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# DEVELOPMENT OF GLUTEN-FREE BISCUITS AND ANALYSIS OF ITS FUNCTIONAL AND RHEOLOGICAL PROPERTIES

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**Keywords:**

Composite flour, Gluten-free biscuits, Rheological properties, Functional properties

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**ABSTRACT:** The present study was undertaken to develop gluten-free biscuits from the processed composite flour. Composite flour was prepared using teff millet flour (TF), navy bean flour (NF), and watermelon seeds flour (WF). Three variation were formulated such as, A (TF: NF: WF = 45:45:10), B (TF: NF: WF = 55:35:10), C (TF: NF: WF = 65:25:10) respectively. These biscuits were evaluated for rheological properties such as physical (Thickness, diameter and spread ratio), textural (Hardness, springiness, cohesiveness, and gumminess), and sensory attributes. This article focuses on the use of composite flour to produce gluten-free biscuits. Some functional properties were assessed, namely water absorption capacity (WAC), oil absorption capacity (OAC), emulsion capacity (EC), foaming capacity (FC), and gelation capacity (GC). The sensory evaluation of biscuits on 9 points hedonic scale revealed that A variant was more acceptable than variant B and C. Gluten-free biscuits were developed in this study have functional characteristics, providing added value to a waste product. Furthermore, the biscuits were suitable for celiac disease with acceptable quality and improved nutritional value.

**INTRODUCTION:** As the consumer demand for convenient and nutritious food products is increasing, the biscuits segment is also growing fast. The quality of food products with taste, safety, convenience, and nutrition has been increasing [1]. The function of using composite flours in the bakery industry is to find a satisfactory level of addition of these flours for processing properties. By adding these flours can increase the nutritional value of cereal products [2]. Therefore, it is important but still difficult for celiac patients to maintain a gluten-free diet mainly because of the high unavailability of gluten-free products, and gluten-free foods usually have poor nutritional quality. They are low in fiber and protein.

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When celiac patients consume food with low dietary fiber content, they suffer from constipation [3]. Sensory quality, as well, is one of the major concerns. Gluten-free bakery products are also more expensive in comparison with gluten-containing food products. Recently, food technologists are focusing on the development of gluten-free bakery products with high fiber content and good overall nutritional quality to deal with health problems. Hence, the nutritional content of gluten-free food products can be improved by incorporating alternative naturally rich gluten-free grains [4].

Therefore, in this study, the composite flour is prepared from processed teff millets, navy beans, and watermelon seeds, which are suitable for gluten-free biscuits. As discussed earlier, the major problem related to the gluten-free products is that they are not so good in taste and structure. However, the use of composite flour can solve these problems by incorporating of teff millets, navy beans, and watermelon seeds.

Teff millets contain all macro and micronutrients in appreciable amounts as well as contain all essentials amino acids. Navy beans impart many functional properties such as emulsifying and foam stability properties in the composite flour, which leads to an increase in the batter's density and color property of baked products.

As per the previous studies, cake volumes of the navy beans are similar to wheat flour that is highest as well among the beans [5]. Watermelon seed flour found to be very useful in terms of good color, aroma, crispiness, texture, and taste [6]. Thus, as a result, composite flour-based baked products will have good physical appearance and texture. Therefore, the main objective of the research is to assess functional properties, rheological properties, and sensory analysis of gluten-free based biscuits.

## MATERIALS AND METHODS:

**Materials:** Teff millet, navy beans, and watermelon seeds were obtained from Chawri Bajar, Delhi. Seeds were cleaned and stored in an airtight container and refrigerated at 4 ºC till further used. Composite flour was prepared in different ratios. Butter, almonds, sugar, coco powder, and skimmed milk were purchased from a local market (Delhi, India).

### Methods:

**Preparation of Composite Flour:** All seeds were washed with water 2-3 times. They were soaked separately before the formulation of composite flour to remove the antinutrients and then dried in sunlight and hot air oven. After drying, the grains were milled in a stone mill. To get uniform particle size, the flour was passed through **a** 60-mesh sieve and stored in refrigerated at 4 °C till further analysis.

**Functional Properties:** Composite flour was used to determine the functional properties, namely water absorption capacity (WAC), oil absorption capacity (OAC), foaming capacity (FC), emulsion capacity (EC), and gelation capacity (GC) [7-8].

**Formulation of Gluten-free Biscuits:** Biscuits were made from wheat to serve as a control. Gluten-free composite flour was prepared using teff millet flour (TF), navy bean flour (NF), and watermelon seeds flour (WF). Three variations were formulated such as, A (TF: NF: WF = 45:45:10), B (TF: NF: WF = 55:35:10), C (TF: NF: WF = 65:25:10) respectively. Biscuits were prepared using the following ingredients: composite flour, shortening (butter) (8 g), sugar (10 g), skimmed milk powder (4 g), almond (4 g), coco powder (4 g). Butter and sugar were mixed to form a cream, then added to the mixture of flour, skimmed milk powder, and mixed it thoroughly to form a dough. Now dough was put on the molds. Baking was carried out at 120 °C for 12 min. Samples of biscuits were cooled and stored in airtight containers.

**Physical Properties:** A digital micrometer (0.001 mm, Mitutoyo, Minoto-Ku, Tokyo, Japan) was used to measure the dimensions (diameter and thickness) of the Biscuits samples. The spread ratio was found using the following formula:

$$\text{Spread ratio} = \text{Diameter (D)} / \text{Thickness (T)}$$

**Textural Properties of Biscuits Samples:** The textural properties analysis of biscuits samples was measured by texture analyzer using the procedure of Aydın C *et al.*, 1991 [9].

**Sensory Evaluation:** Biscuits made from composite seed flours were subjected to sensory evaluation, as shown in **Table 4**. It was done by using 20 semi-trained panelists drawn within the University community. The biscuits were evaluated for taste, aroma, crispiness, color, and overall acceptability. The ratings were done using 9-point hedonic scale ranging from 9 (like extremely) to 1 (dislike extremely). All panelists were regular consumers of biscuits. At room temperature, water was provided to rinse the mouth between evaluations. The control biscuit was made from 100% wheat flour.

**RESULTS AND DISCUSSION:** Standard has excellent functional properties as compared to different variants of composite flour. With the increase in amounts of teff millet in the composite flour, all functional properties decreased. The water (140 ± 7.2) and oil absorption capacity (146 ± 8.9) were highest in standard comparatively than composite flours. Among the ratios of composite flour, the good functional properties were in variant A. On the contrary, in a study, higher differences are seen in wheat flour conducted by Islam MZ *et al.*, 2012 [10]. In composite flour also, contrary results were found in which majorly difference was seen in other gluten-free composite flour which functional properties were good as comparison to gluten-free composite flour [11]. The physical analysis of standard and different ratios of composite flour based Biscuits are shown in **Table 2**. Wheat flour has excellent physical properties as compared to different ratios of composite based biscuits. With the increase in amount of teff millet in the composite flour, diameter and spread ratio increased in variant C. The highest mean value of thickness was observed in variant A and B. On the contrary, major differences are seen in another composite flour based biscuits conducted by Kuchtová V *et al.*, 2018 [12].

**TABLE 1: FUNCTIONAL PROPERTIES OF DIFFERENT RATIOS OF COMPOSITE FLOUR**

| Variants | WAC (%) | OAC (%) | EC (%) | FC (%) | GC (%) |
|---|---|---|---|---|---|
| Standard | 140.0 ± 7.2 | 146 ± 8.9 | 43.8 ± 4.1 | 12.9 ± 5.0 | 59.2 ± 0.1 |
| Variant A | 2.5 ± 0.1 | 1.7 ± 0.1 | 47.1 ± 0.1 | 7.6 ± 0.1 | 55.0 ± 0.0 |
| Variant B | 2.4 ± 0.1 | 1.4 ± 0.1 | 35.8 ± 0.1 | 3.2 ± 0.0 | 52.0 ± 0.0 |
| Variant C | 2.3 ± 0.1 | 1.2 ± 0.1 | 27.5 ± 0.1 | 1.1 ± 0.0 | 49.0 ± 0.0 |

Abbreviation: water absorption capacity: WAC, Oil absorption capacity: OAC, emulsion capacity: EC, foaming capacity: FC, gelation capacity: GC

**TABLE 2: PHYSICAL ANALYSIS OF DIFFERENT RATIOS OF COMPOSITE FLOUR BASED BISCUITS**

| Variants | Diameter mm | Thickness mm | Spread ratio |
|---|---|---|---|
| Standard | 48.5 ± 0.1 | 10.3 ± 0.3 | 4.7 ± 0.1 |
| Variant A | 42.0 ± 0.1 | 11.2 ± 0.2 | 3.7 ± 0.3 |
| Variant B | 43.0 ± 0.0 | 11.2 ± 0.0 | 3.8 ± 0.6 |
| Variant C | 44.0 ± 0.1 | 10.2 ± 0.1 | 4.3 ± 0.4 |

**TABLE 3: TEXTURAL ANALYSIS OF DIFFERENT RATIOS OF COMPOSITE FLOUR BASED BISCUITS**

| Variants | Hardness (N) | Springiness (mm) | Cohesiveness | Gumminess (N.mm) |
|---|---|---|---|---|
| Standard | 53.0 ± 0.6 | 0.8 ± 0.0 | 0.08 ± 0.0 | 6.1 ± 0.4 |
| Variant A | 518.0 ± 0.3 | 1.2 ± 0.6 | 0.8 ± 0.7 | 590.0 ± 0.4 |
| Variant B | 590.0 ± 1.6 | 1.2 ± 0.1 | 0.7 ± 0.6 | 585.0 ± 0.8 |
| Variant C | 620.0 ± 0.9 | 1.2 ± 0.4 | 0.8 ± 0.1 | 582.0 ± 0.9 |

Hardness, defined as the maximum peak force during the first compression cycle (first bite) was increased with the increase in the amount of teff millet in the composite flour. The increase in hardness in Biscuits with the increase in the amount of teff millet could be attributed to the change in gluten content because gluten content is responsible for the matrix of Biscuits dough [13]. The noticeable changes were observed in the hardness and gumminess of the Biscuits. The gumminess of the Biscuits found higher in variant A. Comparatively; less hardness is acceptable for the Biscuits suggesting A be the most acceptable variant for the development of biscuits.

**TABLE 4: SENSORY QUALITY ATTRIBUTES OF GLUTEN FREE BISCUITS PREPARED BY COMPOSITE FLOUR**

| Variants | Color | Appearance | Flavor | Texture | Taste | Overall acceptability |
|---|---|---|---|---|---|---|
| Standard | 8.9 ± 0.8 | 8.9 ± 0.4 | 8.8 ± 0.4 | 8.8 ± 0.2 | 8.8 ± 0.5 | 8.9 ± 0.7 |
| Variant A | 8.6 ± 0.6 | 8.5 ± 0.7 | 8.5 ± 0.7 | 8.4 ± 0.5 | 8.5 ± 0.7 | 8.6 ± 0.8 |
| Variant B | 8.5 ± 0.2 | 8.4 ± 0.4 | 8.6 ± 0.6 | 8.2 ± 0.7 | 8.6 ± 0.3 | 8.5 ± 0.5 |
| Variant C | 8.4 ± 0.5 | 8.2 ± 0.8 | 8.2 ± 0.2 | 8.1 ± 0.5 | 8.1 ± 0.6 | 8.3 ± 0.6 |

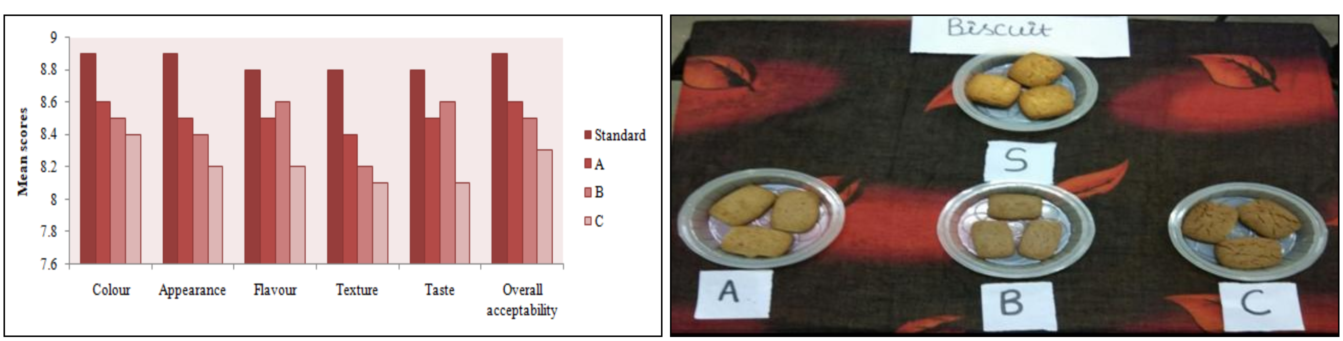


**FIG. 1: IMAGE DEPICTING PHYSICAL APPEARANCE OF GLUTEN-FREE BISCUITS**

The mean sensory scores for color, appearance, flavor, texture, taste, and overall acceptability are presented in **Table 4**. Standard was the most acceptable for all the attributes. Among all three variants of composite flour, variant A was the most acceptable for all the attributes.

**CONCLUSION:** From this study, it can conclude that gluten-free biscuits developed using processed composite flour is beneficial for celiac patients, and the selected variants also fulfill the nutritional requirement in comparison to the one made up of wheat flour. The combination of millet, bean, and seeds makes these biscuits good in taste, texture, enhance the overall acceptability and acceptable by the panelists.

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## REFERENCES:


1. Simona MAN, Adriana PAUCEAN and Sevastiţa MUSTE: Preparation and quality evaluation of gluten-free biscuits. Food Sci Technol 2014; 71(1): 39-44.
2. Mironeasa S, Codina GG and Mironeasa C: The effect of wheat flour substitution with grape seed flour on the rheological parameters of the dough assessed by Mixolab. J Texture Stud 2012; 43: 40-48.
3. Javaria S, Marwat SK, Raza S, Hameed A and Waseem K: Formulation of gluten-free baked products for coeliac patients: a review of contemporary methodologies and quality improving factors. Am-Euras J Agric Environ Sci 2016; 16(4): 826-35.
4. Tess M, Bhaduri S, Ghatak R and Navder KP: Physical, textural and sensory characteristics of gluten free muffins prepared with teff flour (Eragrostis tef (zucc) trotter). J Food Process Technol 2015; 6(9): 2-5.
5. Singh M, Byars JA and Liu SX: Navy bean flour particle size and protein content affect cake baking and batter quality 1. J Food Sci 2015; 80(6): 1229-34.
6. Wani SH, Gull A, Safapuri TA: Effects of incorporation of whey protein concentrate on physicochemical, texture and microbial evaluation of developed cookies. Cogent Food Agric 2015; 1: 1-9.
7. Chowdhury AR, Bhattacharyya AK and Chattopadhyay P: Study on functional properties of raw and blended jackfruit seed flour (a non-conventional source) for food application. Indian J Nat Prod Resour 2012; 3(3): 347-53.
8. Coffmann CW and Garciaj VV: Functional properties and amino acid content of a protein isolate from mung flour. Food Sci Technol 1997; 12(5): 473-84.
9. Aydın C and Öğüt H: Determination of some biological properties of amasya apple and hazelnuts. Selcuk University Agric Faculty J 1991; 1: 45-54.
10. Islam MZ, Taneya MLJ, Shams-Ud-Din M, Syduzzaman M and Hoque MM: Physicochemical and functional properties of brown Rice (*Oryza sativa*) and Wheat (*Triticum aestivum*) flour and quality of composite biscuit made thereof. Agric 2012; 10(2): 20-28.
11. Chandra S and Samsher: Assessment of functional properties of different flours. Afr J Agric Res 2013; 8(38): 4849-52.
12. Kuchtová V, Kohajdová Z, Karovičová J and Lauková M: Physical, textural and sensory properties of cookies incorporated with grape skin and seed preparations. Pol J Food Nutr Sci 2018; 68(4): 309-17.
13. Chung HJ, Cho A and Lim ST: Utilization of germinated and heat-moisture treated brown Rices in sugar-snap cookies. Food Sci Technol 2014; 57: 260-66.


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