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QUALITY ATTRIBUTES OF QUEEN'S CAKE PRODUCED FROM WHEAT AND WATERMELON SEED COMPOSITE FLOUR

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ABSTRACT

Queen's cake is a small-sized, wheat flour-based snack popular in Nigeria among several age brackets. It is available in different shapes and sizes. This study evaluated the quality attributes of queen's cake produced from wheat and watermelon seed composite flour. Watermelon seed was processed into flour and blended with wheat flour at different ratios (10:90, 20:80, 30:70) while 100% wheat flour served as control. The composite flour blends were analyzed for proximate composition, functional and pasting properties. Data obtained were subjected to analysis of variance (ANOVA) and significant means were separated using Duncan multiple range test. The moisture, ash, fat, protein, carbohydrate and crude fibre content of the composite flour are significantly different (p<0.05) with the values that ranged from 7.98-11.45%, 0.98-2.58%, 0.93-34.9%, 11.21-17.71%, 7.76-74.69 and 1.54-26.6% respectively. The moisture content, total ash, crude fat, crude fibre and protein content of the queen's cake produced from wheat-watermelon seed flour blends increased significantly except the carbohydrate content. The overall quality evaluation for queen's cake made from wheat and watermelon seed flour blends showed high acceptability, 90% wheat flour blended with 10% watermelon seed flour showed the best as compared with the control. In conclusion, acceptable queen cakes were prepared from flour blends of wheat flour and watermelon seed flour with regard to colour, taste, texture and overall acceptability which compared favourably with the control. 90% wheat flour and 10% watermelon seed flour were mostly accepted as compared with the control.

Keywords: Composite Flour, Watermelon Seed, Wheat Flour, Queen's Cake.

INTRODUCTION

One possible way of achieving nutrition security in developing countries is through exploitation and utilization of available foods sources and resources (Champ, Langkilde, Bronns, Kettlitz, & Collet,2003). In such countries, plant foods are the most important dietary sources to satisfy individuals' nutrient requirement due to their availability and low cost.The most common problem in food processing is the disposal of the sub-product generated. This waste material produces ecological problem related to the proliferation of insects and rodents and an economic burden because of transportation to repositories (Hussein Kamil, & Mohamed, 2011). In the food processing industry, edible portions of fruits are processed into products such as puree, juice and pickles, whereas seeds often will be discarded as waste since it is not currently utilized for commercial purposes (Ajila,Naidu, Bhat, & Prasada, 2007).Seeds are also promising source of useful compounds because of their favorable nutritional properties (Schieber, Stintzing, & Carle,2001). Watermelon, (*Citrullus lanatus*) is an important seed crop grown on a large scale in Northern Nigeria, Asia, America and other temperate climate in Europe*Citrullus lanatus* is an annual climbing or trailing herb up to 3m high which belongs to the *cucurbitaceae* family of grassy savanna and bush savanna, occurring as an introduced cultivated plant throughout the West African region (Sodeke, 2005).Watermelon is a potent source of biological active compound known as carotenoids. Carotenoids such as Alpha-carotene, Beta-carotene and lycopene fights and neutralize free radicals in the body. Studies have shown that high intake of these anti-oxidants (carotenoids) found in watermelon fruits, tomatoes and other fruit reduces the risks of cancer, arthritis, diabetes, asthma (Seddon,Roser, Willet,& Hankinson, 2004). Apart from its low energy value, watermelon is known for its high micronutrient's concentration such as vitamin K, ascorbic acid, riboflavin, iron and other minerals (Johnson,Iwang, Hemen, Odey, Effiong,&Eteng,2012). Watermelon seeds are known to be highly nutritional, they are rich sources of protein, vitamin B, minerals (such as magnesium, potassium, phosphorus, sodium, iron, zinc, manganese and copper) and fat among others as well as phytochemicals (Braide,Oranusi, & Peter- Ikechukwu, 2012).Watermelon seed is reported to have excellent functional properties and has been found to be effective in baking and in other food preparations (Nasr & Abufoul, 2004). The ultimate success of utilizing plant proteins as ingredient largely depends upon the beneficial qualities, they impact to foods which in turn depend largely on their nutritional and functional properties. Improvement in the utilization of watermelon seeds can be achieved if the functional behavior of the seed flour in the food system is understood.

Wheat flour is a powder made from grinding of wheat and it isone of the major conventional ingredients used in cake baking (Mepha, Eboh,& Nwojigwa, 2007)Cake is one of the relished and palatable baked products prepared from flour, sugar, shortening, baking powder, egg, essence as principal ingredients. It is ready to eat, convenient and inexpensive food product, containing digestive and dietary principles of vital importance (Oyeyinka, **Oyeyinka, Karim, Toyeeb, Olatunde, & Arise,** 2014).According to Hesso, Loisel, Chevallier, Le-Bail, Queveau, & Pontiore, (2015) baking process plays an important role in the structural, textural and physical properties of cakes. Cakes are one of the most popular products in bakery industry, because it is economically cheaper as well as considered being luxurious gifts for infants and school going children (Sindhuja, Sudha, & Rahim, 2005). Thus, cakes could be processed using watermelon seed composite flour that will give better physical, chemical and nutritional properties than plain cake.

LITERATURE REVIEW

Watermelon

Watermelon (*Citrullus lanatus*) is a dicotyledonous plant and it belongs to cucurbitaceae family which is made up of over 750 species (Yamaguchi, 2005). Watermelon (*Citrullus lanatus*) belongs to the Kingdom-*Plantae*, Class-*Dicotyledon*, Order-Cucurbitales, Family-*Cucurbitaceae* and they are widely distributed in the tropics and subtropics, and a few species occur in temperate region. Watermelon grows well in alluvial and sandy soils even in arid regions and coastal saline areas.

Watermelon is grown not only in dry, low altitude tropical areas like Cape Verde, Mali, Mauritania, Chad, Senegal and Nigeria, but also in equatorial countries like Gabon and Democratic Republic of Congo (De Lannoy, 2001).

Watermelon seeds have shown the potential for use in the food industry as they remain intact after removing the pulp and peel (De Conto *et al*., 2011). The seeds have the ability to store well, with both oil and fatty acid content being found to be stable after six months in storage (Jarret and Levy, 2012). Watermelon seeds can be utilized successfully as a source of edible oils for human consumption, and their oil might be an acceptable substitute for highly unsaturated oils (Baboli and Kordi, 2010). The seeds also contain lipids of nutritional interest, with high concentrations of unsaturated fatty acids, including a high concentration of phytosterols, particularly stigmasterol and β-sitosterol (De Conto *et al*., 2011). The use of watermelon seeds as a food source appears to be justified by their reported nutritional value. The seeds are highly nutritive and contain large amounts of proteins and many beneficial minerals such as magnesium, manganese, calcium, potassium, iron,sodium,copper,phosphorus and zincwhich assist in growth and development of a healthy body (Yadav *et al.,* 2011).

Watermelon seed oil has also been shown to have fatty acids that are of importance in the brain, the retina, liver, kidney and the gonads. Some of the fatty acids within the watermelon seed oil have also been shown to increase high-density lipoprotein(HDL) cholesterol, which is beneficial to the human blood stream and while oleic and linoleic acids are known to reducelow-density lipoprotein(LDL), which is the bad cholesterol (Njuguna*et al.,* 2014).

Wheat

Wheat is the most important stable food crop for more than one third of the world population and contributes more calories and proteins to the world diet than any other cereal crops (Shewry, 2009).Wheat is considered a good source of protein, minerals, B-group vitamins and dietary fiber that is an excellent health-building food. Thus, it has become the principal cereal, being more widely used for the making of bread than any other cereal because of the quality and quantity of its characteristic protein called gluten. Gluten makes bread dough, sticks together and gives it the ability to retain gas. Wheat has several medicinal virtues; starch and gluten in wheat provide heat and energy, the inner bran coats, phosphates and other mineral salts, the outer bran, the much-needed roughage, indigestible portion that helps easy movement of bowels, the germ, vitamins B and E, and protein of wheat helps to build and repair muscular tissue. The wheat germ, which is removed in the process of refining, is also rich in essential vitamin E, and its lack can lead to heart disease. The loss of vitamins and minerals in the refined wheat flour has led to widespread prevalence of constipation and other digestive disturbances and nutritional disorders. The whole wheat, which includes bran and wheat germ, therefore, provides protection against diseases such as constipation, heart disease, disease of the colon called diverticulitis, appendicitis, obesity and diabetes (Kumar*et al.,* 2011).

Queen's cake

Queen's cake is a small-sized cake which is portioned into a queen's cake pan before baking. It is a major snack in the fast food industry and highlights of many celebrations. They are usually produced from a mixture of four main ingredients, which are flour, sugar, eggs and butter (Syarbini, 2014). Cake is a food that is rich in protein, carbohydrate, fat, calcium and phosphorus. It also contains vitamin A, vitamin B1, and vitamin C (Subagio, 2007). Thus, cake produced from watermelon seed composite flour offer opportunity of delivering healthy, functional and specialized foods to the populace in order to combat food-related diseases such as celiac disease, diabetes and coronary heart diseases.

MATERIALS AND METHODS

Materials

The materials used are: watermelon fruits, wheat flour, butter, baking powder, flavor, sugar,sodium bicarbonate, and potassium bicarbonate.

Watermelon fruits were purchased from Alogi market in Ogun State. Wheat flour and other ingredient like butter, baking powder, flavor, sugar sodium bicarbonate, and potassium bicarbonate were gotten from Osiele market, Odeda Local Government, Abeokuta, Ogun State.

Methods

Watermelon seed flour processing

The watermelon seeds were processed into flour as shown in Figure 1 below. Watermelon pods was washed, cut into slices and the seeds was extracted, washed, drained and dried at temperature of 60^0C for 6 hours. The dried seeds were milled and sieved through 0.45mm mesh sieve. The watermelon seed flour was sealed in a cellophane bag and stored at room temperature for further analysis (Ubbor & Akobundu, 2009).

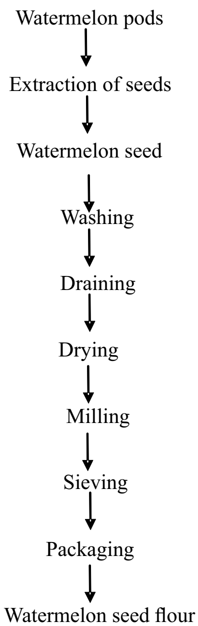

Figure 1: Watermelon seed flour processing (Ubbor & Akobundu, 2009)

PRODUCTION OF QUEEN'S CAKE

Queen's cake was produced using the method described by Ajani,Oshundahunsi, Akinnoso, Arowora,& Aderibigbe,. (2012). The queen's cake samples were in ratios of watermelon seed flour: wheat flour as illustrated in Table 1. All the ingredients (butter, sugar, salt, egg, milk) except flour and potassium bicarbonate were added with continued mixing in a mixer. Then, flour and sodium bicarbonate were added. Mixing was carried out for 5minutes. The batter was dispersed into small baking pans. Baking was done at 100^{o}C for 30minutes in an oven.

Table 1: Blend formulation

Wheat flour (%)	Watermelon seed flour (%)
100	0
90	10
80	20
70	30
0	100

Proximate Analysis

The proximate composition of the wheat and watermelon seed flour blend and queen's cake samples were determined using suitable methods. The samples were analyzed for moisture, ash, crude fibre, crude protein, crude fat and carbohydrate

Determination of moisture content

Moisture content was determined by oven drying method Association of Official Analytical Chemists (AOAC 2005). Five grammesof well-mixed sample was accurately weighed in a clean and dried crucible (W_1). The crucible was left in an oven at 105^{0}C for until a constant weight was obtained. Then the crucible was placed in the desiccator for 30minutes to cool. After cooling, it was weighed again (W_2).

The percentage of moisture was calculated by:

$$\% \text{ Moisture} = \frac{W1\text{-}W2}{\text{Sample weight}} \times 100$$

Where; W1 = Initial weight of crucible + Sample 1

W2 = Final weight of crucible + Sample.

DETERMINATION OF ASH CONTENT

The ash content was determined using the method of AOAC (2005). A clean empty crucible was placed in a muffle furnace (Carbolite, ELF11/14B, S336RB England) at 600 ^{0}C for an hour, cooled in desiccators and then the weight of the empty crucible was noted (W_1). One gramme of the sample was taken in crucible (W_2). The sample was ignited over a burner with the help of a blowpipe, until it was charred. Then the crucible was placed in muffle furnace at 550^{0}C for 2-4 h. the appearances of a gray white ash indicated the complete oxidation of all organic matter in the sample. After ashing the furnace was switched off. The crucible was allow to cool and then weighed (W_3).
The percentage of ash was calculated by:

$$\%\ ash = \frac{Difference\ in\ weight\ of\ ash}{weight\ of\ sample} \times 100 \quad (2)$$

CRUDE FAT DETERMINATION

Crude fat was determined by ether extract method using soxhlet (Thermo scientific EME3100/CEB, UK) apparatus AOAC (2005). Approximately One gramme of moisture free sample was wrapped in filter paper; it was then placed in fat free thimble and then introduced in the extraction tube. Weighed, cleaned and dried receiving beaker was filled with petroleum ether and fitted into the apparatus. The water and the heater were turned on to start extraction. After 4-6 siphoning the ether was allowed to evaporate and the beaker was disconnected before the last siphoning. The extract was then transferred into a clean glass dish with ether washing and the evaporated ether on water bath. Then the dish was placed in an oven at 105^{0}C for 2 h and then allowed to get cooled in a desiccator and was calculated by using,

$$\%\ \text{crude fat} = \frac{\text{weight of ether extract}}{\text{weight of sample}} \times 100 \quad (3)$$

Protein content in the sample was determined by Kjeldahl method as described by AOAC (2005). The samples were digested by heating with concentrated sulphuric acid (H_2SO_4) in the presence of digestion mixture. The mixture was made alkaline. Ammonium sulphate thus formed the released ammonia which was collected in 2% boric acid solution and titrated against standard hydrochlorides (HCl). Total protein was calculated by multiplying the amount of nitrogen with appropriate factor (6.25) and the amount of protein was calculated by:

$$\%\ \text{crude protein} = 6.25^* \times \%N \quad (4)$$

$$\%N = \frac{(Sample\ titration\ reading - Blank\ titration\ reading) \times N \times 0.014 \times Dilution\ of\ sample)}{weight\ of\ sample} \quad (5)$$

Where * = Correction factor

Determination of crude fiber content

Crude fiber was determined by the described method of AOAC (2005). A moisture free and ether extracted sample of crude fiber was made of cellulose and digested with diluted H_2SO_4 and then with diluted KOH solution. The undigested residue was collected after digestion and signeted. The loss in weight after ignition was registered as crude fiber.

$$\% \text{ crude fibre} = \frac{W1-W2}{Wo} \times 100$$

Where; W0 = sample weight

W1= weight of the dried sample

W2 = the re-weighed sample

Determination of total carbohydrate content

Total carbohydrate was calculated by difference after analysis of all the other items in the proximate analysis.

Total Carbohydrate = (100-% moisture-% crude protein- % crude fat -% crude fiber -%ash) (7)

Functional properties of the flour blends

Determination of Water Absorption Capacity

Water absorption capacity was determined according to the methods of Onwuka (2005)**.** One gramme of each sample was weighed into a clean conical graduated centrifuge tube and was mixed thoroughly with 10 ml distilled water using a warring mixer for 30 s. The sample was then allowed to stand for 30 min at room temperature, after which it was centrifuged at 5000 rpm for 30 min. After centrifugation, the volume of the free water (supernatant) was read directly from the graduated centrifuge tube. The absorbed water was converted to weight (in grammes) by multiplying by the density of water (1 g/ml). The water absorption capacity was expressed in grammes of water absorbed per grammes of flour sample.

Absorbed water = total water - free water.

Determination of Bulk Density

The bulk density of each of the flour samples was determined according to the method of Giami,Bekebain, and Emelike,(1992). A calibrated centrifuge tube was weighed using an analytical balance in each case and the samples were filled up to the 10 ml mark. They were then tapped until there were no further change in volume. The contents were each weighed with the aid of an analytical balance and from the difference in weights, the bulk density of each sample was calculated thus;

Determination of Swelling Capacity

One gram (1.0g) of sample was transferred into a weighed graduated 50 ml centrifuge tube. Distilled water was added to give a total volume of 40 ml. The sample in the tube was stirred gently by hand and then heated at 85 ºC in a water bath for 30 min with constant shaking. After cooling to room temperature, the samples were centrifuged for 15 minutes at 2200 rpm. The supernatant was transferred into a can, dried in a hot air and the dry residue was weighed. The sediment paste was weighed. The swelling capacity was calculated by the formula:

$$Swelling\ Capacity = \frac{W\ s}{W\ sample\ \text{-}W\ dried\ residue}$$

W_S is the weight of the sediment paste aftercentrifugation,
$W_{sampledry\ \ basis}$ is the weight of the initial sample on dry basis,
$W_{driedresidue}$is the weight of the residue of supernatant after drying.

Determination of oil absorption capacity

The oil absorption capacity was also determined by the method of Chandra,Singh, & Kumari (2015). One gramme of sample mixed with 10Ml soybean oil (Sp. Gravity: 0.9092) and allow to stand at ambient temperature (30 ± 2 °C) for 30 minutes, the centrifuged for 30 minutes at 300 rpm or 2000 × g. oil absorption capacity was examined as percent oil bound per gram flour.

Determination of pasting properties

Pasting characteristics was determined with a Rapid Visco Analyzer (RVA) (Olatunde,Henshaw, Idowu, &Tomlins,2016) (RVA super 3, Newport Scientific pty. Ltd, Australia). A 3 g sample (at 1% moisture level) was dissolved in 25 ml of water in a sample canister. The sample was thoroughly mixed and fitted into the RVA as recommended. The slurry was heated at a temperature of 50^0C for 1 min and then from 50^0C to 95^0C for 3 min then was held at 95^0C for another 3 min and subsequently cooled to 50^0C over 4 periods. This was followed by a period of 1 min where the temperature was kept at a constant temperature of 50^0C. The 12 min profile was used, and the rate of heating and cooling was at a constant rate of 11.25 ^{0}C/min. Corresponding values for peak viscosity, trough, breakdown, final viscosity, setback, peak time and pasting temperature from the pasting profile was read from a computer connected to the RVA.

Physical characteristic-s of the queen's cakes

The physical characteristics of the queen's cakes was measures using the method outlined by Zoulias,Oreopoulou, and Kounalaki. (2002) and reported by Giami and Barber (2004) for fluted pumpkin cookies. Physical parameters measured included height and weight.

Sensory Evaluation

Consumer acceptance test was used to evaluate the sensory attributes of the queen's cake samples as described by Nwosu,Elochukwu, and Onwurah(2014). 30 panelists were randomly chosen among students of the department of hospitality and tourism from the Federal University of Agriculture Abeokuta to participate in the test. Panelist evaluated the cake samples on a 9-point hedonic scale with 9- like extremely, 8-liked very much, 7-liked, 6- liked mildly, 5- neither liked nor disliked, 4-dislike mildly, 3-disliked, 2-disliked very much and 1-disliked extremely. The sensory evaluation was carried out to determine the taste, colour, texture, flavor, appearance and overall acceptability.

Statistical Analysis

All analyses were carried out in triplicate for each sample. Data collected from the study was subjected to analysis of variance (ANOVA). The differences among means were separated using Duncan Multiple Range Test (DMRT) ($P \leq 0.05$).

RESULTS AND DISCUSSIONS

Table 2: Proximate composition of wheat and watermelon seed composite flour

Sample	Moisture (%)	Ash (%)	Fat (%)	Protein (%)	Carbohydrate (%)	Crude Fibre (%)
AF	11.45±0.04[e]	2.58±0.03[e]	34.9±0.91[e]	17.71±0.09[e]	7.76±0.81[a]	26.6±0.02[e]
BF	7.98±0.02[a]	1.05±0.03[b]	1.8±0.07[b]	13.82±0.03[b]	59.14±0.08[d]	16.21±0.05[b]
CF	8.74±0.02[b]	1.54±0.02[c]	2.73±0.03[c]	14.42±0.03[c]	53.05±0.05[c]	19.42±0.01[c]
DF	9.64±0.11[c]	1.92±0.02[d]	3.94±0.02[d]	16.05±0.02[d]	46.59±0.10[b]	22.06±0.04[d]
EF	10.65±0.08[d]	0.98±0.04[a]	0.93±0.04[a]	11.21±0.04[a]	74.69±0.09[e]	1.54±0.08[a]

Values represent mean and standard deviation, means with the same superscript with a column are not significantly different ($p<0.05$)

AF- 100% watermelon seed flour
BF-10% watermelon seed flour: 90% wheat flour
CF-20% watermelon seed flour: 80% wheat flour
DF-30% watermelon seed flour: 70% wheat flour
EF-100% wheat flour

The proximate composition of wheat and watermelon composite flour is presented on Table 2. The moisture, ash, fat, protein carbohydrate and crude fibre content of the composite flour are significantly different ($p<0.05$) with values that ranged from 7.45-10.65%, 0.98-2.58%, 0.93-34.9%, 11.21-17.71%, 7.76-74.69% and 1.56-26.6%, respectively.

Percentage inclusion of watermelon seed flour to wheat flour significantly increased the moisture, protein, ash, fat and crude fibre content of the composite flour in which sample AF had the highest while sample EF had the lowest value. High crude protein of the wheat and watermelon seed composite flour signifies that the composite flour can serve as cheap source of protein to African populace. Products from the flour would have the potential of solving the problem of protein-energy malnutrition in Africa (Bolarinwa,Olaniyan, Adebayo,& Ademola2015).The results obtained in this study are similar to the findings of Okoye,Nkwocha,&Ogbonnaya. (2008) reported a decrease in carbohydrate content (73.4- 34.9%) of wheat-soy bean flour with increasing soy flour substitution.

The carbohydrate content of the composite flour significantly decreased with increase in percentage inclusion of water melon seed flour to wheat flour in which sample AF- 100% watermelon seed flour had the lowest while sampleEF-100% wheat flour had the highest value as shown in the table below.

Table 3: Functional properties of wheat and watermelon seed composite flour

Sample	Bulk Density (g/dm^3)	Water Absorption Capacity (%)	Oil Absorption Capacity (%)	Swelling capacity (%)
AF	0.62 ± 0.01^b	68.36 ± 0.07^a	76.33 ± 0.44^d	5.20 ± 0.04^a
BF	0.65 ± 0.02^c	75.36 ± 0.06^d	67.44 ± 0.08^{ab}	7.14 ± 0.02^d
CF	0.61 ± 0.01^b	73.56 ± 0.06^c	69.14 ± 0.01^b	6.41 ± 0.03^c
DF	0.58 ± 0.01^a	70.43 ± 0.07^b	72.77 ± 0.03^c	5.81 ± 0.04^b
EF	0.70 ± 0.01^d	77.66 ± 0.16^e	65.89 ± 0.05^a	8.97 ± 0.02^e

Values represent mean and standard deviation, means with the same superscript within a column are not significantly different ($p<0.05$)

AF- 100% watermelon seed flour
BF-10% watermelon seed flour: 90% wheat flour
CF-20% watermelon seed flour: 80% wheat flour
DF-30% watermelon seed flour: 70% wheat flour
EF-100% wheat flour

The water absorption capacity values obtained from this study across all treatments were within the value (70-110%) reported by Adebowale,Adegoke, Sanni, Adegunwaand Fetuga (2012). This is relatively lower than the range (278.51 - 421%) reported for water yam cassava flour (Babajide & Olowe, 2012).

Swelling capacity is a measure of hydration capacity, because the determination is a weight measure of swollen starch granules and water. Moorthy (2002) reported that the swelling power of flour granules is an indication of the extent of associative forces within the granule. Swelling capacity is also related to the water absorption index of the starch-based flour during heating (Adebowale,*et al,*2012). Swelling capacity of starch is described as the ability of starch to absorb water and enlarge/expand under a particular temperature at a given time (Falade,Semon, Fadairo, Oladunjoye,& Orou, 2014).

The oil absorption capacity of the wheat and watermelon seed flour increased significantly with increased in percentage inclusion of watermelon seed flour with values that ranged from 65.89-76.33% in which sample EF had the lowest while sample AF had the highest. The oil absorption capacity (OAC) of flour blends were however lower than 89.7%

reported for pigeon pea (Oshodi &Ekperigin, 1989). According to Oloyede, Ocheme, Chinma, and Akpa (2016), good oil absorption capacity of flour samples suggest that they may be useful in food preparations that involve oil mixing like in bakery products, where oil is an important ingredient. The water/fat binding capacity of proteins is an index of its ability to absorb and retain oil, which in turn influences the texture and mouth feel of food products like ground meat formulations, doughnuts, pancakes, baked goods and soups.

Table 4: Proximate composition of queen's cake produced from wheat and watermelon seed composite flour

Sample	Moisture (%)	Ash (%)	Fat (%)	Crude Fibre (%)	Protein (%)	Carbohydrate (%)
A	7.65±0.23[a]	2.71±0.07[c]	6.53±0.06[a]	7.89±0.92[a]	17.70±0.09[a]	58.17±0.38[d]
B	16.62±0.05[b]	2.16±0.03[a]	12.42±0.03[b]	8.04±0.09[b]	20.17±0.01[b]	40.62±0.21[c]
C	18.68±0.03[c]	2.27±0.02[b]	15.81±0.03[c]	9.29±0.02[c]	22.18±0.03[c]	31.77±0.10[b]
D	19.12±0.02[d]	3.01±0.04[d]	17.76±0.23[d]	9.93±0.05[d]	24.59±0.19[d]	25.62±0.48[a]

Values represent mean and standard deviation, means with the same superscript within a column are not significantly different ($p<0.05$)

A-Queen's cake produced from 100% wheat flour
B-Queen's cake produced from 10% watermelon seed flour: 90% wheat flour
C- Queen's cake produced from 20% watermelon seed flour: 80% wheat flour
D- Queen's cake produced from 30% watermelon seed flour: 70% wheat flour

The ash content of a food material could be used as an index of mineral constituent of the food because ash is the inorganic residue remaining after the water and organic matter has been removed by heating in the presence of an oxidizing agent (Sanni, Adebowale, Filani, Oyewole, & Westby, 2006).

The protein content of the watermelon seed flour is within the range of values reported by Adebowale *et al.,* (2012). The high protein content observed in the baked product of this study could be due to the level of watermelon seed flour that was supplemented into the flour samples during the cake productions. This finding agreed with the report of Kolapo and Sanni (2005). Quality protein intake is a major nutritional problem in many parts of developing countries including Nigeria where cost of animal-based protein is high and not affordable by many less privileged families (Ekpo, 2011).

The increase in the crude fibre content of the baked product could be attributed to supplementation of watermelon seed flour into the wheat flour during the production of the snacks. It has been reported that high fiber intake prevents diseases like cardiovascular disease, cancer of the colon and diabetes (Rimm, Ascherio, Giovannucci, Spiegelman, Stampfer,& Willett1996; Pereira & Pins, 2000). Scientific study has established that one of the physiological roles of crude fiber in the body is to maintain an internal distention for proper peristaltic movement of the intestinal tract (Oduor*et al.,* 2008), and thereby prevent constipation (Groff *et al.,* 1995). Diets with high fiber content have been used for weight control and fat reduction, it provides satiety and thereby reduces the amount of energy given food that would be consumed (Ekop, 2004)

The carbohydrate content of Queen's cake produced from wheat and watermelon seed significantly decreased with increase in percentage inclusion of watermelon seed flour to wheat flour in which sample A had the highest value while sample D had the lowest. The decrease in carbohydrate content is attributed to the low carbohydrate content of watermelon seed flour.

Table 5: Sensory properties of Queen's cake produced from watermelon seed and wheat composite flour

Sample	Colour	Taste	Texture	Aroma	Appearance	Overall acceptability
A	8.5±0.76[c]	8.45±0.75[d]	8.25±0.78[d]	8.00±1.07[d]	8.5±0.83[d]	8.5±0.76[d]
B	7.65±0.87[b]	7.25±0.85[c]	7.15±0.81[c]	7.45±1.31[c]	7.6±0.99[c]	7.7±0.86[c]
C	6.75±1.06[a]	6.9±1.41[b]	6.85±1.38[b]	7.05±0.99[b]	7.15±1.03[b]	7.25±1.11[b]
D	6.6±1.50[a]	6.7±0.97[a]	6.3±1.49[a]	6.55±1.27[a]	6.75±1.25[a]	7.05±1.35[a]

Values represent mean and standard deviation, means with the same superscript within a column are not significantly different ($p<0.05$)

A-Queen's cake produced from 100% wheat flour
B-Queen's cake produced from 10% watermelon seed flour: 90% wheat flour
C- Queen's cake produced from 20% watermelon seed flour: 80% wheat flour
D- Queen's cake produced from 30% watermelon seed flour: 70% wheat flour

The sensory properties of Queen's cake produced from watermelon seed and wheat composite flour is presented on Table 5. The colour, taste, texture, aroma, appearance and overall acceptability are significantly different ($p<0.05$) with values that ranged from 6.6-8.5, 6.7-8.45, 6.3-8.25, 6.55-8.00, 6.75-8.5 and 7.05-8.5, respectively. The sensory score for colour, taste, texture, aroma, appearance and overall acceptability of Queen's cake decreased with increase in percentage inclusion of watermelon seed flour to wheat flour in which sample D had the lowest sensory score while sample A had the highest. Similar results were reported by Mir Gul,&Riar.(2015) for cakes by increasing non-wheat flour in the formulation

Conclusion

The percentage inclusion of watermelon seed flour to wheat flour significantly affected the proximate composition, pasting properties and functional properties of the composite flour and the proximate composition of the Queen's cake. Acceptable queen cakes were prepared from flour blends of wheat flour and watermelon seed flour with regard to colour, taste, texture and overall acceptability which compared favourably with the control. The batch 90% wheat flour and 10% watermelon seed flour were the most accepted as compared with the control.

Recommendation

It is therefore recommended that:

* The percentage inclusion of watermelon seed flour to wheat flour should be optimized for best quality Queen's cake.

* The effect of different packaging materials on the quality of Queen's cake from different blends of wheat and watermelon seed flour during storage should be studied.

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