Mineral composition and Organoleptic Properties of Biscuits Produced from Composite Flour of African Locust Beans Pulp Flour and Wheat Flour.

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ABSTRACT

The aim of this study was to evaluate mineral composition and organoleptic properties of biscuits produced from African locust beans pulps flour and wheat flour. The matured and ripped African locust beans pods purchased from Bauchi market. The pods were manually cleaned and milled. The wheat/locust bean pulp flour were mixed in the ratio; 100:0%, 90:10%, 80:20%, 70:30% and 60:40% respectively. The mineral composition and sensory evaluation are determined by laboratory standard methods. There was increase in mineral composition; such as zinc calcium and magnesium with an increase in blends of composite flour of African locust bean pulp flour and wheat flour. Meanwhile, there significant different in sample E (60:40%) wheat/African locust bean flour, which had the least score. This result revealed that African locust beans flour can be added up to 30% substitution level without altering quality characteristics and organloletic properties of the biscuits.

Keywords: Mineral composition, organoleptic, biscuits, wheat flour, African locust bean pulp flour.

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1. INTRODUCTION

Biscuits may be regarded as a form of confectionery, dried to very low moisture content. Biscuits are usually produced from cereal flours (mainly wheat) and consumed extensively all over the world. According to Agu et al. (2007), a biscuit is defined as a small thin crisp cake made from unleavened dough. Okaka (1997) described the biscuits as a mixture of flour and water, often with the addition of fat, sugar and other ingredients, mixed together into dough which is rested for a period of time and then passed between rollers to make a sheet that is cut in smaller pieces and baked.

Biscuits are ideal for nutrient availability, palatability, compactness and convenience. They differ from other baked products like bread and cakes because of low moisture content, comparative freedom from microbial spoilage and long shelf-life (Mian et al., 2009). Biscuits may be classified either by the degree of enrichment and processing or by the method adopted in shaping them. Based on the enrichment criterion, biscuits may be produced from hard dough, soft dough or from batter (Fayemi, 1981). The nutritional content however varies with the type of flour used. Soft wheat flour is the best flour for biscuit making, because of the composition of its storage proteins, gliadins and glutenins, which undergo hydration in the presence of water, salt and sugar.

These proteins form a visco-elastic matrix known as gluten, which is responsible for the rising nature of dough and permits substantial increase in the volume of baked product with its gas retention capability (Agu et al., 2007). Nigeria, a tropical country, cannot grow wheat in commercial quantity due to its hot climatic condition. Therefore, for the survival of biscuits and other confectionery products, the use of locally available grains or legumes to substitute wheat flour is essential (Kent, 1984). A lot of work involving the use of non-wheat flour from various cereals and legumes has been done to substitute wheat in baked products (Eneche, 1999, Nochera and Caldwell, 1992). In search for plant protein and vitamins substitute, the African locust beans (*Parkia biolobosa*) have found very popular use especially in fermented "Dawadawa" which is the products of the seed. Similarly, the African locust beans pulp is a primary source of reducing sugar (19%), non- reducing sugar (9%) and other complex carbohydrate (36%). The African locust bean (*Parkia biglobosa*) fruit pulp, which has been found to have good nutritional value (protein 6.56, fat 1.8, CHO 67.30, ash 4.18 and crude fibre 11.75%) and low anti-nutrients/toxins (phytic acid 60.00, crude saponin 17.80 and tannin 18.00 mg/100 g), has not been widely exploited as raw materials in confectionery products (Gernah et al., 2007; Akoma et al., 2002, Musa et al., 2005).

Locust beans pulp is sweet to taste which indicates the presence of natural sugar and thus potential energy source, (Young, 2001). The attractive yellow clouration indicates the presence of phyto-nutrients, possible carotenoids are important precursors of retinol (Vitamin A). The pulp has sour taste which indicates the presence of ascorbic acid (vitamin C), (Gernah, 2007). The use of locust bead pulp flour for production of baked products will reduced total independence on importation of wheat and increase the utilization of pulp and create variety. The research is aimed to evaluate quality characteristics of biscuits produced from wheat-African-locust beans pulp flour blends.

2. MATERIAL AND METHODS

2.1 Source of African locus beans

The matured and ripe Africa locust beans (*Parkia biolobosa*) fruit pods were purchased from Muda Lawan market in Bauchi metropolis and other ingredients were purchased in food chemical store in Wunti market, Bauchi State, Nigeria.

2.2 Preparation of locust bean fruit pulp flour

The preparation of locust bean fruit pulp flour was done using the method of Gernah et al. (2007). The outer brown cover of the pods was manually stripped open and the yellow fruit pulp was separated from seeds embedded within the pulp. The yellow pulp was dried in a hot air oven (model T1211, Genlab Widnes, UK) at 60°C for 9 h to a moisture content of 10%. The dried powder was milled with a laboratory hammer mill (Christy Hunt, UK), and sieved through a 0.5 mm mesh screen to obtain a fine flour, which was packaged in low density polythene bags, and stored in air-tight container at room temperature.

2.3 Formulation of blends and Preparation of biscuits

The ingredients used were wheat flour, locust bean fruit pulp flour, baking fat, granulated sugar, baking powder, milk powder, salt, egg (whole egg) and water. Wheat flour and the locust bean fruit pulp flour were the ingredients varied in the research. To prepare blends of different proportions of wheat flour (WF) and African locust bean fruit pulp (ALBFP), the WF/LBFP flours were mixed in the ratio of 100:0, 90:10, 80:20, 70:30 and 60:40%, respectively. Control biscuits with wheat flour and experimental biscuits with flour blends were prepared using a modified method of Jane and Emma (1998). The ingredients were mixed for 10 min to form dough, kneaded into stiff dough.

The dough was rolled out on a sheeting board to a sheet of uniform thickness of about 0.4 cm, and the sheet was stamped out in circular shapes of about 5.8 cm diameter, using a biscuit cutter. The biscuit cuts were placed on greased baking trays, covered, rested for about 15 minutes and baked for 20 min at 180°C. The biscuits were then removed and allowed to cool on a rack, packaged in low-density polyethylene bags and kept in an air-tight container.

2.4 Determination of mineral composition

5 g of each sample of biscuits was ashed, and the mineral content (phosphorus, zinc and iron) were determined using Atomic Absorption Spectrophotometer (AAS). The vitamin C was analyzed by Indophenol method (Maclean ,*et al.,*2003). Fisher pH meter (Model 210, fisher) was used to determine the pH and Abbe refractometer was used to determine the total soluble solids content (Brix) at 20^0C . The total sugar content was estimated by the method of Hedge and Hofreiter, (1962). A 100mg of the sample was weighed into a boiling tube, which was hydrolysed by keeping it in a boiling water bath for three hours with 5.0 ml of 2.5 N HCl. it was cooled to room temperature after which it was neutralized with solid sodium carbonate until the effervescence ceases. This was then made up to 100 ml and centrifuged and the supernatant was collected. Thereafter, 0.2 to 1.0 ml of the supernatant was taken for analysis. The standards were prepared by taking 0.2-1.0 ml of the working standards.

One ml of water served as a blank made up the volume to 1.0 ml in all the tubes with distilled water, after which 4.0 ml of anthrone reagent was added, heated for eight minutes in a boiling water bath, and cooled rapidly. The green to dark green colour was read at 630nm. A standard graph was drawn by taking the concentration of glucose on X-axis and spectrophotometer reading on Y-axis. From the graph the concentration of glucose in the sample was calculated. Tissue was extracted with distilled methanol and extract was partitioned with ether; ether layer separated and evaporated to dryness on water bath. Residue dissolved in dissolved in ethanol. Lipids and chlorophyll were removed by KOH and kept in a dark room overnight. Equal volume water was added to partition the ether layer. Ether layer was collected, evaporated to dryness and residue was dissolved in ethanol and absorbance was measured at 420 nm (Thimmaiah,1999).

2.5 Sensory evaluation

Biscuit samples were evaluated for sensory attributes; appearance, taste, aroma, crispness and overall acceptability using thirty panelists on a hedonic scale (9-point) where 1 represents dislike extremely and 9 extremely like (Iwe, 2002).

2.6 Statistical Analysis

All generated data, in triplicate were subjected to statistical analysis using statistical package for social sciences (SPSSversion23). Separation of means was carried out ($P \leq 0.05$) using Du can multiple range test.

3. RESULTS AND DISCUSSION

Table 1: mineral composition of biscuits from blends of wheat and African locust beans pulp flour.

Sample	Zinc (mg/100g)	Iron (mg/100g)	Magnesium (mg/100g)	Calcium (mg/100g)	Phosphorus (mg/100g)
100:0% (A)	1.20 ± 0.05	4.01± 0.22	10.44 ± 0.44	9.10 ± 1.12	64.02 ± 1.24
90: 10% (B)	1.48 ± 0.02	3.46 ± 0.19	10.79 ± 1.26	10.21 ± 0.18	60.33 ± 0.07
80: 20% (C)	1.76 ± 0.12	3.52 ± 1.25	12.88 ± 2.11	10.58 ± 0.24	58.19 ± 0.09
70:30% (D)	1.84 ± 1.48	3.54 ± 1.19	14.34 ± 0.09	12.32 ± 0.14	56.12 ± 0.12
60:40% (E)	2.02 ± 1.16	3.10 ± 1.04	15.26 ± 1.02	14.67 ± 0.10	62.09 ± 0.17

The results are presented as mean ± standard deviation of triplicate observation. A: 100:0% Wheat flour (control), B;90% Wheat flour and 10% African locust beans flour, C;80% Wheat flour and 20% African locust bean flour, D; 70% Wheat flour and 30% African locust beans four and 60% wheat flour and 40% African locust bean flour. The result of the mineral composition of the biscuit samples produced from composite flour of wheat and African locust bean pulp flour is shown in Table 1. The value for the minerals ranged from 1.20-2.02 mg/100g for Zinc, 3.10-4.01mg/100g for Iron, 10.44-15.26mg/100g for Magnesium, 9.10-14.67mg/100g for Calcium and 56.12-64.02mg/100g for Phosphorus. There was an increase in composition of Zinc, Magnesium and Calcium as the quantity of African locust bean pulp flour was increased in the blends whereas; the reverse was the case of the Iron and phosphorus. The variation the value of the mineral composition of the biscuits samples could be attributed to the varying proportion of the wheat-African locust beans pulp flour blends. The reported increase in zinc, magnesium and calcium could be additional benefits for consumer of these products. Calcium is essential for proper bone and teeth formation and also helps in transporting of long chain fatty acid which in turn helps in the prevention of heart diseases, high blood pressure and other cardiovascular diseases. Meanwhile, magnesium works with calcium to transmit nerve impulse in the brain and it also has a calming effect on the nervous system.

3.1 Organoleptic properties of biscuits from blends of wheat and African locust beans pulp flour.

Table 2: organoleptic properties of biscuits from blends of wheat and African locust beans pulp flour

Samples	Appearance	Taste	Aroma	Crispiness	Overall acceptability
100:0% (A)	8.11± 0.05	8.24 ± 0.12	8.62 ± 0.05	7.24 ± 0.04	8.86 ± 0.14
90:10% (B)	8.03 ± 0.03	8.08 ± 0.10	7.54 ± 0.08	6.38 ± 0.02	8.47 ± 0.20
80:20% (C)	7.43 ± 0.07	7.66 ± 0.09	7.32 ± 0.06	6.13 ± 0.08	7.68 ± 0.16
70:30% (D)	7.23 ± 0.02	6.89 ±0.07	6.88 ± 0.14	5.09 ± 0.03	6.48 ± 0.10
60:40% (E)	6 .45 ± 0.10	5.33 ±0.0.8	5.37 ± 0.09	4. 78 ± 0.02	5.44 ± 0.24

The results are presented as mean ± standard deviation of triplicate observation. A: 100:0% Wheat flour (control), B;90% Wheat flour and 10% African locust beans flour, C;80% Wheat flour and 20% African locust bean flour, D; 70% Wheat flour and 30% African locust beans four and 60% wheat flour and 40% African locust bean flour.

The sensory evaluation of the biscuits samples are presented in table 2. The biscuit samples have sensory values that ranged from 6.45-8.11 for appearance, 5.33-8.24 for taste, 5.37-8.62 for aroma, 4.78-7.24 for crispiness and 8.86-5.44 for overall acceptability. The control (100%:0 wheat biscuits) sample has the highest values for all sensory parameters evaluated and the sensory scores were found to decrease with increase in the addition of African locust bean pulp flour in the blend for most of the parameters evaluated. This may be attributed to off appearance and off taste imparted on the biscuits samples by the African locust bean pulp flour which the panelists might not associated with biscuits. However, all the biscuits samples showed good sensory scores for all the parameters evaluated at least most of the samples were recorded score above 5.00.

4. CONCLUSION

The wheat/African locust bean pulp composite flour used for the production of biscuits had improved mineral contents and the organoleptic properties compared well to 100% wheat flour. Therefore, acceptability nutrient dense biscuits can be produced from blends of wheat flour and African locust bean pulp flour.

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