2012

[7]. A.V. Ikuojenlola and J.B Fashakin, The Pysico-Chemical Properties of a Complementary Diet Prepared from Vegetable Protein, Journal of Food, Agric. Environ, Finland, 3(3): 2005:23-26.

[8]. W,W. Mburu, N.K Gikonyo, G.M Kenji and A.M Mwasaru, Nutritional and Functional properties of a complementary Food Science on Kenyan Amaranth Grain (Amaranthus Cruetus), African. J. Food, Agric Nutri. Dev, 12(2): 2012:5959-5977.

[9]. B.P Lamsal, H Wang and L.A Johnson, Effect of Corn preparation Method on Dry-grind Ethanol Production by Gronnlas Starch Hydrolysis and Partitioning of Spent Beer Solid Bioresource Technology 102:2011:6680-6686.

[10]. A. Hang, O.A Christophersen, J.Linabo, W Kaunda and L.O Eik, Use of Dried Kapenta (Limnothrisse Mioden and Stolothrissa Tanganicea) and other product based on whole for Complementing Maize Based diets. African Journal of Food Science, Agriculture, Nutrition and Development 10:2010:2478-2500.

[11]. S.S. Akoja, Effect of Addition of cocoyam leaf shot (Colocasia Esculenta) on Some Properties of Local Maize Snack (Kokoro), IOSR Journal of Environment Science, Toxicology and Food Technology (IOSR JESTFT), 10 (12): 2016: 26-30

[12]. T.E. Ekpenyong, B.L Fetuga and V.A. Oyenuga, Fortification of Maize Flour Based Diets with Blends of Cashew nut Meal, African Locust Bean Meal and Sesame and Sasame oil Meal, J. Food Agric; 281977:710-716.

[13]. E.O.I. Banigo, J.M. Demand and C.L. Duitschever, Utilization of High-lysine corn for the Manufacture of Ogi using a new improved processing method, cereal chem.. 51:1974:559-572.

[14]. E.O.I. Banigo and H.G. Muller, Manufacture of Ogi (A Nigerian Fermented Porridge): Comparative Evaluation of Corn, Sorghum and Millet, 5:1972:17-221.

[15]. G. Campbel-Platt, African Locust Bean (Parkia Species) and Its West African Fermented Food Products, Dawadawa, Ecol. Food Nutr 9:1980:123-132

[16]. J.O. Akingbala, B.A. Akinwale and P.I Uzo- Peter, Effects of Colour and Flour Chang on Acceptability of Ogi Supplemented with Okra Seed Meal, Plant Food Hum. Nuti, 58:2002:1-9.

[17]. D.D. Spackman, E.H. Stein and S.ore, Automatic Recording Apparatus for the Use in the Chromatography of Amino Acids. Analytical Chem. 30:1958:191-195.

[18]. B.I. Kaga, S.A. Abdullahi and N.D. Dynek, Proximate Composition and Amino Acid Profile of Two Vrnetyes of Beniseed (Sesamum Indium and Sasamum Radiation) J.Agric. Technol, 10(2) 2002:6-10.

[19]. SPSS for Windows, Statistical Package for Social Sciences, 11th Eds Lead Technologies Inc, 2001.

[20]. A.M. Awada Ikareem, A.I. Mustafa and A.H. Eltinay, Protein Mineral Content and Amino Acid Profile of Sorghum Flour as Influenced by soybean Protein concentrate supplementation, Pakistan Journal of Nutritional 7(3):2008:475-479.

[21]. A.L. Stark, L.D. Satterlaee and J.G. Kendenick, Computer Blends and Laboratory Evaluation of Added protein for Specific Function Properties, Food Product Dev. 9:1975:38-42.

[22]. T.I. Mbata, M.J. Ikenebomen and I.Akonkhai, Nutirional Status of Maize Fermented meal by Fortification with Bambara Afri. J Food Agric Nutri. Dev. 7(2): 2007: 1-14.

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