CHEMICAL COMPOSITION, PHYSICAL AND SENSORY PROPERTIES OF CAKES PREPARED FROM FLOUR BLENDS OF WHEAT AND CASHEW NUT KERNELS

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ABSTRACT

The chemical composition, physical and sensory properties of cakes prepared from flour blends of wheat and cashew nut kernels was investigated. Wheat and cashew nut kernels flour were blended at different proportions (100:0%; 90:10%; 80:20%; 70:30%; 60:40% and 50:50%) for cake making where 100% wheat flour was used as standard. Addition of cashew nut kernels four to wheat flour increased chemical composition of cake samples such as moisture, protein, fat, crude fiber, ash contents from (13.19 to 14.42%), (23.05 to 29.36%), (3.41 to 7.06%), (3.57 to 3.95%), (1.42 to 4.02%) while carbohydrate content decreased from (54.28 to 41.19Kcal), similar trend was observed for wheat flour. Mineral elements of cakes such as copper, iron, magnesium, sodium, calcium and phosphorus ranged from 0.13 to 0.19mg/100g, 2.95 to 4.43mg/100g, 61.65 to 164.64mg/100g, and 273.52 to 264. 24mg/100g, 56.33 to 123.27.05 mg/100 g and 298.70 to 356.03 mg/100g respectively. The weight (32.25 to 34.30 g) and volume (242.05 to 246.11 cm^3) of wheat-cashew nut kernels flour cake increased, whereas batter density and volume index of cakes decreased from (0.90 to 0.83) and 103.65 to 99.47) with increasing levels of cashew nut kernels flour. There was no significant ($p \geq 0.05$) difference in crust and crumb colour, crumb grain and texture between wheat cake and composite cakes but taste and overall acceptability of composite cakes were significantly different from standard.

Keywords: wheat, cashew nut kernels, cake, flour blends

Introduction

Cakes are soft bakery products produced by baking batter containing wheat flour, sugar, baking powders and beaten eggs, with or without shortenings (IFIS, 2005). Cake serves as a medium for delivery of important nutrients and the nutritional content varies with the type of flour used. There is an increase in demand of baked products such as cakes, bread and cookies resulting to high demand for imported wheat flour in Nigeria.

The recent past recession has partly resulted in an upsurge in the a number of well informed consumers who put into consideration the health and nutritional benefits of food products they consume; and this has contributed to the stimulation of research into alternative food crops with functional or health benefits to be incorporated into composite flour in wheat-based bakery products (Chinma *et al*., 2010).

Cashew nut kernels contains 21% protein, 22% carbohydrate, 5% moisture and 74% fat. The protein contains much of the essential amino acids, which include lysine, tryptophan, isoleucine and leucine and it has a high biological value (Bicalho and Schuch, 2001). The full fat cashew

nut kernels contain protein 20.23%, ash 6.26%, fat 45.17%, crude fiber 4.55%, carbohydrate 11.39%, energy value 533.01 kcal, iron 3.00g, calcium 321.66g, phosphorus 450.13g, sodium 101.24g, potassium 503.16g. (Alobo *et al.*,2009). Considering these impressive chemical and functional properties of cashew nut kernels and its full fat flour it may represent a useful material in food systems.

The present research therefore aimed at evaluating the effect of cashew nut kernels flour addition on the chemical composition, physical and sensory properties of wheat flour and cakes prepared from their flour bends.

Materials and Methods

Three kilograms of wheat flour (Golden Penny), cashew nut seeds and other ingredients were all purchased from Minna Central Market, Nigeria while the Department of Food Science and Technology, Federal University of Technology, Minna provided the facilities for the work.

Preparations of cashew nut kernels flour

Cashew nut kernels flour was prepared as described by Alobo *et al.* (2009). The nuts were split open with knife to release the kernels. The kernels were dried at 60^{o}C in an air-draft oven (Gallenkamp 300 plus series, England) and then ground into flour using attrition mill (Globe P 44, China). The flour samples were passed through 75µm mesh size sieve, packaged in an air tight polyethylene bag and transferred into a plastic container with lid then stored in a refrigerator from where samples were taken for analysis.

Formulation of blends

Wheat flour and cashew nut kernels flour was mixed at varied proportions (100: 0%; 90 : 10 %; 80 : 20%; 70 : 30 %; 60 : 40% and 50 : 50%) where 100% wheat flour served as standard. A Kenwood mixer was used for mixing samples at speed 6 for 5 minutes to achieve uniform mixing.

Proportion of ingredients

The proportion of ingredients used consists of flour (100 g), sugar (62.5 g), margarine (47.9 g), baking powder (5.7 g) and vanilla essence (three drops) as described by Akubor (2004).

Preparation of cake

The method of Akubor (2004) was adopted for the preparation of cake. The margarine and sugar were creamed manually for 2 min in a bowl until soft and fluffy. The egg was beaten for 3 min, added to the mixture and mixed manually for 3 min. Flour samples from various composite blends were separately sieved, and baking powder was then added and mixed lightly by hand until soft dough was formed. The dough was transferred to a greased baking pan and baked in a preheated oven at 200 ^{o}C for 30 min.

Chemical analysis

The moisture content, crude protein, fat content, crude fiber, ash content, carbohydrate and mineral determination were determined following the procedure outlined by AOAC (2000). The food energy values of the samples were determined according to the method described by Osborne and Voogt (1978).

Determination of physical properties of cake

Batter density was determined with a measuring cylinder and expressed as the relation between the weight of batter and the same volume of distilled water. Volume index of cake samples were measured using AACC template method 1091 (AACC, 2000) while the weight of cake samples were determined by weight measurement using the electronic digital balance.

Determination of sensory properties

A trained twenty-member panel consisting of students and staff members of Food Science and Technology Department of Federal University of Technology, Minna, Nigeria was selected based on their experience and familiarity with cake for the sensory evaluation. Cake samples prepared from each flour blend were presented in coded white plastic plates. The order of presentation of samples to the panel was randomized. Tap water was provided to rinse the mouth between evaluations. The panelists were instructed to evaluate the coded samples for appearance, crust colour, crumb grain, texture, aroma and overall acceptability. Each sensory attribute was rated on a 9-point Hedonic scale (1=disliked extremely while 9-liked extremely).

Statistical Analysis

Data were analyzed by analysis of variance (Steel and Torrie, 1980). The difference between mean values was determined by least significant difference (LSD) test. Significance was accepted at 5% probability level.

Results and Discussion

Tables 1 and 2 showed the chemical composition of flour blends from wheat and cashew nut kernels. Moisture value increased gradually with increasing level of cashew nut substitution. There was no significant ($p \geq 0.05$) difference in moisture value among samples. The low moisture values (9.13 to 10.56%) obtained in this study is indicative that the flour samples will have good storage life. The protein content varied between 10.61 and 25.72% with 100% wheat flour having lowest protein content while 100% cashew nut kernels flour had the highest protein value. The protein content of flour blends increased with increasing level of cashew nut kernels flour in the blends. There were significant differences ($p \leq 0.05$) in protein content among flour blends implying that the treatment had effect.

The high protein, fat, ash, crude fiber and mineral contents of cashew nut kernels flour was expected since cashew nut kernels contains higher protein, fat and ash contents than wheat. The chemical composition of wheat flour nut and cashew nut kernels flours obtained in this study is in close agreement with values reported by Ayo *et al*. (2007) and Alozie*et al*. (2009) for cashew nut kernels flour and wheat flours respectively.

Chemical composition of cakes prepared from flour blends of wheat-cashew nut kernels are presented in Tables 3 and 4. Addition of cashew nut kernels flour to wheat flour increased proximate composition of cake samples such as moisture, protein, fat, crude fiber and ash contents while carbohydrate content decreased from (54.28 to 41.19Kcal). A
similar trend was also observed for mineral elements such as copper, iron, magnesium,
sodium, calcium and phosphorus. The higher moisture content of composite cakes than 100% wheat cake may be attributed to high water-binding properties of the cashew-wheat flour blends than wheat flour.

The increased protein, fat, crude fiber, ash, energyvalue and mineral contents of cake samples preparedfrom composite blends may be because of the addition effect of cashew nut kernels flour

since cashew nut kernels flour contain higher protein, ash, fat, crude fiber and mineral contents than wheat flour. However, the higher protein, ash, crude fiber and low carbohydrate contents of composite cakes than control implies that the composite cakes are of nutritional value than 100% wheat cake. While, low carbohydrate content of composite cakes is an indication that the cookies may serve as a functional food for groups with special caloric and glycemic requirements such as obese or diabetic people. The proximate composition of composite cakes and 100% wheat cakes obtained in this study was higher than to those of Alozie *et al*. (2009) and Akubor (2004) for wheat- African yam and wheat-cowpea cakes respectively but in close agreements with the values reported by Chinma*et al.* (2010)for wheat-tigernut cake.

The physical properties of batter and cakes prepared from flour blends of wheat-cashew nut kernels are presented in Table 5. The weight (32.25 to 34.30 g) and volume (242.05 to 246.11 cm3) of wheat-cashew nut flour cake increased, whereas batter density and volume index of cakes decreased from (0.90 to 0.83) and (103.65 to 99.47) with increasing level of cashew nut kernels flour. However, 100% wheat flour cake had higher batter density, volume and volume index than composite cakes while the weight of the former was lower than the latter. The increase in weight and volume of cakes with increasing the level of cashew nut kernels flour in wheat flour may be attributed to low batter density or increased bulk density of flour blends. This is in line with the earlier report of Chinma*et al.* (2007) that weight and volume of snack products depends on bulk density of the flour blends in the product. Also, the increased moisture content of composite cakes as a result of increasing level of cashew nut flour substitution may be responsible for such increase in weight of composite cake samples. The higher cake volume and cake volume index of 100% wheat cake than composite blends may be attributed to the presence of gluten in wheat flour. Gluten (wheat flour protein) is responsible for gas retention and during dough development, it becomes extensive and strong; this allows the dough to rise and also prevents easy escape of the gas during baking thereby resulting to improved physical properties of baked products (Chinma and Gernah, 2007; Akubor *et al*., 2003).

Table 6 present the sensory properties of cakes prepared from flour blends of wheat and cashew nut flour. There was no significant ($p \geq 0.05$) difference in crust and crumb Colour, crumb grain texture between wheat cake and composite cakes but taste and overall acceptability of composite cakes were significantly different from standard. There was significant difference in texture and overall acceptability between wheat cake and composite cakes. Addition of cashew nut flour to wheat increased sensory attribute scores evaluated.

The increase in sensory scores of wheat-cashew nut kernels cakes could be attributed to addition of cashew nut kernels flour which imparted good sensory attributes to composite cakes. The

Higher texture scores of composite cakes than 100% wheat could be attributed to reduced gluten content due to substitution of wheat flour with cashew nut kernels flour. This could have resulted to a soft crumb which is desirable by cake consumers. However, composite cakes was highly acceptable than 100% wheat cake.

Conclusion

Based on the outcome of this study, cake with improved chemical, sensory and weight can be prepared using wheat –cashew nut flour blends up to 50% cashew nut kernels flour substitution;

Cakes prepared from such composite flour could help in combating protein- energy malnutrition and reduce micro nutrient deficiency prevalent in developing countries such as Nigeria. The low carbohydrate content of wheat-cashew nut cakes is an indication that such cakes can serve as a

functional food. Wheat-cashew nut kernels cake is recommended for people with protein-energy and micro-nutrient deficiency

Table1: Proximate composition of flour blends from wheat and cashew nut kernels.

Flour blends Wheat: Cashew nut	Moisture (%)	Protein (%)	Fat (%)	Crude fiber (%)	Ash (%)	Carbohydrate (%)
100:0 (control)	$9.13^{b}\pm0.05$	$10.61^{g}\pm0.18$	$1.25^{g}\pm0.12$	$0.88^{e}\pm0.01$	$1.25^{c}\pm0.04$	$76.88^{a}\pm 0.60$
0:100	$10.56^{a}\pm0.13$	$25.72^{a}\pm0.24$	$12.18^{a}\pm0.25$	$5.27^{a}\pm0.06$	$7.64^{a}\pm0.00$	$38.63^{g}\pm0.47$
90:10	$9.25^{b}\pm0.07$	$12.03^{f}\pm0.16$	$3.04^{f}\pm0.07$	$1.68^{d}\pm0.01$	$1.89^{b}\pm0.03$	$72.11^{b}\pm0.56$
80:20	$9.33^{b}\pm0.20$	$13.74^{e}\pm0.05$	$4.11^{e}\pm0.10$	$2.14^{c}\pm0.04$	$2.06^{b}\pm0.09$	$68.62^{c}\pm0.72$
70:30	$9.51^{b}\pm0.11$	$14.89^{d}\pm0.17$	$5.52^{d}\pm0.12$	$2.75^{bc}\pm0.01$	$2.87^{ab}\pm0.00$	$64.46^{d}\pm0.39$
60:40	$9.68^{b}\pm0.07$	$16.30^{c}\pm0.33$	$6.75^{c}\pm0.00$	$3.02^{b}\pm0.07$	$3.15^{b}\pm0.02$	$61.10^{e}\pm0.56$
50:50	$9.75^{b}\pm0.19$	$17.23^{b}\pm0.08$	$7.90^{b}\pm0.01$	$3.65^{b}\pm0.15$	$3.49^{b}\pm0.01$	$57.98^{f}\pm0.97$

Values followed by different superscript in a column are significantly ($p\leq0.05$) from each other

Table 2: Mineral contents of flour blends from wheat and cashew nut kernels

Blends Wheat: Cashew nut	Copper (mg/100g)	Iron (mg/100g)	Magnesium (mg/100g)	Sodium (mg/100g)	Calcium (mg/100g)	Phosphorus (mg/100g)
100:0 (control)	$0.09^{a}\pm0.01$	$2.74^{b}\pm0.00$	$60.65^{g}\pm0.16$	$268.91^{a}\pm1.14$	$54.45^{g}\pm0.33$	$270.03^{g}\pm1.78$
00:100	$0.11^{a}\pm0.00$	$3.03^{b}\pm0.01$	$87.37^{f}\pm0.11$	$99.83^{b}\pm0.72$	$319.05^{a}\pm0.89$	$466.13^{a}\pm1.23$
90:10	$0.13^{a}\pm0.01$	$3.10^{ab}\pm0.00$	$88.97^{e}\pm0.24$	$268.90^{a}\pm1.35$	$70.82^{f}\pm0.65$	$313.45^{f}\pm0.98$
80:20	$0.14^{a}\pm0.00$	$3.45^{ab}\pm0.03$	$113.70^{d}\pm0.90$	$268.13^{a}\pm1.10$	$84.40^{e}\pm0.30$	$319.05^{e}\pm1.30$
70:30	$0.14^{a}\pm0.00$	$3.70^{a}\pm0.01$	$122.05^{c}\pm0.83$	$266.08^{b}\pm1.23$	$103.21^{d}\pm0.82$	$328.10^{d}\pm1.21$
60:40	$0.15^{a}\pm0.02$	$4.04^{a}\pm0.02$	$136.69^{b}\pm0.69$	$264.24^{c}\pm0.94$	$111.72^{c}\pm0.64$	$348.75^{c}\pm0.97$
50:50	$0.15^{a}\pm0.00$	$4.19^{a}\pm0.05$	$162.46^{a}\pm0.95$	$263.77^{c}\pm1.01$	$122.04^{b}\pm0.97$	$357.90^{b}\pm1.56$

Values followed by different superscript in a column are significantly ($p\leq0.05$) different from each other.

Table 3: Proximate composition of cakes prepared from flour blends of wheat and cashew nut kernels

Flour	Moisture	Protein	Fat	Crude fiber	Ash	Carbohydrate

blends Wheat: Cashew nut	(%)	(%)	(%)	(%)	(%)	(%)
100:0 (control)	$14.27^{a}\pm0.34$	$23.05^{f}\pm0.61$	$3.41^{f}\pm0.12$	$3.57^{d}\pm0.04$	$1.42^{d}\pm0.00$	$54.28^{a}\pm 1.03$
90:10	$13.19^{c}\pm0.51$	$24.12^{e}\pm0.49$	$3.78^{e}\pm0.09$	$3.63^{d}\pm0.01$	$1.95^{cd}\pm0.03$	$53.33^{b}\pm0.97$
80:20	$13.56^{c}\pm0.29$	$25.39^{d}\pm0.37$	$4.96^{d}\pm0.11$	$3.71^{c}\pm0.07$	$2.66^{c}\pm0.01$	$49.72^{c}\pm1.34$
70:30	$13.89^{bc}\pm0.55$	$26.14^{c}\pm0.68$	$6.03^{c}\pm0.06$	$3.84^{bc}\pm0.00$	$2.78^{c}\pm0.05$	$47.32^{d}\pm0.86$
60:40	$13.96^{b}\pm0.27$	$28.10^{b}\pm0.49$	$6.83^{b}\pm0.02$	$3.88^{a}\pm0.03$	$3.81^{b}\pm0.01$	$44.12^{e}\pm0.95$
50:50	$14.42^{b}\pm0.16$	$29.36^{a}\pm0.23$	$7.06^{a}\pm0.14$	$3.95^{b}\pm0.01$	$4.02^{a}\pm0.03$	$41.19^{f}\pm1.08$

Values followed by different superscript in a column are significantly ($p\leq0.05$) from each other

Table 4: Mineral contents of cakes prepared from flour blends of wheat and cashew nut kernels

Blends Wheat: Cashew nut	Copper (mg/100g)	Iron (mg/100g)	Magnesium (mg/100g)	Sodium (mg/100g)	Calcium (mg/100g)	Phosphorus (mg/100g)
100:0 (control)	$0.13^{b}\pm0.17$	$2.95^{c}\pm0.01$	$61.14^{f}\pm0.18$	$273.52^{a}\pm0.95$	$56.33^{f}\pm0.29$	$298.70^{f}\pm0.80$
90:10	$0.14^{a}\pm0.30$	$3.19^{b}\pm0.05$	$90.89^{e}\pm0.02$	$270.76^{b}\pm0.70$	$75.91^{e}\pm0.90$	$311.84^{e}\pm0.92$
80:20	$0.16^{a}\pm0.24$	$3.65^{b}\pm0.01$	$115.64^{d}\pm0.15$	$269.05^{c}\pm0.87$	$87.65^{d}\pm0.75$	$317.47^{d}\pm0.76$
70:30	$0.17^{a}\pm0.06$	$3.81^{b}\pm0.12$	$123.51^{c}\pm0.43$	$267.42^{d}\pm0.61$	$106.43^{c}\pm0.84$	$326.91^{c}\pm0.85$
60:40	$0.18^{a}\pm0.33$	$4.17^{a}\pm0.10$	$138.48^{b}\pm0.22$	$265.73^{e}\pm0.94$	$114.90^{b}\pm0.55$	$341.27^{b}\pm0.98$
50:50	$0.19^{a}\pm0.10$	$4.43^{a}\pm0.05$	$164.64^{a}\pm0.03$	$264.24^{f}\pm0.89$	$123.27^{a}\pm0.63$	$356.03^{a}\pm0.71$

Values followed by different superscript in a column are significantly ($p\leq0.05$) different from each other

Table 5: Physical properties of cakes prepared from flour blends of wheat and cashew nut kernels

Wheat: cashew nut	Batter density	Cake weight (g)	Cake volume (cm^3)	Cake volume index
100:0	0.90 ± 0.00^{a}	32.25 ± 0.64^{d}	242.05 ± 0.87^{d}	103.65 ± 0.00^{a}
90:10	0.90 ± 0.01^{a}	32.94 ± 0.43^{c}	243.53 ± 0.69^{c}	$102.15^{d}\pm0.00^{b}$
80:20	0.87 ± 0.00^{a}	33.12 ± 0.45^{b}	243.69 ± 0.68^{bc}	101.00 ± 0.01^{c}
70:30	0.85 ± 0.00^{a}	33.79 ± 0.29^{b}	244.05 ± 0.72^{b}	100.57 ± 0.01^{d}
60:40	0.85 ± 0.01^{a}	33.92 ± 0.36^{b}	245.76 ± 0.80^{a}	100.10 ± 0.00^{d}
50:50	0.83 ± 0.00^{a}	34.30 ± 0.80^{b}	246.11 ± 0.45^{a}	99.47 ± 0.00^{e}

Mean value with different superscript in a column are significantly ($p\leq0.05$) different from each other

Table 6: Sensory properties of cakes prepared from flour blends of wheat and cashew nut kernels

Wheat: cashew nut	Crust colour	Crumb colour	Crumb grain	Texture	Taste	Overall acceptability
100:0	7.53 ± 0.01^{a}	7.72 ± 0.01^{a}	6.95 ± 0.00^{a}	7.15 ± 0.01^{a}	7.20 ± 0.02^{b}	7.03 ± 0.01^{b}
90:10	7.60 ± 0.01^{a}	7.47±0.01a	6.02 ± 0.00^{a}	6.88 ± 0.02^{a}	8.11±0.01	7.96 ± 0.03^{a}
80:20	7.82 ± 0.01^{a}	$7.53^{a}\pm0.02^{a}$	6.17 ± 0.01^{a}	7.10 ± 0.01^{a}	8.17 ± 0.02^{a}	8.18 ± 0.05^{a}
70:30	$8.05^{a}\pm0.00^{a}$	$7.58^{a}\pm0.01^{a}$	6.44 ± 0.01^{a}	7.29 ± 0.03^{a}	8.26 ± 0.01^{a}	7.85 ± 0.01^{a}
60:40	$7.97^{a}\pm0.00^{a}$	7.65 ± 0.00^{a}	6.56 ± 0.03^{a}	7.05 ± 0.01^{a}	8.64 ± 0.03^{a}	8.20 ± 0.01^{a}

50:50	$8.11^{a}\pm0.02^{a}$	7.80 ± 0.00^{a}	6.63 ± 0.01^{a}	7.33 ± 0.03^{a}	8.80 ± 0.02^{a}	8.43 ± 0.03^{a}

Mean value of twenty member panelist
Mean value with different superscript in a column are significantly ($p\leq0.05$) different from each other.

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