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Research Article

Proximate composition and sensory properties of fermented sorghum and full fat soy flour blends for "*ogi*" production

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Abstract

Composite flours containing 100:0, 85:15, 80:20 and 70:30 fermented sorghum and full fat soy flours, respectively were prepared. The effect of the soy flour supplementation on the proximate composition of the blends was evaluated. "*Ogi*", a sorghum based fermented food product produced from the blends and the control (all sorghum flour) were subjected to sensory evaluation. All data were statistically analyzed and significance difference was determined at 5% probability level. The result on proximate composition shows that the blends had higher protein contents (16.34, 20.42 and 20.56%) than the 100% fermented sorghum flour used as control (8.92%). There were corresponding increases in the fat, ash and fibre contents of the blends while carbohydrate content of the blends decreases with increased level of soy flour. The sensory evaluation result shows that "*ogi*" produced from sample A (control) was not significantly different ($P > 0.05$) from those produced from sample B and C in terms of appearance and mouth feel. No statistical differences were found for aroma, taste and overall acceptability among the "*ogi*" products ($P>0.05$). The blends containing 15 and 20% full fat soy flour were found to have the best potential for "*ogi*" production.

Keywords: Proximate composition, Composite flour, Ogi, Sensory evaluation

INTRODUCTION

"Ogi" is a locally prepared semi-solid food from fermented cereal (sorghum, maize and millet) in many African countries including Nigeria (Adegbehingbe, 2013). In Nigeria it is called Akamu in Igbo, Ogi in Yoruba, and Koko in Hausa. It is highly energy dense and also a good lactose stimulant for nursing mothers (Sengev & Nwobi, 2016).

In Nigeria the usual first complementary or weaning food is "ogi". Apart from supplementing infant feeding, "ogi" can also be consumed as breakfast meal by many adult in Nigeria and is also regarded as food of choice for the sick (Adegbehingbe, 2013). "*Ogi*" is therefore an important food product in Nigeria as it is consumed by all categories of person. However, it is worthy to note that ogi produced from cereals is inherently deficient in nutrients, especially protein and cannot guarantee adequate supply of nutrients (Femi et al., 2015). Such deficiencies may result in protein malnutrition among consumers of "ogi" particularly the young children who are fed with the product as weaning food. "Ogi" has been reported as contributing to the prevalence of kwashiorkor among infants owing to its high energy density and reduced proteins (Ihokoronye & Ngoddy, 1985).

The major drawback of "ogi" which has drawn the attention of researchers is its poor nutritional composition (Ajanaku et al., 2013), also, being an extract of wet soluble carbohydrate (starch extract) from cereal grains, it is characterized with short shelf life and high transportation cost because of its high moisture content. Malnutrition associated with over-consumption of high energy dense complementary foods such as "ogi" is an area requiring continuous

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intervention through fortification, supplementation, dietary diversification, nutrition education etc. which if not addressed especially during the critical period of infancy, could lead to irreversible adverse effect on their health and quality of life.

Soybean (Glycine max) is one of the most important food plants of the world which in recent times have been receiving increasing research attention owing to the discovery of health benefits associated with it and its products as human food (Lokuruka, 2011) and the increasing awareness of the nutritional value of soybeans couple with shortage or non existence of animal protein in many areas of the world (Jenkins et al., 2010). Protein and lipids, some vitamins and minerals, are the major nutritionally important components of soybeans (Okwute & Olafiaji, 2013).

There is little information on "ogi" enriched with soybean and no study investigated the quality of "*ogi*" produced from fermented sorghum and soybean flour blends. In the present study, factors such as proximate and sensory properties of fermented sorghum and soybean flour blend for the production of "*ogi*" was investigated so that the potentials of the blend can be establish.

MATERIALS AND METHODS

Raw material procurement

The soybean and sorghum seeds were obtained from Gboko market in Benue State. Portable water was strictly used throughout the experiment.

Preparation of Raw Materials

Preparation of fermented sorghum flour

The fermented sorghum flour was prepared by the wet milling process as described by (Ikya et al., 2013) with slight modification. The sorghum grains were cleaned to remove broken grains and foreign objects. The grains were boiled in water (1:2 w/v) at 100 ± 2ºC for 2 min. The boiled grains were wet milled in a commercial sorghum mill and filtered through cheese cloth with excess water. The slurry obtained was left to sediment and ferment for 3 days at room temperature (27 ± 2ºC). The water was decanted and the paste obtained was dried in the oven at 40ºC (2 days). The dried paste was milled into flour in a sorghum mill (model corona- 2N, England). The flour was sieved (45 µm) and sealed in polyethylene bags (55 µm thick). It was then stored in a refrigerator at 4ºC until it was used (Bristone et al., 2016).

Preparation of soy flour

The soybean flour was prepared according to the method described by (Amadou et al., 2009). The procured soybean seeds were thoroughly washed to remove dirt and other extraneous materials such as sands, sticks, leaves and debris. They were then soaked in water at room temperature overnight. After decanting the water, soybeans were cooked in an autoclave (121°C, 15 min) and then cooled and dried. Soybeans were then milled into fine flour using milling machine (hammer mill, model EU 5000D) and sieved through 45 µm mesh size sieve. The flour was then sealed in polyethylene bags and stored in refrigerator (4°C) until it was used.

Blend Formulation

Three different blends were formulated based on fermented sorghum and full fat soybean flours in the ratios of 100:0, 85:15, 80:20 and 70:30, respectively as shown in (**Table 1).**

Proximate Analysis

The proximate analysis (moisture, ash, protein, fat, and crude fibre) of the fermented sorghum flour and the blends was determined by the official methods of AOAC 2005): The moisture content by oven drying method; ash content by muffle furnace ignition method; protein content by macro kjeldah method; fat content by soxhlet solvent extraction method. The carbohydrate content was determined by difference method as described by (Olagunju, 2013).

Sensory Evaluation

The fermented sorghum flour and the blends were processed into "Ogi" (a semi-solid and served to a 15-member panel comprising of students and nursing mothers for evaluation. They tested the samples based on the following attributes; appearance, aroma, taste, mouth feel, and overall acceptability using a 9-point hedonic scale, where 9 indicates extremely like and 1 extremely dislike as described by (Shashank et al., 2015)

Statistical Analysis

A one way Analysis of Variance (ANOVA) was performed on the data obtained to determine significant differences.

Table 1. Blends Formulation.

Samples	Fermented sorghum flour(g)	Full fat soybean flour (g)
A	100	0
B	85	15
C	80	20
D	70	30

While means were separated using Duncan's multiple range test and significance differences was accepted at 5% probability (P<0.05) level of significance. All statistical analyses of data were performed using SPSS (version 20.0) software FAO/WHO (1991).

Results and Discussion

The result of the proximate parameters analyzed for the fermented sorghum-soy flour blends is presented in (**Table 2).** From the result, the moisture content of the samples ranged from 6.82 in sample A to 7.50 in sample D. The moisture content of food gives an indication of its microbial stability and keeping qualities (Dubale, 2014). Therefore, the low moisture content of the blends is an indication of safety and microbial stability. The content of protein, fat, fibre and ash increased with the increase in the level of soy flour in the blends. Conversely, the carbohydrate content of the blends decreased considerably from 76.12% in the 100% sorghum flour to 59.22% in the blend containing 30% soy flour. The protein content of the 100% sorghum flour blend was 8.71% as compared to 16.34, 20.42 and 20.56% for the blends containing 15, 20 and 30% soy flours, respectively. The trend was the same for fat, fibre and ash contents of the blends. This is a reflection of the superior nutritional properties of soybean flour over sorghum flour and it demonstrated their mutual supplementation effect. The moisture, ash, fibre, carbohydrate and protein values compared favourably with the standard of <5, <3, <5, 64 and 13 respectively reported by

The mean sensory scores of the sensory evaluation results and acceptability of the "ogi" samples are presented in **(Table 3)**. From the result, sample A (control) had the highest score of 7.46 and 7.19 for appearance and mouth feel respectively but was not significantly different (P > 0.05) from sample B and C in terms of appearance and mouth feel. However, sample A and D varied significantly (P < 0.05) in their appearance and mouth feel. The appearance was influenced by colour-appeal. Differences in appearance and mouth feel could be due to the relatively high level of soybean flour inclusion (Sengev & Nwobi, 2016).

The aroma, taste and overall acceptability of Sample A (control) did not vary significantly (P > 0.05) from those of sample B, C and D with soybean inclusion. The similarities in aroma, taste and overall acceptability may be attributed to the contribution of the lipid in soybean. It is generally reported that lipids have a positive impact on flavour (Ndife, 2014).

Table 2. Proximate Composition of Fermented Sorghum-Soy Flour Blends.

	Moisture	Crude protein	Fat	Fibre	Ash	CHO
A (100:0)	6.82 ± 0.02	8.71 ± 0.08	4.64 ± 0.30	1.62 ± 0.06	2.09 ± 0.01	76.12 ± 0.01
B (85:15)	6.90 ± 0.03	16.34 ± 0.40	6.69 ± 0.10	1.99 ± 0.05	2.23 ± 0.02	65.85 ± 0.10
C (80:20)	7.23 ± 0.10	20.42 ± 0.05	7.51 ± 0.07	2.12 ± 0.07	2.31 ± 0.02	60.41 ± 0.02
D (70:30)	7.50 ± 0.02	20.56 ± 0.20	7.78 ± 0.05	2.45 ± 0.03	2.49 ± 0.01	59.22 ± 0.02
FAO/WHO	<5	13	10-25	<5	<3	64

Values are means ± standard deviation of duplicate determinations.

KEY:

A (100:0) = 100% sorghum + 0% soy flours

B (85:15) = 85% sorghum + 15% soy flours

C (80:20) = 80% sorghum + 20% soy flours

D (70:30) = 70% sorghum + 30% soy flours

Table 3. Effect of Soybean Inclusion on the Sensory Characteristics of "Ogi".

Samples	Appearance	Aroma	Taste	Mouth feel	Overall acceptability
A(100:0)	7.46^{a}	7.75^{a}	7.43^{a}	7.19^{a}	7.56^{a}
B(85:15)	7.45^{a}	7.61^{a}	7.40^{a}	7.10^{a}	6.91^{a}
C(80:20)	7.36^{a}	7.35^{a}	7.35^{a}	6.95^{ab}	6.86^{a}
D(70:30)	6.31^{b}	7.50^{a}	7.30^{a}	6.30^{b}	6.78^{a}

Values are mean of the scale scores assigned by panelist

Values with same superscript within the same column are not significantly different (P > 0.05).

KEY:

A (100:0) = 100% sorghum + 0% soy flours

B (85:15) = 85% sorghum + 15% soy flours

C (80:20) = 80% sorghum + 20% soy flours

D (70:30) = 70% sorghum + 30% soy flours.

CONCLUSION

The nutritional value of fermented sorghum-soy flour blends for "ogi" production is dependent on the level of soy flour supplementation. Proximate evaluation of the flour blends and sensory evaluation of "ogi" produced from these blends showed an increased nutritive value, stability and a comparative sensory acceptability with respect to the control (all sorghum"ogi"). The sensory data also revealed that all the formulated samples were generally accepted. Soybean flour inclusion therefore imparted positively on the nutritional value of "ogi", making it a good source of nutrients for both weaning infant and adults. The blends containing 15 and 20% full fat soy flour were found to have the best potential for "ogi" production and are therefore recommended.

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