Development, Organoleptic and Nutritional Evaluation of Bajra Sev Supplemented with Mango Seed Powder

VATSALA SAHARAN*, MANJEET[1] AND RENU SHRESTHA[2]

Department of Nutrition and Dietetics, Faculty of Allied Health Sciences, SGT University, Gurugram-122 505 (Haryana), India
*(e-mail: vatsala.saharan@gmail.com; Mobile: 97117 93395)

ABSTRACT

Snacks hold significant importance in the food industry, offering a wide range of options to consumers. "Sev" a traditional Indian fried snack made from bengal gram flour, has been enjoyed for its texture and aroma. The objective of this study was to develop bajra sev enriched with mango seed powder, striking a balance between taste, texture and nutritional value. The incorporation of mango seed powder at different concentrations (5, 10 and 15 g) in bajra sev was evaluated for its nutritional composition and organoleptic acceptability. The results showed that the bajra sev enriched with 10 g of mango seed powder demonstrated the highest nutritional value. The sensory evaluation indicated that the enriched bajra sev was well-accepted in terms of colour, appearance, aroma, texture, taste and overall acceptability. Incorporation of mango seed powder in the formulation of bajra sev offers a delightful and nutritious snack option with potential health advantages.

Key words: Bajra, mango seed powder, nutritional analysis, organoleptic

INTRODUCTION

Snacks play a significant role in the food industry, as they offer a wide range of options to consumers (Verma *et al.,* 2023). Categorizing snacks can be challenging due to the diverse choices. However, they can be generally classified as sweet or savory and further categorized as light or substantial (Patel *et al.,* 2019). Moreover, snacks can possess qualities such as being healthy or purely indulgent, contributing to the diverse landscape of the food industry.

One category of snacks that holds widespread popularity is fried snacks, which are cooked by submerging them in oil, packaged in bags and consumed as a snack between meals. Fried foods are highly favoured by consumers due to their distinctive sensory characteristics, including taste, texture, colour, and overall appeal. The frying process serves multiple purposes, such as cooking the food thoroughly, enhancing its flavour, providing energy and creating a pleasant texture in the final product. Additionally, frying leads to several nutritional changes. The energy content of the food significantly rises due to a considerable increase in its fat content (Sarojani *et al.,* 2021).

Among the well-known fried snack, "Sev" is a well-known traditional Indian snack food that is deep-fried. It is traditionally made from bengal gram flour (besan) and includes additives like salt, spices and sodium bicarbonate. Additional ingredients are incorporated to enhance the crispy and crunchy texture, sensory appeal and overall quality of the fried product. With the increasing popularity and consumption of snack on a daily basis, there is a growing demand for more nutritious and cost-effective options (Namitha *et al.,* 2019). Sev consists of small, crispy noodles and is a popular snack variety in India. It can be easily prepared at home using a mixture of whole bengal gram flour and rice flour, which can be stored for weeks in airtight containers (Verma *et al.,* 2023). It is loved for its texture and aroma and is enjoyed as a well established snack food in various parts of the country (Patel *et al.,* 2019).

In this study, the development of bajra sev enriched with mango seed powder emerges as

[1]Department of Agricultural Extension, Faculty of Agricultural Sciences, SGT University, Gurugram-122 505 (Haryana), India.
[2]Department of Dietetics and Applied Nutrition, Amity Medical School, Amity University, Manesar, Gurugram-122 413 (Haryana), India.

a delightful and nutritious choice. With the growing demand for more nutritious and cost-effective snack alternatives, bajra sev stands out as a popular traditional Indian snack that combines the goodness of pearl millet (bajra) and the nutritional benefits of mango seed powder.

Mango seed powder has unique nutritional advantage to the bajra sev. Though, it is discarded as waste after consumption of mangoes. The mango seed kernel is an under estimated powerhouse of essential nutrients. It contains a significantly higher nutritional value compared to the mango pulp, offering a well-balanced amount of proteins, carbohydrates and oils. Furthermore, the mango seed kernel is rich in calcium, iron, potassium and magnesium, making it an excellent addition to any diet (Rai *et al.*, 2020). The seed kernel provides all the essential nutrients required by our bodies and a substantial portion of the recommended daily allowance (RDA) when consumed in sufficient quantities. It is particularly beneficial when cooked through methods like boiling or roasting (Patel and Kheni, 2018). A wide range of nutritious dishes, including snacks, curries, bread, milk alternatives (similar to almond milk), desserts and various other recipes, can be prepared using the mango seed kernel. Instead of being discarded, it is highly recommended to incorporate it into our diet (Choudhary *et al.*, 2023).

Pearl millet known as bajra, on the other hand, stands out as the traditional crop among various types of millets and is extensively cultivated in regions across Asia and Africa. Pearl millet, scientifically known as *Pennisetum glaucum* and commonly referred to as bajra, is a highly nutritious grain (Satankar *et al.*, 2020). It is an excellent source of energy, providing 361 Kcal per 100 g (Singh *et al.*, 2018). The carbohydrate composition of pearl millet grains includes starch, dietary fiber and soluble sugars. Moreover, pearl millet is gluten-free. In terms of protein content, pearl millet typically contains 9 to 13% of protein. Pearl millet protein stands out with its elevated levels of lysine, threonine, methionine and cystine when compared to the protein compositions of sorghum and maize. Moreover, pearl millet has a higher concentration of tryptophan (Patni and Agarawal, 2017). Pearl millet, often referred to as a "Nutri-cereal," plays a significant role in addressing global hunger by providing an affordable solution in terms of essential micronutrients like zinc and iron. Pearl millet possesses a range of bioactive compounds such as phenolics, phospholipids, flavonoids and linoleic acid (Sarojani *et al.*, 2021). Pearl millet is nutritionally comparable to other popular cereals and its kernels are rich in phytochemicals and phenolic compounds. This makes it a valuable source of both animal feed and human food. Furthermore, these bioactive components act as natural antioxidants in food and biological systems, offering health benefits and potential effectiveness against various health conditions caused by different factors. The objective of the study was to develop healthy traditional snack. Therefore, bajra sev enriched with mango seed powder was taken into consideration, in regard to the consumer choice for fried snacks. By incorporating nutrient rich ingredient, the aim was to strike a balance between taste, texture and nutritional value, offering a unique twist to the traditional fried snacks.

MATERIALS AND METHODS

All the raw ingredients for research purpose were purchased in a single lot from the local market of Dwarka mor, New Delhi, India. All the dry ingredients were cleaned manually to remove damaged seeds, stones, dust, light materials, glumes, stalks and other extraneous materials. Cleaning was done by hand sorting. After cleaning, all the raw ingredients were packed in an airtight container for further use.

The final yield of deep fat fried sev was measured and calculated as the total product obtained by the total blend used expressed as g/100 g. The time taken by sev for cooking was measured using a stopwatch and expressed as minutes and seconds. Water was added to mix ingredients using a measuring glass till the dough was soft and pliable consistency. The amount of water absorbed by the flour was measured as ml per 100 g.

Sensory evaluation of the developed product was carried out by a panel of 10 members of the Department of Nutrition and Dietetics, SGT University, Gurugram. Each of them was served the developed bajra sev incorporated with mango seed powder with one control and

three test samples. Control was prepared from ingredients used in a standardized recipe (Table 1 and Fig. 1) and test samples were prepared by using different quantities of mango seed powder. The judges were asked to score the bajra sev for six sensory attributes: colour, appearance, taste, texture, aroma and overall acceptability by using a scorecard and a 9-point hedonic scale.

Table 1. Standardized recipe of bajra sev

Ingredients	Per 100 g
Bajra flour (BF)	30 g
Gram flour (GF)	60 g
Semolina flour (SF)	10 g
Ajwain	3 g
Kasturi methi	2 g
Salt	3 g
Chilli powder	2 g
Oil	5 ml

Bajra flour, besan, sooji and mango seed powder

↓

Mixed with all spices, oil and water

↓

Kneaded to make dough

↓

Filled in sev machine

↓

Extruded into a pan in frying at 180°C

↓

Drained excess oil

↓
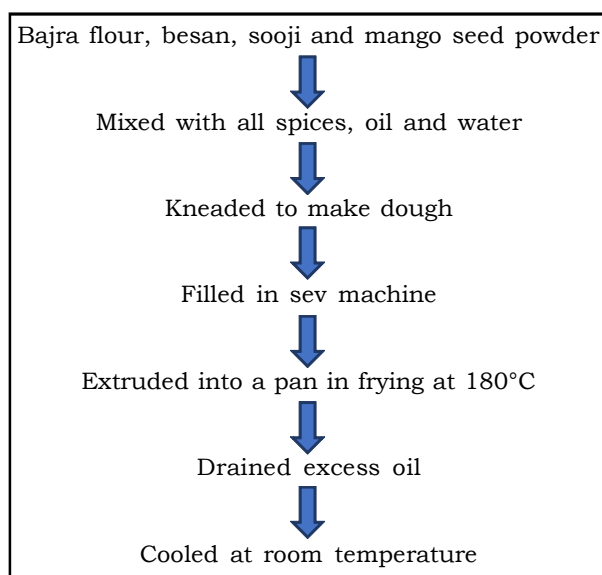
Cooled at room temperature

Fig. 1. Flow diagram for bajra sev preparation.

Proximate composition was estimated by employing the standard method of analysis. Total carbohydrate was estimated by calculation method as:

Total carbohydrate (%) = 100 – [crude protein + crude fat + crude fibre + ash].

Total energy was calculated theoretically by using the following conversion factors 4.0, 4.0 and 9.0 Kcal/100 g for protein, carbohydrates and fat, respectively. Calcium and magnesium were determined by Atomic Absorption Spectrophotometer. The collected data were presented in result as mean and standard deviation. The average sensory scores value of the formulated bajra sev was statistically analyzed by using PSPP.

RESULTS AND DISCUSSION

The effect of mango seed powder on colour of bajra sev score ranged from 7.3 to 6.15. Best score was secured by test sample T_0 (7.3±0.48) which had 0 g of mango seed powder, after that test sample T_1 (7.05±0.37) which had 5 g of mango seed powder, test sample T_2 (6.75±0.23) which had 10 g of mango seed powder and least score was T_3 (6.15±0.67) which had 15 g of mango seed powder in it. There were slight changes in the colour after adding different concentrations of mango seed powder (Table 1). The effect of mango seed powder on the appearance of bajra sev score ranged from 7.1 to 6.75. Best score was secured by test sample T_0 (7.1 ± 0.39) which had 0 g of mango seed powder, after that test sample T_1 (7 ± 0.41) which had 5 g of mango seed powder, test sample T_2 (6.85 ± 0.47) which had 10 g of mango seed powder and least score was T_3 (6.75±0.42) which had 15 g of mango seed powder in it. There were slight changes in the appearance after adding different concentrations of mango seed powder.

The effect of mango seed powder on aroma of bajra sev score ranged from 7.5 to 6.75. Best score was secured by test sample T_0 (7.5 ± 0.42) which had 0 g of mango seed powder, after that test sample T_1 (7.3 ± 0.42) which had 5 g of mango seed powder, test sample T_2 (7.25 ± 0.34) which had 10 g of mango seed powder and least score was T_3 (6.95 ± 0.5) which had 15 g of mango seed powder in it. There were slight changes in the aroma after adding different concentration of mango seed powder (Table 1). The effect of mango seed powder on texture of bajra sev score ranged from 7.45 to 6.3. Best score was secured by test sample T_2 (7.45 ± 0.82) which had 10 g of mango seed powder, after that test sample T_0 (7.35 ± 0.47) which had 0 g of mango seed powder, test sample T_1 (6.9 ± 0.88) which had 5 g of mango seed powder and least score was T_3 (6.3 ± 0.48) which had 15 g of mango seed powder in it. There were changes in the texture after adding different concentration of mango seed powder.

The effect of mango seed powder on taste of bajra sev score ranged from 7.32 to 6.85. Best score was secured by test sample T_2 (7.32 ± 0.79) which had 10 g of mango seed powder,

Table 2. Mean value of sensory attributes of bajra sev supplemented with mango seed powder

Type of bajra sev	Colour	Appearance	Aroma	Texture	Taste	Overall acceptability
Control (T_0) BF:GF:SF 30:60:10	7.30±0.48	7.10±0.39	7.51±0.42	7.35±0.47	7.00±0.41	7.25±0.42
Supplementation level (%) (MSP:BF:GF:SF)						
T_1 (5:30:55:10)	7.05±0.37	7.00±0.41	7.30±0.42	6.9±0.88	7.15±0.76	7.10±0.32
T_2 (10:30:50:10)	6.75±0.23	6.85±0.47	7.25±0.34	7.45±0.82	7.32±0.79	7.41±0.42
T_3 (15:30:45:10)	6.93±0.88	6.15±0.67	6.75±0.42	6.3±0.48	6.85±0.72	6.33±0.71
C. D. (P≤0.05)	0.08	0.42	0.36	0.27	0.09	0.16

MSP-Mango seed powder, BF-Bajra flour, GF-Gram flour and SF-Semolina flour (sooji).

after that test sample T_1 (7.15 ± 0.76) which had 5 g of mango seed powder, test sample T_0 (7 ± 0.41) which had 0 g of mango seed powder and least score was T_3 (6.85 ± 0.72) which had 15 g of mango seed powder in it. There were changes in the taste after adding different concentration of mango seed powder (Table 2). The effect of mango seed powder on overall acceptability of bajra sev score ranged from 7.4 to 6.3. Best score was secured by test sample T_2 (7.4 ± 0.42) which had 10 g of mango seed powder, after that test sample T_0 (7.25 ± 0.42) which had 0 g of mango seed powder, test sample T_1 (7.1 ± 0.32) which had 5 g of mango seed powder and least score was T_3 (6.3 ± 0.71) which had 15 g of mango seed powder in it. There were slight changes in the overall acceptability after adding different concentration of mango seed powder.

It was found that the maximum yield of sev was obtained in T_3 (125) with 15 g of mango seed powder, followed by T_2 (123) with 10 g of

mango seed powder, T_1 (118) with 5 g of mango seed powder and T_0 (115) with 0 g of mango seed powder (Table 3). It was found that the maximum frying time was taken by T_3 (9:30) with 15 g of mango seed powder, followed by T_2 (6:25) with 10 g of mango seed powder, T_1 (4:25) with 5 g of mango seed powder and T_0 (3:10) with 0 g of mango seed powder. It was found that the maximum water uptake was taken by T_3 (55) with 15 g of mango seed powder, followed by T_2 (45) with 10 g of mango seed powder, T_1 (35) with 5 g of mango seed powder and T_0 (30) with 0 g of mango seed powder.

Nutritional determination was conducted only for the control (T_0) and sample scored best in sensory evaluation out of T_1, T_2 and T_3 which was T_2. The average mean of protein in the test (T_2) 13.81 was slightly higher than control (T_0) 11.25 g/100 g (Table 4). But the average carbohydrate in the test (T_0) 64.12 was slightly higher than control (T_2) 62.82 g/100 g. However, the average mean of fat 15.91, energy

Table 3. Physical attributes of bajra sev supplemented with mango seed powder

Treatment	Frying time (minutes:second)	Yield (per 100 g flour)	Water uptake (ml)
T_0 (BF:GF:SF) (30:60:10)	3:10	115	30
T_1 (MSP:BF:GF:SF) (5:30:55:10)	4:25	118	35
T_2 (MSP:BF:GF:SF) (10:30:50:10)	6:25	123	45
T_3 (MSP:BF:GF:SF) (15:30:45:10)	9:30	125	55

MSP-Mango seed powder, BF-Bajra flour, GF-Gram flour and SF-Semolina flour (sooji).

Table 4. Proximate composition, mineral and energy content of bajra sev supplemented with mango seed powder

Parameters	Control (T_0) BF:GF:SF 30:60:10	Test (T_2) MSP:BF:GF:SF 5:30:55:10	CD (P≤0.05)
Protein (g)	11.25±0.82	13.81±0.91	0.36
Carbohydrate (g)	64.12±1.42	62.82±1.12	0.41
Fat (g)	15.89±1.02	15.91±1.09	0.27
Energy (Kcal)	444.49±2.62	449.71±2.92	0.44
Calcium (mg)	406.5±2.10	433.15±2.13	0.16
Magnesium (mg)	767.12±2.76	796.74±2.84	0.28

Table 5. Cost of bajra sev supplemented with mango seed powder by adding the cost of each raw ingredients

Ingredients	Price (Rs./100 g)	T_0 (Rs.)	T_1 (Rs.)	T_2 (Rs.)	T_3 (Rs.)
Mango seed powder (g)	132	-	6.6	13.2	19.8
Bajra flour (g)	11.6	3.48	3.48	3.48	3.48
Besan (g)	8.8	3.96	3.52	3.08	2.64
Sooji (g)	11.2	1.12	1.12	1.12	1.12
Ajwain (g)	38	1.14	1.14	1.14	1.14
Kasturi methi (g)	84	1.68	1.68	1.68	1.68
Salt (g)	25	0.75	0.75	0.75	0.75
Chilli powder (g)	50	1	1	1	1
Oil (5 ml)	115	5.75	5.75	5.75	5.75
Total		18.8	25.04	31.2	37.36

449.71, calcium 433.15 and magnesium 796.74 was slightly higher than control (T_0) 15.89 and 444.49 g/100 g and 406.5 and 767.12 mg/kg, respectively.

The cost for the developed bajra sev supplemented with mango seed powder ranged from 37.36 to 18.8 of the experimental samples (Table 5). The cost of T_1 was (Rs. 25.04), T_2 (Rs. 31.2), T_3 (Rs. 37.36), whereas control T_0 (Rs. 18.8) which was minimum.

CONCLUSION

The addition of mango seed powder to bajra sev offered numerous advantages, including improved nutritional content and the utilization of a by-product that would otherwise be wasted. The incorporation of mango seed powder at varying amounts (5, 10 and 15 g) resulted in organoleptically acceptable and nutritionally superior compared to the control group. Among the supplemented bajra sev samples, 10 g of mango seed powder exhibited the most significant improvement across various nutritional parameters. Notably, protein, fat, energy, calcium and magnesium content which increased in T_2 compared to T_0, while carbohydrates were lower in T_1 compared to T_0. Consequently, the nutrient rich bajra sev can be consumed by individuals of all age groups, contributing to improved consumer health and serving as a beneficial dietary supplement.

REFERENCES

Choudhary, P., Devi, T. B., Tushir, S., Kasana, R. C., Popatrao, D. S. and K. N. (2023). Mango seed kernel: A bountiful source of nutritional and bioactive compounds. *Food Bioprocess Tech.* **16**: 289-312.

Namitha, M. Y., Chavan, U. D., Kotecha, P. M. and Lande, S. B. (2019). Studies on nutritional and storage qualities of foxtail millet Sev. *Studies* **4**: *Int. J. Food Sci. Nut.* **4**: 72-77.

Patel, G. N. and Kheni, J. (2018). Mango seed kernel, a highly nutritious food, should we continue to trash or use? *J. Pharm. Phytochem.* **7**: 04-07.

Patel, S. K., Khan, M. A., Rana, G. K. and Mehra, M. (2019). Formulation, development and quality assessment of nutri-rich snack food (Sev). *Asian J. Dairy Food Res.* **38**: 257-260.

Patni, D. and Agrawal, M. (2017). Wonder millet-pearl millet, nutrient composition and potential health benefits–A review. *Int. J. Innov. Res. Rev.* **5**: 06-14.

Rai, A. K., Das, H. and Dash, S. R. (2020). Mango seed: A potential source of nutrition from waste. *Indian Farmer* **7**: 244-248.

Sarojani, J., Karkannavar, S. S., Nayak, G., Bharati, P. and Govinkoppa, N. (2021). Physico-chemical and nutritional composition of proso millet varieties. *The Pharma Innov. J.* **10**: 136-140.

Sarojani, J. K., Hegde, S. C., Desai, S. R. and Naik, B. K. (2021). Standardization and nutrient composition of the proso millet chakli. *Biol. Forum–An Int. J.* **13**: 44-50.

Satankar, M., Kumar, U., Patil, A. K. and Kautkar, S. (2020). Pearl millet: A fundamental review on underutilized source of nutrition. *Multilogic Sci.* **10**: 1081-1084.

Singh, N., Singh, S. P., Kumar, M., Kanhiya, K. and Kumar, A. (2018). Nutri cereal pearlmillet: way forward. *Int. J. Curr. Microbiol. App. Sci.* **7**: 578-581.

Verma, T., Dey, P., Aggarwal, A., Devpal, R. and Sharma, R. (2023). Optimization and storage study of garlic (*Allium sativum*) incorporated herbal multi-millet sev snack. *Food Chem. Adv.* **3**: 100365. *doi: 10.1016/j.focha.2023.100365.*