

Formulation, Standardization and Sensory Evaluation of Punarnava (*Boerhavia diffusa*) Soup Cube

Anu Priya N^{*1} and Dhanusri S. P²

¹⁻² Food Science, Nutrition and Dietetics, Department of Home Science, Shrimathi Devkunvar Nanalal Bhatt Vaishnav College for Women (Affiliated to University of Madras, Chennai), Chromepet - 600 044, Chennai, Tamil Nadu, India

Abstract

Punarnava soup cube is a novel product formulated with the medicinal herb Punarnava (*Boerhavia diffusa*) known for its therapeutic properties like nephroprotective, antidiabetic and anti-inflammatory activities. This study is aimed to standardize the formulation and evaluate the sensory attributes of Punarnava soup cube. Various treatments were developed, considering different ratios of Punarnava leaves, vegetables, spices, and flavor enhancers. The sensory evaluation was conducted to assess parameters such as appearance, flavor, taste, texture, and overall acceptability. Statistical analysis was performed to determine significant differences among treatments and to identify the most preferred treatment. The most accepted treatment was T5(100g- Punarnava leaves) which was assessed in comparison to the control soup cube. The findings provide insights into optimizing the formulation of Punarnava soup cube to meet consumer preferences while retaining its medicinal benefits. This research contributes to the development of functional food products incorporating traditional medicinal herbs for enhanced health benefits.

Key words: *Boerhavia diffusa*, Punarnava, Soup cube, Herb, Soup

In today's food market, ready-to-eat/serve and ready-to-cook products have acquired a substantial share, serving as the closest replacement for regular meals. Young consumers, in particular, show a propensity to spend on these products due to their convenience, texture, and pleasant taste throughout the shelf life. The demand for ready-to-eat and ready-to-cook foods has increased among consumers globally, leading to a shift away from traditional cooking options. These food products are widely accepted and popular due to their ease of preparation, storage, and consumption. Various snacks fall under the ready-to-eat food category, including biscuits, bread, sandwiches, rolls, soups, chips, fruits and vegetable salads, breakfast cereals, and dairy products. The list of products under this category continues to expand, with new additions almost every day [8].

The nutritional and medicinal advantages of green leafy vegetables contribute significantly to human well-being. These vegetables, alongside numerous edible herbs employed in daily kitchens, offer diverse health benefits. Green leafy vegetables serve as cost-effective and readily available sources of essential fibers, vitamins, minerals, amino acids, and disease-protective substances [5]. The chemical constituents within green leafy vegetables hold considerable pharmacological and medicinal importance. Phytonutrients found in these vegetables contribute to various health benefits, including protection against eye problems, combating oxidative stress, and addressing iron deficiency. The incorporation of green leafy foods into one's diet not only enhances nutritional status but also reduces the risks of specific diseases such as diabetes, cancer, and hepatotoxicity [2]. Some green leafy vegetables are still

unknown to the public, one such green leafy vegetable with great nutritional benefit is *Boerhavia diffusa*.

Punarnava, identified botanically as *Boerhaavia diffusa* Linn, is widely utilized for its significant medicinal properties and therapeutic benefits [7]. *Boerhavia diffusa* (BD) Linn., a member of the Nyctaginaceae family, is esteemed in traditional Indian medicine. Within the framework of Ayurveda, *Boerhavia diffusa* is designated as a "rasayana" herb, renowned for its purported anti-aging properties, rejuvenating effects, enhancement of vitality and cognitive function, and prophylactic potential against diseases [4].

The *Boerhavia* genus encompasses approximately 40 species native to tropical and subtropical regions. It commonly emerges as a weed during the rainy seasons across the Indian subcontinent, as well as in both Northern and Southern America, and Southeastern Africa. It is named after a 18th century Dutch physician, Hermann Boerhaave, while the specific epithet derives from its characteristic diffuse branching pattern [6]. *Boerhavia diffusa* is reputedly endowed with numerous pharmacological properties, exhibiting versatility in its abilities such as antifungal, anticancer, antibacterial, antidiabetic, antiparasitic, cardioprotective, hepatoprotective, nephro-protective, anti-inflammatory, and antifertility effects [3]. Every part of the plant has its own health benefits, in this study the Punarnava leaves were selected for the formulation of the soup cube owing to its nutritional and disease preventive characteristics.

Objectives

***Correspondence to:** Anu Priya N, E-mail: anusai09061998@gmail.com

- To formulate and standardize Punarnava (*Boerhavia diffusa*) soup cube.



Fig 1 Punarnava leaves [1]



Fig 2 Punarnava seeds [1]



Fig 3 Punarnava roots [9]

MATERIALS AND METHODS

A) Selection and procurement of ingredients

All the ingredients required for the study such as Punarnava leaves, Arrowroot flour, mixed herbs, pepper, salt and vegetables such as onion, potato and carrot are procured from the local market from Pallavaram, Chennai.

B) Formulation and standardization of punarnava soup cube

Punarnava soup cubes are prepared by adding punarnava leaves, onion, potato, carrot, arrowroot flour, mixed herbs and

- To analyze the sensory attributes of the Punarnava (*Boerhavia diffusa*) soup cubes.

spices. These cubes are subjected to five different variations, labeled as T1, T2, T3, T4, and T5, respectively.

C) Sensory evaluation

The soup cubes were prepared by dissolving one cube (25g) in 50ml of hot water and then evaluated for product acceptability by a panel of 10 untrained members using a 9-point hedonic scale. Panelists used a scorecard to rate the product from 1 to 9, with 1 indicating extreme dislike and 9 indicating extreme liking, across various attributes including appearance, taste, flavor, consistency, color, and overall acceptability.

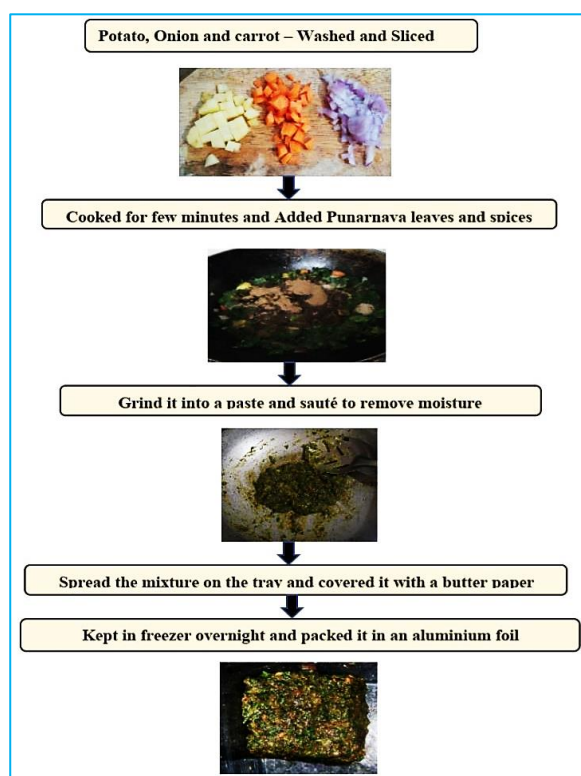


Fig 4 Method of preparation of Punarnava soup cube



Fig 5 Different treatments of Punarnava soup cube

Table 1 Variation proportion of ingredients

Treatment	Vegetable mix (Potato, Onion, Carrot)	Spices	Mixed herbs	Punarnava leaves	Arrowroot powder
Control	50g	25g	15g	-	50g
T1	50g	25g	15g	20g	50g
T2	50g	25g	15g	40g	50g
T3	50g	25g	15g	60g	50g
T4	50g	25g	15g	80g	50g
T5	50g	25g	15g	100g	50g

RESULTS AND DISCUSSION

A) Sensory evaluation

Sensory evaluation is essential for ensuring food quality, optimizing product development, and satisfying consumer preferences in the competitive market. (Table 2) displays the mean acceptability scores and standard deviations for the

control soup cube C and five different treatments of Punarnava soup cube (T1, T2, T3, T4, T5). In this experiment, treatment V exhibited high acceptability across all parameters, including appearance, taste, flavor, consistency, and overall acceptability, compared to other treatments. Treatment V (T5) scored 8.8, 8.73, 8.66, 8.7 and 8.93 respectively for appearance, taste, flavor, consistency, and overall acceptability.

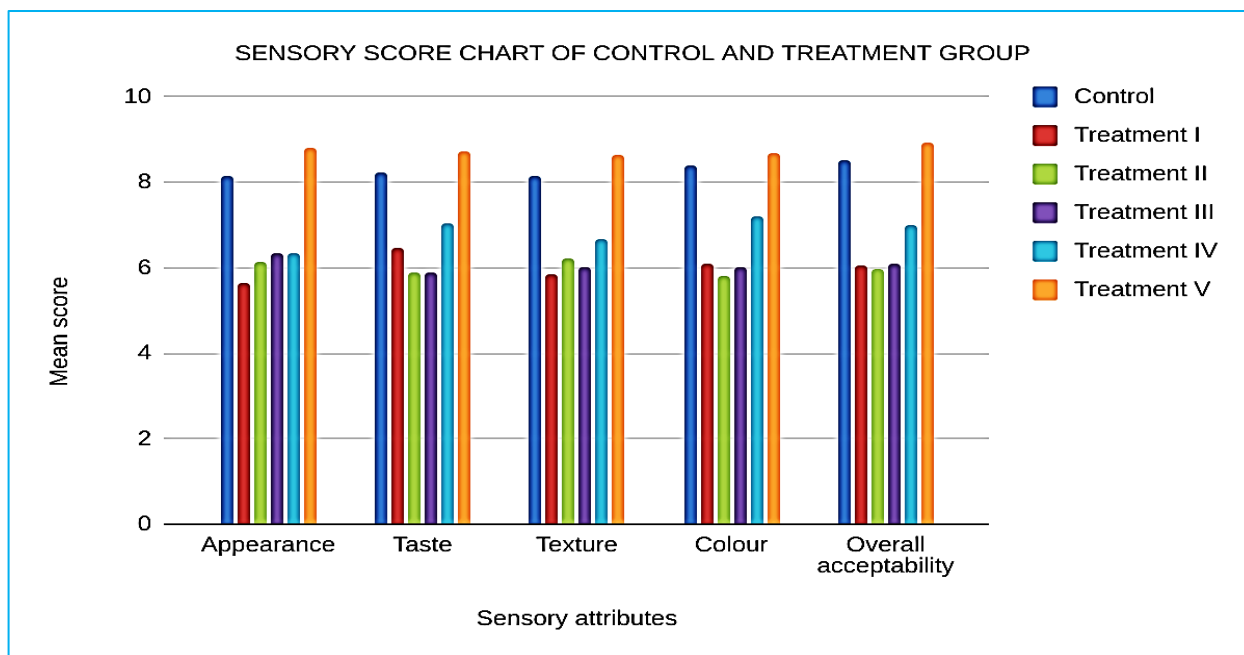


Fig 6 Sensory score chart of control and treatment group

Table 2 Mean and standard deviation scores of control and treatment groups

Sensory attributes	Control (C)	T1	T2	T3	T4	T5
Appearance	8.13±0.73	5.63±0.88	6.13±0.89	6.36±0.92	6.33±0.80	8.8±0.40
Taste	8.23±0.77	6.46±0.89	5.9±1.06	5.9±0.88	7.03±0.85	8.73±0.44
Texture	8.16±0.79	5.83±1.44	6.2±0.92	6.03±0.96	6.66±1.18	8.66±0.54
Colour	8.41±0.60	6.1±0.844	5.8±0.76	6±0.90	7.2±0.84	8.7±0.46
Overall acceptability	8.5±0.62	6.06±0.82	5.96±0.71	6.1±0.84	7±0.83	8.93±0.25

Table 3 Statistical inference of control and treatment V

Sensory attributes	Types	Mean	Standard deviation (SD)	t - value (0.05%) [d.f/v=19 (n-1)]	Rejection (H0) / acceptance (Ha)
Appearance	Control	8.13	0.73	0.000052	H0- Rejected
	Treatment V	8.8	0.40		Ha- Accepted
Taste	Control	8.23	0.77	0.0033	H0- Rejected
	Treatment V	8.73	0.44		Ha- Accepted
Texture	Control	8.16	0.79	0.0060	H0- Rejected
	Treatment V	8.66	0.54		Ha- Accepted
Colour	Control	8.41	0.60	0.011	H0- Rejected
	Treatment V	8.7	0.46		Ha- Accepted
Overall acceptability	Control	8.5	0.62	0.00091	H0- Rejected
	Treatment V	8.93	0.25		Ha- Accepted

*t-value indicates that significant difference at 5% level significance

B) Statistical conclusion

Based on the table provided, the t-values for sensory attributes (color, taste, texture, appearance, and overall acceptability) are higher for Treatment V compared to all other variations, including the control. Hypotheses related to this comparison could be formulated as follows:

The study focused on the development of Punarnava soup cubes, leveraging the medicinal properties of Punarnava (*Boerhavia diffusa*), a well-known herb recognized for its therapeutic benefits. Five variations of the soup cubes were crafted and assessed for sensory attributes, with Treatment V (T5), containing 100g of Punarnava leaves, emerging as the preferred option. Statistical analysis reinforced the significant divergence between Treatment V and the control, underscoring

CONCLUSION

its appeal to consumers. The research underscores the potential of Punarnava soup cubes, particularly Treatment V, in integrating traditional medicinal herbs into convenient functional food products. With a specialized formulation targeting kidney ailments and a low glycemic index suitable for diabetic patients, the product offers tailored health benefits. Moreover, its hepatoprotective qualities cater to individuals

with liver issues, adding to its versatility. Beyond its health advantages, the Punarnava soup cube presents a multifaceted solution. Its nutrient richness, cost-effectiveness, and time-saving nature align with consumer demands for convenient dietary options. The ready-to-consume format further enhances its appeal, making it a convenient choice for individuals seeking both health benefits and convenience in their dietary regimen.

Table 4 Statistical conclusion

Hypothesis	Null hypothesis (H0)	Alternate hypothesis (Ha)	Conclusion
Appearance	There is no significant difference in sensory attribute appearance between control and T5	There is a significant difference in sensory attribute appearance between control and T5	The alternate hypothesis is accepted because the table value showed that there is a significant difference of appearance between control and Treatment - V. It shows that Treatment - V has higher sensory attribute appearance which is more than the control.
Taste	There is no significant difference in sensory attribute taste between control and T5	There is a significant difference in sensory attribute taste between control and T5	The alternate hypothesis is accepted because the table value showed that there is a significant difference of taste between control and Treatment - V. It shows that Treatment - V exhibits a superior sensory attribute in taste compared to the control group.
Texture	There is no significant difference in sensory attribute texture between control and T5	There is a significant difference in sensory attribute texture between control and T5	The alternate hypothesis is accepted because the table value showed that there is a significant difference of texture between control and Treatment - V. It shows that Treatment - V has higher sensory attribute texture which is more than the control.
Colour	There is no significant difference in sensory attribute colour between control and T5	There is a significant difference in sensory attribute colour between control and T5	The alternate hypothesis is accepted because the table value showed that there is a significant difference of colour between control and Treatment - V. It shows that Treatment - V has higher sensory attribute colour which is more than the control.
Overall acceptability	There is no significant difference in sensory attribute overall acceptability between control and T5	There is a significant difference in sensory attribute overall acceptability between control and T5	The alternate hypothesis is accepted because the table value (2.50) showed that there is a significant difference of overall acceptability between control and Treatment - V. It shows that Treatment - V has higher overall acceptability which is more than the control.

LITERATURE CITED

1. Asma, I. A., Ganesh, V., Jeevitha, K., Francis, M. M., Rao, A. M., & Rajaraman, B. (2023). A detailed review of the plant *Boerhaavia diffusa* Linn [Punarnava] on its phytopharmacology and therapeutic uses. *World Journal of Pharmaceutical and Medical Research*, 9(9).
2. Banerjee, S., Joglekar, A., & Mishra, M. (2015). A critical review on importance of green leafy vegetables. *Int J Appl Home Sci*, 2(3), 124-32.
3. Das, S., Singh, P. K., Ameeruddin, S., Kumar Bindhani, B., Obaidullah, W. J., Obaidullah, A. J., Mishra, S., & Mohapatra, R. K. (2023). Ethnomedicinal values of *Boerhaavia diffusa* L. as a panacea against multiple human ailments: a state of art review. *Frontiers in chemistry*, 11, 1297300.
4. Govindarajan R, Vijayakumar M, Pushpangadan P. Antioxidant approach to disease management and the role of 'Rasayana' herbs of Ayurveda. *Journal of Ethnopharmacology*. 2005;99(2):165–178.
5. Kumar, D., Kumar, S., & Shekhar, C. (2020). Nutritional components in green leafy vegetables: A review. *Journal of Pharmacognosy and Phytochemistry*, 9(5), 2498-2502.
6. Mishra, S., Aeri, V., Gaur, P. K., & Jachak, S. M. (2014). Phytochemical, therapeutic, and ethnopharmacological overview for a traditionally important herb: *Boerhaavia diffusa* Linn. *BioMed research international*, 2014, 808302.
7. Raj, Divya & P Y, Ansary & Oommen, Sara & V V, Shincymol. (2023). A review on Punarnava -*Boerhaavia diffusa* Linn. 10.13140/RG.2.2.23716.24966.
8. Temgire, S., Borah, A., Kumthekar, S., & Idate, A. (2021). Recent trends in ready to eat/cook food products: A review. *Pharma Innovation*, 10(5), 211–217.
9. Thakur C, Dahiya K. 2020. Traditional importance of Punarnava: *Boerhaavia diffusa*. *International Journal of Botany Studies* 5(2): 62-64.