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Development and evaluation of gluten free muffins utilizing green banana and pearl millet flour

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Abstract
The purified flours and starches used to make gluten-free muffins typically have low quality properties. In this regard, research was conducted to examine how green bananas, a starchy food that is devoid of gluten and includes a high percentage of indigestible components such resistant starch and non-starch polysaccharides, might be used. The current experiment was carried out with the intention of making muffins with bajra flour (pearl millet flour), a well-known and inexpensive cereal crop. It can be substituted for readily available grains to make one's diet more nutritional and healthier. Raw green bananas were used to make muffins along with pearl millet flour. The different samples were prepared in various treatment *viz*., T0 and T1 in the ratio of (raw green banana: pearl millet flour) 70:30 and 50:50, respectively.

Keywords: Muffins, pearl millet, green bananas

Introduction

Muffins are a single-serving cake that is classified as a quick bread or semi-sweet cake. Baking soda and baking powder mixed together or using egg in place of yeast (Saccharomyces Cerevisiae) are two methods for raising muffins. Some 19th-century sources speculate that the word "muffin" may have originated from the soft bread known as "maphula" in Greek or "mou-pain" in old French. Individually sized, cupcake-shaped treats known as "Quick bread muffins" or "American muffins" are also known as muffins.

Cake's high calorie count and frequent consumption cause obesity. Customers' desire for low-calorie and high-fiber foods is a result of their awareness of nutritional and health programmes. To satisfy consumer demand for higher fibre content in foods without sacrificing preferred sensory aspects, numerous high-fiber additives, notably in baked goods, have been used in a variety of meals.

Pearl millet is one of the top protein-containing grains and is gluten-free while maintaining its alkaline properties. Pearl millet, which is comparable to wheat, barley, and rice, has a higher concentration of amino acids than sorghum and maize. The nutritional value of protein is significantly influenced by the amino acid makeup. It is gluten-free, heavy in calories, low in starch, and has a reduced glycemic index (55). Flavanoids (0.9% by weight) and phenolic acid (4.08 mg/gm), two potent antioxidants, can be found in pearl millet.

The demand of gluten free products is increasing as near to one per cent of the world population is suffering from gluten intolerance. Increasing sensitivity to wheat gluten, increase in number of cases of celiac disease and obesity is the serious public health problems all around the world. Celiac disease (CD) is a life-long autoimmune disease in the small intestine that affect genetically susceptible individuals worldwide. CD is one of the most common genetic disease that result from both environmental (gluten) and genetic (HLA and non-HLA genes) factors. CD is a serious genetic autoimmune disease that damages the villi of small intestine and interferes with absorption of nutrients from food. There is no pharmaceutical cure for celiac disease. A hundred per cent gluten free diet is the only existing treatment for celiac today.

Banana is the 5th most important crop in world export trade after coffee, cereals, sugar and cocoa. Banana is a climacteric fruit, generally consumed in ripe state, however ripe banana losses are more during commercialization. They are highly perishable and if harvesting, handling and transportation are not done properly, the ripe banana soon gets decomposed and become unwholesome for human consumption. To reduce the losses, one of the most interesting processing method is the production of unripe banana flour. The benefits of unripe banana flour is that it is rich in resistant starch (42%) (Ovando-Martinez *et al*., 2009) and dietary fiber content (14.5%) (Alkarkhi *et al*., 2011). Resistant starch by definition, is a part of the starch that is not broken down by enzymes in small intestine. It enters the large intestine where it is partially or wholly fermented by microorganisms. Resistant starch is generally considered as one of the components that make up total dietary fiber.

Banana flour is a starchy food and it is gluten free that may contribute to the gluten intolerance problem. Banana flour also a way of utilizing these green bananas, in addition the shelf. life can be extended and provide easy storage. Banana flour produced by peeled and sliced bananas are dried, milled, sieved then stored. This prepared flour can be suitably used as thickeners in soups and as starch-based ingredient for extruded and bakery products. Muffins are sweet, spongy breakfast or evening snack food prepared traditionally from wheat flour, sugar, oil/fat, milk and eggs. However, wheat-free muffins are of interest in the present times not only for people who are gluten tolerant, but also for people interested in gluten free foods.

Raw green bananas were used to make muffins along with pearl millet flour. The different samples were prepared in various treatment *viz*., T0 and T1 in the ratio of (raw green banana: pearl millet flour) 50:50 and 70:30, respectively.

Materials and methods

Basic ingredients for muffins preparation were purchased from local market. Chemicals and reagents used in the analysis were of analytical grade.

Muffin Formulation and Processing

Muffins were prepared using one basic formulation: 150g flour,60g vegetable oil,80g sugar,50 ml milk,30g banana puree,20g of curd,5g baking powder,1.5g baking soda,5ml vanilla essence. Two variations were performed for the evaluation by green banana flour and pearl millet flour as a substitute for refined wheat flour. In variation 1 the muffins were prepared using 70% banana flour and 30% pearl millet flour and in variation 2 the muffins were prepared using 50% of banana flour and 50% pearl millet flour. The muffin formulation was similar for both; the only variation was in the percentage flour incorporated. Firstly, in a bowl add the curd and baking soda and then keep them aside for some time until air bubbles are formed that would help for better spongy textured muffins. Then in a mixing bowl add the oil and sugar, beat them well then add the curd mixture, banana puree, vanilla essence and finally add all the dry ingredients. Mix them using the cut and float method carefully. Grease the muffin mould, pour the mixture and place them into the preheated oven and allow them to bake at 180℃for about 25 minutes. Once cooled, store them in an airtight container at room temperature.

Variation 1 (T0)	Variation 2 (T1)
70% green banana flour 105 g green banana flour 45 g pearl millet flour	50% green banana flour 75 g of both the flours i.e green banana flour and pearl millet flour

Proximate analysis

Muffins prepared from wheat flour, composite (Green banana flour: pearl millet flour) and green banana flour were evaluated for moisture, protein, fat and ash content.

Moisture: Moisture determination was conducted using the. Disposable aluminium weighing dishes, which had been numbered, dried in the oven for 30 minutes, cooled in a desiccator and weighed again were used. A 2g sample was weighed out and repeated in triplicate. Using tongs, aluminium weighing dishes containing the samples were placed in an air-drying oven at 130° C for about one hour. The samples were removed and placed in a desiccator to cool for 30 minutes and reweighed.

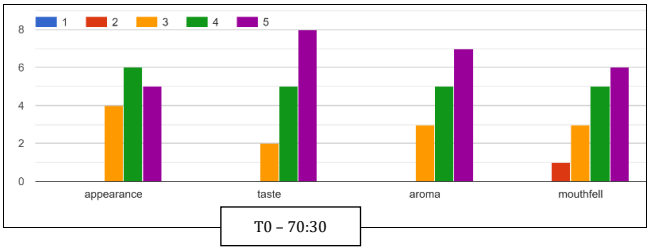
Ash: The ash content was determined according to the using a muffle furnace. Four grams of the sample was weighed and repeated in triplicate into porcelain crucibles, which have been ignited, cooled in a desiccator and weighed and placed in a cool electric muffle furnace. The temperature was 540°C overnight for complete ashing. The ash crucibles were transferred directly into a desiccator, then cooled for 30 minutes and weighed immediately

Protein: Protein content was determined according to the Kjeldahl method described by. Two grams of each sample were placed in digestion flask (500 ml), and sodium or calcium sulphate was added to it. Then 25 ml of concentrated sulfuric acid was added, and the content was heated at 35˚C in a fume cupboard until a clear solution was obtained (2-3 hours) and left to cool before that antidumping granule was added. The digested samples were poured in a volumetric flask (100 mL) and diluted to 100 mL with distilled water. 5 mL were distilled using 10 ml of 40% NaOH; 25 ml of boric acid with drops of methyl red were placed in a conical flask. Distillation of the reaction mixture liberated ammonia and reacted with boric acid, changing the colour from red to light greenish blue. Excess alkali was then titrated using 0.1 N, hydrochloric acid until the colour changed to light purple. The titration reading was reported. The protein content was determined by multiplying the percentage nitrogen by empirical factor 6.35.

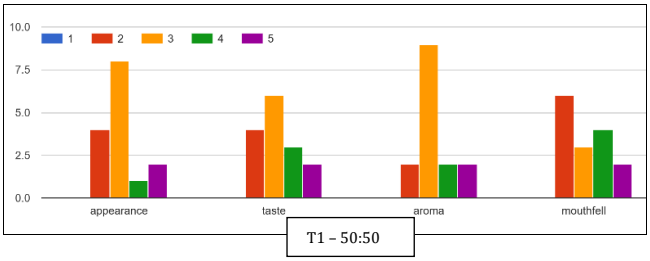
Fat: Requirement: Hexane; Weight accurately about 10g of hexane (food grade) in a soxhlet or other suitable extraction. The extraction period may vary from 4 hrs at a condensation rate 5-6 hours at 2-3 drops per second. Dry the extract on the steam bath for 30 minutes, cool in a desiccator and weigh the extract continue at 30 minutes interval this alternate drying and weighing until the difference between two successive is less than 1 mg. note the lowest mass.

Sensory attributes

Each treatment of the muffin sample was prepared in a muffin mold and subjected to sensory analysis for attributes like taste, body and texture, color and appearance, and overall acceptance by a sensory committee consisting 15 un-experienced panel members as per 5-point hedonic scale.



T0 – 70:30



T1 – 50:50

Results and discussion

Muffins prepared from wheat flour, composite (Green banana flour: pearl millet flour) and green banana flour were evaluated for moisture, protein, fat and ash content. Muffins prepared from wheat flour, composite (Green banana flour: pearl millet flour) and green banana flour were evaluated for moisture, protein, fat and ash content. The proximate analysis of muffins were clearly stated. The moisture content was around 24.39% in T0 and 27.39% in T1. The ash content was 0.986% and 0.987% in T0 and T1 respectively. The protein analysis done according to the kjeldahl principle resulted in 7.17 and 7.76 in T0 and T1. Finally, the fat determination based on soxhlet gave the results in T0 was 20.27% and in T1 14.10%. The below table shows the results for T0 and T1.

Analysis	Variation 1 (t0)	Variation 2 (t1)
Moisture	24.39%	27.39%
Ash	0.986%	0.987%
Protein	7.17	7.79
Fat	20.27%	14.10%

The overall acceptance was given for the variation 1(T0) muffin. In terms of appearance and colour both the variations were similar. For the flavour and taste most of them liked the variation 1 (T0) than that of T1. when it comes to texture, soft and firmness was better in variation 1(T0) muffin. The variation 2 T1 was slightly hard.

Conclusion

According to the research that has been undertaken shows that as the level of pearl millet flour increases there is less acceptance for the product. That could be because of the textural losses as it gives slight hardness (i.e) less softness and moistness to the product. This study on the whole utters the utilization of green banana flour and pearl millet flour for the muffin formulation. This will in turn help for the researchers to utilize the green banana flour and pearl millet flour to formulate various other value-added products. As both the flours are cost- efficient and easily available in our local market that would evidently benefit the people. As the demand for gluten free products are increasing this will clearly be the one such product to satisfy one of those needs. Thus, these gluten free muffins would be both healthy and nourishing products.

Reference

1. Grigelmo-Miguel N, Carreras-Boladeras E, Martín-Belloso O. Development of high-fruit-dietary-fibre muffins. *European Food Research and Technology*,1999:210:123-128.
2. Ramcharitar A, Badrie N, Mattfeldt-Beman M, Matsuo H, Ridley C. Consumer acceptability of muffins with flaxseed (Linum usitatissimum). *Journal of food Science*,2005:*70*(7):s504-s507.
3. Martínez-Cervera S, Salvador A, Muguerza B, Moulay L, Fiszman SM. Cocoa fibre and its application as a fat replacer in chocolate muffins. *LWT-Food Science and Technology*,2011:44(3):729-736.
4. Sanz T, Salvador A, Baixauli R, Fiszman SM. Evaluation of four types of resistant starch in muffins. II. Effects in texture, colour and consumer response. *European Food Research and Technology*,2009:*229*:197-204.
5. Rupasinghe HV, Wang L, Huber GM, Pitts NL. Effect of baking on dietary fibre and phenolics of muffins incorporated with apple skin powder. *Food Chemistry*,2008:*107*(3):1217-1224.
6. Belorio M, Gómez M. Gluten-free muffins versus gluten containing muffins: Ingredients and nutritional differences. *Trends in Food Science & Technology*,2020:*102*:249-253.
7. Man S, Păucean A, Muste S, Pop A. Studies on the formulation and quality characteristics of gluten free muffins. *Journal of Agroalimentary Processes and Technologies*,2014:*20*(2):122-127.
8. Bhaduri S. A comprehensive study on physical properties of two gluten-free flour fortified muffins. *Journal of Food Processing & Technology*,2013:*4*(7):1-4.
9. Soto-Maldonado C, Concha-Olmos J, Zúñiga-Hansen ME. The effect of enzymatically treated ripe banana flour on the sensory quality and glycemic response of banana-wheat flour composite muffins. *Journal of Food Science and Technology*,2020:*57*(10):3621-3627.
10. Harastani R, James LJ, Ghosh S, Rosenthal AJ, Woolley E. Reformulation of muffins using inulin and green banana flour: physical, sensory, nutritional and shelf-life properties. *Foods*,2021:10(8):1883.
11. Vishala J, Singh G. A review on product development through pulp and peel of banana. *Plant Archives*,2021:21(1):693-698.
12. Shipra S, Virginia P, Pallavi S. Sensory acceptability, nutrient composition and cost of multigrain muffins. *International Journal of Food Science and Nutrition*,2017:*2*:38-40.
13. Nami Y, Gharekhani M, Aalami M, Hejazi MA. Lactobacillus-fermented sourdoughs improve the quality of gluten-free bread made from pearl millet flour. *Journal of food science and technology*,2019:*56*:4057-4067.