QUALITY EVALUATION OF CAKE PRODUCED FROM THE BLENDS OF MILLET AND TANGERINE PEEL FLOUR

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Abstract

This study investigated the quality evaluation of cake produced from the blends of millet and tangerine peels flour. The tangerine peels flour was substituted into the millet flour at 5, 10, 15, 20 and 25%, respectively with other ingredients; flour, margarine, sugar, baking powder egg were baked at 170℃ for 15 minutes. The functional, proximate, mineral, and sensory qualities of the flour and cake were analyzed, respectively. Functional properties such as, bulk density, water absorption capacity, oil absorption capacity, foaming capacity, increased from 0.74-0.76 g/ml, 91.65-93.50%, 91.15-91.95 %, 56.00-63.00 %, respectively. While the swelling capacity decreased from 1.59-1.45 g/ml. Proximate such protein, fat, fiber, ash, moisture, increased from 7.97-14.26 %, 9.61-16.92 %, 1.22-2.91%, 3.37-4.67%, 7.02-9.82%, while carbohydrate decreased from 68.54-51.43%. Mineral content like potassium, calcium and phosphorus increased from 423.14-971.02 mg/100g, 215.06-433.25 mg/100g, 151.54-243.57 mg/100g, respectively. The physical properties, such as height, weight and volume ranged from 95.00-104.00 mm, 34.70-39.05 g and 50.00-75.00 respectively. Sensory evaluations such as appearance, aroma, color, mouthfeel and overall acceptability decreased from 7.70-6.10, 7.60-5.95, 6.90-5.95, 7.45-5.35, 8.00-5.80 respectively. The results of this study have shown that the incorporation of tangerine peel flour into millet flour significantly enhanced the quality of cake.

Keyword Millet, Tangerine Peels.

Introduction

Cakes are convenient food products which are sweet and often baked, usually prepared from wheat flour, sugar, shortening, baking powder and egg as principal ingredients (Atef et al., 2011). The wheat, which is the major ingredient, a cereal, is cultivated in many parts of the world, but imported by countries with unfavorable climatic conditions. Such importing countries such as Nigeria spend a lot of foreign exchange on the importation of wheat. There is a compelling need to develop an adequate substitute for wheat, as the demand and price of this product could further be increased by the unstable exchange rates. It was found that moisture content ranging from 9.44% - 9.79%, protein from 8.43% - 13%, fat from 1.97% - 2.5%, ash from 1.25% - 1.62%, crude fiber from 7.14% - 11%, carbohydrate from 62.44% - 71.39%, magnesium from 86.30 - 136 mg/100g, calcium from 32.90 - 38 mg/100g, iron from 2.92 - 3.86 mg/100g (Olalekan *et al*., 2017). Cakes can also be filled with fruit preserves, nuts or dessert sauces (like pasty cream), iced with butter cream or other icings, and decorated with marzipan, piped borders, or candied fruits (Castella *et al.,* 2010).

Millets are classified with maize and sorghum in the grass sub-family Panicoideae. They are the 6th most important cereal grain crop in the world agricultural production after wheat, maize, sorghum, rice, and barley that are regarded as the major economic grains in the world. Millets are resistant to pests and diseases as compared to other cereal grains. Millets are a group of small - seeded species of cereal crops belonging to the family Gramineae and grown widely around the world for food and food. The most important characteristics of millets are their unique ability to tolerate and survive under adverse conditions of continuous or intermittent drought as compared to most other cereals like maize and sorghum (Gull *et al.,* 2015). It contains the highest amount of calcium among all the food grains and also a good source of other micronutrients like potassium, zinc, phosphorus and iron. Apart from minerals such as calcium, phosphorus and iron, finger millet contains appreciable quantity of vitamin B-Complex, thiamine and riboflavin. Epidemiological reports indicate that regular consumption of finger millet reduces incidences of diabetes mellitus, cardiovascular disease, duodenal ulcer and other gastrointestinal tract related disorders. It supports immune system and removes free radicals from the body and also helps to prevent and treat cancer. It is capable of preventing damage to important cellular components caused by reactive oxygen (Audu *et al*., 2018).The calcium and iron contents in finger millet varieties have been reported to be 220–450 and 3–20%, respectively. Carbohydrates include starch as the main constituent being 59.4 to 70.2% (Nirmala *et al*., 2000; Mittal, 2002). Finger millet starch granules exhibit polygonal rhombic shape (Jideani et al., 1996). About 80 to 85% of the finger millet starch is amylopectin and remaining 15 to 20% is amylose (Audu *et al*., 2018). Bhatt *et al*. (2003) reported that non-starch polysaccharide accounts for 20 to 30% of the total carbohydrates in finger millets.

Tangerine (*Citrus reticulata*) fruits have peculiar fragrance partly due to flavonoids and limonoids present in the peel and these fruits are good sources of vitamin C and flavonoids. Tangerine peels are a rich source of Vitamin C which is considered as an important water-soluble antioxidant. The major role of vitamin C is the prevention of scurvy; this causes disease which leads to the formation of spots on the skin, spongy gums and bleeding from the mucous membranes (Ayo *et al*., 2022). The dried peel of Citrus reticulata is used as nutraceutical ingredient in dietary supplements and functional and conventional food (Sobhani *et al*., 2017). Tangerine peel is an excellent source of dietary fiber, which plays a crucial role in maintaining digestive health, regulating blood sugar levels, and lowering cholesterol. Vitamins found in tangerine peel include vitamin (C, A, B_1, B_2 and B_6). (He *et al*., 2021). The primary type of dietary fiber found in tangerine peel are soluble and insoluble fiber. Soluble fiber helps in the forming a gel-like substance in the gut, which can slow down digestion and aid in the absorption of nutrients. Insoluble fiber adds bulk to the stool, facilitating easier bowel movements and preventing constipation (Wu *et al*., 2020)

Materials and Methods

Materials

Millet seeds and tangerine peels and packaging materials were purchased from Wukari main market, while other ingredient such as wheat, sugar, salt, margarine, yeast, eggs, and baking powder were purchased in Wukari old market, Taraba, Nigeria respectively.

Material Preparation

Production of Millet Flour

Using the method described by (Aboshora *et al.,* 2016), millet grains was cleaned manually by hand picking the dirt. Stones were removed by washing in clean water (sedimentation). The washed and de-stoned grains were oven dried at 45^o C for 3hrs and then milled using milling machine (model R175A). The flour was sieved (0.3 mn aperture), packaged (polyethylene) and stored under room temperature (27°C).

Production of Tangerine Peels Flour

Using the method described by (Aboshora *et al.,* 2016), The tangerine fruits will be sorted, washed and peeled with hands. The peels were cut into smaller units and oven dried (45^o C), milled (attrition mill), sieved (1µm sieve) packaged (polyethylene bag) and stored at room temperature 27 °C.

Formulation of Flour Blends

Using the method described by (Aboshora *et al.,* 2016). Formulation of flour blends Composite flours were prepared from millet and tangerine peels flours as shown in Table 1. Sample A consisted of 95% millet flour and 5% tangerine peel flour. Sample B consisted of 90% millet flour and 10% tangerine flour. Sample C was85% millet flour and 15% tangerine flour. Sample D consisted of 80% millet flour and 20% tangerine flour. Sample E consisted of 75% millet flour and 25% tangerine flour. The blends were thoroughly mixed using a blender to achieve uniform blending. One hundred (100) percent of wheat flour was used as a control. The flow chart for the production of millet-tangerine peels flour.

Table 1: Formulation of flour blend

Samples	Millet flour (%)	Tangerine peel flour (%)
A	100	0
B	95	5
C	90	10
D	85	15
E	80	20
F	75	25

Preparation of Cake

Cake was prepared according to the method described by Oyeyinka *et al*. (2014) using the following ingredients; flour 300%, sugar 150%, shortening 200%, baking powder 2% and eggs 4 pcs in Table 2. Sugar was mixed with shortening and egg albumin added. The mixture was whipped for 30 min. And other ingredients were added such as flour and baking powder and mixed. The mixture was poured into baking pan and samples was baked at 170 ^{o}C for 15 min.From the above method, six different formulations of millet and tangerine peels flour cake were obtained.

Table 2: Recipe for the production of cake

Raw Materials (%)	Quantity
Flour	300
Margarine	200
Sugar	150
Baking powder	2.0
Egg	234

Source: Oyeyinka *et al*. (2014)

Analytical Method

Determined the Chemical Properties of Millet-Tangerine Peel Flour

The chemical properties of millet-tangerine peels flour blends, millet-tangerine peels flour blend cake was determined.

Moisture Content

Moisture content was determined by a hot air oven drying method described by AOAC (2020). Two gram of sample was weighed into a crucible of known weight and heated in the oven at 105oc or 4 hours the sample was removed from the oven and cooled in a desiccator before weighing. The crucible was put back into the oven and again until constant weight was recorded. The loss in weight from the original sample weight was calculated as the moisture content as:

$$\%\, moisture = \frac{\text{Weight loss}}{\text{Weight of sample}} \text{ x } 100$$

Crude Protein Content

The total nitrogen content was determined by the semi-micro Kjeldahl method as described by AOAC (2020). Approximately 1.0g of the samples was digested in Kjeldahl digesting system. The digested sample was cooled and then distilled into a flask containing 5ml of 2% boric acid solution and few drops of methyl red indicator will be added. The distillate was diluted with distilled water followed by the addition of about 5ml of 60% sodium hydroxide solution. The distilled sample was titrated against 0.1m HCl solution. A blank titration will be carried out. The percentage nitrogen content was calculated as:

$$\%\, Nitrogen = \frac{\text{Vs} - \text{Vb x Nq x 0.01401}}{\text{1000 x Weight of sample}} \text{ x } 100$$

e protein content will be calculated as:

% Crude protein = Total N × 6.25

Since, on the average, protein contains about 16% nitrogen, one can either divide the percentage of nitrogen by 0.16 or multiply it by a factor of 6.25 to obtain the crude protein content.

Ash Content

The ash content was determined by the method described by AOAC (2020). After the moisture content of the samples was determined, the samples were ignited in a muffle furnace at 550°C for 2 hours until a light gray ash was obtained, followed by cooling to room temperature in a desiccator and weighed.

$$\% \, ash = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

Fat Content

The crude fat content was determined using the Soxhlet extraction method described by AOAC (2020). A Soxhlet extractor with a reflux condenser and a 500l round bottom flask was fixed. 2g of the sample was weighed into a thimble and sealed with cotton wool. The assembled Soxhlet apparatus was allowed to reflux for 6 hours and petroleum ether evaporated into a container for reuse. When the flask will be free of ether, it was dried at 105oC for 1 hour in an oven. It was cooled in a desiccator and weighed. The percentage fat was calculated as:

$$\% \, crude \, fat = \frac{\text{Weight of fat}}{\text{Weight of sample}} \times 100$$

Crude Fiber Content

The crud fiber content was determined according to the method of AOAC (2020). Petroleum ether will be used to defat 2g of sample. This was put in a beaker containing 200ml of 1.25% of H_2SO_4, boiled for 30min, filtered through muslin cloth on a fluted funnel and was washed with boiling water until it was free of acid. The residue was returned into 200ml boiling NaOH and allowed to boil for 30min. It was further washed with 1.0% HCl and then with boiling water to free it from acid. The final residue was drained and transferred to silica ash crucible (porcelain crucible) and dried in the oven to a constant weight and cooled. The crude fiber content was calculated as:

$$\% \, crude \, fiber = \frac{W1 - W2}{W} \times 100$$

Where;
W1 = weight of content before ashing
W2= weight of crucible and ash
W = weight of dried material

Carbohydrate Content

The carbohydrate content was estimated by difference as described by AOAC (2020). The crude protein, crude fat and the total ash was subtracted from organic matter, the remainder accounted for carbohydrate.

%Carbohydrate = 100% - % (Moisture + Protein + Fat + Ash)

Determination of the Mineral Properties of Wheat And Millet-Tangerine Peels Flour Blends

The mineral composition of millet-tangerine peel flour and cake was determined using the method described by Bala and Bashar (2017). Five grams (5g) of fine powdered sample was digested using a mixture of analytical grade acids HNO_3: HCl (1:1). Calcium (Ca) and magnesium (Mg) levels was determined using atomic absorption spectrophotometer (210 vgp model). Sodium (Na) and potassium (K) levels was determined using flame photometric method while phosphorous (p) level was determined colorimetrically using spectronic 20.

Determined the Functional Properties Of Wheat and Millet-Tangerine Peels Flour Blends

The functional properties of millet-tangerine peels flour blends, millet-tangerine peels flour blend cake was determined.

Water Absorption Capacity

According to the method given by AOAC (2020). One (1g) gram of sample was weighed into a conical graduated centrifuge tube and thoroughly mixed with 10ml distilled water for 30seconds using a warring whirl mixer. The sample was then allowed to stand for 30 minutes at room temperature and centrifuged at 5,000rpm for 30 minutes. The volumes of free water (supernatant) were read directly from the graduated centrifuge tube. Absorption capacity is expressed as grams of water absorbed (or retained) per gram sample and it was calculated.

Water absorption capacity = Amount of water absorbed (total-free) x density (water)

Oil Holding Capacity

One (1g) gram of sample was weighed into a conical graduated centrifuge tube and thoroughly mixed with 10ml of oil for 30 sec using a warring whirl mixer. The sample was then allowed to stand for 30 min at room temperature and then centrifuge at 5,000rpm for 30 minutes. The volume of free oil (supernatant) was read directly from the graduated centrifuge tube (AOAC, 2020). Absorption capacity is expressed as grams of oil absorbed (or retained) per gram sample.

Oil absorption capacity = Amount of oil absorbed (total-free) x density (oil)

Swelling Capacity

One gram of dried sample was weighed into 100 ml conical flask and 15 ml distilled water will be added. The mixture was Shaked for 15 min at low speed on a stirrer and transferred into a hot water bath (Stuart, model SWB3, Bibby Scientific Ltd., Staffordshire, U.K) and heated for 40 min between 80-85 oC with constant stirring. The heated mixture was transferred to a pre-weighed centrifuge tube and 7.5 ml distilled water added; centrifuged at 2200 rpm for 20 min. The supernatant will be carefully decanted and cooled in a desiccator. The precipitate with the centrifuge tube will be weighed (Adebowale and Maliki, 2011).

$$\text{Bulk density} = \frac{\text{weight of sample}}{\text{Volume of sample after tapping}}$$

Foaming Capacity and Foam Stability

Foaming capacity (FC) was done by using a modified AOAC method, (2020). Two grams of flour sample was weighed and added to 50ml distilled water in a 100 ml measuring cylinder. The suspension was mixed and properly shaken to foam and the total volume after 30 seconds was recorded. The percentage increase in volume after 30 seconds is expressed as foaming capacity. The volume of foam was recorded 1 hour after whipping to determine foam stability as per percentage of initial foam volume

Determination of the Physical Properties of Millet-Tangerine Peels Flour Blends Cake

The physical characteristics of the enriched cake was measured using the method reported by Giami and Barber (2004) with slight modification. Physical parameters that was measure include height, weight, volume, specific volume. The queen's cake volume was calculated using the cone equation below.

Volume of cake (cm3) = πh (d2+db+b2)

Where d and b are upper and lower diameters of cake. The specific volume was determined by dividing the volume by weight.

Determination of the Sensory Properties of Millet-Tangerine Peels Flour Blend Cake

The sensory evaluation of the samples was carried out for consumer acceptance and preference using randomly selected 20 untrained judges (students and staff of the Department of Food Science and Technology, Federal University Wukari). The panelists were instructed to evaluate the coded samples for colour, crispiness, aroma, taste, texture, and general acceptability. Each sensory attribute was rated on a 9-point Hedonic scale (1= dislike extremely and 9=like extremely). The panelists were offered distilled water to rinse their mouth between evaluations (Ayo *et al*., 2022).

Statistical Analysis

All experiments including organoleptic analyses was replicated. The means and standard deviations (SD) were calculated taking all the readings into consideration. Statistical analysis was performed using SPSS (Statistical Package for Social Sciences). One-way ANOVA (Analysis of variance at the level of significance $p \leq 0.05$) was performed using Duncan multiple range tests to ascertain the significance of the means.

Results and Discussion

Proximate Composition of Acha/Ofsp Blends

Proximate Composition of Cake produced from the blend of millet and tangerine peel flour. Proximate composition of cake produced from flour blends millet and tangerine flour are presented in Table 3. Protein is needed as building blocks for the body, necessary for growth and for repair of damaged tissues (Ubor *et al*., 2022). There is a significant difference ($p > 0.05$) in the protein content of the cake samples. Crude protein content ranges from 7.97- 14.26%. The range of protein obtained in this study is in agreement with 12.20% reported for cake produced from wheat and plantain flour blends (Akubor and Ishiwu, 2013). The increase in the protein content could be due to inclusion of tangerine peel flour.

Ash content of the cake samples ranged from 3.24-4.67%. There is a significant difference ($p > 0.05$) in ash content between samples of cake. Sample F has higher ash content as compared to sample C with the lowest ash content. Akubor and Ishiwu (2013) reported a lower ash content of in wheat and plantain flour blend cake. The increase in the ash content in this study could be due to the inclusion of tangerine peel flour in the cake. Ash content of a food material is an indication of its mineral constituents, therefore, cake samples with high ash will provide vital and beneficial minerals needed for development of human bones and body metabolism (Ubor *et* al., 2022).

Moisture content ranges from 7.02-9.82%. There is no significant difference ($p < 0.05$) among samples in terms of moisture content. The highest value of moisture obtained in cake processed from sample F. This could either be that tangerine peel flour used in this study possessed higher moisture content than millet flour. Akubor and Ishiwu (2013) reported higher value for moisture content of cake from wheat and plantain flour blends to be 29.00%. Moisture content is basically used as a measure of stability and susceptibility to microbial contamination (Ubor *al*., 2022). However, cake samples with moisture content below or within the range of 15% is said to have better shelf stability.

Carbohydrate content of the cake samples ranged from 51.43-68.54%. There is a significance difference ($p > 0.05$) in the carbohydrates of cake samples, Sample A has higher carbohydrates content as compared to sample F with the lowest carbohydrate content. Akubor and Ishiwu (2013) reported a lower carbohydrate value of cake samples produced from wheat and plantain flour blend to be 42.8%. The highest value of carbohydrate obtained in bread from B suggests that it will contribute more in maintenance of the plasma glucose level, sparing the body protein from being easily digested (Onimawo *et al*., 2019). This is in line with the report by Ubor *et al.* (2022) that carbohydrates are principal and indispensable sources of energy.

Minerals Composition of Cake Produced from The Blends of Millet and Tangerine Peel Flour

Mineral composition of cake samples produced from flour blend of millet and tangerine flour is presented in Table 4. Potassium contents were significantly ($p>0.05$) high in cake samples ranging from 423.14-971.02 mg/100g. Sample F have higher potassium with low concentration observed in sample A. A similar result reported by Akubor and Ishiwu (2013) was obtained for potassium concentration of cake samples produced from wheat and plantain flour blend to be 403.00 mg/100g. The high concentration of potassium could be due to inclusion of tangerine peel flour since fruits and vegetables are good sources of minerals.

The composite cake showed a significant increase ($p < 0.05$) in the calcium content (215.06 to 433.25 mg/100g). Akubor and Ishiwu (2013) reported calcium concentration of cake samples produced from wheat and plantain flour blend to be 45.00 mg/100g. The higher calcium concentration could be due to higher calcium content in tangerine peel flour. Calcium is vital in human nutrition, as it is distributed throughout all human skeletal that are required for normal growth and development of bones and teeth.

Phosphorus content among the cake samples increased from 151.54 to 366.01 mg/100g with significant difference ($p < 0.05$). But a significantly low phosphorus content (151.54 mg/100g) was observed in samples E. The results of this research agreed with the findings Akubor and Ishiwu (2013) who reported the phosphorus concentration of cake samples produced from wheat and plantain flour blend to be 312 mg/100g.

Physical Properties of Cake Produced from Millet and Tangerine Peel Flour Blends

Physical properties of cake produced from flour blends of millet and tangerine peel flour are presented in Table 5. Height is affected by type of flour, leavening agents, ingredient ratios, mixing method, oven temperature as well as proofing time (Ubor *et al*., 2022). There is no significant difference ($p > 0.05$) in specific volume between samples of cake. height of cake samples ranged from 95.00-104.00 mm. Sample E has higher height as compared to sample F with the lowest height. The highest value of height obtained in cake produced from sample E could be attributed to the fact that it possesses substantial gluten content unlike the other samples. Akubor and Ishiwu (2013) reported a lower height value for cake to be 1.6-1.9 cm. the variation in result could be due to the use of millet flour in this study.

Weight is determined by amount of baked dough, moisture and carbon dioxide diffused out of the cake during baking (Ubor *et al.,* 2022). There is no significant difference (p >

0.05) in weight between samples of cake. Weight of cake samples ranged from 34.70-39.05 g. Sample B has higher weight as compared to sample A with the lowest loaf weight. Akubor and Ishiwu (2013) reported higher value between 165-180 g. the variation could be due to variation in size of the cake. The highest value of weight obtained in cake for sample B could be attributed to less retention of carbon dioxide gas in the blended dough, resulting in heavy dough and thus heavy loaves (Ubor *et al*., 2022).

Volume can be considered as the most important bread characteristic since it provides a quantitative measurement of baking performance (Ubor *et al*., 2022). There is no significant difference ($p > 0.05$) in volume between samples of cake. Volume of cake samples ranged from 52.50-75.00 cm^3. Sample B has higher volume as compared to sample F with the lowest volume. Akubor and Ishiwu (2013) also reported higher value of cake between 115.2-136.8 cm^3. The least value for volume obtained in bread for sample F could probably be due to the reduction of gluten which is responsible for the viscoelastic property of cake volume (Makinde, 2014). Ubor *et al*. (2022) also affirmed that the use of weak flour or one low in enzyme activity results to decrease in volume.

Sensory Attributes of Cake

Sensory attributes of cake produced from flour blends of millet and tangerine peel flour are presented in Table 6. There is no significant difference ($p > 0.05$). The mean scores for appearance of the cake ranged from 6.10 to 7.70. Cake samples showed that sample E had the lowest mean score (6.10) while the control had the highest (7.70). Appearance determines how fulfilling a food product is before its consumption. The least mean score of appearance obtained in cake produced from sample E could be attributed to adverse effect of millet which is not a source of gluten. Ubor *et al*. (2022) opined that baking properties of composite flours are impaired as well as the organoleptic attributes of their products due to dilution of gluten content.

Flavour is a distinctive typically pleasant smell perceived by the olfactory sense. The mean scores for flavour of the cake ranged from 5.95 to 7.60. Cake samples showed that sample EF had the lowest mean score (5.95) while sample A had the highest (7.60). The highest mean score of flavour obtained in cake produced from the control could be as a result of the fact that millet generally has an attractive flavor. Olaoye and Ade-Omowaye (2011) also reported higher mean score for flavour in bread produced from 100% wheat flour (6.60).

Colour refers to the visual appearance of a food item which can affect its appeal, quality and perceived freshness. There were no significant differences ($p < 0.05$) preferred amongst the cake samples for colour. The mean scores for colour of the bread ranged from 6.20 to 8.53. The highest mean score of texture obtained in bread produced from the control sample (100% wheat) could be attributed to the positive contribution of wheat gluten during baking.

Mouthfeel of baked goods refers to the sweet sensation caused in the mouth by contact with the bread due to the sweetening agent, and is vital in determining its overall acceptability (Ubor *et al.,* 2022). There were no significant differences ($p < 0.05$) preferred amongst the bread samples for mouthfeel. Bread samples showed that sample E and F had the lowest mean score (6.13) while the control had the highest (8.27). The highest mean score of mouthfeel obtained in bread produced from the control sample (100% wheat) could be attributed to the fact that the panelists were already used to the mouthfeel of conventional bread made with 100% wheat.

The highest mean score for general acceptability obtained in bread produced from 100% Wheat flour was expected since it excelled in all the sensory attributes considered. This claim corroborates with the findings of Olaoye and Ade-Omowaye (2011) that wheat bread which had the highest mean score for crust, flavor, shape, colour, mouthfeel and appearance also had the highest rating for general acceptability compared to bread samples supplemented with varying proportions of soybean flour. The implication of this finding is that substitution of acha flour above 50% may result to bread that will not be generally acceptable by the consumers. It is suggested that further study should be carried out on substitution of wheat with acha flour lower than 40%.

Table 3: Proximate Composition of Cake produced from the blends of millet and tangerine peel flour (%)

Samples Mf: tpf	Protein	Fat	Fibre	Ash	Moisture	Carbohydte
A-100:0	$7.97^e±0.02$	$9.61^f±0.01$	$1.22^f±0.03$	$3.37^d±0.02$	$7.02^a±2.31$	$68.54^a±0.08$
B-95:5	$10.41^d±0.600$	$10.56^e±0.01$	$1.65^e±0.01$	$3.47^c±0.00$	$9.35^a±0.00$	$65.86^b±0.04$
C-90:10	$10.83^d±0.01$	$12.87^d±0.01$	$1.97^d±0.01$	$3.24^e±0.02$	$9.35^a±0.02$	$61.76^c±0.08$
D-85:15	$12.35^c±0.01$	$13.74^c±0.02$	$2.52^c±0.02$	$3.50^c±0.00$	$9.47^a±0.02$	$58.43^d±0.07$
E-80:20	$13.48^b±0.01$	$14.76^b±0.01$	$2.57^b±0.02$	$4.42^b±0.02$	$9.47^a±0.03$	$55.32^e±0.09$
F-75:25	$14.26^a±0.01$	$16.92^a±0.02$	$2.91^a±0.01$	$4.67^a±0.03$	$9.82^a±0.02$	$51.43^f±0.10$

Data were expressed as means ± SD. Means within each column not followed by the same superscript are significantly different ($P \leq 0.05$) from each other using Duncan multiple range test. MF- millet flour, TPF- Tangerine peel flour.

Key Words

A- 100% Millet Flour
B- 95% Millet Flour, 5% Tangerine peel flour
C- 90% Millet Flour, 10% Tangerine peel flour
D- 85% Millet Flour, 15% Tangerine peel flour
E- 80% Millet Flour, 20% Tangerine peel flour
F- 75% Millet Flour, 25% Tangerine peel flour

Table 4: Minerals Composition of Cake produced from blends of millet and tangerine peel flour (mg/100g)

Samples MF:TPF	Potassium	Calcium	Phosphorus
A-100:0	423.14^{f}±0.02	215.06^{f}±0.01	151.54^{f}±0.01
B-95:5	646.23^{e}±0.01	268.79^{e}±0.01	226.86^{e}±0.01
C-90:10	753.41^{d}±0.01	372.53^{d}±0.04	291.75^{b}±0.01
D-85:15	12.35^{c}±0.01	396.65^{c}±0.00	366.01^{a}±0.01
E-80:20	833.46^{b}±0.01	410.05^{b}±0.00	288.54^{c}±0.00
F-75:25	971.02^{a}±0.01	433.25^{a}±0.02	243.57^{d}±0.03

Data were expressed as means ± SD. Means within each column not followed by the same superscript are significantly different ($P \leq 0.05$) from each other using Duncan multiple range test. MF- Millet flour, TPF- Tangerine peel flour .

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F- 75% Millet Flour, 25% Tangerine peel flour

Table 5: Physical Properties of Cake produced from the blends of millet and tangerine peel flour

Samples	**Height (mm)**	**Weight (g)**	**Volume (cm^3)**
A-100:0	100.00^{ab}±0.00	34.70^{e}±0.14	65.00^{ab}±2.83
B-95:5	97.00^{b}±1.41	39.05^{a}±0.03	75.00^{a}±2.83
C-90:10	97.00^{b}±2.83	36.55^{d}±0.03	50.00^{b}±14.14
D-85:15	97.00^{b}±4.24	36.56^{d}±0.03	60.00^{ab}±7.07
E-80:20	104.00^{a}±2.83	37.65^{c}±0.03	70.00^{ab}±14.14
F-75:25	95.00^{b}±1.41	38.45^{b}±0.03	52.50^{ab}±0.28

Data were expressed as means ± SD. Means within each column not followed by the same superscript are significantly different ($P \leq 0.05$) from each other using Duncan multiple range test. MF- Millet flour, TPF- Tangerine peel flour.

TPF- Tangerine peel flour.
Key Words
A- 100% Millet Flour
B- 95% Millet Flour, 5% Tangerine peel flour
C- 90% Millet Flour, 10% Tangerine peel flour
D- 85% Millet Flour, 15% Tangerine peel flour
E- 80% Millet Flour, 20% Tangerine peel flour
F- 75% Millet Flour, 25% Tangerine peel flour

Table 6: Sensory Attributes of Cake produced from the blends of millet and tangerine peel flour

SAMPLES	APPEARANCE	FLAVOUR	COLOUR	MOUTHFEEL	OVERALL ACCEPTABILITY
A-100:0	$7.70^{a}\pm1.17$	$7.60^{a}\pm1.19$	$6.90^{ab=}\pm1.37$	$7.45^{a}\pm1.28$	$8.00^{a}\pm0.92$
B-95:5	$7.55^{a-}\pm1.05$	$6.90^{ab}\pm1.41$	$7.57^{a}\pm1.14$	$6.80^{ab}\pm1.40$	$7.40^{ab}\pm1.27$
C-90:10	$6.90^{ab}\pm1.68$	$6.60^{b}\pm1.57$	$6.95^{ab}\pm1.28$	$5.85^{bc}\pm1.60$	$6.70^{ab}\pm1.49$
D-85:15	$6.35^{b}\pm1.53$	$6.60^{b}\pm1.27$	$6.25^{b}\pm1.41$	$5.70^{bc}\pm1.72$	$6.35^{c}\pm1.42$
E-80:20	$6.10^{b}\pm1.74$	$5.95^{b}\pm1.67$	$6.15^{b}\pm1.69$	$5.35^{c}\pm2.37$	$6.15^{c}\pm1.81$
F-75:25	$6.40^{b}\pm1.85$	$5.95^{b}\pm1.57$	$5.95^{b}\pm1.64$	$5.35^{c}\pm2.01$	$5.80^{c}\pm1.54$

Data were expressed as means ± SD. Means within each column not followed by the same superscript are significantly different ($P \leq 0.05$) from each other using Duncan multiple range test. MF- Millet flour, TPF- Tangerine peel flour
TPF- Tangerine peel flour.

Key Words

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