Proximate, Mineral and Sensory Evaluation of Cake Baked from Wheat and Sesame Seed Flour Blends

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ABSTRACT
***Background:** Cake is one of the most common bakery products consumed in the world.*
***Objective:** This study determined the proximate, mineral and sensory attributes of cake from wheat and sesame seed flour blends.*
***Methods:** Sesame seeds were processed into flour and formulated in the ratio 95:5, 90:10, 85:15 for wheat and sesame flour with 100% wheat flour ascontrol. The entire baking ingredients were mixed together thoroughly and the mixtures placed in baking pan and bakedin an electric oven for 20 min at a temperature of 160 °C.*
***Results:**Moisture content was in the range of (11.40% to 17.2%), ash content (1.51% to 2.32%), fat content (38.30% to 39.80%), fibrecontent (0.59% to 1.90%), protein (12.97% to 14.30%) and carbohydrate content (25.70% to 28.90%). Magnesium (26.55mg/100g to 29.07 mg/100g), calcium (14.55mg/100g to16.19mg/100g), sodium (10.67mg/100g to 14.11mg/100g), potassium (327mg/100g to 348mg/100g) and phosphorus (105mg/100g to 195mg/100g). Sensory attributes score varied across the samples. Colour (5.22% to 7.78%), taste (6.19% to 8.22%), texture (6.87% to 7.78%), flavor (7.08% to 8.34%) and overall acceptability (7.27% to 8.43%).*
***Conclusion:** The study showed thatinclusion of sesame seed flour in baking of cake significantly improves the nutritional composition of the cake with an acceptable sensory attribute.*

Keywords: Wheat Flour, Sesame Seed Flour, Cake, Proximate, Mineral

INTRODUCTION

Wheat is one of the prehistoric staple crops that serve as major energy source in human diet across the world (1). Common wheat known as *Triticum aestivum* consist of carbohydrate, proteins, lipids, vitamins, minerals and phytochemicals (1). The grains consist of approximately 75% carbohydrate (1), and therefore, the importance of carbohydrate and fiber in wheat takes precedence over their concentrations of vitamins, minerals, and phytochemicals (2). Sesame (*Sesamum indicum L.*), or benniseed is one of the most ancient oilseeds crop known to mankind and plays an important role in human nutrition (3). Sesame seed is rich in fat, protein, carbohydrates, fibre and minerals (3). The oil seed is renowned for its stability because it strongly resists oxidative rancidity even after long exposure to air (4).

Cake is one of the most common bakery products consumed by people in the world (5). Hence, the need to improve it nutritional qualities especially protein through the addition of sesame seed flour. The objective of this study is to determine the proximate, mineral and sensory attributes of cake made from wheat and sesame seed flour blends.

MATERIALS AND METHODS

Sesame seed (*Sesamum indicum*), wheat flour, egg, margarine, sugar and other baking ingredients for the study were purchased from Kure Market Minna, Niger State.

Preparation of sesame seed flour

The sesame seed flour was processed according to the procedure outlined by (6). Sesame seeds were cleaned, sorted, washed, and dried. Drying was done at 45°C for 30 min and allowed to cool after which the seed was milled to obtain a fine powder. The milled sesame seed was defatted using N- hexane in a soxhlet extractor. Five (5g) of the sesame seed flour was weighed into a filter paper and the filter paper containing the weighed flour was placed into the Soxhlet extractor. The N-hexane was filled into a fat free round bottom flask up to 2/3 of the volume of the flask; the soxhlet apparatus was assembled and allowed to reflux for 6h with heating mantle (KDM 1000) adjusted to 60 -70°C. The filter paper was removed from solvent extractorand the defatted flour was collected.The defatted sesame seed flour was oven dried at temperature of 50^{0} for 1 h and then milled to obtain a finer particle and sieved using a sieve with pore size of 250 μm to removed lumps and make the particle sizes uniform (figure 1

Formulation of blends

Four different samples of wheat and sesame seed flour were formulated as follows 95:5, 90:10, 85:15, 100% wheat flour as control sample (table 1).

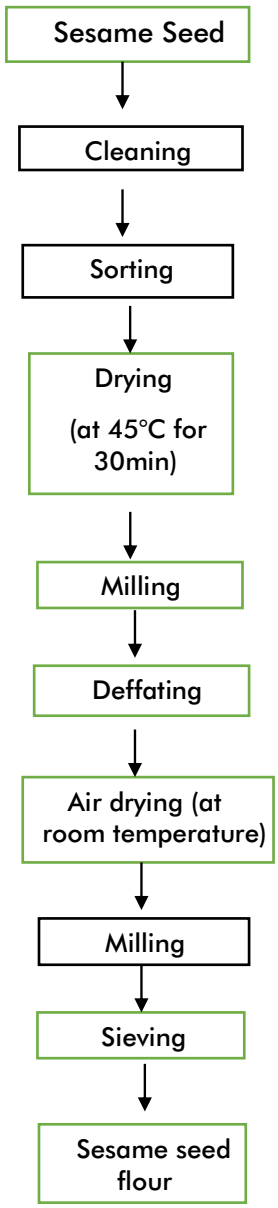

Figure1: Flow chart for the production of sesame seed flour

Table1: Formulation of blends of wheat and sesame seed flour

	Blends			
	100.0%	95:05%	90:10%	85:15%
Wheat flour (g)	100 (A)	95 (B)	90 (C)	85 (D)
SSF (g)	0	5	10	15

*100% wheat flouras control sample

Baking of cake

The cakes were baked according to the method outlined by (7). The sugar and butter were creamed together until it was light and fluffy. Two hundred gram of flour, 100 g of sugar, 80 g of fresh whole eggs, 200 g of butter, 8 g of baking powder and 2 g of vanilla were used. All ingredients were mixed for at least10 min using a Kitchen-Aid Professional mixer. All ingredients of the cake were placed into metallic and lard coated pans (120 mm diameter and 45 mm height), and baked in an electric oven for 20 min at a temperature of 160°C. Wheat flour was substituted by sesame flour at the 0% (control), 5%, 10% and 15% to make the 4 samples A, B, C, and D. After baking, the cakes were removed from the pans and left to cool for 1 h and wrapped with aluminum foil (figure 2).

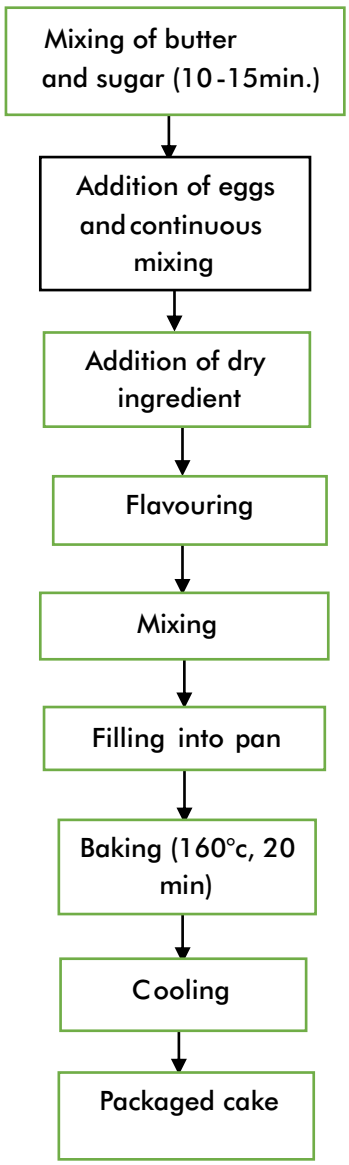

Figure 2: Flowchart for the production of cakes

Proximate composition

Moisture, crude protein, total ash, crude fibre and carbohydrate contents were determined using standard methods as outlined by (8). Briefly, oven drying method at 105°C for 5 h for moisture determination, micro -Kjeldahl method for crude protein, total ash was obtained by igniting 2g sample at 550°C for 4 h using muffle furnace. Crude fibre was determined using digestion method and carbohydrate was estimated by the difference [100 - (% water + % protein + % fat + % ash + % crude fibre)]. Crude fat was determined using standard soxhlet extraction method with diethyl ether as the solvent as specified by (8).

Mineral composition

The mineral composition (sodium, potassium, calcium, phosphorous and magnesium) were determined using corning 400 flame photometer and calorimetrically with Jenway 6100 spectrophotometer as described by (9).

Sensory evaluation

Sensory quality attributes including taste, flavour, texture, crust colour, crumb colour and overall acceptability of the cake samples were evaluated by (20) panelists comprising of students and staff members of the Department of Food Science and Technology, Federal University of Technology, Minna. The panelists were instructed to score the coded samples based on a 9-point hedonic scale ranging from 9=liked extremely to 1=disliked extremely as described by [10].

Statistical analysis

All experiments were carried out in triplicate. Data obtained were subjected to one-way analysis of variance (ANOVA) while Duncan's multiple range test were conducted to separate the means. These were done using the Statistical Package for the Social Scientists (SPSS version 16.0). Significance level was accepted at 5%.

RESULTS AND DISCUSSION

The proximate composition of the samples as presented in Table 2 shows a significant ($p \leq 0.05$) decrease in the moisture content with an increasing inclusion of sesame seed flour from 11.40% to 13.72%. The control sample has the highest moisture content of 17.2% and this may be attributed to the zero-percentage inclusion of

sesame seed flour in the control sample. Lower moisture content in the samples with sesame seed flour is indicative to long shelf life and good keeping quality of sesame seed. This is an advantage since most spoilage organism does not thrive well on food items with low moisture content (11).The significant increase ($p \leq 0.05$) in the protein content from 12.97% to 14.30% with an increase in the level of inclusion of sesame seed flour is due to the fact that sesame seed is a good source of protein (12). Cakes made from wheat and sesame flour blend are good source of digestible protein and carbohydrate (13). The increase in the protein content is beneficial to the consumer as it helps prevent protein energy malnutrition.

The fat content was in the range of 38.30% to 39.80%. High fat content observed in the samples with sesame seed flour is probably due to the fact that sesame seed is an oil seed plant [14]. There was a significant ($p \leq 0.05$) increase in the crude fiber of the samples from 0.59% to 1.90% with an increase in incorporation level of sesame flour. This could be attributed to the fact that sesame seed is a rich source of fibre (14). High fibre content has been reported to be beneficial in the prevention of constipation and diverticulitis, remove toxic materials from the body and has a high holding capacity thereby making stooling easier (15). There was a significant ($p \leq 0.05$) decrease in the carbohydrate content with an increasing level of sesame flour from 28.9% to 25.70%. This could be due to the fact that sesame seed is a seed high in protein (16).

The mineral composition of the samples as presented in Table 3 shows a significant ($p \leq 0.05$) increase with an increasing level of inclusion of sesame seed flour. This might be due to the fact that sesame seed is a rich source of minerals (17). The seeds are incredibly rich sources of many essential minerals which include phosphorus, sodium, and magnesium in concentrated amounts. Many of these minerals have vital role in bone mineralization, red blood cell production, enzyme synthesis, hormone production as well as regulation of cardiac and skeletal muscle activities (18). Mineral elements play vital role in metabolic processes; this includes regulation of muscle contractions, transmitting of impulses, bone formation, maintenance of osmotic pressure, acid-base balance and absorption of glucose (19).

The sensory attributes as presented in Table 3 shows significant difference ($p \leq 0.05$) among samples for colour, taste, texture, flavor and over all acceptability. The sensory characteristics were found to decrease significantly with an increasing inclusion of sesame seed flour. Thus, sensory attributes of the control sample were generally more acceptable than other samples. These findings are in line with the observation of (20) that reported that blend formulation of wheat flour with sesame seed flour in the baking of cake have a significant impact on the resultant cakes by way of reducing its overall acceptability probably due to the concentrated sesame aroma, the brownish colour, and less crispy characteristics of the crumb making them to have low sensory score.

Table 2: Proximate composition of cake from wheat and defatted sesame flour blends

Parameters (%)	Samples			
	A	B	C	D
Moisture Content	17.2 ± 0.1^{a}	11.40 ± 0.05^{c}	13.35 ± 0.45^{b}	13.72 ± 0.02^{b}
Crude Protein Content	12.20 ± 0.02^{d}	13.15 ± 0.02^{b}	13.64 ± 0.16^{ab}	14.30 ± 0.10^{a}
Crude Fibre content	0.59 ± 0.05^{c}	1.35 ± 0.05^{b}	1.78 ± 0.02^{a}	1.90 ± 0.14^{a}
Ash content	1.50 ± 0.10^{c}	2.10 ± 0.01^{b}	2.23 ± 0.10^{a}	2.32 ± 0.02^{a}
Fat content	18.30 ± 0.10^{c}	$18.95^{c} \pm 0.05^{c}$	20.20 ± 0.05^{b}	21.80 ± 0.05^{a}
Carbohydrate content	49.39 ± 0.10^{b}	51.65 ± 0.10^{a}	48.93 ± 0.01^{b}	46.05 ± 0.01^{c}

Values are means ± standard deviation of duplicate determination. Values in the same row with different superscript are significantly ($p \leq 0.05$) different.
Correct the positions of the letters. Apply to all tables.

Table 3: Mineral composition of cake from wheat and defatted sesame flour blends

Parameters (mg|100g)	Samples			
	A	B	C	D
Sodium	12.38^{c} ± 0.1	10.67^{d}± 0.56	12.61^{b} ±0.45	14.11^{a}± 0.00
Potassium	348^{c} ±0.00	359^{a} ± 2.50	356^{b}± 6.50	327^{d}±3.00
Phosphorus	105^{d} ± 1.00	119^{c} ± 1.00	195^{b}± 1.50	128^{a}±0.00
Magnesium	28.4^{b}± 0.00	27.6^{c}± 0.28	26.55^{d}± 0.49	29.07^{a}± 0.35
Calcium	16.19^{b}± 0.85	15.00^{c}± 0.00	17.11^{a}± 0.70	14.55^{d}± 0.55

Values are means ± standard deviation of duplicate determination. Values in the same row with different superscript are significantly (p ≤0.05) different.

Table 4: Sensory attributes of cake from wheat and sesame flour blends

Parameters (%)	Samples			
	A	B	C	D
Colour	7.78^{a} ± 0.05	7.54^{b}± 0.31	6.41^{c} ± 0.31	5.22^{d} ± 0.22
Taste	8.22^{a} ± 0.21	8.23^{b}± 0.10	7.73^{c} ± 0.91	6.19^{d}±0.15
Texture	7.78^{ab} ± 0.05	7.90^{a} ± 0.04	7.48^{b}± 0.05	6.87^{c}±0.11
Flavour	8.34^{ab} ± 0.10	8.53^{a}± 0.10	8.10^{b}± 0.10	7.08^{c}± 0.20
Overall acceptability	8.43^{ab}± 0.10	8.63^{a} ± 0.60	8.37^{b} ± 0.30	7.27^{c} ± 0.25

Values are means ± standard deviation of duplicate determination. Values in the same row with different superscript are significantly (p ≤0.05) different.

Keys:
A = 100% wheat flour cake
B = 95% wheat flour and 5% sesame seed flour cake
C = 90% wheat flour and 10% sesame seed flour cake
D = 85% wheat flour and 15% sesame seed flour cake

CONCLUSION

The study shows blends formulation of sesame seed flour with wheat flour in baking cake significantly increase the protein content, fat content, and fiber content but significantly reduce the moisture content which indicate longer shelf life and it also increase the mineral component significantly. However, the control samples with 100% wheat flour show a better acceptability in terms of sensory characteristics. It is recommended that the ratio of wheat flour to sesame seed flour should not be more than 95% to 5% in order to have a generally acceptable cake.

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