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Production and Quality Evaluation of Biscuits from Blends of Wheat, Millet and Sesame Seeds Composites: Physical and Sensory Properties

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Abstract: Millet and sesame were processed into flours and mixed with wheat flour at different proportion (100:0:0, 90:5:5, 85:10:5, 80:15:5 and 75:20:5) to produce biscuits. Biscuits produced were analysed for physical properties, and sensory attributes. Sensory evaluation of the biscuits samples was carried out with a team of thirty (30) panellists. The hedonic scale of nine was used, and the panellists were instructed to evaluate the coded samples for appearance, taste, aroma, texture, and Overall acceptability with a reference sample A. Biscuit samples were evaluated for weight (g), diameter (cm), thickness (cm) and spread ratio. Six biscuits edge-to-edge were used for the evaluation and the average was noted. The weight was measured using an electronic scale; diameter and thickness were measured using a Vernier Caliper. The Spread ratio was calculated by dividing diameter by thickness. There was a significant difference in weight, diameter, and spread ratio. Furthermore, there was a general decrease in the weight of the biscuits, with values ranging from 10.950g to 9.600 g with increase in the proportion of millet flour. However, there was an increase in diameter and spread factor as well as a decrease in thickness with increase in millet flour, with values ranging from 4.312 to 4.733 cm, 4.288 to 4.729 and 1.006 to 1.001 cm respectively. The sensory evaluation of the biscuits revealed that there were no significant differences in aroma and taste between the treatments whereas there was a significant difference in appearance, texture and general acceptability. Sensory results showed that all biscuits samples were accepted by panelists.

Keywords: Biscuits, Wheat Flour, Millet Flour, Sesame Seed Flour, Sensory, Physical Properties

1. Introduction

Biscuits are flat crispy baked product, chemically leavened, ready to eat, quick snacks with good eating quality and long shelf life [1]. The basic components of biscuits includes flour, sugar, and fat [2]. Other ingredients includes water, milk, salt, flavouring agent and aerating agent [3]. Biscuits are in high demand and are consumed extensively all over the world [4]. Biscuits have high nutrients availability, palatability, compactness and convenience which makes them different from other baked foods such as bread and cakes due to their low moisture content, comparative safety from microbial spoilage and long shelf life [5]. Biscuits have energy and are good sources of proteins and minerals [6]. The consumers demand for quality food products with taste, safety, convenience and nutrition has increased [7]. The texture, flavour and appearance of biscuits are major attributes that affect biscuit acceptability [8]. This study is design to produce biscuits from wheat, millet and sesame seeds flour blends, evaluate the physical properties and the sensory attributes of the biscuits. The outcome of the study will aid in boosting the nutritional value of the product and it will also help in increasing the utilization of millet and sesame seeds which are locally grown crops thereby reducing the over dependence of wheat importation.

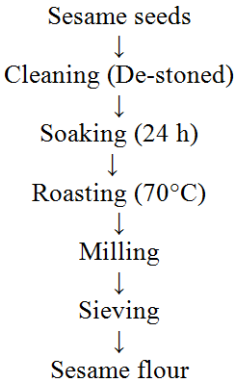
2. Materials and Methods

2.1. Source of Raw Materials and Preliminary Treatments

Millet grains, sesame seeds, wheat flour, sugar, butter, baking powder and of salt were bought from Wurukum market in Makurdi, Benue State Nigeria.

2.1.1. Sesame Seed Flour Production

The sesame seeds purchased were de-stone, washed and Soak in clean water for 24hours, dried in an oven at 70℃ for 1 hour after which they were been ground into fine flour, sieved using 44 mesh sieve then packaged and preserved for further use. As seen in figure 1.



Source; Ayinde [9]

Figure 1. *Flow chat for the production of sesame seeds flour.*

2.1.2. Millet Flour Production

The purchased millet grains were cleaned to remove foreign particles, washed properly and soaked for 24hours followed by drying in an oven at 70°C for s 1hour. The dried grains were then processed into flour using a milling machine and sieved using 44 mesh after which it was packaged and preserved for further use. As seen in figure 2.

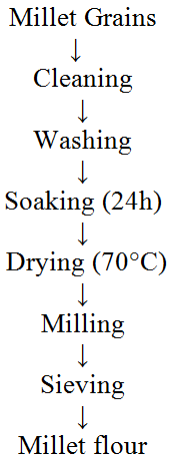


Figure 2. *Flow chat for the production millet flour.*

2.1.3. Recipe for Biscuits Batter from Wheat, Millet and Sesame Seeds Flour Blends

The various blend formulations from mixtures of wheat, sesame seed flour and millet flours were mixed separately with the same quantity of other ingredients (sugar, baking powder, water, baking fat and salt. For 100g of flour, 30 g fat, 33 g sucrose, 1 g salts (NaCl), 3.3g baking powder, were used. 162ml of water was added to make required consistency of batter. [10]. The fat was creamed with sugar until fluffy. The other dry ingredients were added, 160ml of water was added until the desired texture of the batter was obtained. The batter was kneaded on a rolling table to acquire the desired thickness [10]. The batter was later cut into round shape with the aid of biscuit cutter. Shaped pieces were placed into a pan greased with butter and baked in the oven at 200°C for 20min after which they were cooled and packaged [10].

Table 1. *Samples of flour blends for biscuits.*

Flour blends (%)			
Samples	**Wheat**	**Millet**	**Sesame seeds**
A	100	0	0
B	90	5	5
C	85	10	5
D	80	15	5
E	75	20	5

2.2. Physical Determination

Biscuit samples were evaluated for weight (g), diameter (cm), thickness (cm) and spread ratio as described by Gaines [11]. Six biscuits edge-to-edge were used for the evaluation and the average was noted. The weight was measured using an electronic scale; diameter and thickness were measured using a Vernier Caliper. The Spread ratio was calculated by dividing diameter by thickness.

2.3. Sensory Evaluation of Biscuits

Sensory evaluation of the biscuits samples was carried out with a team of thirty (30) panelists. The hedonic scale of nine was used, and the panelists were instructed to evaluate the coded samples for appearance, taste, aroma, texture, and Overall acceptability with a reference sample A. Each sensory attribute was evaluated with panelist adopting the multiple comparison difference test system [12].

2.4. Statistical Analysis

Data obtained from chemical analysis and the sensory evaluation were subjected to a one-way analysis of variance (ANOVA) using SPSS version 20, statistical package in order to determine the significant difference between mean of the various parameters.

3. Results

3.1. Physical Properties of Biscuits

The result of physical properties of biscuits produced from wheat, millet and sesame seeds flour blends are shown in Table 2. There was a significant difference in weight, diameter, thickness and spread ratio. Furthermore, there was a general decrease in the weight of the biscuits, with values ranging from 10.95g to 9.60 g with increase in the proportion

of millet flour. However, there was an increase in diameter and spread factor as well as a decrease in thickness with increase in millet flour, with values ranging from 4.31 to 4.73 cm, 4.29 to 4.73 and 1.006 to 1.001 cm respectively.

Table 2. *Physical Properties of Composite Biscuits.*

Physical properties	BISCUIT					LSD
	W (%)	100	90	85	80	75	
	M (%)	0	5	10	15	20	
	S (%)	0	5	5	5	5	
Weight (g)		10.950^{a}±0.78	10.425^{ab}±0.25	10.105^{ab}±0.43	9.950^{ab}±0.07	9.600^{b}±0.57	0.557
Diameter (cm)		4.312^{b}±0.06	4.371^{b}±0.13	4.466^{ab}±0.11	4.489^{ab}±0.11	4.733^{a}±0.13	0.398
Thickness (cm)		1.006^{a}±0.0042	1.004^{a}±0.002	1.003^{a}±0.0015	1.002^{a}±0.0012	1.001^{a}±0.0003	0.000
Spread ratio		4.288^{b}±0.08	4.353^{b}±0.14	4.454^{ab}±0.12	4.481^{ab}±0.12	4.729^{a}±0.12	0.430

Results are means ± SD of triplicate determinations expressed on a dry weight basis.
Values in each row with common superscripts are not significantly (p>0.05) different.
Key:
W=wheat, M=Millet, S=Sesame, W100%=100% wheat flour, M100%=100% millet flour, S100%=100% sesame seed flour, W100M0S0=100% wheat, millet 0%, sesame 0%, W90M5S5,=Wheat 90%, millet 5%, sesame 5%, W85M10S5=Wheat 85%, M10%, 5%, W80M15S5=Wheat 80%, millet 15%, sesame 5%, W75M20S 5%=Wheat 75%, millet 25%, 5% sesame.

3.2. Sensory Attributes of Biscuits Produced from Wheat, Millet and Sesame Seeds Flour Blends

The sensory evaluation of the biscuits revealed that there were no significant differences in aroma and taste between the treatments whereas there was a significant difference in appearance, texture and general acceptability as shown in Table 3. The mean score for appearance showed that 100% wheat flour rated the highest score of 8.1 followed by W90M5S5 with value 7.5 which contains 90% wheat, 5%millet, and 5% sesame seeds. Sample W8OM15S5 substituted with 15% millet flour, 5% sesame seed flour ranked the lowest value of 6.3. Sample W75M20S5 biscuits substituted with 20% millet flour and 5% sesame seeds flour ranked the highest value of 7.3 for aroma which was closely followed by W100%with value of 7.1. In terms of taste, W100% and M90M5S5 had equal rating for taste 7.3 which was followed by sample W75M20S5. Sample W85M10S5 had the lowest value of 6.5 with respect to taste. Sample W100% and M90M5S5had an equal rating for texture 7.26 which was followed by sample W75M20S5 with 6.46 rating. All samples of biscuits where generally accepted by the panelists in order of merit W100M0S0, W90M5S5, W75M20S5, W85M10S5andW80M15S5 scoring values of 7.7, 7.16, 6.8, 6.7 and 6.4 respectively.

Table 3. *Sensory attributes of biscuits produced from wheat, millet and sesame seeds flour blend.*

Attributes	BUSCUIT					LSD
	W (%)	100	90	85	80	75	
	M (%)	0	5	10	15	20	
	S (%)	0	5	5	5	5	
Appearance		8.17^{a}±1.28	7.50^{a}±1.11	6.53^{b}±1.59	6.33^{a}±1.49	6.40^{b}±1.38	0.405
Aroma		7.10^{ab}±1.11	6.83^{ab}±1.18	6.43^{b}±1.17	6.57^{ab}±1.65	7.23^{a}±1.31	0.381
Taste		7.31^{a}±1.31	7.33^{a}±1.10	6.73^{a}±0.98	6.67^{a}±1.39	7.07^{a}±1.20	0.352
Texture		7.24^{a}±1.22	7.20^{a}±1.27	6.17^{b}±1.29	6.40^{b}±1.45	6.47^{b}±1.41	0.390
General acceptability		7.69^{a}±1.49	7.17^{ab}±1.29	6.73^{b}±1.14	6.47^{a}±1.48	6.80^{a}±1.45	0.403

Results are means ± SD of triplicate determinations expressed on a dry weight basis. Values in each column with common superscripts are not significantly (p>0.5) different
KEY
W=wheat, M=millet, S=sesame seed. Mean values are of 30 panellists on a scale of 1=dislike extremely, 2=dislike very much, 3=dislike moderately, 4=dislike slightly, 5=neither like or dislike, 6=like slightly, 7=like moderately, 8=like very much, 9=like extremely
W100%=100% wheat flour, M100%=100% millet flour, S100%=100% sesame seed flour, W100M0S0=100% wheat, millet 0%, sesame 0%, W90M5S5,=Wheat 90%, millet 5%, sesame 5%, W85M10S5=Wheat 85%, M10%, 5%, W80M15S5=Wheat 80%, millet 15%, sesame 5%, W75M20S 5%=Wheat 75%, millet 25%, 5% sesame.

4. Discussion

Physical analysis of biscuits is very important for both consumers and manufacturers. The spread of the biscuits should be according to specification. Too much elasticity (gluten) in the dough will spring back to give thicker biscuits with smaller diameter; while too little elasticity may cause dough to flow after moulding resulting in thin biscuits with larger diameter [5]. Spread ratio or diameter is used to determine the quality of flour used in preparing biscuits and the ability of the biscuit to rise [13]. The higher the spread ratio of biscuit the more desirable it is [14]. Increase in diameter, spread factor and decrease in thickness with increase in millet flour could be due to the reduction in gluten content (elasticity) with increase in millet flour. This is in agreement with Sharif *et al.* [5] who reported that the decrease in elasticity of batter (decrease in gluten content) may cause batter to flow after moulding resulting in

large diameter and thin biscuits. Increase in diameter and decrease in thickness will lead to increase in spread factor. There was a gradual decrease in the weight of biscuits. The decrease in weight could be due to increase in fat content of the blended biscuits as fat is lighter in weight [15].

Results of sensory evaluation showed that there was no significant different in aroma meanwhile there was a significant different in appearance, texture, taste and overall acceptability between biscuits produced from 100% wheat flour and biscuits produced from wheat, sesame seed and millet composite flour. The results showed that as the millet flour levels increased, the colour of biscuits become darker compared with control. This work is in agreement with that of Ighere et al. [12] on the acceptability and chemical composition of bread from sesame seeds [12]. As such biscuit of acceptable sensory properties were produced from wheat, sesame seeds and millet composite flour.

5. Conclusion

This study concludes that 5% sesame flour and up to 25% millet substitution increased the diameter and spread factor and a decrease in thickness with increase in millet flour. Sensory evaluation showed that all biscuits were generally accepted in the order; W100M0S0 W90M5S5, W75M20S5, W85M10S5andW80M15S5 scoring values of 7.7, 7.16, 6.8, 6.7 and 6.4 respectively.

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