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## Nutraceutical Muffins: Development and Sensory Evaluation

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Article History	Abstract	
Received on: 30 Apr 2024 Revised on: 01 Jun 2024 Accepted on: 02 Jun 2024	Health professionals and consumers are increasingly urging food corporations to produce healthier options, leading to a rise in the popularity of gluten-free flours like millet, sweet potatoes, and mung bean flour. Nutraceutical muffins offer a novel approach by combining the enjoyment of a tasty snack with the health benefits of bioactive compounds. These muffins are formulated with ingredients such as mung bean flour, spinach powder, guava powder, jaggery, and ghee to provide dietary fiber, vitamins, minerals, and antioxidants. Gluten-free and suitable for diabetics, they also address health concerns such as energy enhancement, vitamin deficiency, constipation, and bone health. In conclusion, nutraceutical muffins present an exciting way to merge health and flavor, making functional ingredients easily accessible in daily diets. However, further research is needed to optimize their formulation and validate their health benefits.	
<b>Keywords</b>  Bioactive Compounds, Mung Bean Flour, Spinach Powder, Jaggery, Antioxidants		

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### INTRODUCTION

In recent years, there has been a growing interest in functional foods that provide additional health benefits beyond basic nutrition. This interest has led to the rise of nutraceuticals—a term that combines "nutrition" and "pharmaceutical." Nutraceuticals are food products that offer both nutritional value and therapeutic effects,

promoting overall well-being and potentially preventing chronic diseases [1][2].

Muffins, a popular baked good enjoyed by people of all ages, present an excellent vehicle for incorporating nutraceutical ingredients. Traditional muffins, often high in refined sugars and unhealthy fats, can be transformed into healthier alternatives by integrating ingredients known for their beneficial properties. Nutraceutical muffins aim to retain the delightful sensory attributes of conventional muffins while enhancing their nutritional profile and health benefits [3][4].

The objective of developing nutraceutical muffins is to combine convenience, taste, and health in a single product [5]. By incorporating functional ingredients such as flaxseeds, chia seeds, blueberries, and probiotics, nutraceutical muffins can provide a range of benefits, including improved

digestive health, enhanced immune function, and reduced risk of chronic diseases [6][7]. This innovative approach addresses the growing consumer demand for healthier food options without sacrificing enjoyment [8][9].

This article delves into the formulation of nutraceutical muffins, focusing on ingredient selection, preparation methods, and evaluation of their nutritional and sensory properties. By examining these aspects, we aim to demonstrate the potential of nutraceutical muffins as a delicious and practical addition to a health-conscious diet [10].

## MATERIALS AND METHODS [11]:

### Ingredients:

1. Mung bean flour (Natural)
2. Spinach leaf powder (Natural)
3. Guava fruit powder (Saipro)
4. Jaggery (Swarnaras)
5. Ghee (Mahidhara)
6. Baking soda
7. Almond (for decorating purpose)

**Method:** In a mixing bowl, thoroughly combine 46.15% mung bean flour, 2.56% spinach powder, and 10.25% guava powder. Incorporate 10.25% ghee into the mixture, blending until evenly mixed. Prepare 30.76% jaggery syrup and mix it into the blend, ensuring even distribution. Gradually stir in baking soda to add fluffiness. Preheat the oven to 180°C (350°F) and prepare the muffin molds. Fill the molds four-quarters full with the mixture and bake for 20 minutes until golden brown and a toothpick inserted comes out clean. Allow the muffins to cool slightly before serving.

### Sensory Evaluation:

**Score Card Method:** A 10-point scorecard evaluates a product's quality in appearance, aroma, flavor, texture, and overall acceptability, with 10 being the highest and 0 indicating failure to meet standards.

### Shelf Life:

**Hedonic Scale:** A 9-point Hedonic scale measures product shelf life, with 9 as the highest quality and 0 as failing to meet criteria. In this study, five

individuals rated the overall acceptability of hibiscus jams and cookies using this scale [12].

**Physical Evaluation of Muffins:** Use a ruler to measure the height and radius of muffins, then calculate their volume, density, weight, and average weight using the relevant formulas [13].

**Ash Content of Muffins:** Begin by weighing an empty silica crucible to four decimal places. Add 1 gram of muffin powder to the crucible and record the combined weight. Heat the crucible on a burner until the muffin powder turns ash grey, then cool it to room temperature and weigh the crucible again [14]. Calculate the ash value percentage using the formula: Ash value (%) = [weight of the ash / weight of the sample] x 100.

**Moisture Content of Muffins:** The moisture content of the muffins was determined using the hot air oven method. A 10g sample was weighed in a china dish and placed in an oven set to 105°C. The dish was heated until no further weight loss occurred. After heating, the dish was cooled in a desiccator and then weighed [15]. The moisture content was calculated using the formula: Moisture content (%) = [(initial weight - dry weight) / initial weight] x 100.

**Thin Layer Chromatography (Spinach):** This method separates phyto-constituents based on polarity using a silica gel-coated thin plate as the stationary phase. The mobile phase, a mixture of n-hexane and acetone (8:2), was placed in the chamber, and the spinach acetone extract, prepared by diluting 0.5 ml of the extract with acetone, was applied to the TLC plate using a capillary. The Rf value was calculated.

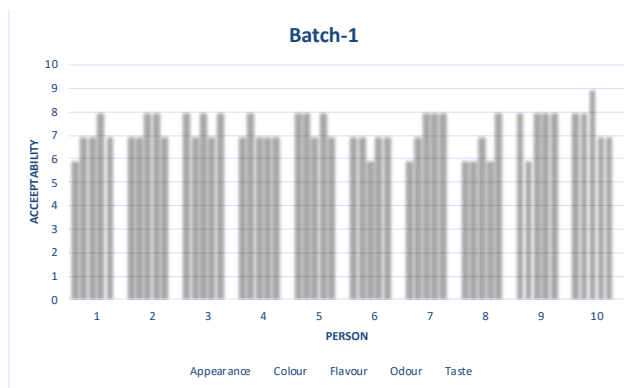
## RESULTS AND DISCUSSION

### Score Card Method for Acceptability of Muffins:

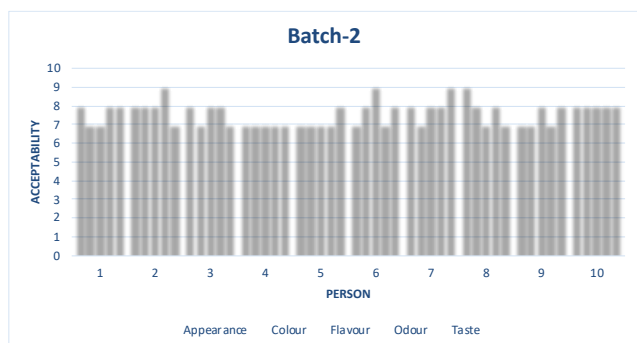
**Sensory Evaluation:** A 10-point scorecard for sensory evaluation assesses product quality and characteristics, with scores ranging from 7.0 to 7.8. It evaluates factors such as appearance, aroma, flavor, texture, and overall acceptability [16].

### Thin Layer Chromatography of Spinach Powder:

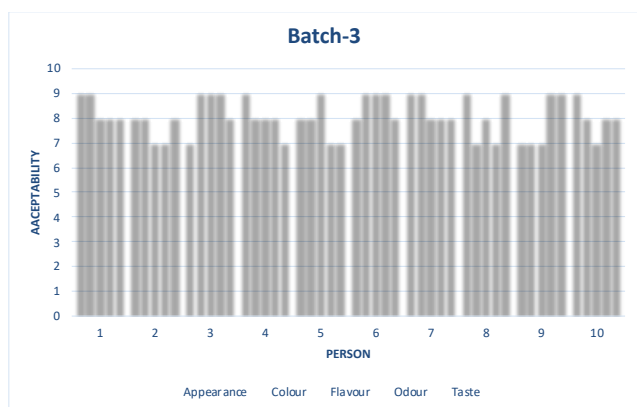
The TLC analysis was used to qualitatively identify the number of phyto-constituents in the extract. The Rf values were found to be 1, 0.75, 0.53, and 0.45 [17].



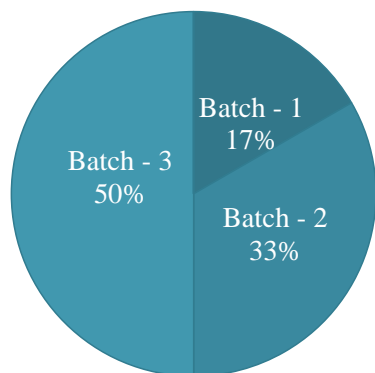
**Figure 1 Sensory evaluation of muffin Batch-1**



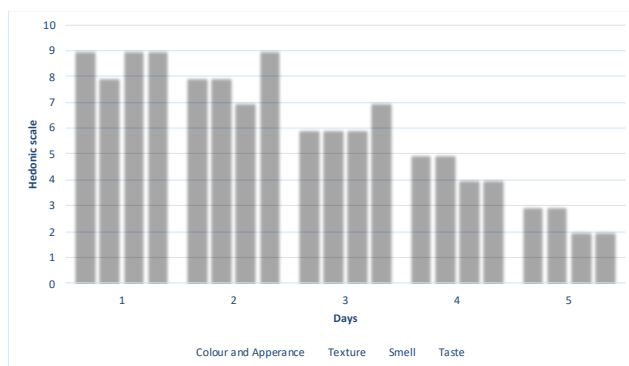
**Figure 2 Sensory evaluation of muffin Batch-2**



**Figure 3 Sensory evaluation of muffin Batch-3**



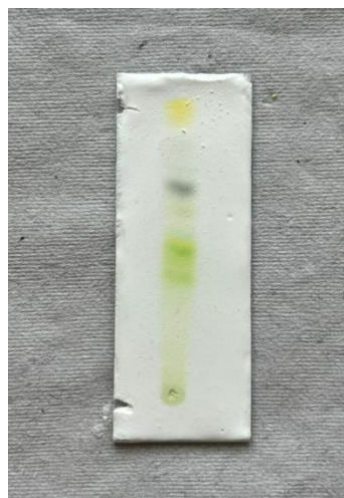
**Figure 4 Overall Acceptability of Muffins**



**Figure 5 Hedonic scale of Muffins**

**Thin layer chromatography of spinach powder:**

The TLC analysis was used to qualitatively identify the number of Phyto-constituents in extract. The Rf values were found to be 1, 0.75, 0.53, 0.45.



**Figure 6 TLC of spinach**

**Table 1 Physical evaluation of Muffins**

Volume	108.9 m <sup>3</sup>
Density	0.37 g/m <sup>3</sup>
Weight	40 gm
Radius	3.4 cm
Height	3 cm
Thickness	3 cm
Total Ash value	72.45 %w/w
Moisture content	21.53%

**CONCLUSION**

The creation of gluten-free, sugar-free muffins is enriched with various health benefits through the incorporation of natural ingredients known for their positive effects. Mung bean flour, a key component, is gluten-free and offers numerous health benefits, making it suitable for individuals with gluten sensitivities or celiac disease.

Replacing sugar with jaggery caters to those seeking to reduce sugar intake or maintain a sugar-free lifestyle. Additionally, the inclusion of spinach introduces benefits such as reduced blood sugar levels, lowered hypertension, anti-inflammatory properties, and overall health enhancement. Combining these gluten-free, sugar-free, nutrient-rich ingredients results in a delightful treat with potential health benefits. It is important to note that individual health outcomes may vary based on personal factors and overall dietary habits. These homemade muffins provide a balanced blend of taste, dietary inclusivity, and potential health advantages, making them a guilt-free indulgence that supports a wholesome lifestyle. In totality, further systematic investigation is warranted to facilitate the refinement and advancement of these nutraceutical muffins.

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### Ethical Approval

No ethical approval was necessary for this study.

### Author Contribution

All authors made substantial contributions to the conception, design, acquisition, analysis, or interpretation of data for the work. They were involved in drafting the manuscript or revising it critically for important intellectual content. All authors gave final approval of the version to be published and agreed to be accountable for all aspects of the work, ensuring its accuracy and integrity.

### Conflict of Interest

The authors declare no conflict of interest, financial or otherwise.

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