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Nutritional Enrichment of Bake Products (Bread, Donut) with Jamun Seed Powder and Pearl Millets

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Abstract

This study offers a novel method for product development that makes use of the nutritional potential of *jamun* seed powder and pearl millets. The nutritional content, sensory qualities and added value of bread and donuts manufactured from HC 10 variety pearl millet flour that has been supplemented with 15% *jamun* (Syzygium cumini) seed powder were examined in this study. Raw pearl millet, *jamun* seed powder, the most palatable variety of baked products, and the control group's nutritional content was all examined. The use of *jamun* seed powder improved the nutritional composition and sensory qualities of baked goods made from pearl millet (HC 10 type). The amount of crude fiber (0.78 to 1.08%), calcium (48.96 to 59.47 mg 100^{-1} gm), phosphorus (215.96 to 199.56 mg 100^{-1} gm), phytic acid (349.63 to 338.53 mg 100^{-1} gm) show a significant difference and total nutritional values (non significant differences) were all boosted by the addition of *jamun* seed powder. *In vitro* digestibility was affected by incorporation of *jamun* seed powder in bread and donut. As the concentration of these functional ingredients increased, there was a decrease in color, appearance, aroma, texture, taste, and overall acceptability scores. These differences were statistically significant ($P \leq 0.05$) compared to the control doughnut and bread. As a result, the value-added baked goods could provide further health advantages, making them a better choice excellent dietary supplement. The bioavailability and health-promoting abilities of these value-added baked goods in humans, however, require more study.

Key words : Bread, Donut, Pearl millet, *Jamun* seed powder, Significant.

Pearl millet (*Pennisetum glaucum*) is crucial in arid Asia, Africa, Middle East. In nations like India, Nigeria, it substitutes cereals, combats food scarcity. Thrives in harsh conditions, aids Indian agri-livestock (Singh G., 2003). Pearl millets are Rich in energy, nutrients, minerals, low glycemic index (Kaushik and Grewal, 2017; Vaijapurkar *et al*. 2015; Nambiar *et al*. 2011). Aids health issues like diabetes, obesity, heat diseases (Veena, 2004).

Jamun (Syzygium cumini) is a tropical fruit known for its rich anthocyanin and polyphenol content, which exhibit potent antioxidant properties (Rahman and Baishnab, 2016). Additionally, *jamun* seeds are a valuable source of proteins, dietary fiber, and essential minerals (Raza *et al*. 2015, Savita *et al*. 2022). India is the world's top producer of *jamun*, providing roughly 15.4% of the 13.5 million tonnes produced globally (Raza *et al*. 2015). They may be used as a quick and inexpensive replacement for current medications (Sidana *et al*. 2016). When ingested at levels of 2-3 g day^{-1}, the jamboline and jambosine found in *jamun* seeds prevent the conversion of starch to sugar, which is advantageous for both diabetics and healthy people (Banu and Jyothi, 2016).

Bread and doughnuts are popular bakery products enjoyed by people worldwide due to their convenient and delectable nature. However, the growing emphasis on healthier and more nutritious food choices has led to an increasing demand for functional and fortified foods. In response to this trend, researchers and food technologists have been exploring various strategies to enhance the nutritional content and health benefits of these baked goods. One innovative approach is the incorporation of

jamun seed powder and pearl millets into bread and doughnut formulations. This study aims to investigate the impact of *jamun* seed powder and pearl millets on the nutrient composition, organoleptic acceptability of bread and doughnuts. By analyzing the proximate compositions, mineral content, in vitro characteristics, and sensory attributes, valuable insights can be gained regarding the feasibility of incorporating *jamun* seed powder and pearl millets into bakery products.

Material and Methods

Procurement of raw materials : The CCS, HAU, Hisar department of Genetics and Plant Breeding was contacted to obtain the pearl millet variety (HC 10). Fresh *Jamun* fruits were purchased from a Hisar neighborhood market. *Jamun* fruits were cleaned, the pulp and seeds were removed, and the remaining seeds were manually sorted. The seeds were dried for a full 24 hours at room temperature in the shade, and then stored in a hot air oven at 55°C. The nutrient content of HC 10 variety of pearl millets and *jamun* seed powder reported in pervious publication by Savita *et al*. 2023.

Ingredients used for bread preparations : Milk powder (2.6g), Gluten (2g), Dried yeast (9g), Sugar (1.4g), Salt (1.4g), Fat (5g), Water (55ml)

Ingredients used for donut preparations : Milk powder (4g), Dried yeast (7g), Sugar (10g), Salt (2g), Fat (9g), Water (55ml), oil for frying

Types of donut and bread

Control: Pearl millets flour (40gm): Refined flour (60gm): Jmaun seed powder (0gm)

Type I: Pearl millets flour (37.5gm): Refined flour (57.5gm): Jmaun seed powder (5gm)

Type II: 35:55:10 Pearl millets flour (35gm): Refined flour (55gm): Jmaun seed powder (10gm)

Type III: Pearl millets flour (32.5gm): Refined flour (52.5gm): Jmaun seed powder (15gm)

Standardize recipes of bread and donut method : Mixed sieved pearl millet flour, refined flour, and gluten. Sieved *jamun* seed powder and added to the mix. Made pre-ferment with yeast, sugar, salt, 1/3rd flour, warm water. Added fat, mixed. Added remaining flour, *jamun* powder, milk powder. Hand-mixed to non-sticky dough. Kneaded for elasticity (5 mins). Till kneading the method of bread and donut are same and difference only incubated time and method.

Bread : Incubated 1st proof (30 mins). Removed, knocked back, shaped in greased loaf pan. 2nd proof (60 mins). Baked at 240°C (15 mins), brushed with water. Cooled 2 hrs, sliced.

Donut : 1st proof in incubator (50 mins). Removed, divided, shaped. 2nd proof (10 mins). Fried divided dough in oil till golden brown.

Sensory assessment : A semi-trained panel of 10 judges evaluated the biscuits' sensory quality using a 9-point hedonic scale. Nutritional evaluations were performed on all of the eligible baked products (Peryam and Pilgrim, 1957).

Nutritional evaluation : By using the accepted analytical techniques recommended by AOAC in 2000, the approximate composition of biscuits was ascertained. After samples were dried at 60°C until their weight remained constant, the moisture content was assessed. Using an automatic KEL-PLUS CLASSIC DX apparatus, the micro-Kjeldahl method was used to estimate crude protein. Utilizing the Soxhlet extraction device, crude fat was calculated. The standard technique of analysis was used to calculate the crude fiber and ash contents (AOAC, 2000). According to Lindsay and

Norwell's (1969) approach, the total mineral content was calculated. We used the modified approach of to determine in- vitro protein digestibility (Mertz *et al*. 1983), and starch digestibility was evaluated using Singh *et al*.'s (1982) methodology. Phytic acid in baked samples was measured using Davies and Reid's (1979) method and Singh and Jambunathan's method from 1981 was used to extract the polyphenols.

Statistic evaluation : According to the accepted methodology, the statistical analysis of the quality evaluation data included the use of mean, standard deviation, and ANOVA (Sheoran and Pannu, 1999).

Results and Discussion

Sensory score : The organoleptic evaluation of doughnut samples reveals significant differences in the mean scores among the control and different types of doughnuts. The control doughnut, received the highest mean scores in all parameters, indicating that it was the most preferred in terms of color (8.05), appearance (7.95), aroma (7.60), texture (7.50), taste (7.30), and overall acceptability (7.68). The Type I doughnut scored 7.55 and 7.65 for color and appearance, respectively, and fell into the "liked very much" group. However, the mean ratings for aroma, texture, taste, and overall acceptability fell into the "liked moderately" area. With overall mean scores of 6.31 and 5.36, Type II and Type III donuts fell into the "liked slightly" and "neither liked nor disliked" categories, respectively. Similar trends were observed in the organoleptic evaluation of bread samples. The control bread received the highest mean scores in all parameters, indicating its superior sensory acceptability (7.57) compared to the other types. In terms of color, appearance, aroma, texture, taste, and overall acceptability, the mean scores for Type I and Type II bread made with 5% and 10% *jamun* seed powder were 6.80, 6.80, 6.50, 6.60, 6.45, and 6.63, respectively, and 6.00, 5.95, 5.70, 5.80, 5.40, and 5.77, respectively. Type I and Type II bread came into the "liked moderately" and "liked slightly" categories, however Type III bread (15%) went into the "neither liked nor disliked" category. As the concentration of these functional ingredients increased, there was a decrease in color, appearance, aroma, texture, taste, and overall acceptability scores. These differences were statistically significant (P 0.05) compared to the control doughnut and bread. This suggests that the addition of pearl millet and *jamun* seeds may have had a minor impact on the overall sensory perception of the doughnut. The decline in acceptability scores with the increasing addition of pearl millet and *jamun* seeds might be attributed to changes in the sensory attributes and taste profile of the doughnuts. The presence of these functional ingredients could have altered the texture, flavor, and appearance of the doughnuts, leading to a less favorable sensory experience for consumers. Bread made by Singh (2003) with 50% blanched pearl millet flour, refined flour, and soybean flour was "liked moderately." According to Kalse *et al*. (2016), Patil *et al*. (2014), and Priyanka and Mishra (2015), Savita *et al*. (2023) biscuits made with *jamun* seed powder up to 9, 8, and 10% were acceptable organoleptically. According to Thorat and Khemnar (2015), *jamun* seed powder up to 40% degree of integration in cookies was acceptable organoleptically. According to 2016 FSSAI regulations, the maximum amount of *jamun* seed powder and raw herb ingestion per day for adults is 5–10 gm and 3–5 gm, respectively.

Nutrients content : The nutrient composition of pearl millet-based *jamun* seeds incorporated bread and doughnut. Moisture (31.37 to 30.85%), crude protein (10.38 to 10.25%), ash (1.94 to 2.09%), fat (3.33 to

3.17%) content showed no significant differences (NS) and crude fiber (0.78 to 0.99%) content show significant difference among the control and different types of bread. Similarly, the nutrient composition of pearl millet-based *jamun* seeds incorporated doughnut was analyzed and compared with the control show that moisture (25.83 to 25.23%), ash (2.35 to 2.40%), crude protein (10.09 to 9.72%) content in the doughnut samples showed no significant differences (NS) among the control and different types of doughnuts. The fat (8.80 to 7.20%) content in Type I doughnut, with pearl millet and *jamun* seeds, was significantly lower than in the control doughnut. Similar to bread, the crude fiber (0.87 to 1.08%) content significantly increased in Type I doughnut compared to the control doughnut. *jamun* seeds slightly reduced the fat content and fiber content of the bread, potentially enhancing its nutritional value. The outcomes for the control loaf of bread were lower than Singh's (2003) reported moisture content. The total mineral content, including calcium, phosphorus, iron, zinc, and magnesium, showed significant differences among the control and different types of bread and doughnut. Significantly higher calcium (48.96 to 56.74 mg 100^{-1} gm), zinc (2.47 to 2.7 3 mg 100^{-1} gm) compared to control bread and phosphorus (215.96 to 200.53 mg 100^{-1} gm) content significantly reduces in *jamun* seed powder incorporated bread. A non significant difference was recorded for iron (5.72 to 5.86 mg 100^{-1} gm) and magnesium (117.00 to 116.59 mg 100^{-1} gm) content in all type of bread. Almost similar results were noted for donut regarding total minerals. A non significant difference was found for iron (5.68 to 5.82 mg 100^{-1} gm), zinc (2.57 to 2.82%) and magnesium (118.20 to 117.44 mg 100^{-1} gm) content and calcium (51.66 to 59.47 mg 100^{-1} gm) content significantly increased. A significant reduction was noted for phosphorus (213.18 to 199.56 mg 100^{-1} gm) content in donut developed with incorporation of *jamun* seed powder. *In vitro* studies, such as protein digestibility (54.29 to 52.61%), starch digestibility (31.78 to 32.41mg maltose released gm^{-1}), and polyphenols (283.06 to 287.10 mg 100^{-1} gm), showed no significant differences (NS) between the control and Type I bread. This suggests that the functional ingredients had minimal impact on these aspects of the bread's nutritional profile. Similarly, for donut that *jamun* seed powder incorporation show a non-significant difference for protein digestibility (52.36 to 50.77%), starch digestibility (33.46 to 33.89 mg maltose released gm^{-1}), and polyphenols (281.60 to 285.95 mg 100^{-1} gm) content in donuts. Phytic acid content in bread (349.63 to 342.73 mg 100^{-1} gm) and donuts (346.30 to 338.53 mg 100^{-1} gm) show a significant difference and the incorporation of *jamun* seed powder reduce the phytic acid content in developed products. By attaching to minerals including iron, zinc, magnesium, and calcium, phytic acid prevents their absorption and decreases their uptake. The amount of phytic acid in grains, according to Coulibaly *et al*. (2011), varies from 0.5 to 2 g 100^{-1} g. According to Abdelrahman *et al*. (2005), pearl millet has between 307 and 714 mg of polyphenols per 100 grams. The present study results supported by Savita *et al*. (2023), it was found that adding *jamun* seed powder to biscuits at a concentration of 10% caused noticeable changes to their nutritional content. Particularly, the quantities of protein (9.56 to 8.85%), fat (21.66 to 20.33%) phosphorus (210.90 to 195.14mg/100gm), and phytic acids (362.13 to 347.09 mg/100gm) were lowered in the biscuits. On the other hand, the ash (1.76 to 1.87%), crude fiber (0.71 to 1.14%), calcium (47.13 to 63.48 mg 100^{-1} gm), iron (4.19 to 4.61 mg 100^{-1} gm), and zinc (2.15 to 2.70 mg 100^{-1} gm) contents of the biscuits supplemented with *jamun* seed powder increased. Similar trends followed by Marufa *et al*. 2019 in cake developed with *jamun* seed

powder (30% level) that moisture (25.56 to 16.92%), protein (8.56 to 6.34%), fat (22.42 to 16.01%) content decreased and ash (1.50 to 2.60%) content increased. Savita *et al*. 2023 reported that *jamun* seed powder contain ash, crude fiber, calcium, iron, zinc content and having many phytochemicals such as flavonoids, glycosides, phytosterols, tannins. These findings suggest that the addition of functional ingredients can be a viable strategy to enhance the nutritional value of bread and doughnut products.

Conclusion

The incorporation of pearl millet and *jamun* seeds in both bread and doughnut resulted in changes in nutrient compositions, including increased fiber and mineral content, while maintaining protein digestibility. The results of this study can contribute to the development of functional baked goods that align with the modern consumer's preferences for healthier and nutritionally enriched food options. As consumers become increasingly health-conscious, these innovative bakery products have the potential to address the rising demand for nutritious, yet delightful, food choices in the market. Additionally, it emphasizes the value of integrating underused crops in food processing, such as *jamun* seeds and pearl millets, to promote agricultural diversity and sustainable food systems. The results of this study open the door for additional research and the commercialization of goods containing these priceless natural components meet consumers' nutritional needs as well as the food industry's environmental objectives.

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