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Research Article
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Functional and Proximate Composition of Biscuit Produced from Wheat (*Triticum aestivum*) Flour, Soybean (*Glycine max*) Flour and Mint Leaf (*Mentha piperita*)

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ABSTRACT

Composite flours were made with various blends of wheat flour, soybean flour and mint leaf to determine their nutritive potential and sensory acceptability in biscuit production. The study revealed that most of the parameters studied were significant in the production of high-quality biscuits. The results obtained showed that increasing soybean flour content of the composite flours increased protein of the biscuits. The functional range of the biscuits produced were 8.17 to 9.83ml for water absorption; 7.90 to 9.23ml for oil absorption capacity; 0.59 to 0.74g/ml for bulk density and 2.73 to 4.50ml for swelling capacity. Proximate composition range of the biscuits produced were 7.14 to 10.20% for moisture; 12.01 to 18.01% for crude protein; 6.40 to 9.50% for fat; 2.51 to 5.98% for crude fibre; 0.70 to 1.80% for ash and 57.57 to 68.18% for carbohydrate. The sensory ratings revealed that the biscuit produced from the blends of 70% wheat flour, 28.75% soybean flour and 1.25% mint leaf having a protein content of 15.01% was generally accepted as that of the biscuit produced from 100% wheat flour. The outcome of the research showed that incorporating soybean flour into biscuit production creates opportunities for food producers to provide more healthy protein enriched products, thus, implies that consumption of large quantities of soybean flour enriched products will contribute to alleviating protein malnutrition in at risk population.

Keywords: Biscuit, soybean flour, mint leaf, wheat flour, sensory

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Introduction

Biscuit is a baked product that is made with ingredients including flour, butter, baking powder, and other ingredients. It is a significant edible wheat product that is used to wean infants and is primarily consumed by people, especially youngsters, with tea (Ferial and Azza, 2011). Cookies, wafers, hard sweet or semi-sweet biscuits, crackers, and other baked goods are all categorized as biscuits. Biscuits can be staple foods, snacks, luxury gifts, dietary products, infant foods and with the addition of chocolate and cream etc., they borderline with confectionery. Biscuits are known for its good characteristics, including greater convenience, relatively long shelf life, wider consumption base, and good eating quality. A moisture level of less than 5% is the fundamental property that distinguishes biscuits, cookies, and crackers from other baked goods, such as bread or cake. Wheat flour, butter, salt, baking powder, whole eggs, sugar, and vanilla are the main components used to make biscuits; nevertheless, they lack protein, which might be improved by adding more nutrient-dense pods and other leguminous crops to the wheat flour (Yao *et al*., 2015). Therefore, it becomes necessary to combine wheat flour with less expensive staples like cereals, tubers, and pulses to help increase the nutritional quality of wheat products. For example, the protein quality of both cassava–soya and cassava – groundnut breads are higher than that of only wheat bread. Recently, researchers have shifted much interest in the development of food products especially bakery products and pastries using composite flours. Composite flours are a combination of starch-rich flours from tubers (such as cassava, yam, and sweet potatoes), as well as protein-rich flours from cereals (such as corn, rice, and millet) and pulses (such as soy, peanut, and Bambara nuts). It supports a greater supply of protein for human nutrition, minimizes currency/capital flight, and improves the overall use of domestic agriculture production, composite flour is economically significant to developing countries (Bugusu *et al*., 2017).

MATERIALS AND METHODS

Wheat (*Triticum aestivum*) flour, soybean (*Glycine max*) and mint leaf (*Mentha piperita*) were purchased from Eke-Awka Market in Awka South Local Government of Anambra State, Nigeria.

Sample preparation

Soybean flour

Soybean flour was prepared according to the method described by Aliyu and Sanni (2011) using seeds free from dirt and foreign particles which was weighed, cleaned, and soaked in clean water for 8 hours. Thereafter, it was drained, boiled at 100^0C for 30minutes, dehulled manually, washed and dried in an oven at 65^0C for 6 hours. The seeds were stirred at intervals of 30 minutes to ensure uniform drying. The dried seeds were milled and sieved to obtain cooked full fat soybean flour (Figure 1). The full-fat soybean flour obtained was finally packaged in an airtight container for biscuit production (Ihekoronye and Ngoddy, 2005).

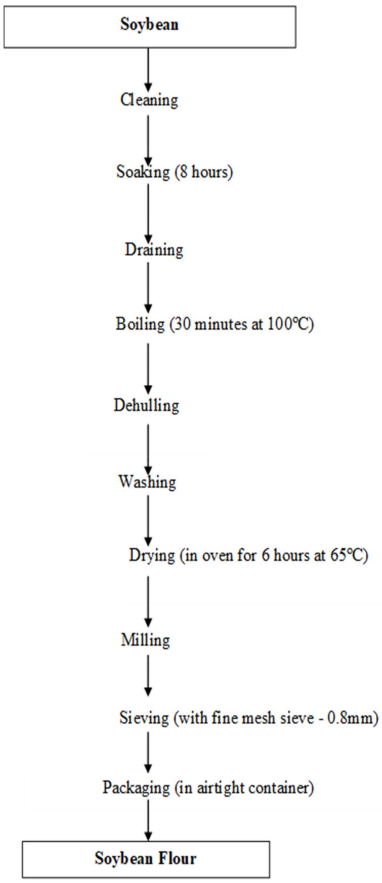

Figure 1: Production Process of Soybean Flour from Soybean (Aliyu and Sanni, 2011).

Mint leaf

This was simply done by first getting freshly harvested mint leaf then washing it properly. After washing, the mint leaves were picked from the stem, stacked, and rolled in preparation for cutting into thin slices. March *et al.* (2007). The flowchart can be seen in (Figure 2).

Preparation of biscuit

The ingredients used are: Composite flour, 100.0g;

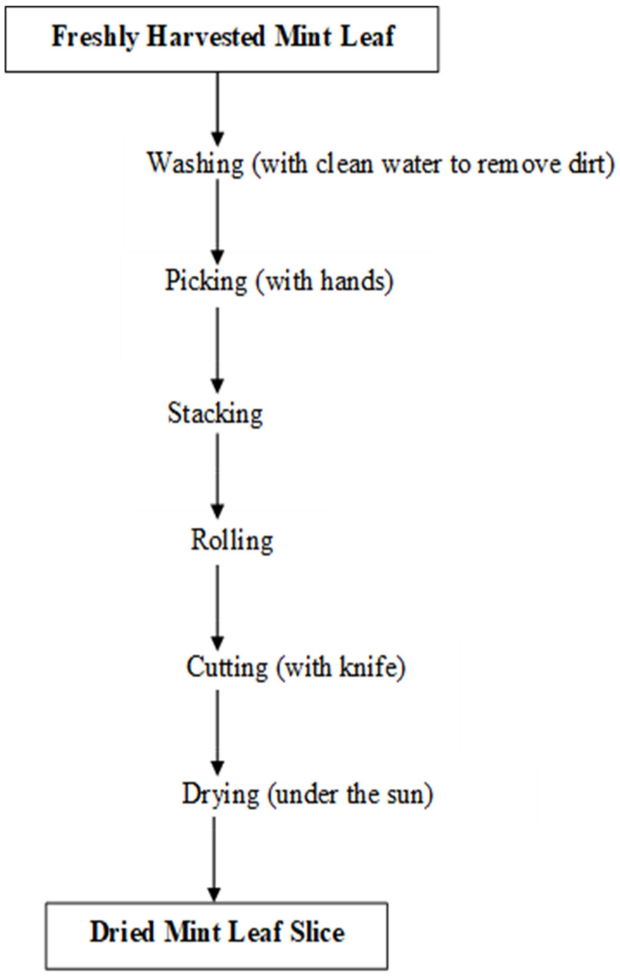

Figure 2: Production of Dried Mint Leaf from Freshly Harvested Mint Leaf (March *et al.,* 2007).

hydrogenated vegetable fat, 40.0g; sugar, 20.0 g; baking powder, 2g; salt,1g; vanilla liquid, 5ml; and water, 35ml. Fat and sugar were creamed using an electric mixer. Sifted flour, baking powder, salt, and vanilla were added to the mixture and mixed continued for about 30 minutes. Water was gradually added to form dough. The dough was kneaded and rolled to a uniform thickness and cut into circular shapes. Baking was carried out at 185^0C for about 15 minutes. The biscuit samples produced were cooled and stored in a polyethylene bag and again in a tight bottle and stored for analysis. Biscuits were made from 100% wheat flour with same processes and quantities of ingredients as above to serve as control. The flowchart can be seen in (Figure 3).

Functional composition

The functional properties of composite flour such as water absorption capacity, oil absorption capacity, bulk density, and swelling capacity were carried out according to Kinsella (2016).

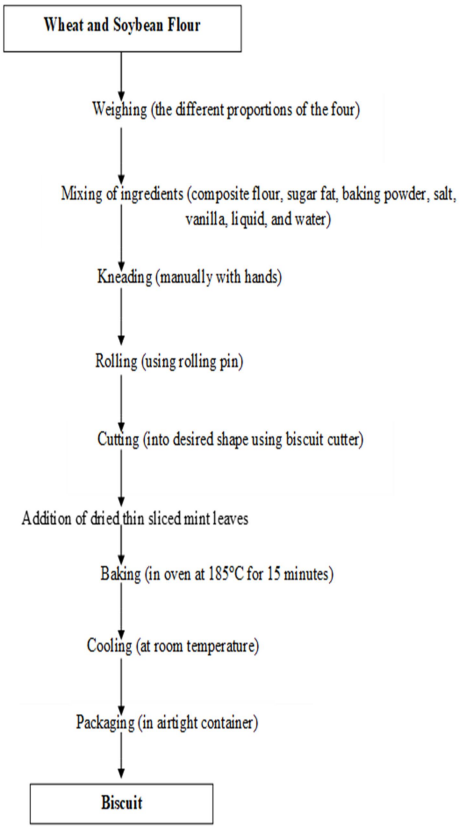

Figure 3: Production of Biscuit from Composite Flour and Mint Leaf (Rhona, 2013).

Proximate composition

The biscuit samples were evaluated to ascertain their nutritional quality. The parameters that were determined according to standard methods were crude protein, fibre, fat, moisture, and ash. Carbohydrate contents were determined by difference AOAC, (2010).

Statistical analysis

The data obtained were analyzed according to a completely randomized design with three replicates. Data were subjected to one way analyses of variance and the differences between means were evaluated by Duncan's multiple range tests using SPSS statistic programme version 23. Significant difference was expressed at $p<0.05$.

RESULTS AND DISCUSSION

Functional composition

The study compared functional properties of wheat flour and composite flours with soybean and mint leaf additives (Table 1).

Table 1: The mean functional scores for the biscuits produced from blends of wheat flour, soybean flour, and mint leaf.

Sample	Parameters			
	Water Absorption (ml)	Oil Absorption (ml)	Bulk Density (g/ml)	Swelling Capacity (ml)
WSM1	9.83^{a} ±0.29	8.80^{b} ±0.01	0.71^{b} ±0.01	2.73^{c} ±0.15
WSM2	9.33^{b} ±0.29	7.92^{d} ±0.01	0.66^{c} ±0.01	3.73^{b} ±0.25
WSM3	9.17^{b} ±0.29	9.23^{a} ±0.01	0.63^{d} ±0.01	3.90^{ab} ±0.10
WSM4	9.00^{b} ±0.00	8.35^{c} ±0.01	0.63^{d} ±0.01	3.10^{c} ±0.10
WSM5	8.17^{c} ±0.29	7.91^{de} ±0.01	0.74^{a} ±0.01	4.17^{ab} ±0.23
WSM6	8.17^{c} ±0.29	7.92^{de} ±0.01	0.64^{d} ±0.01	4.37^{ab} ±0.64
WSM7	8.17^{c} ±0.29	7.90^{e} ±0.02	0.59^{e} ±0.01	4.50^{a} ±0.50

Values with different superscript in each column are significantly different ($p<0.05$). Values are Mean ± Standard deviation.
Keywords:
WSM1 = 100% wheat flour (Control).
WSM2 = 80% wheat flour, 19.25% soybean flour and 0.75% mint leaf.
WSM3 = 75% wheat flour, 24% soybean flour and 1% mint leaf.
WSM4 = 70% wheat flour, 28.75% soybean flour and 1.25% mint leaf.
WSM5 = 65% wheat flour, 33.50% soybean flour and 1.50% mint leaf.
WSM6 = 60% wheat flour, 38.25% soybean flour and 1.75% mint leaf.
WSM7 = 50% wheat flour, 48% soybean flour and 2% mint leaf.

Table 2: The mean proximate scores for the biscuits produced from blends of wheat flour, soybean flour, and mint leaf.

Sample	Parameters					
	Moisture (%)	Crude Protein (%)	Fat (%)	Crude Fibre (%)	Ash (%)	Carbohydrate (%)
WSM1	10.20^{a} ±0.01	12.01^{g} ±0.01	6.40^{g} ±0.01	2.51^{g} ±0.01	0.70^{g} ±0.01	68.18^{a} ±0.02
WSM2	9.54^{b} ±0.01	13.90^{f} ±0.01	6.44^{f} ±0.01	2.97^{f} ±0.01	0.74^{f} ±0.01	66.40^{b} ±0.25
WSM3	9.00^{c} ±0.01	14.60^{e} ±0.01	7.67^{e} ±0.01	3.20^{e} ±0.01	1.01^{e} ±0.01	64.52^{c} ±0.01
WSM4	8.37^{d} ±0.01	15.01^{d} ±0.01	8.10^{d} ±0.01	4.05^{d} ±0.01	1.12^{d} ±0.01	63.36^{d} ±0.02
WSM5	8.11^{e} ±0.01	15.70^{c} ±0.01	8.43^{c} ±0.01	4.60^{c} ±0.01	1.24^{c} ±0.01	61.92^{e} ±0.02
WSM6	7.90^{f} ±0.01	16.98^{b} ±0.01	9.01^{b} ±0.01	5.40^{b} ±0.01	1.60^{b} ±0.01	59.11^{f} ±0.01
WSM7	7.14^{g} ±0.01	18.01^{a} ±0.01	9.50^{a} ±0.01	5.98^{a} ±0.01	1.80^{a} ±0.01	57.57^{g} ±0.01

Values with different superscript in each column are significantly different ($p<0.05$). Values are Mean ± Standard deviation.
Keywords:
WSM1 = 100% wheat flour (Control).
WSM2 = 80% wheat flour, 19.25% soybean flour and 0.75% mint leaf.
WSM3 = 75% wheat flour, 24% soybean flour and 1% mint leaf.
WSM4 = 70% wheat flour, 28.75% soybean flour and 1.25% mint leaf.
WSM5 = 65% wheat flour, 33.50% soybean flour and 1.50% mint leaf.
WSM6 = 60% wheat flour, 38.25% soybean flour and 1.75% mint leaf.
WSM7 = 50% wheat flour, 48% soybean flour and 2% mint leaf.

Water absorption capacity was highest in 100% wheat flour biscuits (9.83ml), followed by a blend of 80% wheat, 19.25% soybean, and 0.75% mint (9.33ml). The control significantly differed from other blends (Singh, 2011). Oil absorption capacity was highest in biscuits with 75% wheat, 24% soybean, and 1% mint (9.23ml), with the control at 8.80ml, differing significantly from other blends (Singh, 2011). Bulk density ranged from 0.59g/ml to 0.74g/ml, with the highest in 65% wheat, 33.50% soybean, and 1.50% mint biscuits. The control differed significantly from other blends (Akpata and Akubor, 2009). Swelling capacity ranged from 2.73 ml to 4.50ml, with the highest in 50% wheat, 48% soybean, and 2% mint biscuits, and no significant difference with 100% wheat or 70% wheat, 28.75% soybean, and 1.25% mint biscuits (Akpata and Akubor, 2009; Singh, 2011).

Proximate composition

The study analyzed the proximate compositions of wheat flour and composite flours of wheat and soybean with mint leaf, focusing on moisture, protein, fat, fiber, ash, and carbohydrate content in biscuits (Table 2). Results showed significant differences ($p<0.05$) between the control (100% wheat) and other biscuit products. Moisture content ranged from 7.14% to 10.20%, within the optimal range for food storage (USDA, 2017). Protein content varied from 12.01% to 18.01%, with soybean substitution contributing to higher protein levels (Agu *et al*., 2014). Fat content ranged from 6.40% to 9.50%, increasing with soybean flour proportion (Ayo and Okoliko, 2004). Fiber content varied from 2.51% to 5.98%, increasing with soybean and mint leaf addition (Malunga *et al*., 2017). Ash content ranged from 0.70% to 1.80%, increasing with soybean substitution due to higher mineral content (Malunga *et al*., 2017). Carbohydrate content ranged from 57.57% to 68.18%, with lower values in composite flours attributed to higher fiber content (Serrem *et al.,* 2011; Codex, 2023).

Conclusion

In wrapping up the study, the research revealed that biscuits crafted from a blend of 70% wheat flour, 28.75% soybean flour, and 1.25% mint leaf garnered the highest

sensory approval, particularly due to their 15.01% protein content. On the other hand, biscuits with a more cost-effective composition containing 18.01% protein could be produced from a mix of 50% wheat flour, 48% soybean flour, and 2% mint leaf, achieving moderate sensory scores. The findings underscored the potential of using locally sourced ingredients to create enriched biscuits, reducing dependence on imported wheat, and fostering local agricultural growth. Moreover, the study advocated for the utilization of under-appreciated crops like soybean on a larger scale to enhance nutritional value, decrease foreign exchange expenditures, and combat protein malnutrition in vulnerable communities. Efforts to explore alternative flours alongside wheat can lead to improved baking quality and increased protein and fibre content in baked goods, promoting food security and sustainability.

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