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Organoleptic Attributes And Nutritional Composition Of Rock Cake Made With Wheat And Millet Flour Blends

Fenteng Rita Adasi[1] , Rebecca Maurice Kaba Kubabom[2] , Mary McArthur – Floyd[3]

[1] Hospitality Management Department, Takoradi Technical University, Ghana.
[2]Vocational/Technical Department, St. John Boscos College of Education, Navrongo- Ghana.
[3]Hospitality Management Department, Takoradi Technical University, Ghana.

Abstract

The current study was undertaken to evaluate the organoleptic attributes and nutritional composition of rock cake made with wheat and millet composite flour in varying percentages of 100%, 90%, 80%, 70%, 60%, and 0%, 10, 20%, 30%, and 40% respectively. Five different rock cake samples were produced and coded as MM0, MM1, MM2, MM3, and MM4 where MM1 served as a control rock cake sample containing 100% wheat flour. The rock cake samples were analysed for proximate composition and sensory evaluation. The values obtained for moisture, ash, fat, crude fibre, protein, and carbohydrate were in the ranges of 17.11 to 21.93%, 1.27 to 2.91%, 10.30 to 14.35%, 1.26 to 2.13%, 11.48 to 12.40 and 64.10 to 67.60%, respectively. The results show an increase in levels of ash, fibre, protein, and carbohydrate contents when the millet flour was increased. The sensory evaluation revealed no statistical differences (p>0.05) between the control rock cake sample and composite samples MM1 and MM2 but differed significantly (p<0.05) from MM3 and MM4. The study found that the control rock cake made entirely with wheat flour and that made with 10% and 20% millet incorporation were preferred. It was suggested that rock cake production of up to 10% and 20% millet flour could be used without negatively affecting the quality.

Keywords: Rock cake, composite flour, Pearl Millet, local raw materials, nutritional composition

Introduction

Rock cake is one of the most popular snacks in the Ghanaian market. It is made with a cereal-based flour component and is enjoyed by practically all age groups. Due to their high calorie, fat, and carbohydrate content, rock cakes are not recommended for everyday consumption, especially for those who are watching their diets (Serrem et al., 2011). The cake is prepared by combining sugar, eggs, shortening, milk, and leavening to make a fluffy baked good (Eke et al., 2008). Cake has long been a mainstay of our diets, and its lasting demand has sparked the production of the newer and more enticing products that are currently on the market (Signori, 2004). Rock cake is suitable for picnics, as a snack or can be eaten alone (Signori, 2004). As more Ghanaians frequent them, the number of baked goods has increased in Ghana over time. As a result of Ghana's economic expansion, more processed food and bakery goods are being consumed, which has increased the country's need for imports (Sanful and Darko, 2010).

Wheat flour is one of the main traditional components in pastry preparation because of its gluten portion, which gives the dough its elasticity by allowing it to stretch and trap carbon dioxide produced by yeast during fermentation (Giami et al., 2004). However, due to low wheat production in tropical nations, it is necessary to import wheat flour to meet local demand (Mepba et al., 2007). Numerous researchers have tried to replace the wheat flour in pastry products with non-wheat flour to reduce the cost of wheat importation and also making pastry products affordable for consumers (Onweluzo et al., 1995). For the purpose of baking bread and pastries, cassava, sorghum, and millet are the main sources of partial substitutes for wheat in Ghana. There is a need to get locally processed flour from indigenous crops that may be used in partial substitution for wheat in the making of bakery items for consumption and industrial purposes due to the rising demand for bakery products that has resulted in the importation of wheat.

An increasing number of patients with celiac disease have trouble eating baked products made from wheat and rye. As a result, there is a market for new, inventive baking items made from other grains like rice, maize, sorghum, and millet (Stephanie et al., 2009). Gluten, the substance that causes celiac disease, is absent from these plants. Additionally, millets are high in protein, particularly in critical amino acids like lysine, which is only found in wheat and rye flour (Meroth et al., 2004). Due to their poor baking quality and the sensory quality of the baked products, the usage of these alternative flours is constrained (Gallagher et al., 2003). Composite flour is valued in developing nations because it increases the use of locally available crops as flour while reducing the importation of wheat flour (Noorfarahzilah et al., 2014). In nations where there are other crops besides wheat, it is deemed economically advantageous to reduce or even eliminate wheat imports in order to supply the demand for confectionery products by using locally cultivated crops (Mepba et al., 2006). Utilizing these composite flours would decrease the demand for imported wheat, save foreign reserves, increase the use of local crops in food preparation, and so enhance the nutritional content of the end products (Ade-Omowaye et 2008).

Internationally, pearl millet is used to prepare a variety of dishes, including unleavened bread (roti or chapatti), porridge, gruel, and desserts (Burton et al. 1972). Its flour can replace wheat flour (10–20%) in "whole-grain" breads, pretzels, crackers, tortillas, dry and creamed cereals, and tortilla chips. In contrast to other major cereals like rice (Oryza sativa L.), wheat (Triticum aestivum L.), and maize (Malassa sativa L.), pearl millet has received little attention in the Sub-Saharan Africa. The aim of this study was to evaluate the organoleptic attributes and nutritional composition of rock cake made with wheat and millet flour blends

Materials and methods

Materials

The ingredients used for the rock cake were wheat flour, pearl millet flour, margarine, sugar, egg, milk, baking powder and salt. Pearl millet and all other ingredients were bought from Bolgatanga Central Market in the Upper East Region of Ghana.

Pearl Millet flour preparation

The grains of pearl millet (Pennisetum glaucum) were thoroughly cleaned by sorting and winnowing to get rid of all the impurities. The cleaned grains were dehulled, rinsed, and dried in a cabinet dryer at 50 °C for 24 hours. The grains were crushed using a hammer mill to a fine powder, sieved through a 0.25 m sieve, placed in a cellophane bag, and kept for later analysis (Adebayo-Oyetoro, et al., 2017).

Formulation of composite flour blends

The blends of whole wheat flour and Pearl Millet flour were made by adding different percentages of wheat and Pearl millet, including 100%, 90%, 80%, 70%, 60%, and 0%, 10%, 20%, 30%, and 40%. The flours were carefully mixed using a Binatone food mixer to achieve a uniform combination. The samples were tagged and stored in an airtight container at a 302°C ambient temperature until they were required for the creation of rock cakes.

Table 1 ingredient for rock cake preparation

INGREDIENTS	MM0	MM1	MM2	MM3	MM4
Soft wheat flour (g)	100	90	80	70	60
Pearl Millet flour (g)	0	10	20	30	40
Margarine (g)	50	50	50	50	50
Baking powder(g)	1	1	1	1	1
Sugar (g)	40	40	40	40	40
Water+ Milk (mL)	120	120	120	120	120
Vanilla essence (mL)	1	1	1	1	1
Eggs (g)	10	10	10	10	10

Keys: MM0 (100% wheat flour), MM1 (90% wheat flour and 10% Pearl Millet flour), MM2 (80% wheat flour and 20% Pearl Millet flour), MM3 (70% wheat flour, 30% Pearl Millet flour) and MM4 (60% wheat flour, 40% Pearl Millet flour).

Methods of preparing rock cake

The rock cake was made in accordance with Ceserani and Kinton's instructions (2008). The flour, salt, and baking powder were sieved, to put it briefly. After rubbing margarine into the flour to create a sand-like consistency, sugar was added. A well-beaten egg was gradually added, and everything was blended by stirring as gently as possible. Currants and sultanas, two dried fruits, were mixed into the combination. The mixture was shaped with a fork on a baking sheet that had been greased with milk. The mixture was then baked for roughly 20 minutes at 220°C in a fairly hot oven. The same procedure was used to prepare the composite rock cake samples (MM1, MM2, MM3, and MM4) respectively.

Proximate composite of wheat and Pearl Millet rock cake

The AOAC (1990) technique was used to assess the flours' proximate composition, which includes moisture, ash, fat, protein (percent N% x 6.25), and fiber content. The following calculation was used to calculate the amount of total carbohydrates: Total carbohydrates content was determined using the following formula: Total carbohydrates =100− (moisture +ash + fat + protein+ fiber).

Sensory Evaluation

The rock cake samples were evaluated by a 30-member semi-trained panel; they assess the appearance, texture, taste, flavour, and overall acceptability of the wheat -millet rock on a 7-point hedonic scale, where 7-Like extremely, 6-Like very much, 5-Like much, 4-Neither like nor dislike, 3-Dislike much, 2-Dislike very much, and 1-Dislike extremely.

Statistical Analysis

The one-way analysis of variance (ANOVA) was performed using SPSS version 16 on the data presented in the tables, which were completed in duplicate. Means were separated using Duncan's multiple tests at 5% probability.

Results and Discussion

Table 2 displays the findings of the proximate composition of samples of composite rock cakes made of wheat and millet. The moisture content ranged from 17.11 -21.93%. The samples with the highest and lowest moisture contents, respectively, were MM0 (100% millet flour) and MM4 (60% wheat flour and 40% Pearl Millet flour). At $p<0.05$, the samples' moisture contents differed significantly from one another. It was observed that increasing the quantity of millet flour resulted in a corresponding decrease in moisture contents of the composite rock cake samples. The samples fall in the range needed for pastries to have a consistent shelf life (Iwe et al., 2017). This observation is inconsistent with information from (Njintang et al., 2008) and (Olaoye et al., 2006). They claimed that adding more non-wheat flour enhanced the moisture content of their composite bread, although the findings are not different from those reported by (Mepba et al., 2007) and (Eddy et al., 2007).

Ash is the term used to describe the inorganic by-product left over after the full oxidation of organic materials in a food sample or after its burning. An essential quality trait for various food ingredients is ash content, which can be determined as part of proximate analysis for nutritional evaluation. The ash content ranged from 1.27 -2.97%, with sample rock cake MM4 (60% wheat flour and 40% Pearl Millet flour) having the highest mean percentage (2.91%) and sample rock cake made entirely of wheat flour having the lowest (1.27%). The study's conclusions showed that increasing the amount of millet flour caused the composite rock cake's ash level to rise in proportion. The composite rock cakes' ash contents varied from one another in a way that was statistically significant ($p<0.05$). This demonstrated that millet flour with a larger value of ash was advantageous, in line with Legesse's (2013) claim that the ash level reflects an estimate of the mineral content of the products. Due to the inclusion of millet flour, which has a high ash level, there was a difference in the ash content between the composite rock cake samples and wheat rock cake. This implies that since millet is known to contain a significant amount of minerals, adding millet flour to flour blends may improve the mineral intake of consumers of such rock cake products.

The fat contents of both whole wheat and composite rock cake samples ranged from 10.30-14.35%. Samples MM4 (60% wheat flour and 40% Pearl Millet flour) and MM0 (100% wheat rock cake) showed the greatest and lowest respective fat levels. The fat level increased as the amount of wheat and millet flour increased (Table 2). In confectionery items, fat imparts properties like as tenderness, moistness, flavour, colour, and anti-staling. There was a noticeable difference between the samples (p <

0.05). It is possible that millet's high oil content in the germ accounts for its high fat content in the rock cake (Manley, 2000). The amount of indigestible substances like cellulose, pentosans, lignin, and other similar substances that are present in food is measured as crude fiber. It is the leftover plant material from solvent extraction and digestion with weak acid and alkali. Although they have little nutritional value, these ingredients give the intestinal tract the bulk it needs to function properly.

The crude fiber content of the whole wheat and composite rock cake samples ranged from 1.26-2.13%. A composite rock cake sample made with 60% wheat flour and 40% millet flour blends had the highest value of 2.13% (MM4) while the lowest was for the control rock cake sample (100% wheat flour). The amount of crude fiber increased as the percentage of millet flour in the blends increased. Between rock cake samples of crude fiber content, there was a significant difference ($p< 0.05$). Similar results regarding enhanced fiber content were shown by Ayo et al. (2014) when malted soy flour was added to the production of biscuits. Ndife et al.'s (2011) study on the addition of soy flour to bread-making suggests that the rise in fiber content may be due to the addition of more soy flour to the blended flour. According to well-established studies, dietary fiber is now widely recognised to play a significant role in the prevention of several diseases, including cardiovascular disease, constipation, irritable colon, cancer, and diabetes (Slavin 2005; Elleuch et al. 2011). As a result, these rock cakes that are enriched with wheat and pearl millet flour blends might help to prevent such situations. Also, according to Anderson, Baird, and Richard (2009), fiber helps to lower blood cholesterol levels and slows down the process of absorbing glucose, helping to maintain blood glucose levels under control.

The protein content of the rock cake samples ranged from 11.48-12.40% (Table 2). All types of millet incorporated rock cake samples MM1 (90% wheat flour and 10% Pearl Millet flour), MM2 (80% wheat flour and 20% Pearl Millet flour), MM3 (70% wheat flour and 30% Pearl Millet flour) and MM4 (60% wheat flour and 40% Pearl Millet flour) were significantly different ($p<0.05$) from the control rock cake (100% wheat flour). The protein level of rock cake samples were higher than that reported by Saleh et al. (2013), who claimed that several millet varieties had a protein content ranging from 7.7 to 12.1 g/100 g, but it was comparable to that reported by Ali et al. (2003), who reported 12.5 to 13.6%. These varieties, which have a protein content of over 7%, may help prevent protein-energy malnutrition, especially in young people in the regions where the crop is grown. The composite cake may have had a higher protein level due to the usage of pearl Millet flour, which enhanced the protein content of the cake (Ijah et al., 2014). Comparable findings for wheat-yam flour composite bread were reported by Amandikwa et al. (2015), and similar findings for wheat-sweet potato flour composite bread by Mitiku et al. (2018). Again, Adegunwa et al. (2014) prepared samples of products using wheat and millet flour blends. They revealed that among millet-wheat composite chin-chin prepared, the 100% millet chin-chin had the highest protein content.

The amount of total carbohydrates in the rock cake samples ranged from 64.10 to 67.60%, with sample MM4 (60% wheat flour and 40% Pearl Millet flour) rock cake having the greatest value (67.60%) and sample MM0 (100% wheat flour) rock cake having the lowest (64.10%). When pearl millet flour was substituted to a greater extent, the amount of carbohydrates increased MM4 (60% wheat flour and 40% Pearl Millet flour).The differences in carbohydrate contents between the control and composite rock cakes may be to attributed to the incorporation of the pearl millet which has high carbohydrate content. At ($p < 0.05$), there was no significant difference between the samples. The high carbohydrate content of the composite rock cake samples can be attributed to their raw ingredients' high carbohydrate content, which was not significantly impacted by processing.

Table 2: Proximate composition of wheat-millet rock cake

Samples	**Moisture** (%)	**Ash** (%)	**Fat** (%)	**Fiber** (%)	**Protein** (%)	**CHO** (%)
MM_0	21.93^a	1.27^e	14.35^a	1.26^e	11.48^e	64.10^e
MM_1	20.69^b	1.75^d	13.34^b	1.48^d	11.54^d	$64. 96^d$
MM_2	19.50^c	2.80^c	13.07^c	1.71^c	11.65^c	65.85^c
MM_3	18.29^d	2.86^b	11.31^d	1.93^b	11.70^b	66.73^b
MM_4	17.11^e	2.91^a	10.30^e	2.13^a	12.40^a	67.60^a

Values in the same column with different superscripts are significantly different ($p>0.05$). Keys: MM0 (100% wheat flour), MM1 (90% wheat flour and 10% Pearl Millet flour), MM2 (80% wheat flour and 20% Pearl Millet flour), MM3 (70% wheat flour, 30% Pearl Millet flour) and MM4 (60% wheat flour, 40% Pearl Millet flour).

Sensory analysis of wheat- Millet rock cake

Table 3 presents the findings of the sensory evaluation on the rock cake samples produced using wheat/millet flour blends. The aroma of a product significantly affects whether or not it is accepted, claim Abu-Salem et al., (2011). The aroma of the rock cake samples ranged from 6.41-4.15% with rock cake sample made with 60% wheat flour and 40% Pearl millet flour having the lowest mean value (4.15%) while the highest was for the control (100% wheat flour) with 6.41. It was observed that as the proportion of millet flour in the rock cakes increased, the sensory evaluation for colour reduced drastically. A significant difference ($p<0.05$) was recorded between the control rock cake sample (100% wheat flour) and the composite samples MM1 (90% wheat flour and 10% Pearl Millet flour), MM2 (80% wheat flour and 20% Pearl Millet flour), MM3 (70% wheat flour, 30% Pearl Millet flour) and MM4 (60% wheat flour, 40% Pearl Millet flour). A customer may have a favourable or unfavourable sensory experience depending on how delicately the aroma of food interact (Asumugha et al., 2010). Even while the sight of the food product may cause an initial reaction, whether it will be liked or disliked ultimately depends on its aroma.

The average colour score of the composite rock cake fell as the amount of pearl millet flour increased. The finding revealed significant differences ($P< 0.05$) between the control rock cake sample (100% wheat flour) and the composite samples MM1 (90% wheat flour and 10% Pearl Millet flour), MM2 (80% wheat flour and 20% Pearl Millet flour), MM3 (70% wheat flour, 30% Pearl Millet flour) and MM4 (60% wheat flour, 40% Pearl Millet flour). Sample MM0 (100% wheat flour) received the highest colour rating from the judges while the least was for MM4 (60% wheat flour, 40% Pearl Millet flour). According to Alice and Rosli's (2005) research, the sensory score for colour was significantly lower in the Kuih Talam Pandami (KTP) mixture when 30-90 percent unpolished brown rice flour was used as a substitute. The amount of replacement in the composite flour may be the cause of the composite rock's poor colour means score. This is because wheat flour facilitates the development of desired colours in baked items.

The texture of the rock cake samples ranged from 6.30-6.65. The highest texture was recorded by a rock cake sample made with 60% wheat flour and 40% pearl millet flour blends and the lowest was for the control rock sample (100% wheat flour) with 6.30. The quantity of millet flour in the composite rock cake samples increased, and this resulted in an increased in texture of the composite rock cakes. This could be attributable to the high fiber content of pearl millet. Higher percentages of millet flour (40%) were found to produce foods with good texture (Table 3). The findings disagrees with that of Nwanekezi (2013), who reported that high amounts of other flours substituted for wheat flour lessen the elastic qualities of the dough, which results in low gas retention properties during fermentation, which in turn lowers the textural quality of the finished product.

The greatest influence on a product's market success and the most crucial factor in determining whether or not it will be accepted is its taste. Rock cake composed of 100% wheat flour obtained the highest mean ratings (6.42), whereas cakes made of 60% wheat and 40% millet flour were ranked the least (4.50). There were significant differences ($p<0.05$) between the control rock cake sample MM0 (100% wheat flour) and the composite rock cake samples, MM1 (90% wheat flour and 10% Pearl Millet flour) and MM2 (80% wheat flour and 20% Pearl Millet flour) but differed significantly with the samples MM3 and MM4. The results are inconsistent with those of (Noorfarahzilah et al., 2014) show that bread with a higher percentage of wheat (95%) and a lower percentage of cocoyam flour (5%) rated the highest.

An essential parameter in the organoleptic assessment is the overall acceptability of a product and this has several results. The panelists rated rock cake sample MM0 (100% wheat flour) as the highest mean value (6.40), for general acceptability, followed by the sample MM1 (90% wheat flour and 10% Pearl Millet flour) with (6.37) and MM3 (70% wheat flour, 30% Pearl Millet flour) respectively. Although, the control rock cake sample MM0 received higher ratings, yet recorded no significant differences ($p<0.05$) between MM1 and MM2. Similar results were reported by Nwaojigwa et al. (2007), who claimed that the sensory qualities of biscuits made from sweet potato-wheat flour were satisfactory up to a supplementation level of 40%.

Table 3: Sensory analysis of wheat- Millet rock cakes

Samples	Aroma	Colour	Texture	Taste	Overall Acceptance
MM_0	6.41^a	6.26^a	6.30^a	6.42^a	6.40^a
MM_1	6.35^b	6.24^b	6.35^b	6.39^a	6.37^a
MM_2	5.30^c	5.85^c	6.40^c	6.37^a	6.38^a
MM_3	4.35^d	5.05^d	6.45^d	5.28^d	5.24^d
MM_4	4.15^e	4.11^e	6.65^e	4.50^e	4.10^e

Values in the same column with different superscripts are significantly different ($p>0.05$). Keys: MM0 (100% wheat flour), MM1 (90% wheat flour and 10% Pearl Millet flour), MM2 (80% wheat flour and 20% Pearl Millet flour), MM3 (70% wheat flour, 30% Pearl Millet flour) and MM4 (60% wheat flour, 40% Pearl Millet flour).

Conclusion

The study showed that the flour made from pearl millet and wheat is high in ash, fiber, protein, and carbohydrates. The flour mixtures can therefore be used to make nutrient-dense flour-based goods for the baking industry. The repercussion is that rock cake made from millet and wheat blended flour has a higher nutritional value than rock cake made from whole wheat flour. Additionally, millet can be used as a rock cake fortifier, and foods made from millet flour can help develop countries, particularly the northern region of Ghana, address the issues of protein-energy malnutrition (PEM) and some micronutrient deficiencies. As a result, it might be suggested that rock cake production techniques adopt millet flour up to 10% and 20% without negatively affecting the quality.

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