

Formulation, Acceptability and Promotion of Pearl Millet (*Pennisetum Glaucum*) Incorporated Indian Sweets

Monica Ramakrishnan and Aruna Narayanan

Department of Nutrition and Dietetics, PSG College of Arts and Science, Coimbatore

ARTICLE INFO

Article history:

Received: 4 March 2022;

Received in revised form:
29 March 2022;

Accepted: 4 April 2022;

Keywords

Millet,
Indian Sweets.

ABSTRACT

Millet is one of the oldest foods known to humans and pearl millet (*Pennisetum glaucum*) is the most widely grown type of millet. To test the acceptability and cost effectiveness of pearl millet based Indian sweets, establish their nutritional superiority and to promote them among school-going adolescent girls. Pearl millet was selected, procured, cleaned, roasted and milled. The milled flour was sieved repeatedly to get a fine flour. The flour was stored at room temperature in airtight HDPE. The pearl millet flour was incorporated in Indian sweets such as *appam*, Sweet *murukku*, Sesame balls, Groundnut balls and Roasted bengal gram balls. *Appam* (PMA), sesame balls (PMSB), groundnut balls (PMGB) and roasted bengal gram balls (PMRB) contained 40 percent of pearl millet flour and sweet *murukku* (SPMM) contained 60 percent of pearl millet flour. Their acceptability was evaluated, nutrient content and the Cost Effective Ratio (CER) were calculated. An overall acceptability score percentage of 90 and above was obtained by all the prepared sweets namely, sesame balls, groundnut balls, roasted Bengal gram balls and sweet *murukku*. Pearl millet *appam* and control sweet *murukku* which obtained a score of 86.67 percent and 87.56 percent respectively. The cost of preparation of 100 g of pearl millet based sweets and their control is well below Rs. 10. Pearl millet based Indian sweets are low cost recipes and highly acceptable.

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Introduction

The term millet is widely used to refer to a variety of grains which have substantial potential in making the genetic diversity in the food, thereby, warranting an improvement in the food and nutrition security (Mal *et al.*, 2010). Millets are very popular for their culinary uses as well as their health promoting qualities. Millet is known to be one of the oldest foods and it is possible that it was the first cereal grain used for domestic uses (Sharma, 2008).

The most extensively grown millet is pearl millet (*Pennisetum glaucum*). Pearl millet is a drought tolerant and dual purpose crop of rain fed area (Nambiar *et al.*, 2011). Pearl millet has a lower energy content when compared to rice but has a higher protein, fat and micronutrients (iron, phosphorus, zinc and calcium) than most other cereals.

The present project “**Formulation, acceptability and promotion of pearl millet (*Pennisetum glaucum*) incorporated Indian sweets**” aims

- To test the acceptability and cost effectiveness of pearl millet based Indian sweets
- To establish the nutritional superiority of pearl millet based sweets over the normal recipe
- To promote the pearl millet sweets among school-going adolescent girls

Methodology

Pearl millet grains were selected, cleaned, roasted, milled, sieved and stored. The pearl millet flour was incorporated in Indian sweets such as *appam*, Sweet *murukku*, Gingelly balls, Groundnut balls and Roasted bengal gram balls. The base flour used for control *appam* (CA) and

Control Sweet *murukku* (CSM) was rice flour and for Control Sesame balls (CSB), Control Groundnut balls (CGB) and Control Roasted bengal gram balls (CRB) was semolina.

Table1. Percentage of substitution with pearl millet in Indian sweets

| Items | Percentage of substitution of base flour in the recipes with pearl millet |
|---------------------------|---|
| Appam | 67 |
| Sesame balls | 100 |
| Groundnut balls | 100 |
| Roasted bengal gram balls | 100 |
| Sweet murukku | 100 |

The consumer acceptability of each product was evaluated with the help of twenty five semi trained members (aged between twenty five and thirty) using the nine point hedonic scale with scores ranging from 1 to 9, where 1 denotes “dislike extremely”, 5 denotes “neither like nor dislike” and 9 indicates “like extremely”. The parameters assessed were color, appearance, flavor, texture, taste and over all acceptability (Devi and Nazni, 2016). The mean value of the twenty five scores was taken for evaluating the quality (Kultha, Throat and Lande, 2017).

The nutrient content of the pearl millet sweets was determined by factorial method. The cost and effect (viz. iron, calcium and zinc content) of the formulated pearl millet based Indian sweets and their control were assessed. The pearl millet based Indian sweets were popularized among two hundred adolescent girls who belonged to sixth, seventh,

eighth, and ninth standards of St. Ann's High School, Coonoor. Popularization of pearl millet was done with charts, pamphlets and a demonstration of pearl millet roasted bengal gram balls recipe. The results were consolidated, tabulated and statistically analyzed for proper interpretation.

Results and discussion

Appam

The light brown color of the Control *Appam* (8.68 ± 0.61) was more appealing than the dark brown color of PMA (8.52 ± 1). The pearl millet *appam* had obtained a score 8.36 ± 1.54 for flavor. The control *appam* had a pleasant roasted flavor (8.6 ± 0.74). The control *appam*'s texture was better (8.68 ± 1.44) than the texture of pearl millet *appam* (8.48 ± 1.44). The control *appam* tasted better (8.64 ± 0.68) and the pearl millet *appam*'s taste score (8.32 ± 1.08) was 3.7 percent lower than that of the control due to its bitter after taste. Vaijapurkar *et al.* (2015) also found that pearl millet incorporated biscuits tasted bitter. Overall pearl millet *appam* (7.8 ± 1.87) was less acceptable than control *appam* (8.48 ± 1.38).

Sesame Balls

The color and appearance of control sesame ball was 8.84 ± 0.61 and pearl millet sesame balls was 8.2 ± 1.74 . Devi and Sangeetha (2013) also found an undesirable brown color in pearl millet pasta. The flavor score of both; the control and pearl millet sesame balls, was 8.96 ± 0.19 . The taste score of pearl millet sesame balls (8.48 ± 1.06) was 1.9 percent higher than that of the control sesame balls (8.32 ± 1.08). Pearl millet sesame balls' texture (9 ± 0) was better than the control balls' (8.64 ± 0.68) texture. The overall acceptability of pearl millet sesame balls (8.8 ± 0.561) was 1.85 percent above that of the control (8.64 ± 0.68).

Groundnut Balls

Dark brown colored PMGB was rated 5.9 percent lower (8.28 ± 1.61) than the control balls (8.8 ± 0.54), as it was less enticing. The flavor score of PMGB was 8.68 ± 0.61 and its control balls was 8.96 ± 0.19 . The control groundnut balls was hard in texture (8.76 ± 0.81) and pearl millet groundnut balls was soft and not crumbly in texture (8.96 ± 0.19). Due to the raw taste of the groundnut flour in "pearl millet groundnut balls"; the PMGB obtained a score of 8.32 ± 1.08 which is 4.4 percent lower than the taste score of Control balls (8.7 ± 0.44). The overall acceptability of PMGB (8.60 ± 0.74) was 2.2 percent lower than that of the control groundnut balls. Singh and Mehra's study (2017) had also demonstrated that addition of increasing levels of pearl millet flour (upto 100 percent) in *ladoo* affected the quality of sensory attributes yet the *ladoo* prepared with pearl millet flour was acceptable and can be utilized.

Roasted Bengal Gram Balls

The color and appearance score of Pearl Millet Roasted Bengal gram Balls was 8.84 ± 0.61 and that of control balls was 8.92 ± 0.39 . The control ball was compact and tightly packed whereas the PMRB was crumbly in texture. The ground pearl millet had imparted a crumbly texture for the PMRB; and this could be the reason for the lower texture score of PMRB (8.84 ± 0.61) when compared to the score of control balls (8.96 ± 0.19). Panelists rated the taste of CRB at 98.2 percent, (8.84 ± 0.61), very much higher than that of "pearl millet roasted Bengal gram balls" score of 8.32 ± 1.08 (92.4 percent) because the roasted semolina in CRB imparted a better taste. For both, PMRB and CRB, the flavor score was 97 percent (8.8 ± 0.56). The overall acceptability of control balls was higher (8.71 ± 0.44) compared to that of PMRB (8.64 ± 0.68). Singh *et al* (2012) had also replaced wheat

flour with pearl millet flour in bread making to some extent with good acceptability.

Sweet Murukku

A high score of 8.76 ± 0.81 was obtained by "control sweet *murukku*" and the "sweet pearl millet *murukku*", received a score of 8.36 ± 1.46 for color and appearance. For flavor, both the control and SPMM obtained a score of 8.68 ± 0.61 which is 96.44 percent, because both had an agreeable roasted flavor. SPMM texture (8.44 ± 0.98) score was 43.5 percent higher than the control score (5.88 ± 2.06). SPMM tasted (8.76 ± 0.81) better than control *murukku* (7.56 ± 1.67). Suma *et al* (2014) had also revealed that pearl millet cookies had a crispy and crumbly texture which enhanced their sensory appeal making them highly palatable.

Comparison of overall acceptability of the prepared recipes:

Pearl millet *appam* and control sweet *murukku* obtained a score of 86.67 percent and 87.56 percent respectively for overall acceptability. All the other recipes obtained an overall acceptability score percentage of 90 and above. Of all the items formulated and prepared, Pearl millet Sesame Balls and Control Groundnut Balls obtained the highest overall acceptability score (97.78 percent). The study of Dudhate *et al*, 2017 also revealed that the iron, phosphorus and zinc content of *Kharodi* increased on addition of pearl millet.

Comparison of the nutritional value of the prepared sweets:

All the pearl millet recipes had high micronutrients (calcium, iron, phosphorus and zinc) content. Pearl millet sesame balls had the highest amount of protein (18 g), ash (5.87 g), fat (37.98 g), insoluble fiber (17.01 g), energy (3317.4 KJ), carbohydrate (77.29 g), calcium (1231.10 mg), iron (16.75 mg), phosphorus (731.96 mg) and zinc (8.51 mg), in comparison to all the other formulated recipes. Pearl millet *appam* had a lower protein (6.71 g), ash (1.43 g), fat (2.34 g), insoluble fiber (4.05 g), calcium (55.24 mg), iron (4.55 mg), phosphorus (164.61 mg) and zinc (1.53 mg) when compared to the other pearl millet incorporated sweets.

Cost-effect ratio:

The cost of preparation of 100 g of pearl millet based sweets and their control was well below Rs. 10. Pearl millet *appam* was the cheapest with a cost of Rs. 5. SPMM's price was Rs. 5.74. Sesame seeds, groundnut and roasted bengal gram dal balls cost was either Rs. 7 or Rs. 7.05. For a same or lower cost, pearl millet based sweets contributed a higher amount of iron, phosphorus and zinc.

Conclusion

Overall, pearl millet based Indian sweets were highly acceptable. Micronutrients content was more in pearl millet incorporated sweets. The cost price of formulated sweets was low. Therefore, these affordable sweets can help people of all age groups and income status to combat micronutrient deficiencies.

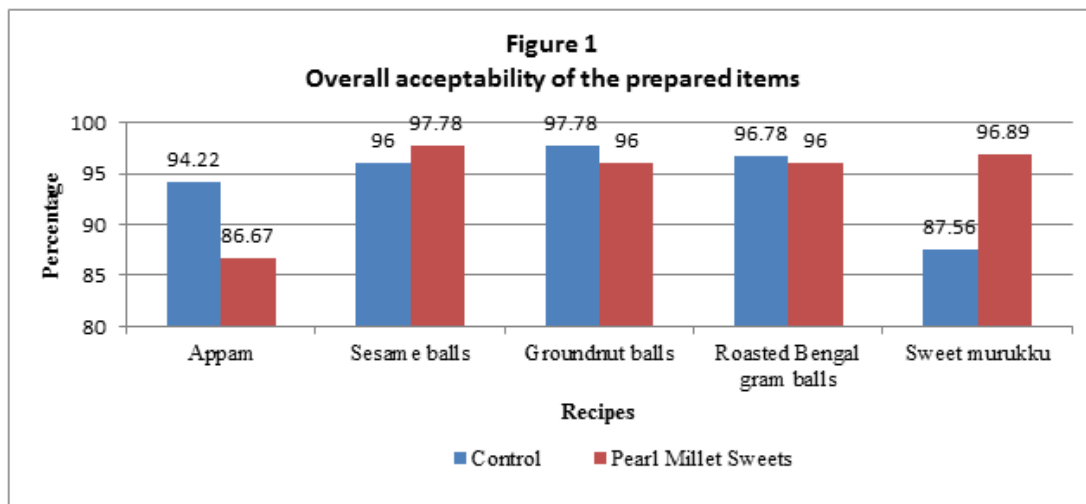


Table 2. Comparison of the nutritional value of the prepared sweets

| Nutrients/100g | Pearl Millet Appam (PMA) | Pearl Millet Sesame Balls (PMSB) | Pearl Millet Groundnut Balls (PMGB) | Pearl Millet Roasted Bengal Gram Balls (PMRB) | Sweet Pearl Millet Murukku (SPMM) |
|---------------------|--------------------------|----------------------------------|-------------------------------------|---|-----------------------------------|
| Protein (g) | 6.71 | 18 | 12.03 | 11.40 | 7.38 |
| Ash (g) | 1.43 | 5.87 | 1.70 | 1.70 | 2.18 |
| Fat (g) | 2.34 | 37.98 | 14.11 | 3.81 | 3.33 |
| Insoluble fibre (g) | 4.05 | 17.01 | 6.41 | 7.46 | 5.52 |
| Energy (KJ) | 1473 | 3317 | 1679 | 1440 | 1479 |
| Carbohydrate(g) | 74.3 | 77.29 | 55.33 | 64.17 | 71.74 |
| Calcium (mg) | 55.24 | 1231.10 | 59.24 | 56.94 | 61.87 |
| Iron (mg) | 4.55 | 16.75 | 4.99 | 5.78 | 5.86 |
| Phosphorus(mg) | 165 | 732 | 225 | 236 | 204 |
| Zinc (mg) | 1.53 | 8.51 | 2.19 | 2.33 | 1.85 |

Table 3. Cost of the prepared sweets

| Sweets | Control (Rs) | Pearl Millet Sweets (Rs) |
|---------------------------|--------------|--------------------------|
| Appam | 5.40 | 5.00 |
| Sesame balls | 7.05 | 7.05 |
| Groundnut balls | 7.00 | 7.00 |
| Roasted Bengal gram balls | 7.05 | 7.05 |
| Sweet murukku | 6.34 | 5.74 |

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