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Quality Characteristics and Sensory Evaluation of Cakes Produced from Composite Blends of Wheat (*Titricum Aestivum L.*) and Finger Millet *(Pennisetum Glaucum)* Flour

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Abstract

The proximate composition and functional properties of flour blends from wheat and millet at 0%, 10%, 20%, 30% and 40% were determined using AOAC standard method. The products were coded as A(100% Wheat flour as control), B(90% Wheat flour and 10% Millet flour), C(80% Wheat flour and 20% Millet flour), D(70% Wheat flour and 30% Millet flour), E(60% Wheat flour and 40% Millet flour). Cakes were prepared using these blends and their sensory properties assessed. Results obtained revealed that the protein content of the flour increased with increase in millet flour addition from 9.36–13.74%. Significant differences ($p < 0.05$) were observed in the fat (12.38–20.35%), ash (0.69–1.28%), crude fibre (1.78–3.85% and carbohydrate (51.65–55.48%) respectively. The bulk density, water and oil absorption capability, emulsion ability, and foaming capacity had significant variations ($p<0.05$) in all the flour samples. The cake with 40% millet flour (D) was most accepted amongst the samples produced. The composite cake samples recorded a significant difference ($p < 0.05$) between the control in most parameters assessed. The study concluded that millet flour could be used to supplement wheat flour up to 40% in baking to minimize wheat flour imports while also increasing millet flour production and its value.

Keywords: Millet flour, flour blends, composite cake, functional properties acceptable, sensory

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INTRODUCTION

The nutritional adjustment of food products has gained popularity in recent years as consumers' interest in healthy eating has grown (Shandilya and Sharma, 2017). Cake is a popular and widely consumed cereal-based dish that offers key nutrients like carbohydrate, fat, protein, fibre, vitamins, and minerals (Bagdi et al., 2016; Callejo et al., 2016).

It is a sweeter confectionary product than other confectionery goods. Flour, sugar, oil, eggs, flavour, and leavening are used to make it.Cakes are one of the most popular confectionary products since they are seen as expensive gifts for adults and children, particularly on birthdays, and because someone birthday is celebrated every day, this makes it even more popular (Shameena Beegum, 2016).

People are more anxious about what they eat these days due to health concerns, thus, many additional or more nutritive elements are utilized to fortify cakes. Wheat flour is basic ingredient in bread and cakes preparation. It contains starches and glutens that aid in the baking of leavened aerated bread and batters, although it is low in fat and balanced amino acids (Goesaert et al., 2005). However, much of the imported wheat with high gluten functionality is unsuitable for tropical climes. The performance of cassava flour with soybean flour used in wheat bread and cakes has been documented, with a surge in interest in locally based food components to partially replace wheat flour in cakes and bread preparation (Ayele et al., 2017). Due to the high price of wheat on the global market, partial substitution of wheat flour with flour from other crops such as root and tuber could be a useful method for developing nations to solve wheat shortages and also enhance the nutritional value of the food as well as diversifying the use of underutilised crops (Mitiku et al., 2018). To address the needs of individuals who consume wheat products, it is critical to employ locally available affordable crops like finger millet (FM) for baking.

Millets are small-seeded subsistence cereal plants in the *Poaceae* family and it is one of the main drought-resistant crops and the world's sixth most-produced cereal grain. They are a staple food for a vast number of poor people in Africa, East Asia, and the Indian subcontinent (Chandrasekara et al., 2012). In comparison to other grains, millet possesses pest and disease tolerance, a short growing season, and high yield during droughts, therefore are an important part of many developing countries' economies. (Devi et al., 2011). Millets are high in phytochemicals and micronutrients (Mal et al., 2010; Singh et al. 2012). It is high in carbohydrate, protein, dietary fibre, vitamins B complex, and minerals like calcium, phosphorus, magnesium, and manganese (OkwudiliUdeh et al., 2017), as well as phenolic compounds (OkwudiliUdeh et al., 2017; Shahidi and Chandrasekara, 2013). These phenolic have been linked to several potential health benefits including cancer prevention, cardiovascular disease prevention, and blood pressure reduction (Saleh et al., 2013). Finger millets have a higher dietary fibre and mineral content than wheat and rice (Ramashia et al., 2018).

For human consumption, finger millet is used to make chapatti, dumpling, and porridge. A prior study shows that finger millet flour could be mixed with wheat flour in various quantities for making cakes, biscuits, and snacks (Gavurnikova et al., 2011). The iron and calcium content of composite cake increases when wheat flour is partially replaced with flour from locally grown cereal grains (Oladele and Aina, 2009). Jensen et al., (2015) and Begum et al. (2011) conducted previous research in which wheat flour was replaced with 30 and 20% cassava flour respectively, and created satisfactory composite bread with negligible differences when compared to 100% wheat flour bread. Nowadays, confectionery industries have the difficulty of making meals that contain useful components in order to meet the nutritional needs of all people, including those with unique health concerns, which is why millet flour has been added to wheat flour for cakes making.

As a result, the goal of this research was to determine the quality characteristics of cakes that was partially substituted with finger millet (*Eleusine corocana*) flour in order to produce a composite cake from wheat and Finger Millet flours to improve the nutrients and diversify the use of an underutilized crop.

MATERIALS AND METHODS

Source of raw materials

Finger millet grain was procured from Kumasi Central Market in the Ashanti Region of Ghana. Other ingredients such as wheat flour, margarine, eggs, sugar, salt, vanilla essence and baking powder were purchased from the same Market in the Ashanti Region of Ghana.

Sample Preparation
Finger Millet

To eliminate foreign contaminants and sand, 3 kg of grains were washed in distilled water and dried for 24 hours at 50°C in a hot air oven drier (Apex, Royce Ross Ltd). In a Quaker City Crushing Co, Model 4-E, Phoenixville, Dad mill. It was then milled into flour using the Jideani (2005) process. The flour was sieved, packed and sealed in a polythene bag for preparation of composite flour.

Formulation of composite flour

Table 1 shows how composite flours were made from wheat and Finger Millet. The flour samples were prepared with the incorporation of 0, 10, 20, 30 and 40% finger millet flour (FMF). As a control (sample A), one hundred percent (100%) wheat flour was used. 90% wheat flour and 10% Finger Millet flour were used in Sample B, 80% wheat flour and 20% Finger Millet flour were used in Sample C, while Sample D was made up of 70% wheat flour and 30% Finger Millet flour, then 60% wheat flour and 40% Millet flour were used in Sample E. To achieve uniform blending, the mixes were carefully blended in a blender (Aboshora et al., 2016).

Table 1. Formulation of ingredients for cake making

Ingredients	A	B	C	D	E
Soft wheat flour (g)	100	90	80	70	60
Millet flour	0	10	20	30	40
sugar (g)	100	100	100	100	100
Margarine (g)	100	100	100	10	10
Eggs (large size)	10	10	10	10	10
Baking powder (g)	10	10	10	10	10
Salt (g)	1	1	1	1	1
Vanilla essence (ml)	5	5	5	5	5

A(100% Wheat flour), B(90% Wheat flour and 10% Millet flour), C(80% Wheat flour and 20% Millet flour), D(70% Wheat flour and 30% Millet flour), E(60% Wheat flour and 40%Millet flour)

Method of preparation

For the production of the various cake samples, Tanya SNC (2016) approach was followed with minimal changes. In a medium sized mixing bowl, sugar (100 g) and margarine (100 g) were creamed together until light and fluffy. Ten grams (10 g) of eggs were beaten into the mixture and gradually mixed. Wheat flour (200 g), baking powder (10 g), salt (1 g), and nutmeg powder (1 g) were combined in a separate bowl with a food mixer.

The combined dried ingredient was gradually added to the wet ingredients and gently mixed until there were no lumps. The mixture was then spooned onto a prepared 6 x 2 inch loaf pan and baked in a preheated electric oven (De'Longhi Kenwood A.P.A Ltd, M0746, Hong Kong) at 180 °C for 30 min until a toothpick inserted in the center comes out clean (approx.30-32 min). The cake samples were allowed to cool for 10 min, which was then packaged in a sealed polyethylene bags and stored at 4°C until analyzed.

Proximate composition

To ascertain the nutritional quality of the cake samples, they were evaluated. Moisture, ash, protein, fat, and carbohydrate content were all assessed using established procedures by AOAC (2015).

Moisture content and total solids: Oven Drying Method

Five grams (5g) of the cake sample was transferred to the previously dried and weighed dish. The Dish was placed in an oven and thermostatically controlled at 105 degrees for 5 hours. Dish was removed and placed in a desiccator to cool to room temperature and weighed. It was then dried again for 30 minutes, cooled down again and weighed. Drying, cooling and weighing were repeated until a constant weight was reached. (Alternatively, sample could be dried in a thermostatically controlled oven for at least 8 hours where a constant weight would be achieved). The determinations were duplicated and the average found.

Calculations

$$\% \text{ Moisture (wt/wt)} = \frac{\text{wt } H_2O \text{ in sample}}{\text{Wt of wet sample}} \times 100$$

$$\% \text{ Moisture (wt/wt)} = \frac{\text{wt of wet sample-wtof dry sample}}{\text{Wt of wet sample}} \times 100$$

$$\% \text{ Total solids (wt/wt)} = \frac{\text{wt of dried sample}}{\text{Wt of wet sample}} \times 100$$

Where wt= Weight of sample/spread

Ash content

Five grams 5g sample was weighed into a tarred crucible and was pre-dried. Crucibles were placed in cool muffle furnace using tongs, gloves and protective eyewear. The crucibles Ignited for 2 hours at about 600 degrees Celsius. Muffle furnace was turned off and opened when temperature dropped to at least 250^{o}C preferably lower. The door was carefully opened to avoid losing ash that may be fluffy. Safety tongs was used to transfer crucibles to a desiccator with a porcelain plate and desiccant. Desiccator was closed and allowed crucibles to cool prior to weighing.

Calculations

%Ash = wt of ash ×100
Wt of sample
%Ash = (wt of crucible+ ash) – wt of empty crucible ×100
(wt of crucible+ sample) – wt of empty crucible
Where wt= Weight of sample/spread

Fat content: soxhlet extraction

Previously dried (air oven at 100°C) 250 ml round bottom flask was weighed accurately. 5.0g of dried sample to 22 ×80mm paper thimble or a folded filter paper was weighed. A small of cotton or glass wool was placed into the thimble to prevent loss of the sample. 150ml of petroleum spirit B.P 40-60°C was added to the round bottom flask and assembled the apparatus. A condenser was connected to the soxhlet extractor and reflux for 4 - 6 hours on the heating mantle. After extraction, thimble was removed and recovered solvent by distillation. The flask and fat/oil was heated in an oven at about 103°C to evaporate the solvent. The flask and contents were cooled to room temperature in a desiccator. The flask was weighed to determine weight of fat/oil collected.

% Fat (dry basis) = fat/oil collected × 100
Weight of sample
% Fat (dry basis) = (wt of flask + oil) – wt. of flask × 100
Weight of sample

Crude fibre determination

Two grams (2g) of the sample from crude fat determination was weighed into a 750ml Erlenmeyer flask. Two hundred milliliters (200ml) of 1.25% H_2SO_4 was added and immediately flask was set on hot plate and connected to the condenser. The contents were boiled within 1 minute of contact with solution. At the end of 30 minutes, flask was removed and immediately filtered through linen cloth in funnel and washed with a large volume of water. Filtrate (containing sample from acid hydrolysis) was washed and returned into the flask with 200ml 1.25% NaOH solutions.

Flask was connected to the condenser and was boiled for exactly 30 minutes. It was then filtered through Fischer's crucible and washed thoroughly with water and added 15ml 96% alcohol. Crucible and contents was dried for 2 hour at 105 °C and cooled in desiccator and it was weighed. Crucible was ignited in a furnace for 30 minutes and after that it was cooled and reweighed.

% Crude fibre = <u>weight of crude fibre × 100</u>
Weight of sample
% Crude fibre = <u>wt of crucible + sample (before – after) ashing × 100</u>
Weight of sample
Where wt= Weight of sample/spread

Protein Determination

Digestion Method

Two grams (2g) of sample and a half of selenium –based catalyst tablets and a few anti-bumping agents were added to the digestion flask. Twenty five milliliters (25ml) of concentrated H_2SO_4 was added and the flask was shaken for the entire sample to become thoroughly wet. Flask was placed on digestion burner and heated slowly until boiling ceased and the resulting solution was clear. The sample was then cooled to room temperature and digested sample solution was transferred into a 100ml volumetric flask and made up to the mark.

Distillation Method

To flush out the apparatus before use, distilled water was boiled in a steam generator of the distillation apparatus with the connections arranged to circulate through the condenser, for at least 10 minutes. The receiving flask was lowered and continued to heat for 30 seconds in order to carry over all liquid in the condenser. 25 ml of 2% boric acid was pipetted into 250ml conical flask and 2 drops of mixed indicator added. The conical flask and its contents were placed under the condenser in such a position that the tip of the condenser is completely immersed in solution. 10ml of the digested sample solution was measured into the decomposition flask of the Kejdahl unit, fixed it and add excess of 40% NaOH (about 15-20ml) to it. The ammonia produced was distilled into the collection flask with the condenser tip immersed in the receiving flask till a volume of about 150ml– 200ml is collected. Before distilling another sample and on completion of all distillations, the apparatus was flushed as in step 1 above. Steam was allowed to pass only until 5ml of the distillate is obtained.

Titration Method

The Distillate with 0.1N HCL solution was titrated. The acid was added until the solution became colourless. Any additional acid added made the two solutions become pink. The nitrogen content was determined in duplicate, and a blank determination was run using the same amount of all reagents as used for the sample. The blank was meant to correct for traces of nitrogen in the reagents and included digestion as well as distillation methods.

Calculation

$$\% \text{ Total nitrogen} = \frac{100 \times (Va-Vb) \times NA \times 0.01401 \times 100}{W \times 10}$$

Where:
Va- volume in ml of standard acid used in titration
Vb- volume in ml of standard acid used in blank
NA- normality of acid
W- Weight of sample taken

Carbohydrate content

The calculation of available carbohydrate (nitrogen-free extract-NFE) was made after completing the analysis for ash, crude fibre, ether extract and crude protein. The calculation was made by adding the percentage values on dry matter basis of these analysed contents and subtracting them from 100%.

Calculation

Carbohydrate (%) =100 - (% moisture +% fat +% protein +% ash)

x. Calculation for dry basis = $\frac{(100-\%\ \text{moisture}) \times \text{wet basis}}{100}$

Functional Properties

Water and oil absorption capacity

The water/oil absorption capacity and emulsion stability of the various flours were determined using the method described by Chandra et al. (2015). One gram (1g) of the flour sample was dispersed in 10ml of oil and vortex the suspension for 5 minutes. The suspension obtained was centrifuged at 3500 rpm for 30min. it was then decanted and measured with supernatant in a 10ml graduated cylinder. The density of the oil, and calculated oil absorption capacity were determined using the formula;

Oil absorption capacity (% OAC) = $\frac{(y-z)\times d}{x} \times 100$

Where
y= initial volume of oil added
Z= volume of supernatant collected
X= initial weight of (dried) sample taken
d= density of oil
y-z =volume of water retained by the sample after centrifugation

Water absorption capacity

One gram (1g) of the sample in 10ml distilled water was dispersed and vortex the suspension for 5 minutes. The suspension obtained at 3500 rpm for 30min was centrifuged. It was then decanted and measured with supernatant in a 10ml graduated cylinder. Density of water was taken as $1.0 gcm^{-3}$, and calculates water absorption capacity as

Water absorption capacity (% WAC) = $\frac{y-z}{x} \times 100$
Where y= initial volume of water added
Z= volume of supernatant collected
X= initial weight of (dried) sample taken
y-z =volume of water retained by the sample after centrifugation

Bulk density

The bulk density (BD) of the flours was determined using Amandikwa et al (2015) method. An amount of 100g of the sample was weighed directly into 250ml capacity graduated cylinder and tap the measuring cylinder 10 to 15 times until no change in volume is observed.

Bulk density = weight of sample (g)
Volume of sample after tapping (ml)

Foaming capacity and foaming stability

Foaming capacity and foaming stability were determined as described by Narayana & Narsinga Rao (1982) with slight modifications. Five millilitre (5ml) of sample was weighed and mixed in 40ml distilled water and homogenized for 5min at high speed using a homogenizer with a suitable stirrer. The volume of foam separated was noted. For stability, the collapse in foam if any at the end of a specific time was measured (e.g. 1 minute, 2 minutes, 4 minutes and 5 minutes).

Calculation of the capacity and stability is as follows:

%foaming capacity= $\frac{(vol after homogenization)-(vol before homogenization)}{vol before homogenization} \times 100$

%foam stability= $\frac{foam volume after time (t)}{initial foam volume} \times 100$

Sensory Evaluation

The cakes were put through a sensory evaluation utilizing the Larmond method (1977). A total of 50 semi-trained panelists took part in the evaluation. Colour, taste, flavour, texture and overall acceptance were among the qualities evaluated. In discrete cubicles with adequate lighting, the coded samples were served in clean plastic plates at room temperature. The panelists were given a random sample presentation. Panelists were asked to sample the items and rate them on a five-point hedonic scale (5-like very much, 4-like much, 3-neither like nor dislike, 2-dislike much, and 1-dislike very much).

Statistical Analysis

Data were subjected to Analysis of Variance (ANOVA) and Tukey Test was used to determine significant difference among the various samples in duplicates. Data were analyzed using the software, Statistical Package for Social Science (SPSS) version 22.00 (SPSS inc., Chicago), IL, USA at the 0.05 level of significance.

RESULTS AND DISCUSSION

Table 2 shows the proximate composition of cake samples produced from wheat-millet flour blends. The moisture content of the cake samples ranged from 31.25% to 36.26% with cake sample produced from wheat flour having the highest moisture content (36.26 ± 0.46) while cake sample 'E' made of 60% wheat flour and 40% millet flour had least moisture content. The moisture contents of the composite cake samples decreased significantly ($p < 0.05$) with increasing levels of Finger Millet flour substitution. Besbes et al., (2016) have reported similar moisture content in bread produced from millet and wheat composite flour. The decrease in moisture content of composite cake could be attributed to protein denaturation, which resulted in greater contacts between proteins and polysaccharides. This resulted in the formation of an intermolecular network, water entrapment, and a decrease in free water content, all of which are linked to a drop in food moisture content (Zhang et al., 2016). Moisture is required for cake to maintain its quality, and excessive moisture has a negative impact on bread storage stability.

Adeleke and Odedeji (2010) found comparable findings using wheat and sweet potato flour blends in their bread. The ash contents ranged from 0.69 ± 0.05 to 1.28 ± 0.27 with the control cake sample having the least ash content while cake sample produced from 60% wheat flour and 40% finger millet recorded the highest ash content. The ash content increased significantly ($p < 0.05$) with increasing levels of Finger Millet flour. Because Finger Millet grains are a good source of calcium, phosphorus, magnesium, and iron, the increased ash concentration in the composite cakes indicates that Finger Millet flour contains more minerals than wheat flour. Our findings support Mitiku et al. (2018) for wheat-sweet potato flour composite bread.

The protein content of samples A to E ranged from 9.36 to 13.74 g/100 g, and was substantially different ($p <0.05$) from one variety to the next (Table 2). There was a substantial difference in protein levels among all millet kinds in sample BCDE. The protein content of these varieties was close to Ali et al., (2003), who reported 12.5-13.6 percent protein content, but greater than Saleh et al., (2013), who reported 7.7-12.1 g/100g protein content for diverse millet varieties. With a protein level of more than 7%, these types could be useful in combating protein-energy malnutrition, particularly among youngsters in places where the crop is produced. The use of Finger Millet flour may have increased the protein content of the composite cake, resulting in a high protein level (Ijah et al., 2014). Amandikwa et al. (2015) reported similar results for wheat-yam flour composite bread, and Mitiku et al. (2018) reported similar results for wheat-sweet potato flour composite bread.

With increasing quantities of Finger Millet flour substitution, the fat content of the cakes increased significantly from 12.38% (Sample A) to 20.35% (Sample E). This could be due to the fact that Finger Millet contains roughly 1% to 3% fat, which could have contributed to the increase of the fat level. Furthermore, fat functionality, such as emulsifier capacity, has an impact on cake texture and bubble formation. The capacity to make a cake from composite flour blends without using any shortening could be explained by the high fat content of the composite flour samples (Menon et al., 2015). Because fat promotes food palatability, composite cake samples with a significantly ($p < 0.05$) higher fat content will be more palatable (Bolarinwa et al., 2019).

These results are in support of Man et al. (2015) on incorporation of chickpea flours to bread. As the quantity of of Finger Millet flour increased, it caused the fiber content to increase significantly ($p < 0.05$), ranging from 1.78% to 3.85% for Sample A (10%) and Sample E (40%) Finger Millet flour composite cakes. When compared to the control sample (100% wheat cake), it was realized that cakes with finger millet incorporation had higher fiber content. The crude fiber content of the 100% wheat cake exceeded the maximum permitted fiber value of 1.5% (Oluwamukomi et al., 2011). The fiber content of the cakes was found to rise as the amount of finger millet flour increased. The findings of this study matched those of a study conducted by by Henshaw and Agunbiade, 2004).

Carbohydrate content increased when the percentage of Finger Millet flour substituted increased from 51.65% (Sample A) to 55.48% (Sample E). The changes in carbohydrate content between control and composite cakes may be attributable to variances in other components including protein, fat, and ash. The high carbohydrate content of composite cakes is advisable because starch granules swell and create a gel when heated in the presence of water, which is vital for bakery product structure and texture (Inyang and Asuquo, 2016).

Table 2. Proximate composition of cake

Sample	**Moisture**(g/100g)	**Ash**(g/100g)	**Protein**(g/100g)	**Fat**(g/100 g)	**Fibre**(g/100 g)	**CHO**(g/100 g)
A	36.26 ± 0.46^e	0.69 ± 0.05^e	9.36 ± 0.40^e	12.38 ± 1.49^e	1.78 ± 0.03^e	51.65 ± 0.03^e
B	34.73 ± 0.22^d	0.95 ± 0.30^d	10.64 ± 0.19^d	14.98 ± 0.83^d	1.94 ± 0.01^d	52.66 ± 0.25^d
C	33.73 ± 1.04^c	1.20 ± 0.21^c	11.36 ± 0.23^c	16.74 ± 0.04^c	2.52 ± 0.02^c	53.13 ± 0.23^c
D	32.71 ± 0.06^b	1.25 ± 0.08^b	12.47 ± 0.28^b	18.65 ± 0.03^b	2.56 ± 0.07^b	54.15 ± 0.12^b
E	31.25 ± 0.28^a	1.28 ± 0.27^a	13.74 ± 0.30^a	20.35 ± 0.02^a	3.85 ± 0.07^a	55.48 ± 0.15^a

Values represent means and standard deviation replicate readings for various parameters. Values in the same column with different superscripts are significantly different (p>0.05). Keys: A(100% Wheat flour), B(90% Wheat flour and 10% Millet flour), C(80% Wheat flour and 20% Millet flour), D(70% Wheat flour and 30% Millet flour), E(60% Wheat flour and 40%Millet flour)

Table 3 shows the results of the functional attributes of the flour blends. Bulk density, water and oil absorption capability, emulsion ability, and foaming capacity all had significant variations ($p<0.05$). For all flours, the water absorption ranged from 108.00g to 134.87g. The highest value was 134.87g for control sample (100% wheat flour), while the lowest was 80.61g for composite sample D (60% wheat flour and 40% finger millet flour).

The results revealed that using millet blended flour instead of 100% wheat flour affected the amount of water absorbed. It was discovered that increasing the millet flour substitution resulted in lower water absorption for the composite flours. Previously, similar reports had surfaced (Kaushal et al., 2012).

Oil absorption capacity refers to the ability of flour protein to physically bind fat through capillary attraction and is potentially useful in structural interactions in food, particularly in flavour retention, palatability improvement, and shelf life extension of bakery or meat products, doughnuts, baked goods, pancakes, and soups where fat absorption is desired (Iwe, et al., 1999, Aremu et al 2007).

The oil absorption capacity ranged from 72.63g to 96.44g, the highest oil absorption capacity was found in flour sample A (100% wheat flour), whereas the lowest oil absorption capacity flour sample C(70% wheat flour and 30% millet flour). The oil absorption capacity of the composite flours (B–E) rose dramatically as the quantity of millet flour increased. High water and oil absorption capacities are advantageous, especially in bakery items such as cakes and cookies, where hydration and shortening are desired to ease handling. They may also affect how foods taste and feel in the mouth (Okezie and Bello, 1988). The bulk density ranged from 0.58 to 0.69 g/m3. The bulk density of the control sample A (100% wheat flour) was 0.58 g/m3, while the bulk density of the flour sample B (90% wheat flour and 10% millet flour) was 0.69 g/m3. The flour's emulsion ability ranged from 11.57 to 62.25 g/g, with A (100% wheat flour) having the highest value at 62.23 g/g. Significant differences ($p>0.05$) were found between flour blends B (90:10), C (80:20), D (70:30), E (60:40) and the control (100%).

Table 3. Functional Properties of wheat/finger millet flour blends

Sample	WAC	OAC	BD	EA	FC
A	134.87 ± 0.66^{e}	96.44 ± 3.01^{a}	0.58 ± 0.03^{a}	62.25 ± 1.77^{e}	13.05 ± 0.00^{a}
B	120.97 ± 0.88^{d}	69.00 ± 1.48^{b}	0.69 ± 0.01^{e}	11.57 ± 1.69^{a}	2.43 ± 0.00^{b}
C	94.64 ± 1.50^{c}	72.63 ± 0.29^{b}	0.68 ± 0.00^{d}	12.42 ± 1.27^{b}	2.43 ± 0.00^{b}
D	92.10 ± 1.69^{b}	74.21 ± 1.90^{b}	0.65 ± 0.00^{c}	15.73 ± 1.18^{c}	2.43 ± 0.00^{b}
E	80.61 ± 2.29^{a}	75.21 ± 1.52^{b}	0.63 ± 0.05^{b}	18.16 ± 0.69^{d}	2.43 ± 0.00^{b}

Values represent means and standard deviation replicate readings for various parameters. Values in the same column with different superscripts are significantly different ($p>0.05$). WAC = Water Absorption Capacity, OAC = Oil Absorption Capacity, BD = Bulk Density, EA = Emulsion Ability, FC = Foaming Capacity

Table 4 shows the sensory evaluation results of cakes made using wheat/millet flour mixtures. The sensory evaluation revealed significant differences ($p<0.05$) between the samples in colour, taste, flavour, texture, and overall acceptability (Table 4) as the amount of millet flour in the cakes increased. The sensory evaluation of the current investigation revealed a pattern that differed from that described by Sukhcharn et al., (2008). The distinctive baking quality of millet flour (Okoye, Nkwocha and Ogbonnaya, 2008; Adeyeye and Akingbala, 2015) and the varying rates of preference and acceptable values of panelists may explain the different directions of score patterns.

The judges gave sample A (100% wheat flour) cake the highest colour rating, yet it was substantially different (P<0.05) from the composite cake. The cakes' colour shifted from light brown to dark brown, and the mean scores began to decline. It is possible that the darker colour comes from the Maillard reaction between lowering carbohydrates and protein (Dhingra and Jood, 2000).

Taste is the most important component in determining a product's acceptability, and it has the greatest impact on the product's market success. Cake made with 60% wheat flour and 40% millet flour tasted sweet, while those made with 100% wheat flour received the second highest mean ratings. Texture is one of the most essential criteria associated with product quality, since it is the sensory indicator of the structure of food and the manner in which the structure reacts to applied force (Jean-Xavier and Rossella, 1996).

Texture analysis is the process of determining the factors that influence how a food feels in the mouth. The texture of composite cakes and the control cake were significantly different (p<0.05) (100% wheat flour). The control sample had the highest texture score, while cake sample E (60% wheat flour and 40% millet flour) had the highest texture mean value (8.64). The overall acceptability, which is an important metric in organoleptic estimate, includes several implications. In terms of general acceptability, the cake sample made with 60% wheat flour and 40% millet flour had the greatest mean value (10.59) and therefore was preferred by the panellists' followed by Sample A (100% wheat flour cake). Nwaojigwa et al., (2007) reported similar findings, stating that biscuits prepared from sweet potato-wheat flour were satisfactory up to a 40% supplementation level based on sensory qualities.

Table 4. Sensory attributes of the composite cake

Sample	Colour	Taste	Flavour	Texture	Overall Acceptance
A	8.63 ± 0.95^{d}	8.77 ± 1.13^{d}	9.62 ± 1.17^{c}	8.50 ± 0.98^{a}	9.63 ± 0.73^{d}
B	7.85 ± 0.70^{c}	8.70 ± 0.97^{c}	9.83 ± 1.00^{d}	8.50 ± 1.21^{b}	9.12 ± 0.80^{b}
C	5.61 ± 0.72^{b}	8.67 ± 0.76^{b}	8.73 ± 0.82^{b}	8.50 ± 1.06^{c}	9.54 ± 0.88^{c}
D	4.56 ± 1.00^{a}	9.15 ± 0.72^{e}	10.96 ± 0.82^{e}	8.64 ± 1.18^{e}	10.59 ± 0.67^{e}
E	4.35 ± 0.80^{a}	7.81 ± 1.02^{a}	8.48 ± 1.07^{a}	7.60 ± 1.26^{d}	8.87 ± 0.92^{a}

Values represent means and standard deviation replicate readings for various parameters. Values in the same column with different superscripts are significantly different (p>0.05). Keys: A(100% Wheat flour), B(90% Wheat flour and 10% Millet flour), C(80% Wheat flour and 20% Millet flour), D(70% Wheat flour and 30% Millet flour), E(60% Wheat flour and 40%Millet flour)

CONCLUSIONS

The use of millet flour to supplement wheat flour in baking could minimize wheat flour imports while also increasing millet flour value. The millet/wheat flour blends had enough protein, ash, fats, dietary fibre, and carbohydrate contents. As a result, combining it with wheat flour to make cakes would be nutritionally beneficial. When compared to the cake made with 100% wheat flour, the cake made with wheat flour supplemented with 40% millet flour was highly acceptable. The result revealed that Millet flour could be a better substitute for wheat flour in preparation of flour products.

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