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Standardization of process variables for development of traditional Indian dairy product herbal apple *rabri* with improved organoleptic, textural, antioxidants, functional attributes and shelf life

Rajnee Lata[1], Ved Prakash Jaiswal[2], Veena Paul[1], Abhishek Dutt Tripathi[1*], Aparna Agarwal[3] and Dinesh Chandra Rai[1]

Abstract

Rabri is a concentrated whole milk product from India that has been heat desiccated and sweetened. Herbs are reported to possess therapeutic properties. The addition of these herbs in the food enhances the functionality of the food. Herbal apple *rabri* was prepared by adding two herbs (*brahmi* and *shatavari*). The herbal apple rabri was optimized based on its organoleptic attributes. The sensory evaluation revealed that adding *brahmi* up to 2.5% and *shatavari* up to 1.5% is acceptable. The optimized rabri was further analyzed for its texture profile. The shelf life was evaluated based on the physicochemical, antioxidant, phenolics, and microbial content like total plate count and yeast and molds count. The DPPH inhibition activity shows that the optimized rabri has antioxidant potential (58.41 ± 0.03%) compared to control rabri (34.30 ± 0.04%) due to adding herbs. The microbial spoilage in the optimized sample was less as compared to the control sample.

Keywords Apple *rabri*, *Brahmi*, *Shatavari*, Brown sugar, Physicochemical and microbiological analysis, Herbal product, Storage study

Introduction

In 2021–2022, milk production was 221.1 million metric tonnes [1]. Milk is a great provider of all essential nutrients in the right amounts for human growth and development. Traditional milk products have been produced in India since the dawn of humanity. These items are important for religious, social, cultural, nutritional, medical and economic reasons. About 50% of the milk produced is used to make traditional dairy products like khoa, basundi, rabri, which are heat-desiccated milk products, dahi, shrikhand, paneer and chhana and chhana-based products, which are coagulated milk products and clarified products like butter oil, ghee, etc., which are inherent in ancient traditions and have a strong social and cultural heritage in Indian society [2]. *Rabri* is a sweetened, condensed whole milk product with multiple layers of clotted cream popular in the Indian subcontinent. *Rabri* is made from sweetened condensed milk and appears to range in color

*Correspondence:
Abhishek Dutt Tripathi
abhishek.tripathi@bhu.ac.in
[1] Department of Dairy Science and Food Technology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi 221005, India
[2] Department of Food Processing and Management, RGSC, Barkacha, Banaras Hindu University, Mirzapur, India
[3] Department of Food Science and Nutrition, Lady Irwin College, Delhi University, New Delhi, India

from pale yellow to light caramel [3]. It has numerous layers of clotted cream, which is created during the production of *rabri* [4]. In India's eastern and northern regions, *rabri* is consumed as an ethnic milk dessert (Meena et al. 2022). Furthermore, adding fruit pulp improves the color and flavor of *rabri* [5], Dhumal et al. [6].

Rabri is a concentrated, sweetened whole milk delicacy, containing several layers of clotted cream and skimmed off from slowly evaporating milk. Rabri is popular Indian dessert, has demand during festivals and celebrations specially in northern and eastern parts of India and has a rich historical and cultural basis, and it is celebrated for its ethnic excellence in various ways:

Historical significance; royal heritage Rabri has been historically associated with royal feasts and palaces in India. It was often prepared for aristocratic gatherings and special occasions, making it a symbol of opulence and indulgence.

Culinary tradition; preservation technique The slow-cooking and milk-reduction process used in making rabri was developed as a way to preserve milk in the pre-refrigeration era. The reduction process helped remove the moisture content, allowing milk to be stored for longer periods.

Cultural significance; festivals and celebrations Rabri is a staple during various Indian festivals and celebrations, such as Diwali, Raksha Bandhan, Holi and weddings. It symbolizes the sweetness of life and is often used to welcome guests and mark important life events.

Regional diversity Different regions of India have their own variations of rabri. For example, in North India, it is often served with jalebi or malpua, while in West Bengal, variations like "roshogolla payesh" are popular. This regional diversity showcases the versatility of rabri within the Indian culinary landscape.

Ethnic excellence; traditional preparation Rabri is prepared using age-old, time-honored techniques that require patience and skill. Achieving the perfect consistency and flavor without burning the milk requires expertise and is considered a culinary art.

Flavors and ingredients The use of aromatic spices like cardamom and saffron, along with nuts and rose water, adds a layer of ethnic excellence to rabri. These ingredients have been integral to Indian cuisine for centuries and contribute to the dessert's unique taste.

Craftsmanship The act of stirring and reducing milk to create the thick, creamy texture of rabri is a craft in itself, passed down through generations. This showcases the dedication to preserving traditional culinary practices.

Contemporary adaptations Modern chefs and home cooks continue to innovate with rabri, incorporating contemporary flavors and presentation styles, while respecting its historical roots. This adaptability reflects the ongoing evolution of Indian cuisine.

Rabri is not just a dessert; it is a cultural symbol of India's rich culinary heritage and a testament to the ethnic excellence that has been cherished and preserved for generations. Its historical significance, regional diversity and cultural prominence make it a beloved part of Indian cuisine [7].

Apple (*Malus domestica*) is a popular Rosaceae fruit produced in temperate locations worldwide, including India. The therapeutic efficacy of apples has long been recognized for various ailments, including anemia, dysentery, cardiac disease and kidney stones. It contains 85% water, 13% carbohydrate and 2.2% total dietary fiber.

Herbs are used as food additives all over the world to improve the organoleptic qualities of food as well as its shelf life by preventing foodborne pathogens. This is due to their antimutagenic, anti-inflammatory, antioxidative and immune-modulating qualities [8]. Ayurveda has suggested that herbs' medicinal properties can be transferred using specific foods as carriers. One of the most significant of these transporters is milk [9].

The climbing ayurvedic plant *shatavari* (*Asparagus racemosus* Wild) is used to treat hyperlipidemia, hypertension, angina, dysmenorrhea, anxiety disorders, benign prostatic hyperplasia (BPH), leucorrhoea, urinary tract infections. Steroids, alkaloids, dihydrophenanthrene derivatives, flavonoids, furan derivatives and essential oils are among the secondary metabolites found in this plant [10].

Brahmi is one of India's most ancient traditional Ayurveda medications. It was created more than 3000 years ago in India. *Brahmi* is well-known for its ability to improve memory, cognition, mood and other mental disorders. *Brahmi* contains saponins, which are the main chemicals responsible for improving nerve impulse transmission.

Food items with functional components could be added to enhance customer demand and acceptability. Shatavari bread, herbal Ghee (Arjuna Ghee), herbal yoghurt, herbal milk, herbal Sandesh, herbal Rasogolla, Functional snacks, Spirulina biscuits and other functional foods have been produced. Anticancerous, antidiabetic, dietary fiber-loaded and protein-enriched qualities have been discovered in these goods. Due to their bitter flavor and unappealing appearance, medicinally vital herbs in food products cannot be immediately accepted. Incorporating entire herbs into culinary products may cause negative alterations in the food. Incorporating botanical extracts with active components into nutraceutical foods could be a better choice [11].

Materials and methods

Materials

Fresh Full Cream Milk (Amul, Anand) (6% fat/9% MSNF) was used for the manufacture of apple *rabri*; fresh apple (Kashmiri) and *Brahmi* (*Bacopa monnieri*) powders were procured from local market. *Shatavari* (*Asparagus racemosus*) powder was collected from the Department of Ayurveda, BHU, Varanasi, UP. Brown sugar was purchased from Amazon. All the chemicals used in the study were of analytical grade and procured from HiMedia laboratories (P) Ltd, Mumbai.

Methods

For the preparation of apple *rabri*, the fresh apples were washed and peeled. Then the apples were grated using a grater. Then the milk (fat: 6%; SNF: 9%) was heated at a simmering temperature (85–90 ℃) in a shallow iron pan and held undisturbed. The skin formed during this process was collected separately on the side of the pan. When the volume was reduced to 25%, a uniform mixture of *Brahmi* and *Shatavari* at different combinations (Table 1) with brown sugar (6% of milk) and grated apple (10% of milk) was added. After that, the separated skin layers were immersed in the milk and heated gently. The finished product was cooled to room temperature. Then it was filled in earthen pots and stored at refrigerated temperature (4 ± 2 °C) till use.

Physicochemical analysis

Herbal apple *rabri* was analyzed for moisture, total solids, fat, protein, ash, pH, titratable acidity, percent DPPH inhibition, total phenolic content and reducing sugar. The pH of herbal apple *rabri* was measured using thermo scientific digital pH meter, Model Sn 821,899. AOAC [12] was used to determine the moisture and ash content of the herbal apple *rabri*. The herbal apple *rabri*'s total solids content was calculated by subtracting the moisture content from 100. Gerber's approach was used to calculate the fat content of herbal apple *rabri*. The fat percentage was measured directly in Gerber's butyrometer at the lower point of the meniscus, as indicated by ISI bulletin no IS: 1224(part I) [13]. Protein was determined by estimating the percent nitrogen by micro-Kjeldahl method as prescribed in IS: 1479 (part II) [14]). The approach specified in IS: 1479 (part I) 1960 was used to calculate the titratable acidity percentage. Zhang et al. [15] used Folin–Ciocalteu's technique with slight modifications to determine the total phenolic content of herbal apple *rabri*. The antioxidant capacity of the herbal apple *rabri* was assessed using the DPPH (2, 2-diphenyl-1-picrylhydrazyl-hydrate) inhibition method, as described by Mimica-Dukic et al. [16] with minor modifications and reducing sugars determined using Fehling's method [17].

Table 1 Preliminary trial details

Sample code	*Brahmi* powder (%)	*Shatavari* powder (%)
T_0	0	0
T_1	1	3
T_2	1.5	2.5
T_3	2	2
T_4	2.5	1.5
T_5	3	1
T_6	0	4
T_7	4	0

T_0 – *Rabri* as per standard procedure (control) (as per standards, sugar was added @) 6% by weight of milk and 10% grated by weight of milk

Microbial analysis

Herbal apple *rabri* was analyzed for the total plate count (TPC), yeast and mold count (Y&M) by the methods as described in Indian standards (5550:2005), (6611:2004) and (5402:2002), respectively. The storage temperature was held at 5 ± 1 °C for the duration of the trial.

Sensory evaluation

The rabri sample was analyzed for sensory characteristics by a panel of ten judges using a 9-point hedonic scale. The products were judged for color and appearance, flavor, body and texture, mouthfeel and overall acceptability. All analyses were done in triplicate for better findings [18].

Texture profile analysis

Texture Analyzer TA-XT2i (Stable Micro Systems, UK) fitted with a 25-kg load cell was used to assess the firmness of the herbal apple *rabri* sample. A P/25-mm cylinder aluminum compression platen probe was used to apply force to the product to a depth of 25.0 mm.

Storage and analysis

Herbal apple *rabri* samples were stored in earthen jars at a temperature of 4 °C. The samples were examined for physicochemical and microbiological changes after 7 days of storage.

Statistical analysis of data

All of the data were examined and given as a mean with a standard deviation based on a triplicate analysis.

Results and discussion

Optimization of process variables for the selection of products was performed based on their organoleptic attributes.

Table 2 Effect of different levels of herbs and brown sugar on sensory properties of apple *rabri*

Trial no	Color and appearance	Body and texture	Flavor	Mouth feel	Overall acceptability
T_0	7.16 ± 0.26	7.28 ± 0.30	6.92 ± 0.17	7.04 ± 0.09	7.10 ± 0.11
T_1	6.76 ± 0.43	6.98 ± 0.67	6.42 ± 0.57	6.36 ± 0.38	6.63 ± 0.17
T_2	7.02 ± 0.70	7.22 ± 0.44	6.66 ± 0.47	6.82 ± 0.46	6.93 ± 0.39
T_3	7.22 ± 0.43	7.44 ± 0.60	7.22 ± 0.86	7.04 ± 0.63	7.23 ± 0.31
T_4	8.42 ± 0.53	8.64 ± 0.49	8.82 ± 0.40	8.64 ± 0.49	8.63 ± 0.20
T_5	8.22 ± 0.44	8.42 ± 0.53	8.28 ± 0.70	8.08 ± 0.57	8.25 ± 0.20
T_6	6.64 ± 0.58	6.84 ± 0.35	6.52 ± 0.45	6.44 ± 0.60	6.61 ± 0.33
T_7	6.48 ± 0.57	6.56 ± 0.55	6.36 ± 0.49	6.24 ± 0.46	6.41 ± 0.23

Each observation is a mean ± **SD 0.05** of three replicate experiments ($n = 3$)

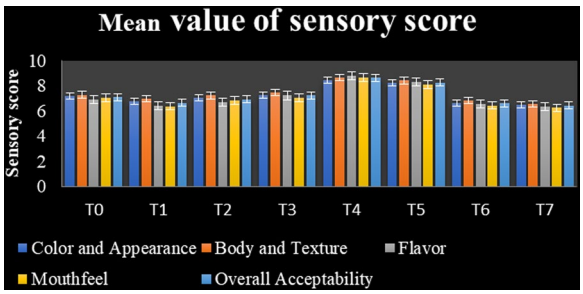

Fig. 1 Graphical representation of sensory evaluation of herbal apple *rabri* using with *Brahmi* and *Shatavari* powder

Sensory analysis of herbal apple *rabri*

The effect of different levels of herbs on the organoleptic attributes of herbal apple *rabri* is shown in Table 2 and Fig. 1. The result showed that the treatment T_4 (*brahmi* 2.5% and *shatavari* 1.5%) has maximum color and appearance, body and texture, flavor, mouthfeel and overall acceptability compared to other treatments. Based on this, treatment T_4 was optimized for further analysis.

Texture profile analysis

The optimized sample (T_4) had average values of − 31.828Ns, 0.478, 0.511 mm, 1.187, 0.567N, 0.128,and 2.323 for the seven texture characteristics of adhesiveness, cohesiveness, springiness, gumminess, hardness, chewiness and resilience, respectively. − 30.754Ns, 0.342, 0.621 mm, 1.211, 0.432N, 0.134 and 1.911 were discovered to be the texturing parameters of the control sample. Springiness, gumminess and chewiness were lower in the optimized sample than in the control sample. This is in line with the findings of Prasad et al. [19], who found that adding herbs to burfi reduced the springiness, gumminess and chewiness of the burfi.

Table 3 Effect on moisture content (%) during storage period

Days	Mean value of control sample	Mean value of optimized sample
0	42.64 ± 0.09	43.80 ± 0.05
7	46.12 ± 0.03	48.11 ± 0.11
14	48.54 ± 0.07	50.21 ± 0.13
21	50.17 ± 0.15	52.62 ± 0.13

Each observation is a mean ± **SD 0.05** of three replicate experiments ($n = 3$)

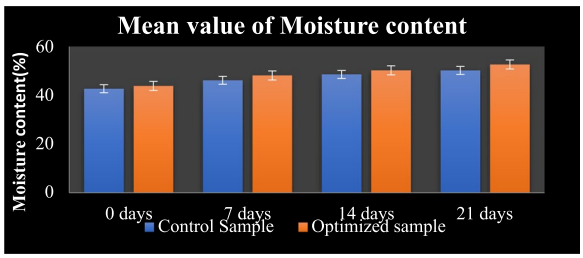

Fig. 2 Graphical representation of moisture content of herbal apple *rabri* using with *Brahmi* and *Shatavari* powder

Effect of storage on physicochemical properties of herbal apple *rabri*

The effect of moisture content during storage is summarized in Table 3 and graphically represented in Fig. 2**.** This is in correlation with previous findings by Kaushik et al. [20] and Bandyopadhyay et al. [21].

Table 4 summarizes the findings on the fat content of herbal apple *rabri*. The fluctuation in fat content of herbal apple *rabri* is depicted in Fig. 3. This is in correlation with previous findings by Kaushik et al. [20] and Kahandal et al. [22].

The protein content of both samples was reduced during storage, as seen in Table 5 and Fig. 4. After 21 days of storage, the protein level of the optimized sample was higher than the control sample. This may be

Table 4 Effect on fat content (%) during storage period

Days	Mean value of control sample	Mean value of optimized sample
0	16.44 ± 0.32	15.75 ± 0.29
7	15.19 ± 0.26	14.46 ± 0.27
14	14.18 ± 0.20	13.31 ± 0.07
21	13.22 ± 0.14	13.14 ± 0.12

Each observation is a mean ± **SD 0.05** of three replicate experiments ($n = 3$)

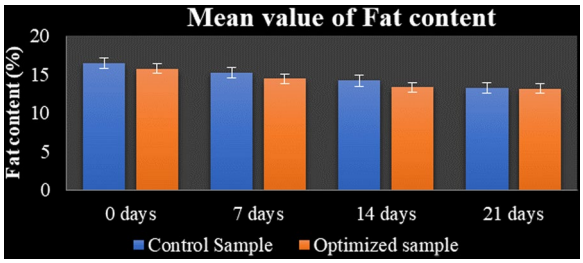

Fig. 3 Graphical representation of fat content of herbal apple *rabri* using with *Brahmi* and *Shatavari* powder

Table 5 Effect on protein content (%) during storage period

Days	Mean value of control sample	Mean value of optimized sample
0	8.86 ± 0.11	9.21 ± 0.22
7	7.57 ± 0.23	8.09 ± 0.16
14	6.87 ± 0.07	7.42 ± 0.19
21	5.96 ± 0.04	6.48 ± 0.07

Each observation is a mean ± **SD 0.05** of three replicate experiments ($n = 3$)

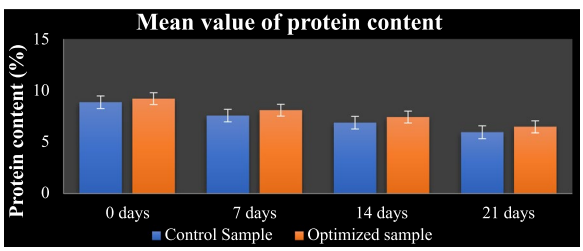

Fig. 4 Graphical representation of protein content of herbal apple *rabri* using with *Brahmi* and *Shatavari* powder

due to the inclusion of *Brahmi* and *Shatavari* powder. This is in correlation with previous findings by Prasad et al. [19] and Ojha et al. [23].

Table 6 depicts the pH of herbal apple *rabri*, which is graphically depicted in Fig. 5. At 0 day, the pH of both the control and optimized samples was higher. These

Table 6 Effect on pH value during storage period

Days	Mean value of control sample	Mean value of optimized sample
0	7.42 ± 0.03	7.54 ± 0.10
7	7.01 ± 0.09	7.06 ± 0.04
14	6.58 ± 0.16	6.61 ± 0.09
21	6.17 ± 0.19	6.27 ± 0.06

Each observation is a mean ± **SD 0.05** of three replicate experiments ($n = 3$)

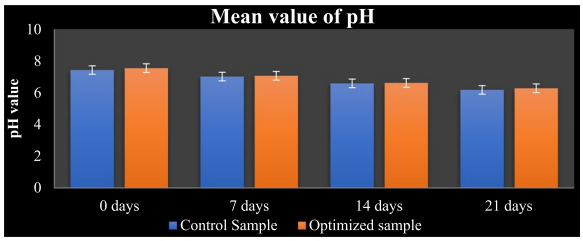

Fig. 5 Graphical representation of pH content of herbal apple *rabri* using with *Brahmi* and *Shatavari* powder

Table 7 Effect on ash content (%) during storage period

Days	Mean value of control sample	Mean value of optimized sample
0	2.83 ± 0.01	2.97 ± 0.01
7	2.83 ± 0.01	2.98 ± 0.01
14	2.82 ± 0.01	2.97 ± 0.01
21	2.83 ± 0.01	2.97 ± 0.01

Each observation is a mean ± **SD 0.05** of three replicate experiments ($n = 3$)

numbers clearly showed that the pH of both the optimized and control samples dropped dramatically as the storage time increased. This could be due to increased microbial activity, while the product is being stored. This is in correlation with the previous finding by Londhe et al. [24].

The ash content of the freshly made control and optimized apple *rabri* samples was 2.83 ± 0.01% and 2.97 ± 0.01%. The ash content remained consistent between 2.83 ± 0.01 and 2.97 ± 0.01% on the last day of storage. Table 7 contains data on the ash content of Herbal apple *rabri*, which is graphically depicted in Fig. 6. Kaushik et al. [20] reported a similar trend of change in the ash content of *rabri* during storage days when they worked on *rabri* utilizing date syrup as a sugar substitute.

As the storage durations lengthened, the acidity content in both groups grew significantly. The acidity concentration in the optimized sample increased slowly, as seen in Table 8 and Fig. 7. Choudhury et al. (2017) found

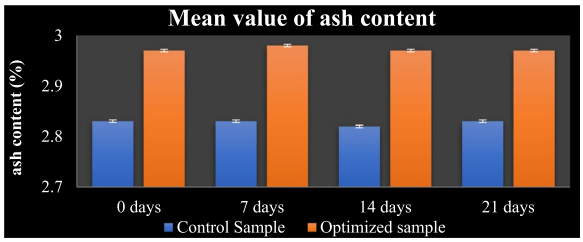

Fig. 6 Graphical representation of ash content of herbal apple *rabri* using with *Brahmi* and *Shatavari* powder

Table 8 Effect on acidity content (%) during storage period

Days	Mean value of control sample	Mean value of optimized sample
0	0.15 ± 0.03	0.24 ± 0.03
7	0.42 ± 0.03	0.54 ± 0.03
14	0.51 ± 0.04	0.64 ± 0.01
21	0.62 ± 0.04	0.71 ± 0.07

Each observation is a mean ± **SD 0.05** of three replicate experiments ($n = 3$)

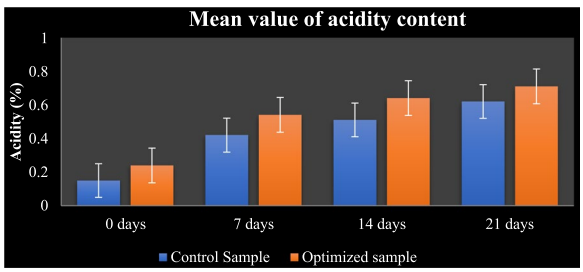

Fig. 7 Graphical representation of acidity content of herbal apple *rabri* using with *Brahmi* and *Shatavari* powder

Table 9 Effect on TS content (%) during storage period

Days	Mean value of control sample	Mean value of optimized sample
0	57.35 ± 0.09	56.20 ± 0.05
7	53.88 ± 0.02	51.88 ± 0.11
14	51.45 ± 0.07	49.78 ± 0.13
21	49.82 ± 0.15	47.38 ± 0.13

Each observation is a mean ± **SD 0.05** of three replicate experiments ($n = 3$)

that the acidity content of khoa increased with storage, like it did in the shelf-life study.

The findings in Table 9 and Fig. 8 clearly show that the TS content in the optimized sample declined as the storage periods extended. As the storage time increases, the TS content in the control samples reduces dramatically.

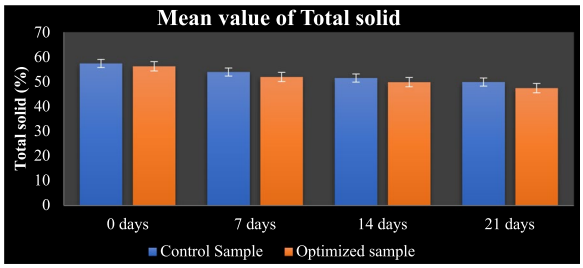

Fig. 8 Effect of storage time on TS content of control and optimized (*Brahmi* and *Shatavari* powder added) samples

Table 10 Effect on %DPPH inhibition activity during storage period

Days	Mean value of control sample	Mean value of optimized sample
0	34.30 ± 0.04	58.41 ± 0.03
7	33.53 ± 0.07	57.84 ± 0.02
14	33.04 ± 0.04	57.14 ± 0.03
21	32.81 ± 0.03	56.75 ± 0.04

Each observation is a mean ± **SD 0.05** of three replicate experiments ($n = 3$)

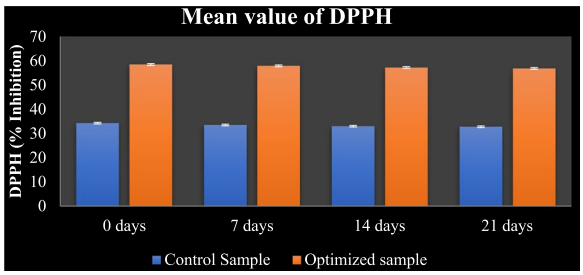

Fig. 9 Graphical representation of %DPPH inhibition activity of herbal apple *rabri* using with *Brahmi* and *Shatavari* powder

During storage (up to 21 days) at refrigeration temperature, the percent TS ranged from 56.20 ± 0.05 to 47.37 ± 0.13% for the optimized sample and from 57.35 ± 0.09 to 49.82 ± 0.15% for the control sample.

The antioxidant potential of the optimized herbal apple *rabri* was studied by DPPH scavenging activity. The DPPH inhibition activity study revealed that the optimized sample had 58.41 ± 0.03% DPPH inhibition activity as compared to the control sample having 34.30 ± 0.04% of DPPH inhibition activity (Table 10; Fig. 9). The higher DPPH inhibition activity in the optimized sample is due to the presence of herbs (*brahmi* and *shatavari*). After 21 days, there was a reduction in the antioxidant activity of both the control and optimized sample (Table 10; Fig. 9).

Table 11 Effect on TPC (mg/g) during storage period

Days	Mean value of control sample	Mean value of optimized sample
0	13.31 ± 0.03	31.05 ± 0.05
7	13.05 ± 0.06	30.85 ± 0.04
14	12.96 ± 0.04	30.31 ± 0.03
21	12.54 ± 0.03	30.04 ± 0.04

Each observation is a mean ± **SD 0.05** of three replicate experiments ($n = 3$)

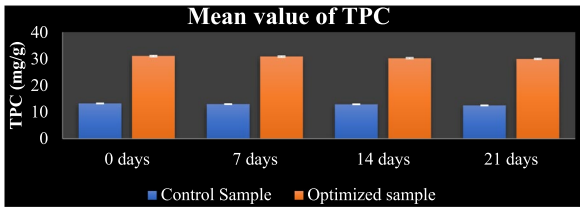

Fig. 10 Graphical representation of TPC content of herbal apple *rabri* using with *Brahmi* and *Shatavari* powder

Table 12 Effect on reducing sugar (mg/ml) during storage period

Days	Mean value of control sample	Mean value of optimized sample
0	21.62 ± 0.10	32.31 ± 0.05
7	21.87 ± 0.04	33.07 ± 0.05
14	22.64 ± 0.05	33.94 ± 0.06
21	23.04 ± 0.05	34.65 ± 0.06

Each observation is a mean ± **SD 0.05** of three replicate experiments ($n = 3$)

The total phenolic content (TPC) of the optimized sample was 31.05 ± 0.05 mg/g due to the addition of herbs (*brahmi* and *shatavari*), whereas for the control sample, it was 13.31 ± 0.03 mg/g (Table 11; Fig. 10). There was a significant decrease in the phenolic content of both the sample after 21 days.

The amount of reducing sugar in the control and optimized *rabri* was studied. At zero days, the reducing sugar content in the control sample was 21.62 ± 0.10 mg/ml and in the optimized sample was 32.31 ± 0.05 mg/ml. The reducing sugar content in both samples increased with time (Table 12; Fig. 11). After 21 days, the reducing sugar content in the control sample was 23.04 ± 0.05 mg/ml and in the optimized sample was 34.65 ± 0.06 mg/ml.

Microbial analysis

The microbial count increased with the increase in the storage period. At 0-day storage, the TPC count of the optimized herbal apple *rabri* sample was lower than the

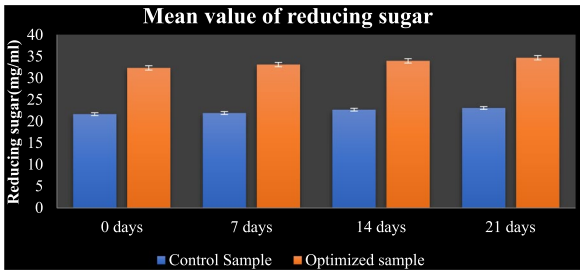

Fig. 11 Graphical representation of reducing sugar content of herbal apple *rabri* using with *Brahmi* and *Shatavari* powder

Table 13 Effect of storage period on microbial quality of herbal apple (5 ± 1 °C)

Storage period days	TPC (Total plate count) (CFU × 10^{-5} per g)		YMC (Yeast and mold count) (CFU × 10^{-5} per g)	
	Control sample	Optimized sample	Control sample	Optimized sample
0	4.42	3.97	0	0
7	9.18	7.80	0	0
14	17.40	12.14	1.21	1.04
21	21.70	17.85	4.34	3.91

control apple *rabri* sample (Table 13). The optimized herbal apple *rabri* sample had a lower yeast and mold count than the control apple *rabri* sample. It signifies that the product was properly pasteurized during the manufacturing process of the *rabri* and that there is no post-pasteurization contamination in the product. At 0 day, there were the fewest cfu per gram, and at 21 days, there were the most. TPC levels increased significantly after 14–21 days of storage. However, yeast and mold counts were detected on the 14th day. The result found was more or less similar results reported by Chauhan et al. [25] and Bharti et al. [26].

Conclusion

Herbal apple *rabri* was made using *brahmi* and *shatavari* powder, with a shelf life of 15 to 16 days in refrigerated storage. The designed product was created in response to the growing demand for dairy products that include plant-based nutrients and phytonutrients. The developed product was found to be satisfactory in terms of body and texture, color and appearance, flavor and mouthfeel. The optimized herbal apple *rabri* (T_4) was the most palatable, with an overall acceptability score of 8.63 ± 0.20. The organoleptic study revealed that the *brahmi* (2.5%) and *shatavari* (1.5%) can be added to the food product without changing the sensorial attributes of the product. The texture analysis study showed that there was no significant difference in the texture of the optimized sample

after the addition of herbs. Fat, protein, pH and total solids decreased with storage (0–21 days) and vice versa. However, moisture, acidity and reducing sugar increased. The percentage DPPH inhibition activity and the total phenolic content study revealed that the developed product has antioxidant potential due to the incorporation of herbs. The microbial study revealed that with the addition of herbs, the microbial count decreased in the optimized sample compared to the control sample.

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ADT helped in conceptualization, investigation, writing, reviewing and editing; RL investigated the study; VPJ, VP, AA contributed to writing, reviewing and editing.

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Declarations

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Ethical approval has been taken.

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There are no competing interests.

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