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Snehlata Tiwari
Research Scholar Warner School of Food and Dairy Technology SHIATS, Allahabad India.

Sangeeta Shukla
Assistant Professor Warner School of Food and Dairy Technology SHIATS, Allahabad India.

Correspondence:
Snehlata Tiwari
Research Scholar Warner School of Food and Dairy Technology SHIATS, Allahabad India.

Evaluation of quality parameters of banana bread prepared with gluten free flour

Snehlata Tiwari, Sangeeta Shukla

Abstract
Demand for health oriented products such as sugar free, low calorie and Gluten free products is increasing. One such trend is to use gluten free flour content in food products to over come health problems such as Autism, Celiac disease (Chronic diarrhea, Abdominal bloating and pain, Chronic constipation) among others. Rice flour and Corn flour as Gluten free source incorporation was used to study its effect on Chemical, and Sensory and Microbiological Characteristics. The Sensory parameters were evaluated for consumer acceptability by using a 9-point hedonic scale and Sensory results found to be Significant (5% level of confidence). In combination of flours, amount of Corn flour was increased as Rice flour decreased fat, ash, Protein content showed an increase on increasing the Corn flour amount. Moisture content in bread were decreased from 52.45, 52.30 to 52.20 and 51.74 respectively. So the 25:75(T_3) level of Gluten free flour incorporation was highly acceptable while the other samples were also acceptable.

Keywords: Gluten free flour, Rice flour, Corn flour, Banana bread

1. Introduction

Bakery products have become very popular throughout the country. Breads and biscuits are the most common products but other items like cakes, pastries, cream-rolls, cookies etc. are also not lagging far behind. These items are consumed by people of all age groups across the board. Nature of these products is such that the consumers prefer fresh items. Shelf life of cakes & pastries is limited and thus local manufacturers enjoy distinct advantage. There is, thus, good scope for these items.

Bread is a staple food in many homes, however upon diagnosis with celiac disease traditional wheat based breads are no longer an option for consumers. One of many challenges to individuals with celiac disease is the increased cost of gluten-free foods. On average gluten-free products are approximately 240% more expensive than their gluten-based counterparts (Lee *et al.* 2007; Stevens & Rashid 2008) [14]. Further studies showed that 56.5% of participants reported it was difficult to find gluten-free food outside the home, while 75.3% of participants reported that quality of gluten-free products was a significant concern [15]. The most frequently used grains for a gluten-free diet are corn, potatoes, rice, and tapioca (derived from cassava).

Banana bread is a type of bread that is made with mashed fully ripe bananas. It is often a moist, sweet, cake-like quick bread. Banana bread first became a standard feature of American cookbooks with the popularization of baking soda and baking powder in the 1930s, appeared in Pillsbury's 1933 *Balanced Recipes* cookbook, and later gained more acceptance with the release of the original *Chiquita Banana's Recipe Book* in 1950.

In a 2005 survey, (Thompson *et al.* 2005) found that less than 46% of female respondents consumed the daily-recommended amount of dietary fiber and only 44% of female respondent`s consumed the daily-recommended amount of iron during the 3-day recording period.

These low values are problematic because enriched/fortified grain foods are a large contributor to the US adult daily intakes of iron (Subar *et al.* 1998). Initial investigations of fortifying gluten-free breads with iron have shown potential but no iron fortified breads are currently available in the United States (Kiskini *et al.* 2007). Developing gluten-free breads from whole grain and pseudo cereal flours like buckwheat, flax, quinoa, brown Rice, Teff, Legumes, Sorghum, and Nuts would be an ideal option for improving the nutritional quality and the

dietary fiber content of gluten-free breads (Niewinski 2008) [16]. Rice (*Oryza sativa* L.) flour is made from ground and polished rice, is mainly starch and is completely gluten free. The appearance of rice flour is white to creamy white, which is relatively free from specks. The flavour is blend and is of typical rice flavour with no rancid or off flavours (Anonymous, 2003). Rice flour is a particularly good substitute for wheat flour, which causes irritation in the digestive systems of those who are gluten-intolerant. Rice flour is very commonly used in gluten free baked goods to give them structure and substance, but it is also a popular addition for non-gluten free baked goods because of its unique and slightly sandy texture.

Corn (***Zea mays***) flour is very popular. Maize flour is derived from grounded and desiccated seed of the maize plant. It is the second most produced and consumed flour after wheat flour, competing with rice flour. The flour is naturally rich in dietary fibre, antioxidants, vitamin B, omega 6 unsaturated fat and vegetable proteins. It recommends consuming whole-grain foods to reduce heart disease risk and provide vital nutrients. Whole-grain corn flour is high in fiber, containing about 7.3 grams per 100-gram serving, according to the U.S. Department of Agriculture. This fiber travels through your digestive tract and absorbs water to help your stool move more easily through your body.

Celiac disease is an autoimmune disease acquired through genetics and the environment. People with Celiac Disease cannot eat foods with wheat, rye, or barley because of their gluten content. These symptoms include diarrhea, weight loss, malnutrition, and abdominal distension (Tenório *et al.,* 2011). Unfortunately, the only treatment of Celiac Disease this far is through a strict diet that includes refraining from all foods that contain gluten, (Tenório *et al.,* 2011). Approximately 6% of children and approximately 4% of adults in the western countries including the US have food allergies (Gonipeta *et al.,* 2009) This condition results because of an immune reaction to the gliadin contained in the protein of wheat and similar grains (Alvarez-Jubete *et al.,* 2010 and Fasano *et al.,* 2003). The most frequently used are corn, potatoes, rice, and tapioca (derived from cassava).

2. Material and Methods

The experiment "**Effect of gluten free flour on quality of Banana Bread**" was carried out in lab of Food Technology Warner school of Food and Dairy technology Sam Higginbottom Institute of Agriculture Technology & Sciences Deemed to be University, Allahabad (U.P.).The Control and Experimental Gluten free Banana Bread samples was tested and Statistically analyzed. The details of experimental techniques employed during the course of present investigation are summarized under the following headings:

1. Material required for prepration of control and experimental gluten free banana bread.
2. Procurement and collection of ingredients.
3. Treatments and procedure adopted for manufacturing control & experimental Gluten free banana bread
4. Testing of control and experimental product.

- Chemical analysis
- Microbial analysis
- Sensory analysis
- Statistical analysis.

Material required for Preparation of Control and Experimental gluten free banana bread.

- Rice flour
- Corn flour
- Banana
- Sugar
- Butter
- Egg
- Baking powder
- Yeast
- Vanilla essence

Procurement and Collection of ingredients

Rice flour – Rice flour under the brand name of "Sehat" was obtained from local market of Allahabad

Corn flour – Corn flour under the brand name of "Sehat" was obtained from local market of Allahabad.

Banana - Banana was obtained from local market of Allahabad.

Sugar - was procured from local market of Allahabad.

Butter – butter sold under the name of "Delicious" was obtained from local
Market of Allahabad.

Egg - was procured from local market of Allahabad.

Baking powder- Baking Powder sold under the brand name of "Wakefield" was
Obtained from local market of Allahabad.

Baker's Yeast- was procured from bakery shop of Allahabad market.

Vanilla essence- vanilla essence sold under the name of "Wakefield" was obtained from local market of Allahabad.

Salt-sold under the brand name of "Tata salt" was obtained from local market of Allahabad

3. Results and Discussion

The present study was based to evolve **"Effect of Gluten free flour on quality of Banana Bread"** The data collected on different aspects were tabulated & analyzed statistically using the methods of analysis of variance & critical difference. The significant & non-significant differences observed have been analyzed critically within & between the treatment combinations.

The results obtained from the analysis are presented in this chapter under the following headings:

1. Chemical Characteristics of Gluten free Banana Bread.
2. Organoleptic Characteristics of Gluten free Banana bread.
3. Microbiological Characteristics of Gluten free Banana Bread.

Mean value of the Parameter of the Control and Experimental Gluten free Banana Bread under the study are as follows-

Parameters	Treatments				C.D Value
	T_0	T_1	T_2	T_3	
1. Organoleptic scores (9-point Hedonic scale)					
Flavour and Taste	7.76	8.06	8.70	8.68	0.60
Body & Texture	7.74	8.36	8.84	8.98	0.31
Colour & Appearance	8.30	7.90	8.24	7.62	0.40
Over all acceptability	7.13	7.73	8.32	8.41	0.35
2. Chemical Analysis (in per cent)					
Moisture	52.45	52.0	52.20	51.74	0.35
Protein	5.20	5.36	5.64	5.70	0.60
Fat	10.22	11.24	11.67	11.70	0.27
Ash	1.44	1.44	1.60	2.06	0.29
Carbohydrate	30.69	29.66	28.89	28.80	0.57
3. Microbial analysis					
S.P.C. (10^3 cfu/gm)	4.80	4.60	4.20	4.60	NS
Yeast & Mouldcount (/gm)	1.80	1.80	1.40	1.60	NS
Coliform	N	N	N	N	-

N=Negative

Summary and Conclusion

Various **Chemical Parameters** Such as Moisture, fat, protein, ash and Carbohydrate were studied. The moisture content showed an increases due to water absorption by increasing the corn flour in amount of rice flour. The moisture content ranged from 52.45 % to 51.74 % in sample T_0 and T_3 respectively. The Protein content increased on increasing the Corn flour percentage level and ranged from

5.20 % and 5.70 % of sample T_0 and T_3 respectively. The fat content increased on increasing Corn flour percentage which contains more fat as compare to Rice flour, level from 10.22 % to 11.70 % in sample T_0 and T_3 respectively. The highest ash content was found in T 2.06 % followed by 1.60% T_3, 1.44 % T_2, 1.44% T_1 respectively. The Carbohydrate content showed a decrease in gluten free flour percentage level and minimum for T_3 i.e. 28.80 % and maximum for control i.e. 30.69 % in T_0

Micro-biological analysis such as S.P.C., Yeast and mould and Coliform count were studied for different Gluten free flour samples. The Coliform showed Negative result assuring hygienic production of product. The highest mean of S.P.C. was observed in control T_0 of 4.80 and highest mean value of Yeast and Mould was observed in control T_0 and sample T_1 i.e. 1.80 and ANOVA for micro-biological analysis also Showed Non-significant results.

Sensory attributes such as Colour and Appearance, Flavour and Taste, body and Texture and overall acceptability were correlated among gluten free flour samples. The highest Correlation was found for the sample T_3 (25% Rice flour:75% Corn flour), as 8.98. Bread Containing 50% Rice flour and 50% Corn flour i.e. T_2 sample level showed maximum Flavour and taste scores among the other sample; however T_3 sample (25% Rice flour:75% Corn flour) showed maximum texture score. the overall acceptability was highest in T_3 sample 8.41 followed by 8.32 i.e.T_2 sample and ANOVA shows the Significant results for all the Sensory Characteristics.

4. Conclusion

Overall the results of the study indicates that Rice flour can be added satisfactory in Corn Flour to make Gluten free Banana Bread. It was concluded that bread with 25% Rice flour: 75%Corn flour (T_3) treatment was highly acceptable in terms of sensory quality. The microbial quality was found satisfactory for all the treatments.

Therefore, it may be concluded that, there is a great scope of manufacturing Gluten free Banana Bread as it is proved low in calorie and harmless for people.

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