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RESEARCH ARTICLE

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Development and quality evaluation of complementary based foods from sprouted Sorghum, Soybean and Tiger nut blends

Onyekwelu Chinyere Nkemakonam *, and Enemuo Ngozika Karen

Biochemistry department, Federal University of Technology, Nigeria

* For correspondence: chykems@gmail.com

ABSTRACT

The sorghum grain, soybean and tiger nut tubers were processed into flour which were formulated in ratio of 75:25:0, 70:20:10, 60:25:15 and 50:30:20 designated as M75, M70, M60 and M50 respectively to produced complementary food. Proximate, mineral composition and sensory evaluation of complementary foods were evaluated. The result revealed that moisture contents ranged from 5.00 to 12.74%, protein from 21.25 to 25.48%, ash contents from 1.90 to 2.97%, crude fibre from 0.60 to 1.60%, fat contents from 3.00 to 500% and carbohydrate from 58.00 to 67.78%. Increase in addition of tiger nut and soybean flour in malted sorghum flour significantly ($p<0.05$) increased potassium contents from 293.90 to 306.15PPM, calcium from 10.10 to 11.80 PPM and iron contents from 1.48 to 1.59PPM. Sample M70 (70% malted sorghum, 20% soybean, 10% tiger nut) was most preferred to other samples by panellists in terms of colour, taste, texture and overall acceptability. Complementary food produced from blends of sprouted Sorghum, Soybean and Tiger nut had improved nutritional contents and accepted by consumers' test.

Keyword: complementary food, sorghum, soyabean, Tiger nut, quality evaluation

1. INTRODUCTION

Complementary foods are precisely non- breast milk or nutritive foods which may be solid, liquid or semi-liquid that are rich in energy and micro nutrition [1]. In Nigerian traditional weaning food consist of cereal produced from either ogi or akumu. This fermented product is of poor nutritional values due to deficiency in some of the essential amino acids such as lysine and tryptophan. While commercially available weaning foods are too expensive in the developing countries for average family, so nursing mothers find the alternative, traditional weaning foods that are low in nutritive values which contain low protein, low energy density and high bulk density [2]. There is need to improvement of nutritional quality of complementary foods; this can achieved by

supplementary cereals based complementary foods with legumes [3].

Sorghum (*Sorghum bicolor* L.) is a cereals and provides staple food for large population. . It is the principal source of energy, protein, vitamins and minerals for millions of the poorest in African. Unfortunate Sorghum grain contains low quality protein and the presence of anti-nutritional factors such limits their nutrition value. Protein – energy malnutrition is a major health problem in developing countries and contributes to poor physical and intellectual development of infant low resistance to disease as well as infant mortality [4]. But processing method such as sprouting, cooking fermentation among others is a means of improving nutritional values of foods. Sprouting improves nutrient, increase mineral bioavailability and sensory properties [5].

Soybean (*Glycine max*) is an oil seed that contain complete protein which provides all essential amino acids in amount needed for human health. It is also rich in unsaturated fatty acids, low in saturated fatty acids a source of omega3-fatty acids. Soyabeans contain a beneficial phytochemicals such as isoflavones, it has been reported that consumption of soy foods is associated with a reduction in prostate cancer in men, breast cancer in women [6].

Tiger nut (*Cyperus esculentus var sativa*) contain high in carbohydrate and dietary fibre with moderate protein, oleic acid, mineral, vitamin C and E contents as well as some therapeutic properties [7-8].

Tiger nut produces about 25% oil of high quality and protein about 8% of the nut, where valued for their nutritious content, and dietary fibre. According to Belewu and Belewu, (2007), the tiger nuts can be eaten raw, dried, roasted or grated and used as flour, vegetable milk, cosmetics, fuel, hog feed [9]. It is pressed for its juice to make beverage called (chufa) which is equally obtained from the rhizome Tiger nut is rich in myristic acid, oleic and linoleic acid [7]. Tiger nut tubers could be used for the treatment of flatulence, indigestion, diarrhea, dysentery and excessive thirst [10]. Formulating complementary foods from Sprouted sorghum, soyabean and tiger nut would provide protein –fibre base complementary foods that will meet nutritional requirement of infants.

The aim of this study was to develop and evaluates complementary based foods made from sprouted sorghum, soybean and tiger nut flour blends.

2. METHOD AND MATERIAL

2.1. Sample Collection

All the three samples of Soya bean, tiger nut and sorghum was collected by purchasing from local market of Eke- Ekwulobia in Anambra State, Nigeria

2.2. Preparation of soyabean

The soybean seeds were sorted, washed and soaked in water for 12hrs. The soaked soyabean were boiled for 45 min, dehilled and then dried. Dried soyabean were milled using attrition mill,

sieved and packaged in air tight container. The powder was kept for further use.

2.3. Preparation of Tigernut Flour

The method of Ade-Omowaye, *et a*l., (2008) was used in the production of tigernut flour (TF) [11]. Tigernut tubers were sorted to remove damaged and other extraneous materials, washed with potable water and soaked for 48 hrs then drained. The sample was dried in a cabinet dryer at 65 °C for 24 hrs. After drying it was then milled and sieved using 250mm sieve size to obtain tigernut flour. The flour sample were stored in high density polyethylene for further use.

2.4. Preparation of sprouted sorghum

The sorghum grains (2kg) were sorted to remove stones, dirt and other extraneous materials. The cleansed grains were thoroughly washed and step in water for 12 hours so as to attain a 42-46% moisture level. The hydrated grains were spread on a moist Jute bag which had been previously sterilized by boiling or 30 minutes and the grains were allowed to germinate for four days. Non-germinated grains were discarded and the germinated seeds were dried at 60 °C in a cabinet dryer to a moisture content of 10-12%. The withered rootless grains were gently brushed off, and the malted grains were dry milled, sieved and packaged in an air tight container and kept for further use.

2.5. Formation of Weaning Food

Sprouted sorghum grain, soybean seeds and tigernut were blended in ratio as shown in the table 1.

Table 1. Formulation of weaning food

Sample	Malted Sorghum grain	Soyabean seeds	Tiger nuts
M75	75	25	00
M70	70	20	10
M60	60	25	15
M50	50	30	20

2.6. Sensory Evaluation

The sensory evaluation of the complementary food was conducted at the department of food science and technology Oko. 10 panelists were recruited to evaluate the degree of likeness of the test products. The panelists evaluated the samples using a 9-hedonic scale where 9 (like extremely) was the highest and 1 (dislike extremely) was the lowest score.. The samples were evaluated by the panelist for texture, taste, colour, flavour, and general acceptability.

2.7. Determination of Proximate and Mineral Composition

The moisture, protein, fat, ash and crude fibre contents of complementary food were carried out according to the methods of AOAC (2010) [12]. The carbohydrate was determined by difference [13]. The calcium, potassium and iron content were determined by methods of AOAC (2010) [12].

2.8. Statistical Analysis

Data obtained were subjected to Analysis of Variance (ANOVA) using the Statistical Package for Social Science (SPSS) version 17.00 Duncan

Multiple Range Test (DMRT) was used to compare the treatment mean. Statistical significance was accepted at ($P<0.05$)

3. RESULTS AND DISCUSSION

All the result observed were well tabulated and discussed properly. Table 2 shows the sensory evaluation of complementary foods from sprouted Sorghum, soybean and tiger nut blends. There significant difference in all the sensory attributes scored by the panellists. All samples were accepted by the panellists since the least mean score is 6.70. Sample M70 (70% malted sorghum, 20% soybean, 10% tiger nut) had highest mean scores in colour, taste, texture and overall acceptability.

The result of proximate composition of complementary foods from sprouted sorghum, soybean and tiger nut Flour Blends is presented in Table 3. The moisture content of the formulated complementary foods varied significantly ($P<0.05$) from 5.00 to 12.74%. Moisture content is the key factors affecting the storage life and safety of food. The result

Table 2. Sensory evaluation of complementary foods from Sprouted Sorghum, Soybean and Tiger nut blends

Sample	Colour	Taste	Texture	flavour	Overall Acceptability
M75	$7.50^{b}\pm0.10$	$6.70^{b}\pm0.10$	$6.90^{c}\pm0.10$	$7.10^{a}\pm0.10$	$7.10^{c}\pm0.10$
M70	$7.80^{a}\pm0.10$	$8.10^{a}\pm0.10$	$7.90^{b}\pm0.10$	$6.90^{a}\pm1.00$	$7.70^{a}\pm0.10$
M60	$7.70^{a}\pm0.10$	$7.60^{b}\pm0.10$	$7.60^{b}\pm0.10$	$7.00^{a}\pm1.00$	$7.50^{b}\pm0.10$
M75	$7.40^{b}\pm0.10$	$7.90^{b}\pm0.10$	$7.60^{b}\pm0.10$	$7.40^{a}\pm0.10$	$7.60^{b}\pm0.10$

Table 3. Proximate composition of complementary based foods from sprouted Sorghum, Soybean and Tiger nut blends

Sample	Moisture content (%)	Protein content (%)	Ash content (%)	Crude fiber (%)	Fat content (%)	Carbohydrates (%)
M75	$5.00^{d}\pm1.00$	$21.25^{c}\pm0.01$	$2.00^{a}\pm1.00$	$1.00^{a}\pm1.00$	$2.97^{c}\pm0.01$	$67.78^{a}\pm1.00$
M70	$7.84^{c}\pm1.00$	$23.82^{b}\pm1.00$	$1.96^{a}\pm0.01$	$1.00^{a}\pm1.00$	$3.96^{ab}\pm0.01$	$61.42^{a}\pm1.00$
M60	$10.57^{b}\pm1.00$	$25.48^{a}\pm1.00$	$2.97^{a}\pm1.00$	$1.60^{a}\pm1.00$	$5.00^{a}\pm1.00$	$59.38^{c}\pm1.00$
M50	$12.74^{a}\pm1.00$	$23.17^{b}\pm0.10$	$1.90^{a}\pm1.00$	$0.60^{a}\pm1.00$	$3.00^{c}\pm1.00$	$58.00^{d}\pm0.10$

Table 4. Mineral composition of complementary based foods from Sprouted Sorghum, Soybean and Tiger nut blends

Sample	Potassium (PPM)	Calcium (PPM)	Iron (PPM)
M75	$293.55^{c}\pm1.00$	$9.30^{c}\pm0.10$	$1.44^{a}\pm0.10$
M70	$293.90^{c}\pm1.00$	$10.10^{b}\pm1.00$	$1.48^{a}\pm0.10$
M60	$298.05^{b}\pm1.00$	$10.40^{b}\pm1.00$	$1.50^{a}\pm0.10$

Values are Mean ± Standard Error Mean of determination of three replicates. Values with different superscript on same column are $p<0.05$ (significantly different)

revealed that increasing tiger nut substitution increased moisture content of complementary food. Similar result was reported by Ezeocha and Onwuneme, (2016) in sweet potatoes – tiger nut [7]. In sample M60 (60% Sprouted sorghum: 25%soyabeans: 15% tiger nut) the protein content significantly (P<0.05) increased from 21.25 to 25.48 %. There was no significant (P<0.05) difference in ash content. Sample M60 had the highest value in ash contents. This may be attributed to more proportion of tiger nut in complementary foods. Crude fibre of formulated complimentary did not differed (P<0.05) significantly from 0.60 to 1.60%. Crude fibre was observed to increase with increasing proportion of tiger nut and soybeans. Dietary fibre intake provides many health benefits. An adequate intake of dietary fibre reduces the risk of developing diseases such as coronary heart disease, stroke, hypertension, diabetes, obesity, and certain gastrointestinal disorders. In addition increased consumption of dietary fibre improves serum lipid concentrations, lowers blood pressure, improves blood glucose control in diabetes, promotes regularity, aids in weight loss, and a improve immune function [15].

Fat content ranged from 2.97 to 5.00 % increasing proportion of tiger nut and soybean increased fat content from 3.00 to 5.00%. Similar result was observed by Ejiofor (2013) [16].

Carbohydrates of formulated complementary foods varied significantly from 58.00 to 67.78. It was observed that increase in addition of tiger nut and soy bean decreased carbohydrate content. The decrease may be due to increase in protein and fat content which is indicative of modification in the composition of the sample.

The mineral composition of complementary based foods from sprouted sorghum, soybean and tiger nut flour blends is shown in table 4. There were significantly (P<0.05) difference in calcium and potassium contents of the samples. Potassium Contents ranged from 293.55 to 306.15 PPM. Increase in addition of soybean and tiger nut in complementary foods increased potassium contents. The presence of potassium in complementary food is necessary to reduce high blood pressure. It is also essential for normal functioning of nerve and muscle and maintains the acids–balance of the body. Calcium contents varied (P<0.05) significantly from ranged from 9.30 to 11.80. Calcium is essential for building healthy strong bones and teeth in infant There was no significantly (p<0.05) difference in iron contents. Increase in proportion of soybean and tiger nut increased iron content of complementary food. Iron content is good constituent of haemoglobin and its presence is important in the process of blood formation.

4. CONCLUSION

Complementary food can produced from blends of sprouted sorghum, soybeans and tiger nut sample M60 (60 sprouted sorghum: 25% soybean: 15% tiger nut) was significantly higher in protein, ash, fibre and fat contents. Increase in addition of soybean and tiger nut significantly increased potassium, calcium and iron contents of complementary food. All

samples were accepted by the panellists. Addition of tiger nut up to 15% significantly improved nutrition contents of complementary foods.

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NA

6. CONFLICT OF INTEREST

The authors have declared that there is no conflict of interest.

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