International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(10): 547-554
www.biochemjournal.com
Received: 21-07-2025
Accepted: 25-08-2025

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Formulation and standardization of value-added *Puran* with nutritional characterization of raw materials

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DOI: https://www.doi.org/10.33545/26174693.2025.v9.i10Sg.5885

Abstract
Traditional Indian foods are gaining attention for their cultural significance and potential for nutritional enhancement through value addition. The present study aimed at the formulation and standardization of value-added *Puran* by incorporating soybean with Bengal gram to improve its nutritional profile. The raw materials used for product development were analysed for their proximate composition (moisture, protein, fat, carbohydrate, fiber, and ash) along with mineral and phytochemical content to assess their nutritional contribution. Based on preliminary trials, different formulations of *Puran* were developed and its product (*Puran poli*) evaluated for sensory attributes including colour and appearance, texture, flavour, taste, and overall acceptability using a trained panel. Among the formulations, the optimized recipe demonstrated a balance between enhanced nutritional value and consumer acceptability. The findings highlight that soybean incorporation significantly improves the protein and mineral content of *Puran* without adversely affecting its sensory quality. This research suggests that soybean-enriched value-added *Puran* can serve as a nutritious traditional food product, contributing to dietary protein intake and supporting functional food development.

Keywords: Value-added *Puran*, soybean incorporation, nutritional composition, recipe standardization, sensory evaluation, traditional foods

Introduction
Traditional foods have long been central to cultural diets, valued across generations. The rise of industrialized food production in the mid-20th century created a divide between mass-produced, uniform products with unclear origins and small-scale, artisanal foods that foster trust through traceable raw materials. Though artisanal production methods may not always be transparent, consumers perceive them as more authentic. Globalization has both challenged and revived traditional foods, and since the 1990s, efforts to promote and preserve them have emphasized their cultural and nutritional importance [1].

Traditional foods reflect cultural heritage and offer vital nutrients such as vitamins, minerals, antioxidants, and fiber that support health. They are associated with reduced risks of chronic diseases like heart disease, diabetes, and obesity. Incorporating them into modern diets can promote healthier eating patterns and prevent nutrition-related illnesses [2].

Puran poli, a traditional delicacy of Marathi cuisine, is widely prepared during festivals and auspicious occasions. It is also popular across India under different names *Poli* in Tamil, *Lanchipoli* in Malayalam, *Bobbatlu* in Andhra Pradesh, *Vermi* in Gujarati, *Bakshalu* in Telugu, and *Holige* in Karnataka. The dish consists of a thin outer layer (*Kanaka*) encasing a sweet filling (*Hoorna*), resembling a chapatti. Like chapatti, its shelf life is limited to 24-36 hours, after which spoilage or textural decline may occur depending on storage conditions [3].

Puran, the filling for *Puran poli,* is made from cooked chickpea dhal, sweetened with sugar or jaggery, and flavoured with cardamom and nutmeg. Its recipe varies regionally in ingredient proportions, highlighting the need to standardize formulation and processing parameters to ensure consistent quality for consumers [4].

Pulses, known as the "poor man's meat," are rich in protein and serve as an essential food in developing countries. As leguminous crops, they improve soil fertility through nitrogen fixation while supporting both economic and environmental sustainability [5].

Chickpea (*Cicer arietinum* L.), also called Bengal gram or garbanzo bean, is an ancient legume and among the earliest seven crops domesticated during the Neolithic period in the Fertile Crescent of the Near East [6]. In developing countries, chickpeas are a staple crop consumed in diverse forms across regions. According to the World Health Organization, they are low in calories yet rich in non-starch polysaccharides, vitamins, minerals, and fiber. Along with other pulses, their high nutritional value makes chickpeas a potential functional food for managing health conditions [7].

Soybean (Glycine max), also called soja bean or soya bean, is an annual legume from the Leguminosae family. As the world's most significant bean crop, it provides vegetable protein for millions and serves as a key ingredient in numerous chemical products. Originating in China, where it has been cultivated for around 5,000 years, soybean spread to Southeast Asia, reached Europe in the 18th century, and was introduced to America in the 19th century [8]. Soybean is a major global source of vegetable oil and animal protein feed [9]. Soybean boasts the highest protein content (40-42%) among food crops and ranks second only to groundnut in oil content (18-22%) among food legumes [10].

Soybean is recognized as a health-promoting food owing to its abundance of isoflavonoids and folic acid. It is a major plant-based protein source, providing essential amino acids along with various health benefits. Its content of polyunsaturated fatty acids and high-quality fats further enhances its value as a nutritionally significant nutraceutical [11, 12].

Soybeans possess certain undesirable traits such as beany flavor, bitterness, flatulence-causing compounds, and anti-nutritional factors that hinder their direct use in foods compared to other legumes. Research shows their incorporation in traditional foods is generally acceptable only at 10-20%, which modestly improves protein quality but limits nutritional impact. Higher inclusion levels could further enhance protein and energy value, but acceptability decreases. To address this, processing methods such as soaking in salt and sodium bicarbonate have been used effectively to reduce off-flavours and flatulence-causing compounds, thereby improving consumer acceptance [13].

Cardamom (*Elettaria cardamomum*), known as the "Queen of Spices," is a perennial herb of the Zingiberaceae family, mainly cultivated in southern India, Sri Lanka, Guatemala, and Southeast Asia. Valued for its distinct aroma and flavor, it is a key ingredient in culinary practices such as *garam masala*. Beyond its culinary role, cardamom has therapeutic potential due to 1,8-cineole, which exhibits antiseptic, expectorant, and anti-inflammatory effects. Traditionally used in Ayurveda for respiratory, digestive, and infectious ailments, its pharmacological properties are now being validated through modern research [14].

Nutmeg (*Myristica fragrans*), obtained from the seed and its aril (mace) of the Myristicaceae family, is valued for its diverse health benefits. Its phytochemical constituents such as myristicin, sabinene, and terpinene-4-ol exhibit antimicrobial, anti-inflammatory, antioxidant, antidiabetic, antidepressant, anticonvulsant, and anticancer activities [15, 16]

Sugar was selected as the sweetening agent in the preparation of value-added *Puran* in place of traditional jaggery due to several practical and sensory considerations. One of the primary reasons is its positive impact on shelf life. As explained in [17] that sucrose acts as an effective natural preservative by reducing water activity in foods, limiting moisture available for microbial growth and thereby preventing spoilage. Its hygroscopic nature enhances this effect by absorbing moisture, extending the shelf life of products like jams, jellies, fruit preserves, and sweet sauces. Sugar also improves texture, flavor, and microbial safety while preventing enzymatic browning, thus maintaining the natural color of preserved foods.

Table sugar, a disaccharide of glucose and fructose, as a rapid energy source due to its quick digestion and absorption. Widely used in foods and beverages, sucrose enhances flavor, texture, and palatability [18].

Food processing and value addition play a crucial role in ensuring safe, nutritious, and convenient foods while reducing waste, extending shelf life, and enhancing nutritional quality. These processes not only support food security but also increase farm incomes by creating value-added products. The food industry is increasingly adopting innovative, cost-effective technologies that meet consumer demand for healthier options. Value addition can be achieved through preservation, fortification, incorporation of functional ingredients, and skill development, thereby improving product quality, market value, and diversification [19].

The need for value-addition in traditional recipes stems from the growing demand for foods that balance cultural heritage with modern nutritional requirements, as consumers increasingly seek healthier, nutrient-dense options without sacrificing familiar flavours. Traditional Indian dishes, often rich in carbohydrates but lacking in protein or micronutrients, can benefit from the incorporation of ingredients like soybean, millets, or fortified flours to enhance protein quality, micronutrient content, and bioactive compounds, thereby addressing dietary deficiencies and promoting health benefits such as improved cardiovascular function [20].

Incorporating soybean into traditional recipes like *Puran* is economically feasible due to its wide availability, affordability, and high nutritional value. As a low-cost source of quality protein and bioactive compounds, with stable global production and strong domestic supply in India, soybean offers a cost-effective means of enhancing the nutritional profile of traditional foods [21].

In this context, the present study focuses on the formulation and standardization of value-added *Puran* through soybean incorporation, along with the nutritional characterization of its raw materials. By evaluating both the nutritional profile and the sensory attributes of the developed product, the study aims to enhance the nutritional quality of a traditional food without compromising its acceptability. This approach not only contributes to the preservation and modernization of traditional recipes but also supports the development of affordable, protein-rich value-added foods that can help address nutritional needs in diverse populations.

Materials and Methods

Materials

Procurement of raw materials

The MAUS-725 soybean variety was obtained from the College of Agriculture, VNMKV, Parbhani. All other components needed for making *Puran*, such as Bengal gram dal, sugar, nutmeg powder and cardamom powder were of food grade quality and purchased from local markets in Parbhani 431402.

Chemicals and glassware
Analytical grade chemicals and reagents, along with adequate glassware, were readily available in the laboratories of the Department of Food Science and Nutrition, College of Community Science, and the Department of Food Process and Technology, College of Food Technology, VNMKV, Parbhani (Maharashtra).

Equipment and utensils
All essential equipment and utensils used for performing experiment and for analysis of nutritional profile of selected raw materials for value-added *Puran* were made available and utilized in the laboratories of the Department of Food Science and Nutrition, College of Community Science, and the Department of Food Chemistry and Nutrition, College of Food Technology, VNMKV, Parbhani (Maharashtra).

Methods
Analytical methods
Proximate analysis
Proximate composition including moisture, fat, protein, ash and mineral content were determined as per the method given by [22]. Crude fibre was determined by following the method No. 32-10 as described in [23]. The total carbohydrate content in the sample was calculated by subtracting the combined percentages of moisture, protein, fat, ash, and crude fibre per 100 g of the sample from 100.

Mineral analysis
The mineral composition of the raw materials used in value-added *Puran* preparation, including elements such as calcium, phosphorus, magnesium, iron, zinc, manganese and others, was analysed following the protocols outlined in [24].

Phytochemical analysis
The method described by [25] was followed with slight modifications for the analysis of total phenolic content and total flavonoid content. Total phenolic content was determined by the modified Folin-Ciocalteu colorimetric method based on the oxidation-reduction reaction. The total flavonoid content of extracts was estimated by the aluminium chloride colorimetric method with some modifications.

Preparation of soybean dal from whole soybean
To prepare soybean dal from whole soybeans, the process begins with cleaning to remove impurities like dirt and stones. The soybeans are then soaked in water for 6 to 8 hours to soften the seed coat, followed by dehulling to remove the outer hull using mechanical dehullers. The dehulled soybeans are split into cotyledons (dal) using roller mills, then dried to 8-10% moisture content via sun or mechanical drying. Dal is graded for size and quality before being packaged in airtight containers. Finally, the dal is stored in cool, dry conditions to ensure shelf stability.

Whole Soybean
↓
Cleaning
↓
Soaking (in potable water for 6-8 hours)
↓
Dehulling
↓
Splitting (using dal mill/pulse splitter)
↓
Drying (to reduce moisture to 8-10%)
↓
Sieving and Grading (to remove broken/undersized particles)
↓
Packing (in moisture-proof packaging)
↓
Storage (in cool, dry conditions)

Fig 1: Processing steps involved in the Soybean dal preparation from whole Soybean

Preparation of Value-added *Puran* prepared with incorporation of soybean

Selection of ingredients
↓
Cleaning of Bengal Gram dal and Soybean dal
↓
Pressure Cooking the Bengal gram Dal and Soybean dal (until soft)
↓
Draining Excess Water
↓
Grinding Cooked Dal to Fine Paste
↓
Addition of Sugar to Dal Paste
↓
Cooking Mixture on low Flame
↓
Addition of Flavouring Agents such as Cardamom and Nutmeg powder
↓
Stirring Continuously Until Mixture Thickens
↓
Cooling of *Puran* Mixture
↓
Use as filling for *Puran Poli* or Other Products

Fig 2: Traditional *Puran* with incorporation of Soybean dal.

The product development aimed to enhance the nutritional value of traditional *Puran* by partially replacing Bengal gram dal with soybean dal (5, 10, 15, and 20%). Cardamom and nutmeg powders were added to balance flavour, ensuring desired taste, texture, and traditional appeal while improving protein and fibre content. Bengal gram and soybean dals were cleaned, pressure-cooked, and blended into a smooth paste, then combined with sugar and cooked on low heat with continuous stirring. Spices were added as the mixture thickened, and cooking continued for 20-25 minutes until a semi-solid texture suitable for filling was obtained. The prepared *Puran* was cooled and either used immediately in Puran poli or stored hygienically for later use.

Preparation of dough of wheat flour and preparation of *Puran poli*

To prepare the dough for *Puran poli*, whole wheat flour was sifted, kneaded with water for 8-10 minutes into a smooth, elastic dough, and softened with 1-2 tablespoons of oil or ghee and a pinch of salt. The dough was rested under a moist cloth for 30-45 minutes to aid gluten formation. It was then divided into portions, shaped into discs, and filled with a measured amount of Bengal gram-soybean *Puran*. The filled balls were rolled into flatbreads (6-7 inches) and cooked on a preheated iron tava until golden-brown spots appeared on both sides, brushing with ghee or oil for enhanced flavour. The *Puran poli* was served hot or cooled for later evaluation.

Sieving of Whole Wheat Flour
↓
Addition of Water (and optional salt, ghee/oil)
↓
Kneading of Dough (8-10 minutes)
↓
Resting of Dough (30-45 minutes under damp cloth)
↓
Use dough for preparation of *Puran poli*

Fig 3: Preparation of Dough from whole wheat flour

Rounding and weighing of dough (60 g)
↓
Weighing and rounding of *Puran* (30 g)
↓
Stuffing of *Puran* in dough and rounding of dough
↓
Flatting of dough by rolling pin and Board like Chapati (6-7inch diameter)
↓
Cooking of *Puran poli* on frying pan up to desired colour and flavour (with ghee/oil)
↓
Cooked *Puran poli*

Fig 4: Method of preparation of prepared product of *Puran* (*Puran poli*) (Adapted from [3])

Standardization of process and recipe formulation of traditional *Puran* with incorporation of Soybean.

The *Puran* was prepared in Department of Food Science and Nutrition of the College of Community Science VNMKV, Parbhani (MS). The recipe formulation for preparation of traditional *Puran* with incorporation of Soybean dal. mentioned in Table 1 and standardization of traditional *Puran* with incorporation of Soybean dal in Table 2.

Table 1: Recipe formulation of traditional *Puran* with incorporation of different levels of Soybean dal.

Ingredients (g)	T_0 (Control)	T_1	T_2	T_3	T_4
Bengal gram dal	100	95	90	85	80
Soybean dal	00	05	10	15	20
Table Sugar	99	99	99	99	99
Cardamom powder	0.8	0.8	0.8	0.8	0.8
Nutmeg Powder	0.2	0.2	0.2	0.2	0.2

Table 2: Standardized recipe for preparation of traditional *Puran* with incorporation of different levels of Soybean dal.

Ingredients	Quantity (g)	Quantity (%)
Bengal gram dal	85	42.5%
Soybean dal	15	7.5%
Table Sugar	99	49.5%
Cardamom powder	0.8	0.4%
Nutmeg Powder	0.2	0.1%

Sensory evaluation

The sensory characteristics of the products were evaluated by a panel of 30 academic staff members from the College of Community Science in Parbhani. Sensory evaluation for the acceptability of all 5 samples (control, T_1, T_2, T_3, T_4) was done using a 9-point Hedonic scale. Five samples of Puran and the prepared product were evaluated based on their color and appearance, texture, taste, flavour and overall acceptability.

Statistical analysis

The collected data were systematically arranged, tabulated, and subjected to statistical evaluation. Each sample was analysed in triplicate to ensure reliability. Variance analysis was conducted using the standard ANOVA procedure. The data from various treatments were documented and analysed statistically using a Completely Randomized Design, as described by [26], to assess significance levels. The ANOVA results indicated statistical significance at the $p < 0.05$ threshold. Standard error (SE±) and critical difference (CD) at the 5% level were reported where applicable.

Results and Discussion

Proximate composition of selected raw materials.

The study investigates the nutritional composition of raw materials used in the formulation of the value-added *Puran*, with specific focus on moisture, protein, fat, carbohydrate, ash, and crude fiber content. These proximate components, expressed on a percentage basis, are presented in Table 3. Analyzing the proximate composition of raw materials is essential for understanding the nutritional contribution of each ingredient to the final product.

Table 3: Proximate composition of selected raw materials

Chemical parameters (%)	Samples of selected raw materials				
	Bengal gram dal	Soybean dal	Table sugar	Cardamom powder	Nutmeg powder
Moisture	9.85±0.06	8.19±0.08	3.41±0.05	17.61±0.04	11.24±0.04
Fat	5.71±0.04	28.29±0.05	_	13.7±0.03	24.36±0.03
Protein	20.6±0.02	37.74±0.05	_	1.15±0.04	16.7±0.05
CHO	57.36±0.02	16.01±0.07	95.54±0.08	44.65±0.05	30.76±0.08
Crude fibre	3.68±0.03	5.59±0.02	_	14.96±0.05	13.81±0.03
Ash	2.8±0.02	4.18±0.07	1.05±0.03	7.93±0.03	3.14±0.02

*Values are Mean ± SD of three determinants

The tabulated data represents the proximate composition of Bengal gram dal, Soybean dal, Table sugar, Cardamom powder and Nutmeg powder, the raw materials utilized in the development of the value-added *Puran*. As depicted in Table 3, Bengal gram was found to contain approximately 9.85 percent moisture, 5.71 percent fat, 20.6 percent protein, 57.36 percent carbohydrates, 3.68 percent crude fiber and 2.8 percent ash. These values are in close agreement with earlier reviewed by [27].

On the other hand, soybean dal showed a composition of 8.19 percent moisture, 28.29 percent fat, 37.74 percent protein, 16.01 percent carbohydrates, 5.59 percent crude fibre and 4.18 percent ash. These results align well with the findings of [28], indicating the high protein and fat content typical of soybean. The inclusion of both the ingredient in the *Puran* formulations contributes significantly to its nutritional value.

Tabulated results for granulated table sugar, cardamom powder and nutmeg powder revealed distinct nutritional profile granulated sugar was composed 3.41 percent moisture, 95.54 percent carbohydrate, 1.05 percent ash with negligible protein, fat and crude fibre as reported by [29].

Cardamom powder exhibited approximately 17.61 percent moisture, 13.7 percent fat, 1.15 percent protein, 44.65 percent carbohydrate, 14.96 percent crude fibre and 7.93 percent of ash. These values correspond with [30].

Proximate analysis of nutmeg powder closely aligns with the values reported by [31]. Observed a 11.24 pe cent moisture, high fat content 24.36 percent, 16.7 percent protein, 30.76 percent carbohydrates, 13.81 percent crude fibre and 3.14 percent of ash.

Mineral composition of selected raw materials.

Mineral composition of the selected raw materials was analyzed to assess their contribution to the overall nutritional value of the developed product. Minerals such as Ca, P, Fe, Mg, Mn and Zn play vital role in human health, and their presence in the raw ingredients is essential for the enhancing the functional and dietary quality of the final formulation. The result obtained provide insights into the mineral richness of each ingredient, which supports their selection for product development and justifies their role in improving the nutritional profile of the value-added *Puran*. Table 4 presents the mineral profiles of these raw materials.

Table 4: Mineral composition of selected raw materials

Minerals (mg/100 g)	Samples of selected raw materials				
	Bengal gram dal	Soybean dal	Table sugar	Cardamom powder	Nutmeg powder
Ca	54.41±0.05	301.2±0.04	19.63±0.06	109.55±0.08	166.93±0.04
P	334±0.04	693.36±0.04	_	150.78±0.08	137.75±0.08
Fe	5.09±0.07	17.78±0.02	_	11.93±0.05	7.85±0.05
Zn	1.66±0.04	2.24±0.05	_	1.65±0.05	0.61±0.04
Mg	132.97±0.07	260.55±0.04	_	103.47±0.09	57.36±0.07
Mn	1.16±0.03	2.4±0.07	_	28.88±0.03	1.3±0.03

* Values are Mean ± SD of three determinants

The tabulated data reveals the mineral content in different raw mineral samples i.e., Bengal gram dal, soybean dal, table sugar, cardamom powder and nutmeg powder. Bengal gram dal demonstrated substantial mineral values Ca (54.41 mg/100 g), P (334 mg/100 g), Fe (5.09mg/100 g), Zn (1.66 mg/100 g), Mg (132.97 mg/100 g) and Mn (1.16 mg/100 g). The study showed that Bengal gram was good sources as Ca, P, Fe, Mg, Mn and Zn. The close reading reviewed by [27].

Tabulated results indicate that soybean dal an essential ingredient in formulation of *Puran* revealed Ca (301.2 mg/100 g), P (693.36 mg/100 g), Fe (17.78 mg/100 g), Zn (2.24 mg/100 g), Mg (2.24 mg/100 g), Mn (2.4 mg/100 g) closely mirroring values reported by [32].

In analyzing the mineral content of table sugar, detected only Ca (19.63 mg/100 g) other minerals are below detectable levels this aligns with [33] which reports same.

Cardamom powder exhibited (109.55 mg/100 g) Ca, (150.78 mg/100 g) P, (11.93 mg/100 g) Fe, (1.65 mg/100 g) Zn, (103.47 mg/100 g) Mg and (28.88 mg/100 g) Mn. These values are similar to [30].

As shown in table 4 nutmeg powder contained (166.93 mg/100 g) Ca, (137.75 mg/100 g) P, (7.85 mg/100 g) Fe, (0.61 mg/100 g) Zn, (57.36 mg/100 g) Mg and (1.3 mg/100 g) Mn. These results are closely related with values reported by [31].

Phytochemicals present in selected raw materials.

Phytochemicals are naturally occurring non-nutritive bioactive compounds found in plant-based foods, known for their role in promoting health and preventing chronic diseases. In the preparation of *Puran* raw ingredients used such as Bengal gram dal, soybean dal, cardamom powder, nutmeg powder that are rich in beneficial phytochemicals. Analyzing the phytochemical content of these raw materials helps in understanding their health promoting potential and support the nutritional value of traditional recipes. The given table present TPC and TFC of the raw materials used in the formulation of *Puran*

Table 5: Phytochemical composition of selected raw materials

Sample	Phytochemical composition of selected raw materials	
	Total phenols (mg GAE/gm)	Total flavonoids (mg QE/gm)
Bengal gram dal	43.18±0.15	178.65±0.12
Soybean dal	47.29±0.12	196.46±0.14
Cardamom Powder	6.68±0.07	1.65±0.09
Nutmeg Powder	53.70±0.14	562.58±0.27

***** Values are Mean ± SD of three determinants

As shown in the table, the TPC and TFC varied significantly among the raw materials used for *Puran* preparation. Bengal gram dal founded 43.18 mg GAE/gm total phenols and 178.65 mg QE/gm total flavonoids. Similarly, TPC observed in soybean dal 47.29mg GAE/gm and TFC 196.46 mg QE/gm. Comparable levels were quantified in earlier studies by [34]

As presented in the above table TPC present in cardamom powder 6.68 mg GAE/gm and TFC 1.65 mg QE/gm . Similar results were observed by [35]. The data in table revealed that total phenols of nutmeg 53.70 mg GAE/gm and total flavonoids 562.58 mg QE/gm. These results supported by [31].

Table 3: Sensory evaluation of prepared product of *Puran* (*Puran poli*) with different formulations of Soybean dal and Bengal gram dal

Sample	Sensory attributes				
	Colour and Appearance	Flavour	Taste	Texture	Overall acceptability
T_0	8.8	8.9	9.0	8.9	8.9
T_1	8.7	8.5	8.7	8.5	8.6
T_2	8.4	8.2	8.2	8.4	8.3
T_3	8.8	8.6	8.8	8.6	8.7
T_4	8.0	7.6	7.7	7.9	7.8
SE±	0.02	0.02	0.06	0.05	0.05
CD at 5%	0.06	0.07	0.18	0.16	0.14

* Each value is the mean value of all sensory reports

The sensory scores of *Puran poli* prepared with different formulations of soybean dal and Bengal gram dal *Puran* are presented in Table 3 The data revealed that all samples were well accepted by the panelists, with mean scores ranging between 7.6 and 9.0 for different sensory attributes.

For colour and appearance, the maximum score (8.8) was obtained by T_0 and T_3, which were at par with each other, followed by T_1 (8.7). The lowest score (8.0) was recorded in T_4, which was, however, significantly different from the control (T_0).

With respect to flavour, T_0 recorded the highest score (8.9), closely followed by T_3 (8.6), while T_4 obtained the minimum (7.6). The difference between treatments was significant as indicated by the CD value (0.07).

The taste of the products also varied significantly among treatments. T_0 registered the maximum score (9.0), followed by T_3 (8.8) and T_1 (8.7). The minimum score was obtained in T_4 (7.7), which was significantly lower than the control.

Regarding texture, T_0 scored the highest (8.9), followed by T_3 (8.6). Treatments T_1 and T_2 recorded moderate scores (8.5 and 8.4, respectively), whereas T_4 had the lowest (7.9). The CD value (0.16) indicated that the differences were statistically significant.

For overall acceptability, T_0 was most preferred (8.9), followed by T_3 (8.7), while T_1 and T_2 were moderately accepted with scores of 8.6 and 8.3, respectively. T4 was the least preferred (7.8). The significant CD value (0.14) further confirmed that incorporation of higher levels of soybean dal adversely affected acceptability.

In general, it was observed that the control sample (T_0) consistently recorded the highest sensory scores, while moderate incorporation (T_3) was also well accepted and comparable to the control. However, higher substitution levels (T_4) resulted in lower scores for all attributes, indicating a negative impact on sensory quality. These findings suggest that soybean dal can be successfully incorporated at moderate levels without adversely affecting the consumer acceptability of *Puran poli*.

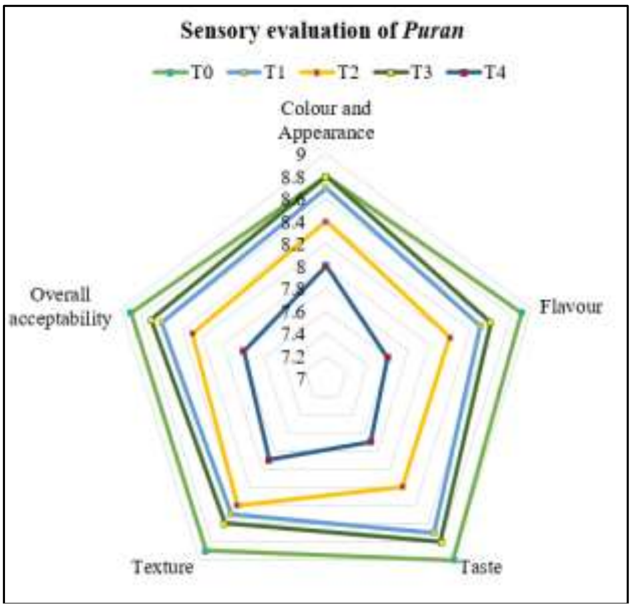

Fig 5: Sensory evaluation of *Puran* prepared with and without incorporation of soybean dal

Conclusion

The present study successfully formulated and standardized a value-added *Puran* by incorporating soybean along with Bengal gram, aiming to enhance its nutritional profile while retaining sensory acceptability. Nutritional characterization of the raw materials revealed soybean as a rich source of high-quality protein, essential fatty acids, minerals, and bioactive compounds, whereas Bengal gram contributed significantly to carbohydrates, dietary fiber, and micronutrients. The optimized formulation demonstrated improved nutritional quality, particularly in protein and micronutrient content, without compromising traditional taste, texture, and overall acceptability. This highlights the potential of soybean incorporation as an effective strategy for value addition in traditional recipes. Furthermore, the study emphasizes that utilizing nutrient-dense raw materials in culturally familiar foods can promote better nutritional security, consumer acceptance, and economic feasibility, thereby supporting both public health and food innovation.

Acknowledgment
I express my deep sense of gratitude to Dr. Vijaya Pawar, my Research Guide, Professor and Head, Department of Food Process Technology, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani for her invaluable guidance, encouragement, and constant support throughout the course of this research work. I am also thankful to the faculty members and staff of the Department of Food Science and Nutrition for their cooperation and for providing the necessary facilities during the study. I sincerely appreciate the timely help and suggestions of the laboratory staff and my fellow students.
Above all, I am deeply indebted to my family for their unconditional love, encouragement, and moral support, which motivated me throughout this journey and enabled me to successfully complete my research.

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