Studies on Development of Gluten Free Muffins

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***Abstract*— This study focused on creating gluten-free muffins using blends of rice flour, amaranth flour, and corn flour, aimed at providing suitable options for individuals with celiac disease. The muffins were made using these flour blends and assessed for their physico-chemical and sensory properties. The objective was to optimize the muffin formulation by experimenting with different proportions of the gluten-free flours. Four different recipes (GF1, GF2, GF3, GF4) were tested, each with varying amounts of brown rice flour (BRF), amaranth flour (AF), and corn flour (CF), while keeping other ingredients constant. The recipe with 40% corn flour, 30% brown rice flour, and 30% amaranth flour (GF2– CF:BRF:AF at 40:30:30) received the highest overall score and was the most preferred by consumers.**

Keywords—Gluten free, muffins, amaranth

I. Introduction

Nowadays, consumers are altering their eating habits as well as their purchasing and usage behaviors regarding food products. Ready-to-eat convenient food items have become highly popular due to the demand for fast, convenient, and easily transportable options. The daily necessity for such products is also on the rise. Bakery items in this category, such as muffins, donuts, breads, and biscuits, are now widely available across the globe (Zahn et al., 2010).

Celiac disease is an autoimmune disorder triggered by the consumption of gluten, a storage protein found in wheat, rye, and barley (Cheng et al., 2010). When individuals with celiac disease ingest gluten, they experience histological changes in their small intestine, which can disrupt nutrient absorption. The only effective treatment for celiac disease is a lifelong adherence to a gluten-free diet (Bao & Bhagat, 2012).

A gluten-free diet excludes wheat, rye, and barley, as even small amounts of gluten can be harmful to most individuals with celiac disease. Patients with this condition must adhere to a gluten-free diet for life. Following such a diet can significantly improve the quality of life for those with celiac disease (Smith et al., 2011).

Rice flour has significant potential as a wheat flour substitute in muffins, as it has previously been used to make gluten-free bakery products like breads and cakes, which are typically made with wheat flour (Man et al., 2014).

Amaranth grain is a highly nutritious gluten-free pseudocereal. Its inclusion in food products is particularly valuable for enhancing the nutritional content. This is especially important for individuals with celiac disease, as their diet often lacks certain nutrients. By incorporating amaranth into their food, it helps to address these nutritional gaps and improve overall dietary quality (Kupper, 2005).

In gluten-free products, starch is added to improve baking characteristics like specific volume, color, crumb structure, and texture (Stefan et al., 2017).The aim of this study was to evaluate brown rice flour, amaranth flour, and corn flour for the development of gluten-free muffins with good sensory acceptance and nutritional value. Additionally, assessing the quality parameters of these muffins was a key objective.

II. Materials and Method

The brown rice, amaranth, and corn flour, along with other raw materials, were purchased from the local market in Loni Kalbhor, Pune. Low-density polyethylene bags and necessary chemicals were sourced from both laboratory stock and local markets..

A. *Production of the gluten-free muffins:*

The first step is to mix fat and sugar until smooth and creamy. After achieving the desired texture, eggs and other ingredients like milk powder, essence, and salt are added gradually. Next, a mixture of brown rice flour, amaranth flour, and corn flour, along with baking powder and calcium propionate, is added and blended for 2-3 minutes.

The batter was transferred into small paper cups and baked in an oven at 135°C for 30 minutes. Following baking, the muffins were taken out of the oven, allowed to cool at room temperature, and then placed into plastic packaging.

Recipe formulation of gluten free muffins:

Sample name	**Wheat flour (%)**	**Corn flour (%)**	**Brown rice flour (%)**	**Amaranth flour (%)**
Control	100	-	-	-
GF1	-	50	25	25
GF2	-	40	30	30
GF3	-	30	35	35
GF4	-	20	40	40

B. *Maintaining the Sensory analysis of gluten-free muffins:*

The sensory characteristics of gluten-free muffin samples were assessed by a panel comprising 10 members who used a 9-point Hedonic scale. This comprehensive evaluation included detailed assessments of color, texture, taste, flavor, mouthfeel, and overall acceptability. The study adhered to specific criteria designed to integrate seamlessly with broader proceedings, emphasizing the interconnected nature of the research without altering any current designations

C. *Proximate Analysis:*

The muffins underwent analysis for moisture, fat, protein, carbohydrates, crude fiber, and ash using established protocols. Prior to ash, protein, and mineral analysis, the muffins were defatted..

III. RESULTS AND DISCUSSION:

Table 2. Sensory evaluation for gluten-free muffins

Sample	Colour and appearance	Taste	Flavour	Mouth feel	Textu re	Overall acceptability
Control	9.0	8.5	9.0	9.0	9.0	8.8
GF1	7.9	7.6	7.4	7.5	7.8	7.8
GF2	7.8	8.5	8.4	8.3	8.1	8.3
GF3	7.5	8.0	7.8	7.4	7.0	7.5
GF4	7.2	7.3	7.2	7.0	6.8	7.2

A. Sensory evaluation for gluten-free muffins.

Table 2 presents the four samples (GF1-GF4) of gluten-free muffins. A sensory analysis conducted by panelists assessed attributes such as color, taste, flavor, mouthfeel, texture, and overall acceptability. From the table, it is evident that the GF2 sample received the highest scores for sensory characteristics including color and appearance, taste, flavor, and texture compared to the other three samples. Keep text and graphic files separate until after formatting and styling. Avoid using hard tabs and limit hard returns to a single return at the end of paragraphs. Do not paginate the document or number text heads—let the template handle those details.

B. Chemical analysis of gluten-free muffins

Table 3. Chemical analysis of prepared muffins

Parameters	**Contr ol sample**	**Gluten free Muffins (GF2)**
Moisture (%)	19.40	14.65
Fat (%)	12.22	13.20
Protein (%)	9.78	7.34
Carbohydrate (%)	55.20	61.85
Crude fibre (%)	0.52	0.15
Ash (%)	1.03	1.13
Calcium (mg/100g)	7.9	10.5
Iron (mg/100g)	25.9	30.6

The results from Table 3 depict the chemical analysis of gluten-free muffins, including moisture, fat, protein, carbohydrates, crude fiber, and ash content. The moisture levels in the muffins were all below 20%, which reduces susceptibility to microbial spoilage and extends shelf life. Compared to control muffins with 12.22% fat content, gluten-free muffins contained 13.20% fat. Excessive fat levels in food products are undesirable as they can lead to rancidity and the formation of unpleasant odors. The chemical analysis revealed that gluten-free muffins (GF2) had significantly lower protein content (7.34%) compared to control muffins (9.78%). However, gluten-free muffins had a higher carbohydrate content (61.85%) compared to control muffins (55.20%). Ash content in food indicates mineral presence, with control muffins having 1.03% and gluten-free muffins containing 1.13%, prepared from brown rice flour, amaranth flour, and corn flour. The calcium content was 7.9 mg/100g in control muffins and 10.5 mg/100g in gluten-free muffins. Additionally, gluten-free muffins had higher iron content (30.6 mg/100g) compared to control muffins (25.9 mg/100g). This suggests that gluten-free muffins offer a richer source of minerals compared to control muffins.

C. Sensory evaluation of GF2 muffins packed in LDPE for storage study:

The muffins were wrapped in Low Density Polyethylene (LDPE) sheets and stored at room temperature. Panelists assessed Appearance, Taste, Flavor, Texture, and overall acceptability of GF2 muffin samples, with scores recorded in Table 4. Up to the 6th day of storage, there were no notable differences in these attributes. However, significant changes were observed in all parameters after the 9th day of storage..

Table 4 Sensory evaluation of gluten free muffins packed in LDPE for storage study

Sample	Colour and appearance	Taste	Flavour	Mouth feel	Texture	Overall acceptability
Control	9.0	8.5	9.0	9.0	9.0	8.8
GF1	7.9	7.6	7.4	7.5	7.8	7.8
GF2	7.8	8.5	8.4	8.3	8.1	8.3
GF3	7.5	8.0	7.8	7.4	7.0	7.5
GF4	7.2	7.3	7.2	7.0	6.8	7.2

Overall, there was a decline in sensory scores from the fresh sample to the muffin stored for 9 days, showing a decreasing trend across all parameters. The lowest score observed among all samples was on the 9th day of storage, specifically for overall acceptability (8.3). This decline could be attributed to changes in texture and flavor, possibly influenced by oxygen and water vapor transfer through the LDPE packaging material during storage.

IV. CONCLUSION:

Gluten-free flour blends offer a viable option for producing high-quality gluten-free muffins that meet acceptable sensory standards compared to regular muffins.

These products are particularly advantageous for individuals with gluten intolerance. Utilizing combinations of flours such as brown rice flour, amaranth flour, and corn flour enhances both the sensory appeal and nutritional value of gluten-free muffins.

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Coconut Water as a Functional Beverage: Bring the Nature Closer

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Abstract

Coconut water, the clear liquid found inside young coconuts, has garnered attention globally for its refreshing taste and potential health benefits. This review explores the nutritional composition and diverse health-promoting properties of coconut water. Firstly, coconut water is a low-calorie beverage rich in electrolytes, particularly potassium and sodium, making it an effective hydrating option, especially after physical exertion or in hot climates. Its natural sweetness and minimal fat content also render it suitable for individuals seeking weight management solutions. Secondly, the presence of potassium in coconut water plays a pivotal role in supporting heart health by aiding in the regulation of blood pressure levels, thus potentially reducing the risk of cardiovascular diseases. Lauric acid, another component found in coconut water, has demonstrated cardio-protective effects, further enhancing its cardiovascular benefits. Moreover, coconut water's fiber contributes to improved digestion, promoting gastrointestinal health and regularity. It may also alleviate indigestion and mitigate acid reflux symptoms. Studies suggest that coconut water consumption may help prevent the formation of kidney stones by reducing urinary crystal concentration and enhancing hydration. Additionally, its antioxidant properties, attributed to vitamin C and other compounds, confer protection against oxidative stress, potentially lowering the risk of chronic ailments such as cancer and diabetes. Furthermore, coconut water's hydrating properties extend to skin health, fostering a clear complexion and combating dryness and inflammation. Its immune-boosting potential, attributed to vitamins and minerals, including vitamin C, enhances the body's ability to ward off infections and illnesses. Despite its myriad benefits, moderation is crucial, especially for individuals with kidney-related issues or those on low-potassium diets. Overall, coconut water stands as a natural, nutritious beverage offering a spectrum of health advantages, making it a valuable addition to a balanced diet.

Keywords: coconut water, nutritional value, health benefits, hydration, heart health, digestion.

Introduction

Coconut water has gained worldwide recognition due to its high electrolyte content and low-calorie content. More than two out of every five Brazilians and seventy-five percent of Indians say they drink coconut water. It's especially well-liked by Gen Z and Millennial customers throughout Europe. The increased demand from customers for naturally useful and healthier drinks is met by coconut water.[1]

Mature coconuts are a good source of potassium and iron. The white meat inside the shell of a coconut contains about 86% of its calories, which are from fat, mostly