ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, S Iss 1,December 2022

Studies On Quality Characteristics Of Muffins Prepared Using Pearl Millet Flour And Jackfruit Seed Powder

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ABSTRACT

The current investigation was conducted with the goal of preparation of Muffins containing bajra flour (*Pearl millet* flour), Wheat flour and Jackfruit seed powder to determine the suitability, content of nutritional components, and proximate composition of the obtained product. A low-priced familiar cereal crop bajra, therefore it is cost-effective. It may be used in place of available grains to build one's diet better healthful and nourishing. Muffins were prepared by combining wheat flour, flour of pearl millet and jackfruit seed powder. The different samples were prepared in various treatment viz., T0, T1, T2, T3 and T4 in the ratios of (Wheat flour: Pearl millet flour) 100:0, 80:20, 60:40, 40:60 and 20:80, respectively with the amount of

ISSN PRINT 2319 1775 Online 2320 7876

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jackfruit seed powder being fixed at 10%. The muffins were rated palatable using a nine-point hedonic scale. The amount of carbohydrate was found to be 50.02%, fat was observed to be 8.22%, protein, ash and moisture content was found to be 24.53%, 2.32% and 23.26%, respectively. The acidity was observed to be 1.49%, polyphenol content was found to be 99.73 (mg GAE/100gm), phytate and saponin content were observed to be 4.83 (mg/100 g) and 0.176 (mg/100g) in optimized Muffins. The outcome revealed that muffins prepared with bajra flour, wheat flour and jackfruit seed powder was found to be high in protein, fat, fiber than Muffins prepared with wheat flour. Addition of bajra flour and Jackfruit seed powder increased the nutritional composition of Muffins. Therefore, replacement of wheat flour with bajra flour and Jackfruit seed powder for making muffins is simple and helpful, and it was also highly received.

Keywords: Composition, jackfruit seed powder, muffins, pearl millet, phytochemicals

INTRODUCTION

Muffins are a kind of fast bread or semi-sweet cake which is a single-serving cake. Muffins are raised by using a combination of baking soda and baking powder or by using egg instead of yeast (*Saccharomyces Cerevisiae*). According to some 19th-century sources, the term “muffin” might have come from the Greek bread “Maphula” or old French “mou-pain” which means soft bread. Muffins are also known as “Quick bread muffins” or “American muffins” individual-sized, cupcake-shaped desserts.

The high-calorie content and excessive eating of cake leads to obesity. Consumer awareness of nutritional and health programs has their desire for low levels of calories and high-fiber diets. Numerous high-fiber additions have been used in a wide range of meals, particularly baked goods, to address consumer desire for higher fiber content in foods without losing favored sensory qualities.

Pearl millet is a grain-free of gluten that preserves its alkaline characteristics and ranks among the highest in protein content. According to Rai et al. [1] pearl millet has a higher level of amino acids than sorghum and maize and is equivalent to wheat, barley, and rice. The composition of amino acids has a considerable impact on the nutritional value of protein. According to Vanisha et al. [2], it is high in calories, low in starch, has a lower level of glycemic index (55), and free from gluten. Pearl millet contains flavanoids (0.9% by weight) and phenolic acid (4.08 mg/gm) which are both highly effective antioxidants.

Generally, jackfruit seeds are treated to improve the functional, nutritional, or organoleptic qualities of the resulting flour. In food processing, functional characteristics are essential for the creation of novel products. According to Kent [3], flour made from jackfruit seeds has a high water-absorption capacity and is used for breadmaking. Additionally, it is useful

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, S Iss 1,December 2022

against diarrhea and dysentery, jackfruit seeds aid with digestion. It is generally understood that an abundance of free radicals damages biomolecules; therefore, their avoidance is essential for cytoprotective actions. According to Baliga et al. [4], studies have demonstrated that antioxidants such as polyphenols, carotenoids, and anthocyanin are efficient free radical scavengers, as a result, the human body is protected from cellular harm. According to Omale and Friday [5], seeds of jackfruit include numerous phytonutrients, lignans, isoflavones, and saponins. These phytochemicals have numerous physiological advantages, ranging from anticancer to antihypertensive. These antioxidants also have anti-ulcer and anti-aging properties. Swami et al. [6] reported that jackfruit seeds aid in healthy blood circulation as well as promote healthy hair development. The American Diabetes Association has recognized it as a natural therapy for controlling diabetes. It is a low-carbohydrate and low-sugar replacement, and adding it to everyday cooking enhances bowel movement by increasing soluble fibre intake.

No investigations on the partial substitution of Wheat flour, Pearl millet flour, and Jackfruit seed powder in muffin batter compositions have been conducted so far. In order to investigate the quality characteristics of muffins made with Pearl millet flour and Jackfruit Seed powder, the present study was conducted.

Materials and Methods

The current research was undertaken to prepare muffins. Jackfruit seed powder was purchased from Wellversed Health Private Ltd., Gurgaon. Wheat Flour (WF) was acquired from the Prayagraj local market. Bajra seeds were procured online from Millet Amma, Bangalore. The seeds were manually cleaned and then steeped overnight. It was stored for germination for 48 hours and sun-dried until all moisture was removed. The resulting fine pearl millet flour (PF) was stored in sealed containers until further use. Butter was acquired from the Prayagraj local market. Local dairy was sourced for condensed milk. Baking powder, vanilla extract, and salt were purchased from a local store at Prayagraj. Herboveda India, Noida, was the supplier of Stevia.

Development of Muffins

The sugar dough method was used to make the muffins. Prior to the inclusion of flour, all fats were combined, including baking powder, baking soda, and flavoring. First, all of the fats were introduced to the container and beaten with an immersion blender before adding the powdered sugar. The flour, sodium bicarbonate, and baking powder were then combined with the earlier creamed fats. Using appropriate dry and moist ingredient blending, a batter with the correct consistency was prepared by either clockwise or counterclockwise mixing. After preparing the mixture, it was placed into greased muffin molds and baked at 180°C for 25 minutes. Once cooled, the muffins were wrapped in PET boxes and stored at room temperature.

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Treatment Combination

Four treatments were developed in the current investigation viz. T_0, T_1, T_2, T_3, and T_4, wherein T_0 was the control muffin (100% WF), T1 was prepared with 80% WF and 20% PF (80% WF+20% PF), T2 was prepared with 60% WF and 40% PF (60% WF+40% PF), T3 was prepared with 40% WF and 60% PF (40% WF+60% PF) and T4 was prepared with 20% WF and 80% PF (20% WF+80% PF). The Jackfruit seed powder was kept constant (10%) for all treatment combinations.

Physico-Chemical Analysis

Determination of specific volume and height of muffins was determined according to Lee et al. [7]. Baking loss and baking yield were calculated based on batter weight. The determination of specific gravity and specific volume of muffins was determined according to Lee et al. [7]. Percent total solids, fat, protein, carbohydrate, ash, crude fiber, acidity and antioxidant activity was determined by the method suggested by AOAC [8]. Amount of polyphenol was done as per the procedure suggested by Lee et al. [7]. Saponin and Phytate composition was calculated as per protocol done by Owheruo et al. [9].

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 six experienced panel members as per 9-point hedonic scale.

Statistical Analysis

Data were analyzed using Analysis of Variance (ANOVA) at a level of 5% significance using MS Excel 2010.

Results and Discussion

Effect of incorporation of different levels of Pearl millet flour and Jackfruit seed powder on physical properties of Muffins.

The influence of varying concentrations of Pearl millet flour and Jackfruit seed powder on the physical qualities of muffins is discussed below. Table 1 displays the physical parameters of Muffin samples prepared during the investigation.

The results revealed that the highest mean specific volume of control and experimental muffins was 2.23 in T0, followed by 2.13 in T1, 1.6 in T2, 1.4 in T3, and 1.3 in T4. The mean specific gravity of control and experimental muffins was found to be 1.1 in T0, 1.24 in T1, 1.13 in T2,

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1.13 in T3, and 1.3 in T4, respectively. The maximum mean height of muffin samples were 4.85 in T0, followed by 4.34 in T1, 3.64 in T2, 3.43 in T3 and 3.23 in T4. The highest mean baking loss percentage for control and experimental muffins was 11.36 in T0, followed by 10.53 in T1, 10.43 in T2, 10.32 in T3, and 9.94 in T4. Khan et al. [10] prepared cake by replacing 10%, 20%, and 30% of the wheat flour with jackfruit seed flour. Their findings revealed that the specific volume of the cake having 20% replacement was higher compared to the other cakes.

Effect of incorporation of Pearl millet flour and Jackfruit seed powder on the Chemical properties of Muffins.

According to the results, the mean percent total solids content of treatments T0, T1, T2, and T4 were 74.70, 75.76, 76.74, 79.64, and 82.76, respectively (Table 2). The percent total solids were highest in T4 while T0 had the lowest. The mean treatment values rose from T0 to T4 experimental samples, resulting in a significant rise in the overall solids of various treatments ($P<0.05$).

After the addition of Pearl millet flour and Jackfruit seed powder, the findings showed that the average moisture content decreased until it reached its lowest level. The maximum mean muffin moisture content was reported in T0 and the lowest in T4. The mean moisture content dropped from T0 to T4 experimental samples, resulting in a significant difference in moisture content ($P<0.05$).

The maximum amount of fat was found in the T4 treatment, while the minimum amount of fat was seen in T0. As the amount of Pearl millet flour in the muffins increased, so did the muffins' fat level. The average percentage of fat in muffin samples from treatments T0, T1, T2, T3, and T4 was 8.15, 8.20, 8.22, 8.23, and 8.24, respectively. From T0 to T4 experimental samples, it was noted that the mean treatment values rose, leading to a substantial rise ($P<0.05$) in the amount of fat of the various treatments.

The amount of protein of treatments T0, T1, T2, T3, and T4 had respective mean values of 24.33, 24.43, 24.53, 24.75, and 24.95%. T4 had the highest mean percentage of protein among the muffin samples, followed by T3, T2, T1, and T0. Table 2 demonstrates that the protein levels rose as the amount of pearl millet flour increased.

The mean total carbohydrate content of the four treatments T0, T1, T2, T3, and T4 varied between 48.84 and 50.92 percent (Table 2). The Muffins sample with the greatest mean percentage of total carbohydrates was T4 (50.92), followed by T3 (50.54), T2 (50.02), T1 (49.92), and T0 (48.84). The total carbohydrates in the muffin samples were significantly higher than in the control. The mean treatment values was observed to increase from T0 to T4 experimental samples, resulting in a substantial rise in carbohydrate content ($P<0.05$).

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Information regarding the ash content of muffin samples from various treatments is presented in table 2. The average proportion of ash in treatments T0, T1, T2, T3, and T4 was 1.12%, 2.20%, 2.32%, 2.36%, and 2.40%, respectively. The muffin sample with the highest ash concentration was found in T4 and the sample with the lowest mean was T0. It reveals that as the level of Pearl millet flour grew, so did the ash content.

Table 2 displays data regarding the titratable acidity of Muffin samples subjected to various treatments. The mean percent titratable acidity for treatments T0, T1, T2, T3, and T4 was 0.65%, 1.18, 1.49, 1.55, and 2.09%, respectively. The sample of muffin with the greatest mean titratable acidity was T4, and the sample with the lowest mean was T0. It indicates that as the level of pearl millet increased, so did the titratable acidity. Table 2 displays data regarding the crude fiber content of muffin samples prepared with various treatments. The mean percentage of crude fiber for treatments T0, T1, T2, T3, and T4 was 1.43, 1.45, 1.53, 1.62, and 1.73%, respectively. The muffin sample with the greatest mean crude fiber content was T4, whereas the lowest was seen in sample T0. It implies that when pearl millet content increased, so did crude fiber content. The antioxidant activity of treatments T0, T1, T2, T3, and T4 had respective mean values of 24.85, 28.43, 30.64, 34.64, and 37.54%. The sample with the greatest mean antioxidant activity of the muffin sample was T4, while the sample with the lowest antioxidant activity was T0. It demonstrates that as the level of pearl millet increased, so did its antioxidant activity.

Khan et al. [10] also observed that the cake's proximate composition was affected by the substitution of jackfruit seed powder; elements such as carbohydrates, ash, fiber, and protein increased, whereas fat and protein decreased. Composite cakes with varying quantities of jackfruit seed powder were determined to be superior to the control sample. The range of the mean value of polyphenol for the five treatments T0, T1, T2, T3, and T4 was 47.23 to 145.25 mg GAE (Table 2). The muffin sample with the greatest mean polyphenol content was T4 (145.25), followed by T3 (120.54), T2 (99.73), T1 (72.84), and T0 (47.23). From T0 to T4 experimental samples, it was noted that the mean treatment values rose, therefore the antioxidant activity of various treatments rose significantly ($P<0.05$). The phytate concentration of the five treatments T0, T1, T2, T3, and T4 ranged from 2.75 to 6.83 mg. The muffin with the greatest mean phytate content was T4 (6.83), followed by T3 (5.53), T2 (4.83), T1 (3.63), and T0 (2.75). From T0 to T4 experimental samples, the mean treatment values increased, indicating that the phytate content of various treatments improved considerably ($P<0.05$). The mean value of the saponin content for the five treatments T0, T1, T2, T3, and T4 ranged from 0.154 to 0.226 mg. The muffin sample with the greatest average saponin concentration was T4 (0.226), followed by T3 (0.203), T2 (0.176), T1 (0.164), and T0 (0.154). The mean treatment values increased from T0 to T4 experimental samples, resulting in a significant rise in the saponin content of different treatments ($P<0.05$).

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Singh et al. [11] also reported that different cake samples formulated using 50%, and 75% malted pearl millet flour had low levels of protein, fat, and ash contents although the crude fiber level was much greater in cakes made comprising 50% and 75% blanched pearl millet flour.

Effect of incorporation of Pearl millet flour and Jackfruit seed powder on a sensory score of Muffin samples.

Muffin samples produced with varying levels of pearl millet flour and jackfruit seed powder were evaluated using a nine-point based hedonic scale by panelists with specialized training. The color and appearance, flavor, body and texture and general acceptance of muffin samples were evaluated. The findings revealed that muffin sample T0 had the highest scores for flavor, color and appearance, as well as body and texture, and overall acceptability. Amongst the samples containing pearl millet flour and jackfruit seed powder, samples of treatment T1 fetched higher sensory scores as compared to T2, T3 and T4. The mean flavor score for muffins ranged between 8.06 and 6.38, as shown in Figure 1. The color and appearance score of muffin was recorded as 8.06, 7.64, 7.44, 7.38, and 6.84 for T0, T1, T2, T3, and T4, respectively. The mean color and appearance score was highest for T0 and lowest for T4. Similarly, the body and texture mean scores for the various muffins treatments ranged from 6.36 to 8.44. The mean values for body and texture were highest for T0 and lowest for T4. The various treatments were found significantly different ($P<0.05$). The overall acceptability value of muffin samples ranged from 6.58 to 8.06, as shown in Figure 1. There was a statistically significant difference, according to the report's findings ($P<0.05$) in between the sensory scores for the various treatments. Khan et al. [10] also stated that the amount of cake substituent increased, substantial changes in color, flavor, texture, and taste were noted, as well as an increase in cakes' overall acceptance. However, the cake with 10% jackfruit seed received the highest rating from the panelists. Syed et al. [12] prepared low-calorie foods such as cake utilizing fat substitutes derived from carbohydrates. There have been attempts to substitute fat in cake containing pearl millet maltodextrin derived from the hydrolysis process of pearl millet starch at concentrations of 20, 30, and 40%. On the basis of organoleptic evaluation, it is recommended to use up to 30% maltodextrin as a fat replacement in cake formulation, as it produces the best results in comparison to the experimental control. The muffins prepared in the study with varying treatments have been shown in figure 2.

CONCLUSION

According to the findings of this investigation, as levels of bajra flour in the muffins increased, the sensory attributes were affected. Muffins with bajra flour and jackfruit seed powder had the most protein, lipids, fiber, and other essential components. The current study's findings may aid in the development of industrial manufacturing techniques for the appropriate exploitation of

ISSN PRINT 2319 1775 Online 2320 7876

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bajra flour, particularly for the production of muffins. As a result of the current investigation, it can be concluded that the Muffins made with bajra flour are nourishing and organoleptically acceptable. As a consequence, the findings indicate the existence of an improved potential for the consumption of bajra flour and Jackfruit seed powder in products like muffins. The current study's outcome might help with evolution of value-added products using bajra so that efficient exploitation of this low-cost agricultural produce may benefit the farmer.

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Table 1.Physical properties of Muffin prepared with Pearl millet flour and jackfruit seed powder

Parameters	T_0	T_1	T_2	T_3	T_4
Specific volume(cc/g)	2.23±0.01	2.13±0.01	1.6±0.15	1.4±0.15	1.3±0.15
Specific gravity	1.1±0.15	1.24±0.16	1.13±0.01	1.13±0.01	1.3±0.15
Height(cm)	4.85±0.03	4.34±0.23	3.64±0.02	3.43±0.01	3.23±0.01
Baking loss (%)	11.36±0.01	10.53±0.01	10.43±0.01	10.32±0.01	9.94±0.01

Table 2.Chemical properties of Muffin prepared with Pearl millet flour and jackfruit seed powder

Parameters	T_0	T_1	T_2	T_3	T_4
Total solid (%)	74.7±0.01	75.76±0.02	76.74±0.01	79.64±0.02	82.76±0.01
Moisture (%)	25.3±0.15	24.24±0.11	23.26±0.11	20.36±0.24	17.24±0.11
Fat (%)	8.15±0.03	8.20±0.02	8.22±0.01	8.23±0.01	8.24±0.02
Protein (%)	24.33±0.01	24.43±0.02	24.53±0.52	24.75±0.03	24.95±0.03
Carbohydrates (%)	48.84±0.02	49.92±0.01	50.02±0.01	50.54±0.02	50.92±0.01
Ash (%)	1.12±0.13	2.2±0.15	2.32±0.19	2.36±0.15	2.40±0.27
Crude Fiber (%)	1.43±0.01	1.45±0.02	1.53±0.01	1.62±0.01	1.73±0.01
Antioxidant value(%RSA)	24.85±0.01	28.43±0.01	30.64±0.02	34.64±0.01	37.54±0.01
Titrable acidity(%Lactic	0.65±0.01	1.18±0.01	1.49±0.01	1.55±0.01	2.09±0.01

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acid)					
Polyphenol content(mgGAE/g)	47.23±0.01	72.84±0.01	99.73±0.01	120.54±0.01	145.25±0.01
Phytate content(mg/100g)	2.75±0.015	3.63±0.015	4.83±0.015	5.53±0.015	6.83±0.011
Saponin content(mg/100g)	0.154±0.00	0.164±0.00	0.176±0.00	0.203±0.00	0.226±0.00

Note: Data represented as mean ± standard deviation of five replications. Values with significantly different ($p \leq 0.05$)

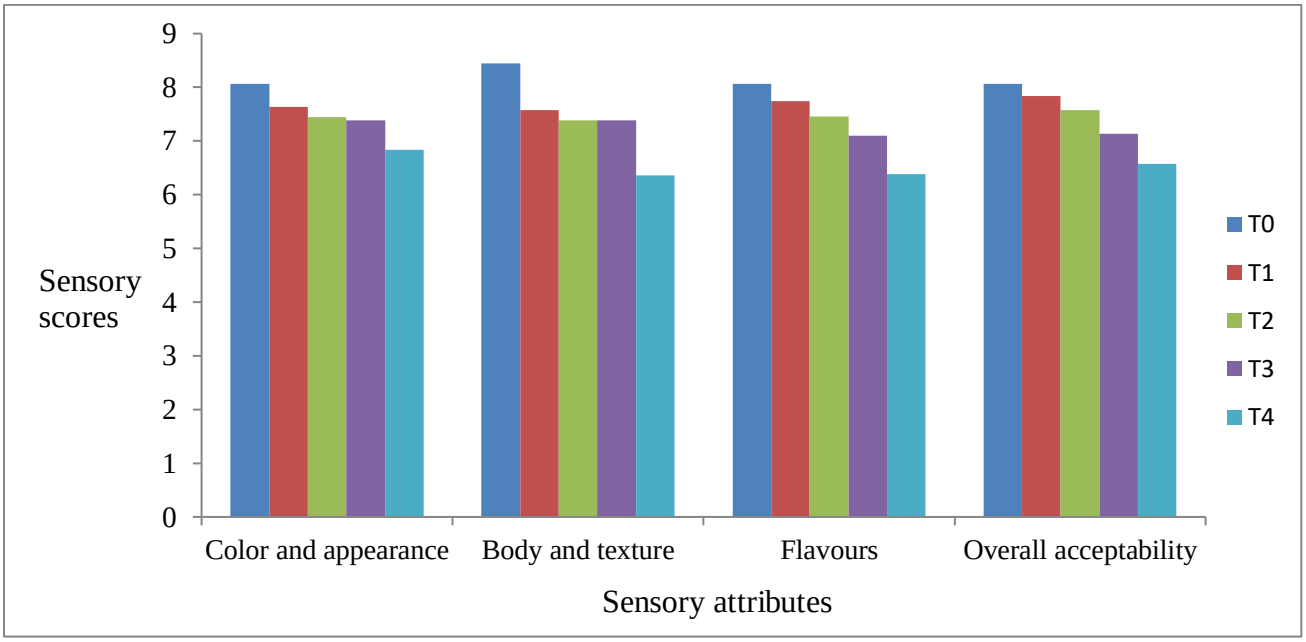

Figure 1 Graphical representation of sensory score of Muffins sample.

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(a) Treatment T0 (b) Treatment T1 (c) Treatment T2

(d) Treatment T3 (e) Treatment T4

Figure 2 (a-e): Figures showing muffins of different treatments prepared using pearl millet flour and jackfruit seed powder.