# NUTRITIONAL, MICROBIAL AND SENSORY QUALITIES OF CAKE MADE FROM WHEAT FLOUR FORTIFIED WITH SESAME SEED AND CARROT FLOUR

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**Abstract**

The present study is aimed at determining the effect of sesame seed and carrot flour on the quality of cake produced from wheat flour. Cake, a baked food was produced from wheat flour fortified with sesame seed and carrot flour in the ratio 100:0:0, 80:20:0, 80:20:0, 80:10:10, 70:15:15 respectively. Proximate, mineral composition, microbial analysis and sensory properties of the cakes were determined using standard methods. The results showed that moisture, ash, fat, protein, fibre and carbohydrate content ranges from 17.58 - 23.21, 1.55 - 3.81, 15.18 – 24.06, 0.46 – 1.00, 10.27 – 23.53, 35.80 – 42.93 respectively . There was increase in protein, fat and moisture contents. The mineral analysis depict an increase in calcium, magnesium, manganese, zinc, molybdenum contents and vitamin A ranges from 7.04 – 10.00, 5.91 – 8.91, 0.28 – 2.19, 0.79 – 5.27, 0.04 – 0.27, 0.05 – 0.39 respectively and varied significantly. The total viable count ranges from $12\times10^2$ to $19\times10^2$ cfu/g while there was no growth of *Staphylococcus*. However, decrease in the sensory ratings of cake with increase in sesame seed flour and carrot flour was observed in samples D and E. There were significant differences ($p< 0.05$) in sensory attributes analyzed. Sample B (80:20) had the best overall acceptability ratings of 7.80 among the fortified samples. Wheat, Sesame seed and carrot flour blends in production of cakes provide healthy and highly nutritious snacks.

**Keyword**: nutrient, microbial, cake, sesame seed, carrot flour

## Introduction

Bakery products have been consumed for hundreds of years by man. Among the different bakery products is the cake. Cakes are soft bakery products produced by baking a batter containing flour, baking powders and beaten eggs with or without shortenings (IFIS, 2005). Depending on desired final products, other ingredients such as flavourings, nuts, chocolate and dried fruits can as well be included. In its oldest form, cakes are bread modification but now cover a wide range of preparations that can be simple or elaborate. Typical cake ingredients are flour, sugar, eggs, butter or fat (a liquid), and leavening agents, such as baking powder (Akubor, 2011). Cakes are important baked product in human diet and are usually eaten with soft drinks, juice or tea and are also used as weaning foods for infants.

Wheat (*Triticum aestivum*) is a cereal grain grown all over the world for its highly nutritious and useful gain. It is one of the top three most produced cereals in the world, along with corn and rice. According to Okaka (2005), only wheat contains substantial amount of gliadin and gluten (special protein) which when kneaded with water gives gluten, the elastic material important in yeast or aerated baked goods.

Sesame (*Sesamum indicum*) seed equally known as beniseed, is one of the most cultivated oilseed crops grown all over the world. The sesame seed flour can be used in food products as a protein, tryptophan and methionine supplement (Escamilla-silva et al., 2003). Sesame seed is an excellent source of high quality oil, stable and free flavour component having natural anti-oxidants which prevent aging and production of liver cells (Weiss, 2000). Sesame seed oil is one of the few vegetable oils that can be used directly without cooking (Borchani, 2008). The seed cake is a good source of protein supplement in the industry.

Carrot (*Daucus carota*) is grown on a large scale in northern Nigeria (Asagbara & Oyewole, 2010). However, it is widely consumed in all parts of Nigeria. Indeed, the consumption of carrot in Nigeria has increased tremendously in recent years because of increasing awareness of its benefits. Among vegetables, carrot is the best source of carotene

which is the precursor of vitamin A, an essential nutrient for maintaining health (Akubor & Ike, 2012; Heiman, 2010). Carrot also contains oxycarotenoids such as leutin which has shown to be protective against colon cancer in man and woman (Jonas, 2011). Appreciable amount of other vitamins, minerals and anthocyanins are also found in carrot. In Nigeria, local utilization of carrots is mostly limited to direct unprocessed eating. Carrot can be dehydrated; therefore dehydrated carrot could be processed into flour for foods to increase vitamin A and mineral content (Weiss, 2000).

Cakes are generally preferred by children and teenagers. At these stages in life, the amount and nutritional quality of protein are important because of their essential functions in physical and mental development (Kolawole et al., 2013). The addition of Sesame seeds and carrots flour with wheat would be of essential nutrient in the diet of children and teenagers that are major consumers of cakes. The problem associated with deficiency in ordinary wheat cake can be resolved by fortifying it with carrot sesame flour thus increasing its protein and vitamin A content. This research therefore studied the nutritional content and microbial analysis of wheat carrot sesame seed cake and its acceptability through sensory evaluation.

## Materials and Methods

### Source of Materials

Processed wheat flour used in this study was purchased in a store at Ilaro. The sesame seed, carrot and other baking ingredients (sugar, fat, nutmeg, baking powder, eggs and flavoring) were purchased at Sayedero market in Ilaro, Ogun State, Nigeria while all reagents used were of analytical and microbiological grade.

### Sample Preparation

#### *Preparation of carrot flour*

The method described by Marvin (2009) was used in the production of carrot flour. The carrot were washed in portable water, scraped, peeled and sliced into 56mm thickness. The sliced carrots were blanched for 3 minutes in hot

water containing sodium metabisulphite to prevent browning and discolouration. The sulphited carrots were immediately cooled by exposing to air and dried in a cabinet dryer at 50$^{o}$C for 12 hours. The dried carrot was ground to fine powder using blender (model HL 3294Cphilips) and sieved with 0.150µ sieve, this was later packaged in a black polythene bag and labeled for further use.

#### *Preparation of sesame seeds flour*

Sesame seed were destoned and washed thrice with portable water and then dried in an oven at 105$^{0}$C for 6 hours. The dried grains were milled in a laboratory type hammer mill (Christy type) to pass through a 250µm mesh sieve and then packaged in an air tight container for production and further analysis.

#### *Sample formulation*

Wheat flour was blended with carrot flour and sesame seed flour in the ratios 100:0:0 (wheat flour as control) 80:20 (Wheat and carrot flour), 80:20 (Wheat and sesame seed flour) 80:10:10 and 70:15:15 (wheat, sesame seed and carrot flour) using a Kenwood Food Processor (Model A 907, D, Kenwood Ltd, England).

#### *Cake preparation from wheat-sesame-carrot flour*

Cakes were prepared by mixing the following ingredients 500g flour, 200g sugar, 4g baking powder, 10 eggs, 70g butter and a teaspoonful of vanilla flavour. In preparation of cakes, baking fat and sugar were creamed together for 30mins until soft and light, the eggs were beaten for 5minutes, sesame-carrot flour were incorporated at different ratios 100:0, 80:20 (wheat and carrot flour), 80:20:0 (wheat and sesame seed flour), 80:10:10, 70:15:15 (wheat, carrot flour and sesame seed flour). Other ingredients were added and mixed thoroughly until dropping consistency was achieved, and then poured in an already greased baking pan at 170$^{o}$C for 15minutes. The cakes were cooled and removed from the pan after an hour, the cooled cake were packaged in aluminum foils and kept until required (Atef et al., 2011). Hundred percent (100%) wheat flour was used as the control sample.

**Proximate Analysis**

**Determination of moisture content**
The moisture content was determined using Hot-air oven according to the method of Association of Official Analytical Chemists (AOAC, 2006).

**Mineral Analysis**
The mineral analysis was done using Ashing method according to (AOAC, 2010). The mineral content (Calcium, Zinc, Magnesium, Manganese, Molybdenum and vitamin A) were determined using Atomic Absorption Spectrometer (AAS).

**Microbial Analysis**
Freshly prepared 1gram of each cake samples were serially diluted with sterile distilled water and appropriate dilutions were plated on nutrient agar, potato dextrose agar (PDA), Baird Parker agar, for total viable, fungal and *Staphylococcus* count respectively. All the plates except PDA plates were incubated at 35°C for 24hrs. The PDA plates were incubated at 28°C for 72hrs and were supplemented with streptomycin to inhibit the growth of bacteria (Lynne, 2013).

**Sensory Evaluation**
Coded samples of cakes were presented to ten (10) panelists. All panelists were regular consumers of cakes and were familiar with sensory quality attributes of cakes. They were instructed to score the following attributes: colour, texture, taste, flavour and overall acceptability of the products using 9-point hedonic scale ranging from 1 (dislike extremely) to 9 (liked extremely) according to the method of (Ihekoronye & Ngoddy, 1985).

**Results and Discussion**

**Table 1:** Proximate Composition of cake from wheat flour fortified with carrot and sesame seeds flour

| | SAMPLES | | | | |
|---|---|---|---|---|---|
| **Parameters** | **A** | **B** | **C** | **D** | **E** |
| **Moisture** | $23.21^{e}$±0.02 | $17.58^{a}$±0.01 | $18.34^{b}$±0.01 | $19.13^{c}$±0.01 | $21.9^{d}$±0.01 |
| **Ash** | $3.81^{c}$±0.01 | $4.70^{e}$±0.01 | $4.49^{d}$±0.01 | $1.55^{a}$±0.01 | $2.17^{b}$±0.01 |
| **Fat** | $24.06^{e}$±0.02 | $15.18^{a}$±0.02 | $18.35^{b}$±0.08 | $19.95^{c}$±0.01 | $22.93^{d}$±0.01 |
| **Fibre** | $0.87^{c}$±0. 01 | $1.00^{e}$±0.01 | $0.92^{d}$±0.01 | $0.46^{a}$±0.01 | $0.71^{b}$±0.01 |
| **Protein** | $10.27^{a}$±0.01 | 23.53e±0.02 | $19.29^{d}$±0.01 | $16.05^{b}$±0.02 | $16.42^{c}$±0.01 |
| **Carbohydrate** | $37.40^{b}$±0.04 | $38.05^{c}$±0.01 | $38.65^{d}$±0.06 | $42.93^{e}$±0.07 | $35.80^{a}$±0.07 |

**Values are means of duplicate determination ± SD (Standard deviation)*
**Means in the same column with different superscript are significantly different ($p<0.05$)*

**Key:**
A=100:0:0 (Wheat flour)
B= 80:20:0 (Wheat and carrot flour)
C= 80: 0: 20 (Wheat and sesame seed flour)
D=80:10:10(Wheat, carrot flour and sesame seed flour)
E=70:15:15(Wheat, carrot flour and sesame seed flour)

**Table 2**: Mineral composition of cake from wheat flour fortified with carrot flour and sesame seeds

| | SAMPLES | | | | |
|---|---|---|---|---|---|
| **Parameters** | **A** | **B** | **C** | **D** | **E** |
| **Calcium** | $10.00^{e}$±0.01 | $9.55^{d}$±0.01 | 7.04a±0.00 | 7.77c±0.01 | 7.20b±0.01 |
| **Magnesium** | $5.91^{a}$±0.01 | $6.95^{b}$±0.01 | $7.26^{c}$±0.01 | $8.91^{e}$±0.01 | $8.04^{d}$±0.01 |
| **Manganese** | $2.19^{e}$±0.01 | $1.23^{b}$±0.01 | $1.61^{c}$±0.01 | $0.28^{a}$±0.01 | $2.05^{d}$±0.01 |
| **Zinc** | $5.27^{e}$±0.01 | $2.71^{b}$±0.01 | $3.95^{c}$±0.01 | $0.79^{a}$±0.01 | $4.34^{d}$±0.01 |
| **Molybdenum** | $0.06^{b}$±0.01 | $0.20^{d}$±0.01 | $0.04^{a}$±0.01 | $0.05^{ab}$±0.00 | $0.10^{c}$±0.01 |

| | | | | | |
|---|---|---|---|---|---|
| **Vitamin A** | $0.05^{a}$±0.00 | $0.26^{a}$±0.00 | $0.39^{a}$±0.44 | $0.10^{a}$±0.00 | $0.15^{a}$±0.00 |

***Values are means of duplicate determination ± SD (Standard deviation)*

**Table 3**: Microbial analysis of cake from wheat flour fortified with carrot and sesame seed flour

| | SAMPLES | | | | |
|---|---|---|---|---|---|
| **Parameters** | **A** | **B** | **C** | **D** | **E** |
| **Total viable Count (cfu/ml)** | $14.50^{a}$±3.54 | $17.50^{a}$±2.12 | $22.50^{a}$±3.54 | $15.50^{a}$±4.95 | $18.30^{a}$±4.32 |
| **Fungi Count (**cfu/ml**)** | $1.00^{a}$±1.41 | $0.50^{a}$±0.71 | $0.50^{a}$±0.71 | $0.00^{a}$± 0.00 | $0.00^{a}$±0.70 |
| ***Staphylococcus* Count (**cfu/ml**)** | $0.00^{a}$±0.00 | $0.00^{a}$±0.00 | $0.00^{a}$±0.00 | $0.00^{a}$±0.00 | $0.00^{a}$±0.00 |

**Table 4:** Sensory Analysis of cake from wheat flour fortified with Carrot and *Sesame* seeds flour

| | SAMPLES | | | | |
|---|---|---|---|---|---|
| **Parameters** | **A** | **B** | **C** | **D** | **E** |
| **Colour** | $7.90^{b}$±0.87 | $6.70^{a}$±1.33 | $6.30^{a}$±1.25 | $6.80^{a}$±0.91 | $6.20^{a}$±1.20 |
| **Taste** | $8.10^{b}$±0.73 | $7.50^{cd}$±0.97 | $5.20^{a}$±1.47 | $6.20^{ab}$±1.54 | 6.60bc±0.84 |
| **Flavour** | $7.50^{b}$±1.08 | $7.20^{b}$±1.03 | $4.50^{a}$±1.08 | $5.50^{a}$±1.26 | $6.60^{b}$±1.50 |
| **Texture** | $7.80^{b}$±0.78 | $7.80^{b}$±0.91 | $6.50^{a}$±1.71 | $6.10^{a}$±1.44 | $6.40^{a}$±1.42 |
| **Overall acceptability** | $8.60^{b}$±0.69 | $7.80^{b}$±0.78 | $6.10^{a}$±0.99 | $6.40^{a}$±1.07 | $6.40^{a}$±1.64 |

**Values are means of duplicate determination ± SD (Standard deviation)*

**Means in the same column with different superscript are significantly different (p>0.05)*

The proximate composition of the prepared cake is presented in Table 1. The result shows that moisture content decreased from 23.21 to 17.58% due to the varying ratios. The ash content of the cake samples increases from 1.55 to 4.70% with increasing proportion of wheat flour and carrot flour. The protein content of the cakes ranges from 10.27 to 23.53 %, sample B exhibited significantly and recorded as 23.53%. This is obviously due to the presence of protein in the carrot and eggs used. The increase in ash and protein content is in agreement with the findings of Kolawole et al., (2013), who fortified wheat flour with moringa leaf in cake production. The Fat content ranges from 15.18 to 24.06%.The values obtained for the fat content showed that sample E had the highest value; the progressive increase in the fat content may be attributed to the addition of full fat sesame seed flour, which is an oil seed. High fat content will impact negatively on the shelf stability of a product due to rancidity development. Thus for better storage quality, defatting oil seed before utilization may yield better result, if sesame seed flour is to be used at higher substitution level. Crude fiber values showed that the B has the highest values while the least crude fiber was the A (control) sample. This was in agreement with the findings of Oyeyinka et al., (2014) who produce cake from wheat and cowpea using date fruits as sweeteners. High fiber is beneficial to the body as it would help maintain bowel integrity, lower blood cholesterol level, and control blood sugar level. Thus consumption of these products would provide appreciable amount of fiber to the body for proper functioning of the digestive and excretory system. The result shows a significant difference ($p<0.05$) between all the samples in the carbohydrate values where sample D had the highest value of 42.93 and sample E had the least value of 35.80.

The result of mineral composition of the prepared cake is presented in Table 2. The result shows that calcium content ranged from10.00 to 7.20%. The magnesium value was the highest in sample E and the values ranged from 8.91 to 5.91%. The magnesium content (8.91 – 5.91%) of the fortified cake increase significantly ($p<0.05$) which could be due to high magnesium content in *sesame seed* flour. Unfortified cake has the lowest magnesium content (5.91%) while 10% carrot flour and 10% *sesame seed* flour respectively in the fortified cake sample has the highest magnesium content (8.91%) with no significant difference between the cake samples (Soetan et al., 2010). Magnesium is important for maintaining normal nerve and muscle function, supports a healthy immune system and helps to regulate blood glucose levels and aid in the production of energy and protein (Ufot et al., 2010). The molybdenum content (0.04 – 0.20%) of the fortified cake increased significantly ($p<0.05$) across the samples while sample C has the least molybdenum content. There is no significant difference ($p<0.05$) between the samples.

Molybdenum is a cofactor for enzymes necessary for the metabolism of sulphur-containing amino acid and nitrogen-containing compounds present in DNA and RNA (Soetan et al., 2010). The vitamin A of the cake samples shows that sample B has the highest vitamin A content which ranged from 0.05 to 0.39%. The control sample A has the least vitamin content.

Microbial loads of the samples are presented in Table 3, Sample C has the highest total viable count $22.50\times10^2$, and followed by sample E with 18.30×102 cfu/g. Sample A has the least viable count of 14.50×102 cfu/g. For the fungal count, sample A has the highest value of $1.00\times10^2$ cfu/g while sample B and C has the same and lowest count ($0.50\times10^2$ cfu/g), there was no growth of yeast or mould in sample D and E which may be due to the composition of the cake that inhibit their growth. Antimicrobial activity of sesame seed has been reported by Ogunsola and Fasola, (2014). There was no growth of *Staphylococcus* in all the samples. This might have been due to the increase in the content of the sesame flour in the cake and hygienic practice kept to, during production. The presence of some of the few microorganism associated with cake sample are not surprising as most of them are known to thrive in medium rich in moist bakery products.

The result of the sensory evaluation of the fortified cake is presented in Table 4. The result shows that the mean scores by the panelists for colour, texture, taste, flavor and overall acceptability varied among the samples. Colour and taste are important sensory characteristics that affect the acceptability of any food product by the consumers.

The result for colour shows no significant difference ($p<0.05$) across the fortified cake samples which ranged from 7.90 to 6.20 with sample A and D having the highest mean scores for colour. Other samples are also rated high where sample B, C, and D have mean scores of 6.70, 6.30 and 6.80 respectively. The result for texture ranged from 7.80 to 6.10. The scores for texture of the fortified cake are 7.80, 7.80, 6.50, 6.10 and 6.40 respectively. The texture of sample D is the least preferred as the mean score value (6.10). This could be that the texture of the product is affected at the level of substitution of flour incorporation used. The result of taste shows significant difference ($p<0.05$) across the samples which range from 8.10 to 5.20 with sample A and B having the highest mean scores for taste. The result of the flavour ranged from 7.50 to 4.50, and there is significant difference ($p<0.05$) between the values. The overall acceptability (8.60 – 6.10) shows there is slight significant difference ($p<0.05$) between the sample. However, sample A (control) with the highest mean score (8.60) and among the fortified samples ,sample B (80, 20) is the most preferred sample in terms of overall acceptability, while sample C is the least preferred sample.

**Conclusion**

The study poised to have shown that 10%, 15% sesame seed flour and 20% carrot flour substitution rate for wheat flour produced an acceptable cake with high nutritive quality compared to whole wheat flour. This would provide a healthy snack and also protect against obesity and diabetes in both infants and adults. Productions of cakes of different kinds from 10-20% sesame, carrot flour composite with wheat flour purvey extra nutritional composition especially for growing children.

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