Scholarly Journal of Agricultural Science Vol. 4(4), pp. 213-217 April, 2014
Available online at http:// www.scholarly-journals.com/SJAS
ISSN 2276-7118 © 2014 Scholarly-Journals

Full Length Research Paper

Dietary Fortification of Ogi (Maize slurry) with Okra seed flour and its Nutritional value

[1]Akinrinola Aderonke, [1]Adejimi Moronkeji, [2]Idabor Vivian, [3]Oliseh Chinwe, [2]Sanni Rotimi, [4]Oshagbemi Henry, and [*4]Oyefuga Olalekan

[1]Food and Agricultural Biotechnology unit, South-west Bioresources Development Centre, National Biotechnology Development Agency, Owode-Ogun State, Nigeria.
[2]Environmental Biotechnology unit, South-west Bioresources Development Centre, National Biotechnology Development Agency, Owode-Ogun State, Nigeria.
[3]Molecular Biology/Bioinformatics Unit, Bioresources Development Centre, National Biotechnology Development Agency, Owode, Nigeria.
[4]Medical Biotechnology/ Centre DirectorSouth-west Bioresources Development Centre,National Biotechnology Development Agency, Owode-Ogun State, Nigeria.
[5]Medical Biotechnology /Bioinformatics Unit, National Biotechnology Development Agency, Lugbe-Abuja, Nigeria.

Accepted 1 April, 2014

Ogi is fermented cereal porridge from West Africa, typically made from maize, sorghum, or millet. Traditionally, the grains are soaked in water for up to three days, before wet milling and sieving to remove husks. The filtered cereal is then allowed to ferment for up to three days until sour. It is then boiled into a pap, or cooked to make a stiff porridge. The fermentation of *ogi* is performed by various lactic acid bacteria including *Lactobacillus* spp, and various yeasts including *Saccharomyces* and *Candida* spp. However, this requisite fermentation also erode the meal of its nutritive values, thus need arise for complementary natural fortification whose accessibility and affordability would be close to that of maize. The utilization of okra seed as a constituent of maize – "ogi" was investigated by preparing a mixture of 'ogi' with increasing level of okra seed power (between 25% and 75%).The sorted and cleaned okra seed was dry milled to powdery form. The maize was wet milled, fermented, decanted and the fresh 'ogi' was dried at 60^0Cfor 24hrs and milled into powdery form. The okra seed powder was included at different ratio into 'ogi' powder (25% : 75%), (50% : 50%) and (75% : 25%) to make maize – okra 'ogi' while plain ogi (100% maize ogi) and dry skimmed milk were served as controls. Each sample was subjected to proximate and physiochemical analyses and nutritional evaluations. For the rat feeding study, fifteen albino rats were divided into five groups of three rats each.Three of the five groups were fed the experimental diets while 1st and last group of rat were fed with control diets.The data showed an increase in protein, fat, moisture content and ash content but decreased in carbohydrate. The physiochemical analysis indicated decrease in pH, titratable acidity and water absorption capacity while minerals component (iron, calcium, potassium) increased as okra seed powder substitution increasing. The amylograph pasting viscosity revealed that the pasting characteristic of maize-okra 'ogi' were significant different from the 100% maize ogi. The Nutritional evaluation showed that the rats fed with casein and those fed 25% maize plus 75% okra seed powder gained significantly more weight than the rats fed on 100% maize ogi, 75% maize ogi plus 25% okra seed and 50% maize ogi plus 50% okra seed powder respectively.

Key words: Maize-okra 'ogi', amylography pasting, physio-chemical properties, nutritional evaluation, casein, fortification.

INTRODUCTION

In developing countries, despite the many efforts to ensure food security and food self-sufficiency, malnutrition is still a major problem in many African countries, Nigeria inclusive and it affects young children

more than other members of the society. Intake of calories and protein is estimated at 1.964kcal and 46.7g per day in Nigeria, this falls shorts the 2,19kcal and 53g of protein recommended. It is estimated that 200 million children under age 5 years are chronically malnourished and are locked early in a pattern of ill-health and poor development, thus contributing to more than half the death (about 12 million) of children under age 5 every year in developing countries (UNICEF, 1998).In Nigeria, the number of malnourished children is forecast to increase by more than 30% to reach 40 to 45 million by 2020 (WHO, 1997; Pinstrup-Adersen et al.., 1999).As a baby grows older, the demand for nutrient increases and the breast milk alone becomes insufficient. Usually about this age (from 4 months) many mothers begin the introduction of other foods. Commonly, it is inform of a watery porridge made from the staples while breast-feeding is progressively reduced. The process of getting a baby used to the thin, watery porridge and other semi-solid food is known as weaning, and in many societies, it is an integral part of the child-rearing practices. The weaning food such as 'ogi' is a traditional fermented starchy food processed from wet milling of maize, sorghum or millet grains in many parts of West Africa and it is used extensively as a weaning food, breakfast cereal and even lunch and dinner when made into a very stiff paste called "eko" (Banigo and Akpapunam 1987).

Studies by Banigo and Muller, 1972 have indicated that the thin, watering porridge has very little nutritive value and the nutritional losses have been reported in the wet milling method of preparing 'ogi'.Owning to this loss, 'ogi' porridge has been implicated in the high incidence of protein-energy malnutrition (PEM), a major cause of infant mortality in Nigeria.In reducing this, many attempts have been made at improving the nutrients particularly protein.Such attempts include fortification of 'ogi' with vitamin & growth factors, supplementation with sources of protein such as legumes (soybean).It also includes co-fermentation with some fruits like pawpaw (Akinrele and Edward, 1971).Due to the low level of proteins in 'ogi', it can be supplemented with other foods which have high level of protein, such as okra seed.

Okra (Hibiscus esculentus) is of African origin and is easy to cultivate and grows well in both tropical and temperate zones (Tindall, 1968). Okra has been to be a potential source of protein and oil, which makes it useful as complimentary food (Karakoltisidis and Constantinides, 1975). Previous studies revealed that high protein meal remained after oil extraction of okra seeds, similar to that of cotton seed meal (Oyenuga, 1968). Present research studies the proximate, mineral composition, physiochemical properties and nutritional evaluation of maize-okra ogi produced from blends of ogi powder and okra seed powder.

*Corresponding author. E-mail:oyefug@yahoo.com.

MATERIALS AND METHODS

The NH47-4 variety of okra seed was purchased from NIHORT, Ibadan; the yellow maize grain was purchased from a local market, Bodija in Ibadan, Nigeria.

Preliminary operation such as cleaning and sorting were carried out to remove extraneous materials from yellow maize and okra seed respectively. Cleaned & sorted maize was steeped in tap water (1:2w/v) for 72 hrs. After decanting the steeping water, the maize was milled in a local sieve (1mm).The through were left to sediment for 12 hrs before decanting the water. The fresh 'ogi' was dried at 60^0C for 24hrs and milled; the sorted okra seed was dry milled using a premier mill to give okra powder. The okra seed powder was mixed with maize ogi powder at different ratio (25% : 75%), (50%:50%) and (75%:25%).100% maize ogi and skimmed milk were served as control diet. Fifteen albino rats (male and female) weighing 50 and 55g were grouped into 5 groups; so that the average weight difference per group did not exceed 5g. The group contained three animals each housed in individual metabolic cages and water and food were supplied to them.

The diets were fed to the animals for a period of 28days.Each sample was subjected to chemical and nutritional evaluations.

Chemical analysis: Proximate composition and titratable acidity were determined according to AOAC (1984). Minerals composition were determined using both atomic absorption spectrometry (11TA 1979) and colorimetry. pH was determined using glass electrode pH meter.

Pasting Viscosity: Pasting viscosity was determined using Brabender Amylograph.

Nutritional evaluation: The animals were evaluated nutritionally using protein efficiency ratio (PER) and Net protein retention (NPR) formulas (Pellet and young, 1980; Phillips et al. 1981)

RESULTS AND DISCUSSION

Table 1 shows the proximate composition of maize-okra 'ogi' powder. The percentage carbohydrate of the fortified ogi decreased as the amount of okra seed powder increased.The protein content increased with substitution level from 5-62% at no inclusion of okra seed flour to 11.3% when okra seed flour was included at 75%.Indicating about 50% increase. Karakottisides and Constantinides (1995) had earlier reported that utilization of okra seeds has a great prospect because of its high protein. The percentage fat, ash and moisture content also increased as the inclusion of okra seed powder increased. The increase in the ash content was expected

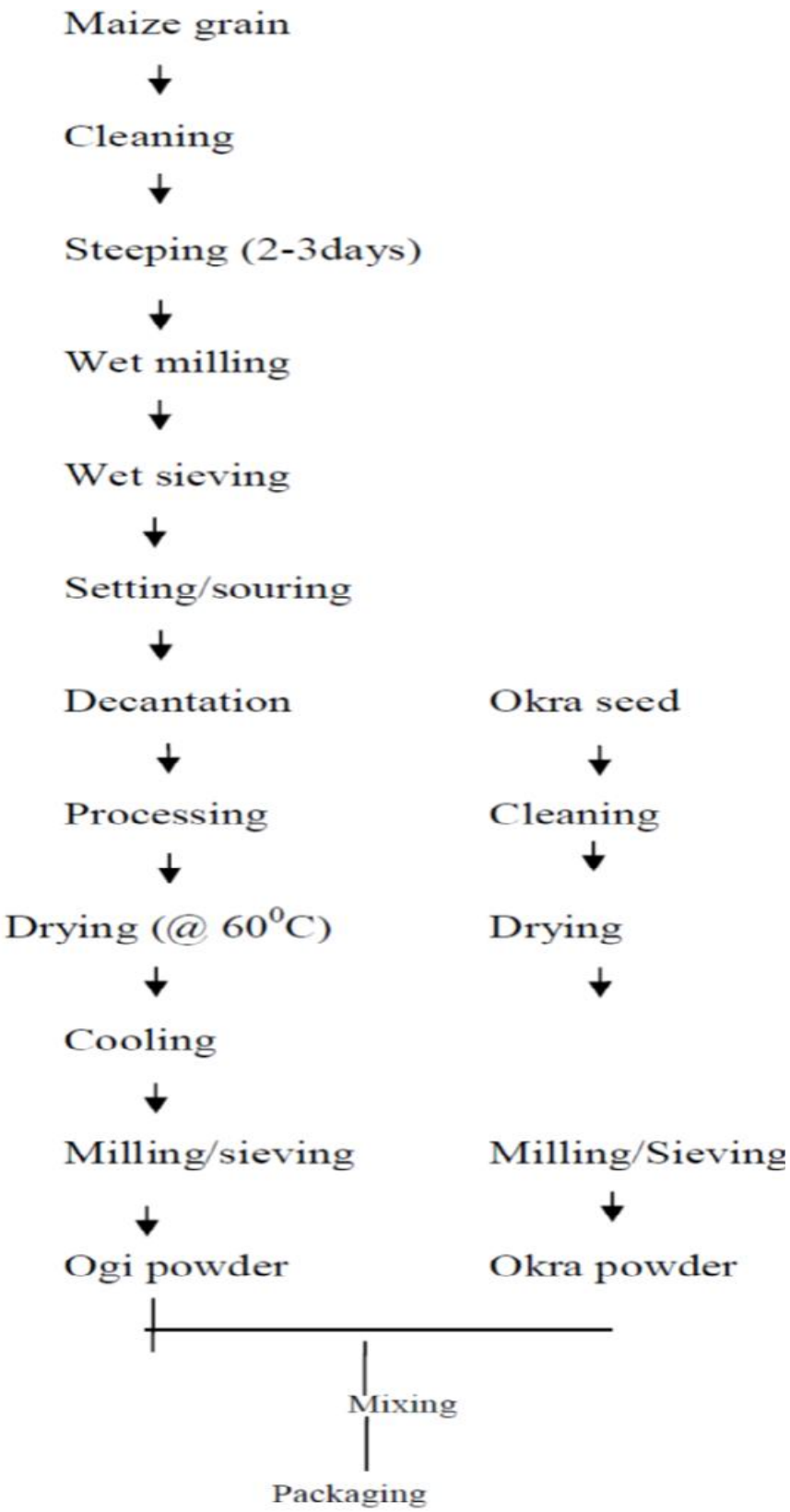

Figure 1: Processing of maize–okra Ogi

Table 1: Chemical composition of fortified ogi with okra seed

Sample	Moisture%	% protein	% fat	% Ash	% CHO	Fe(mg)	Ca(mg)	K(mg)	P(mg)
100% maize ogi	12.5	5.62	1.5	0.10	80.28	0.65	37.0	0.76	5.55
75% maize ogi+ 25% okra seed powder	13.2	7.82	1.35	0.79	76.84	1.25	28.8	0.87	7.12
50% maize ogi + 50% okra seed powder	13.95	9.30	1.61	1.40	73.74	1.39	129.0	127.5	8.62
25% maize ogi + 75% okra seed powder	14.20	11.3	1.92	1.81	70.77	1.48	146.5	147.5	8.77

Table 2: Physiochemical composition of ogi powder fortified with okra seed powder (maize – okra ogi).

	100% maize ogi	75% + maize 25% okra	50% + 50%	25% maize ogi flour + 75% okra seed flour
Water absorption capacity (ml)	92.01	66.31	48.01	32.01
PH	6.7	7.8	5.3	3.2
Titratable Acidity (mg NaoH (O.1M)	5.06	4.32	4.10	3.96

Table 3: Biological Evaluation of Protein Quality of Fortified Ogi-Okra Flour

Group	Mean initial weight(g)	Mean final Weight (g)	Mean weight gain	Mean protein intake	Protein efficiency ratio	Net protein retention
Group 1 Control (ogi flour	51.7	61.6	9.9	5.62	1.76	3.54
Group 2 75% maize-ogi+ 25% okra seed powder	55	76.6	21.6	7.82	2.76	4.04
Group 3 50%maize- ogi + 50% okra seed powder	55	83.3	28.3	9.30	3.04	4.12
Group 4 25%maize-ogi 75% okra seed powder	51.7	96.7	45	11.3	3.98	4.86
Group 5 Skimmed milk Casein grow	55	186.7	131.7	32.1	4.10	4.41

since one of the most important contributions of okra tohuman is the provision of mineral. The moisture content was found to increase from 12.5% to 14.20%.At this moisture range, the samples might keep for at least 3 months if properly stored. The fat content of fortified ogi was also increased as okra seed powder increased from 1.5% to 1.92%. The mineral contents (iron, calcium, potassium & phosphorus) of all the maize-okra ogi were increased significantly with increasing proportion of okra seed powder. This is confirming earlier reports that the wet milling sieving processes of ogi manufacture lead to loss of nutrients especially the minerals (Akinrele, 1966; Akingbala et al, 1981; Adeyemi et al; 1987).Table 2 shows the pH, titratable acidity and water absorption of fortified ‘ogi’. As okra seed flour is increasing, the pH, titratable acidity and water absorption were found decreasing.

Amylograph pasting viscosity data of the samples are shown in table 3.The peak viscosity (vp) ranged from 60 B. U and 212 B. U., indicating that with increasing proportion of okra seed powder, it was found that the swelling property of ‘ogi’ sample were significantly altered. The amylograph peak viscosity has been indicated to reflect the level of raw starch in ‘ogi’ (Bamgo et al., 1974).From table 3, it was found that pasting characteristic of maize-okra ‘ogi’ are significantly

Table 4: Amylography pasting characteristics of Ogi flour Fortified with okra seed flour

Samples	Tp (^{0}C)	Mg (min)	TVP (^{0}C)	Vp (B.U)	Mn (min)	Vr (B.U)	Ve (B.U)	M_n-M_g (B.U)	V_p-V_r (B.U)	V_e-V_p (B.U)	V_e-V_r (B.U)
100% Maize ogi	74	23	88	212	27	150	290	4	62	82	140
75% maize ogi + 25% okra seed	76	25	84	170	29	110	230	4	60	60	120
50% maize ogi + 50% okra seed	78	28	80	95	30	40	153	2	55	58	113
25% maize ogi + 75% okra seed	86	35	74	60	36	10	110	1	50	50	100

different from the normal 'ogi'.

Table 4 shows data on nutritional evaluation of protein quality of fortified maize ogi' with okra seed powder (experimental diet) and "ogi" and dry skim milk powder (control diets).The skimmed milk and 75% okra seed flour group's animal gained significantly more weight than the animals fed mainly on 'ogi', 25% and 50% okra seed flour substitution respectively. All these facts level the possibility of the use of okra seeds as a protein source. Okra protein appeared to be equal to the casein with respect to inducing growth to the animal.

CONCLUSION

Okra seed, like other vegetable is not accorded the importance it deserves in the diet of Nigerians, probably because of ignorance of its nutritive value and its sliming nature. This case study has thrown some light on the possible utilization of okra seed as a constituent of a weaning and adult food (ogi). The finding from this study revealed that fortifying maize-'ogi' with okra seed powder can be used to improve the nutrient composition of the 'ogi'. Equally, further study is needed that would determine the microbial loads and toxicity to certify the safety of the product.

REFERENCES

A.O.A.C (1984).Official Methods of Analysis.10th Edition of the Association of Official Analytical Chemists. Washington DC.

A.O.A.C (1990).Official Methods of Analysis.15th Edition of the Association of Official Analytical Chemists.AOAC Press, Gaithersburg, USA.

A.O.A.C (1995).Official Methods of Analysis.11th Edition of the Association of Official Agricultural Chemists. Washington DC.

Adeyemi, I.A., Osunsami, A.T. and Fakorede, M.A.B. (1987).Effect of Corn Varieties on Ogi Quality. J. of food Sci. 152:322-324.

Akingbala, J.O, Rooney, L.W. and Fanbion, J.M. (1981).A Laboratory Procedure for the preparation of Ogi; A Nigerian Fermented Food. J. of Food Sci. 46:1523-1526.

Akinrele, I.A and Edward, C.C.A. (1971).An assessment of the nutritive value of a maize-soya mixture "soy-ogi" as a weaning food in Nigeria. Br. J. Nutri.

Akinrele, I.A. (1966). A Biochemical study of the Traditional Methods of Preparation of ogi' and it effect on the nutritive value of corn. Ph.D Thesis, University of Ibadan, Nigeria.

Atinmo, T. (1983).Food Problem and Nutrition Situation in Nigeria. Nutrition and Food Policy in Nigeria(Atinmo, T. and Akinyele, L.). National Institute of Policy and Strategy Studies.pp.1-25.

Banigo, E.O.I, DeMan, J.M. and Duitis, C.C.L. (1974). Utilization of high –lysine corn for the manufacture of Ogi using a new improved processing system. Cereal Chemistry, 51:559-592.

Banigo,E.O.I and Muller, H.G. (1972). Carboxy acid Patterns in Ogi Fermentation. J. Sci. Food Agric. 23: 101-11 1.

Karakoltisidis, P.A and Constantinides, S.M. (1995). A New Source of Protein: The Okra Seed.4th International Congress of Food Science and Technology: pp.7-10.

Oyenuga, V.A. (1968). Nigeria Food and Feeding stuff. Their Chemistry and Nutritive value. Ibadan, University Press.

Pinstrup–Andersen, P.R, Pandya, L and Rosegrant, M. (1999). World Food Prospect: Critical issues for the early Twenty –First Century.2020 Vision Food Policy Report. Washington D.C. International Food Policy Research Institute.

World Health Organization(WHO) (1997). WHO Global Database on Child Growth and Malnutrition, Program of Nutrition, WHO Document NO: WHO/NUT/97.4 Geneva, Switzerland. World Health Organization.