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Development of fiber-enriched probiotic goat milk *dahi* by incorporating black carrot (*Daucus carota* subsp. sativus) pomace powder

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Abstract

The present investigation was conducted to evaluate the use of black carrot pomace powder (BCPP) in manufacturing of high-fiber *dahi* with goat milk and probiotic culture, as well as the effect on the physicochemical, antioxidant, sensory attributes and probiotic viability of dahi. BCPP was prepared by tray drying method and added to probiotic goat milk *dahi* mixtures at the rate of 1, 1.5, 2, 2.5, and 3%, respectively. The findings of this investigation showed the nutritional and antioxidant properties of BCPP. The result indicated that BCPP contains high fiber and antioxidants with low protein and fat. As powder levels increased in the *dahi*, the pH, ash, and fiber per cent were significantly increased, while acidity, fat, protein, and whey syneresis significantly decreased. Antioxidants and phenolic content were found to be significantly higher in the 3% BCCP group and significantly lower in the control group. The BCPP with 1% incorporation level in *dahi* demonstrated higher overall acceptability when compared to other BCPP groups. There was a significant effect of storage duration on the probiotic count in *dahi* (control) and BCPP *dahi*. Consequently, BCPP could be used as a high-fiber, natural antioxidant, and phenolic ingredient to formation of unique fiber-enriched goat milk *dahi*.

1. Introduction

The fermented foods are the most liked foods around the world as they contain beneficial live microorganisms, proteins, and vitamins A, B, C, D, and E, as well as many health advantages (Mishra *et al.*, 2020; Meena *et al.*, 2023a). The fermentation process has been used to process foods to prevent spoilage, improve nutritional value, develop suitable physiochemical characteristics, and improve sensory properties (Meena *et al.*, 2022). Among the fermented milk product, *dahi* is one of the most demanded products and is considered as probiotic. *Dahi* is a fermented product made by fermenting milk with starter cultures to provide easily digestible nutrients with potential therapeutic benefits (Meena *et al.*, 2023b). As a result, *dahi* has become one of the most preferred products to explore from a functional food standpoint. In light of this, researchers are constantly exploring various functional ingredients for their possible positive effects, such as prebiotics, probiotics, plant extracts, *etc.* (Fazilah *et al.*, 2018). There is a current trend in the food industry to include plant constituents known as phytochemicals in different types of food products.

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Black carrots (*Daucus carota* subsp. *sativus*) are becoming more popular among consumers due to their high antioxidant, anthocyanin, and phytochemical content (Kaur *et al.*, 2023). In addition to being probiotic and fermented, black carrot beverages are high in antioxidants. It aids in the prevention of lifestyle diseases and chronic ailments, gut infections, and cholesterol levels. It also improves lactose metabolism, boosts immunity, stimulates calcium absorption and vitamin synthesis, improves protein digestibility, and combats illness (Lamba *et al.*, 2019). Carrot pomace is a byproduct produced during the processing of carrot juice that contains high levels of dietary fiber and even up to 80% carotene (Kumar and Kumar, 2011). The pomace produced by juice processing is mostly used in animal feed. However, it can be utilized to increase the value of food products by providing a good amount of fiber.

Nutritional balance is considered one of the best reasons to consume milk. In addition to improving digestion, metabolic processes for ingested nutrients, organ growth, development, and disease resistance, milk also performs many beneficial biological functions within the human body (Davoodi *et al.*, 2016). Biological functions in the body are influenced by goat milk, which contributes to better health and well-being, as well as reducing the risk of developing illnesses. Since goat milk has a high concentration of MCFAs and a low level of s-1-casein, it offers excellent digestibility for human nutrition (Rai *et al.*, 2022). Fermented goat milk is an excellent carrier for probiotic bacteria, but fermented goat milk of comparable consistency with fermented cow milk is difficult to produce. Recently several attempts have been made to utilize goat milk for the development of diversified indigenous milk products like Butter, Ghee, Khoa, Channa, and Cheese (Sepe and Arguello, 2019). In addition to providing traditional nutritional benefits, dairy products have the potential to provide consumers with a range of additional health benefits. The present investigation aimed to develop a functional *dahi* using goat milk and probiotic culture by incorporating BCPP. Further, the product was evaluated to determine its physicochemical properties, antioxidant, phenolic activity, and sensorial characteristics.

2. Materials and Methods

Fresh goat milk was procured from the locality of Varanasi, Uttar Pradesh. Milk samples were collected during milking and transport and stored at refrigeration temperature. Further chemical analysis of goat milk was carried out after warming up to 42°C. The goat milk sample contained 4% fat, 8.5% SNF, and 0.16 % acidity. A vivid deep black variety of Black carrots was procured from the local vegetable market of Varanasi, India. The freeze-dried starter culture (*Lactobacillus acidophilus* La-5 and *Lactococcus lactis* subspp. *lactis biovar diacetyllactis*) was procured from Shree Additive (Pharma and Foods) Pvt. Ltd., Gandhinagar, India. The culture was stored below -18°C till further use. All the chemicals used during the study were of analytical grade and were procured from "Hi media laboratories, Pvt. Ltd., Mumbai, India".

2.1 Preparation of black carrot pomace powder

Black carrots pomace powder was prepared as per (Sahni and Shere, 2017) with slight modifications. Fresh black carrots were cleaned with water, and carrots were spread evenly in trays to remove excess water. Then black carrot pomace was obtained after juice extraction using a lab type juice extractor (Bajaj Process pack Pvt. Ltd., Noida). The carrot pomace obtained was put in a tray drier at 45°C till a 5-6% moisture level was reached. After drying, black carrot pomace was ground into powder form then the powder was sieved and packaged in polythene bags at room temperature for further preparation of functional *dahi*. The flow chart for the preparation of BCPP is presented in Figure 1.

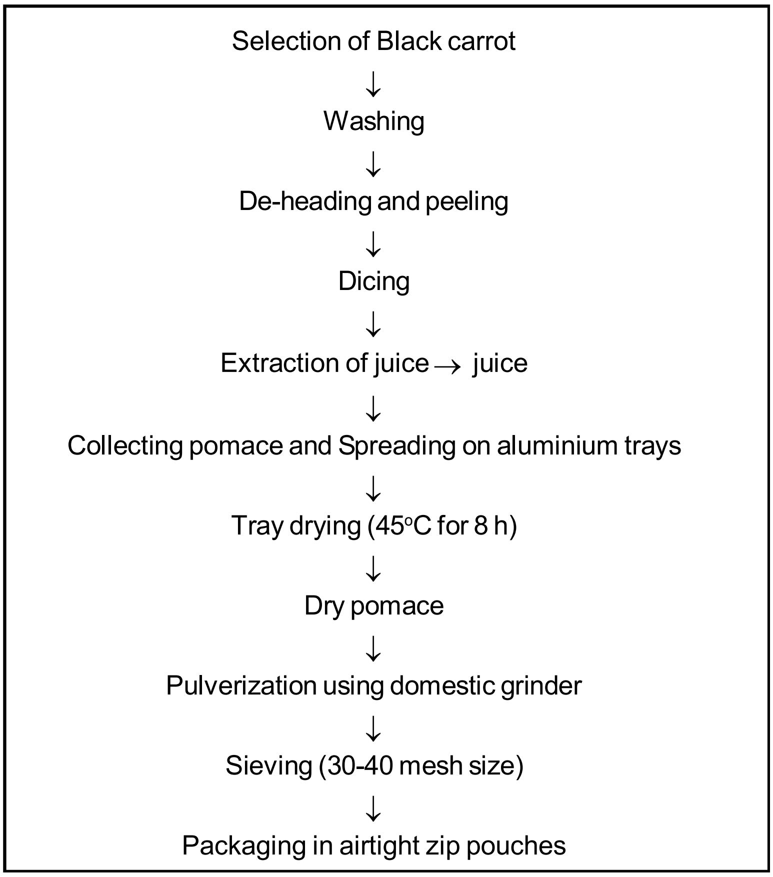

Figure 1: Flow diagram of manufacturing of black carrots pomace powder.

2.2 Preparation of probiotic goat milk *dahi*

The functional *dahi* was prepared in the laboratory of the "Department of Dairy Science and Food Technology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi." The method followed for the developing of functional *dahi* and formation of the sample was as per De (2005) after slight modification. Figure 2 illustrates the product-making process of functional *dahi*. Goat milk was heated to 85°C for 5 min, and BCPP was added at different levels T_0 (control *dahi*); T_1 (*dahi* consisting of 1% (w/v) BCPP); T_2 (*dahi* consisting of 1.5% (w/v) BCPP); T_3 (*dahi* consisting of 2% (w/v) BCPP); T_4 (*dahi* consisting of 2.5% (w/v) BCPP) and T_5 (*dahi* consisting of 3% (w/v) BCPP). After proper mixing, milk was cooled to 37°C. Then, milk was inoculated @ 0.02% with freeze-dried starter culture and mixed properly. Further, incubated at 42 ± 1°C for 8 h and stored at 4°C for further use. Prepared probiotic goat milk *dahi* samples were packed in 100 ml polypropylene plastic cups.

Standardization of goat milk
(4% Fat and 8.5% SNF)

↓

Pasteurization (85°C for 5 min)

↓

Cooling (60-62°C)

↓

Addition of black carrot pomace powder (T1-T5) as per treatment

↓

Stirring for 3 min

↓

Cooling (37°C)

↓

Addition of starter culture (Lactobacillus acidophilus La-5 and *Lactococcus lactics* subspp. *Lactis biavar diacetyllactis* @ 0.02 per cent)

↓

Stirred properly

↓

Incubation (8 h at 42°C), acidity upto (0.70%)

↓

cooling (4°C)

↓

Set probiotic *dahi*

Figure 2: Flow diagram of manufacturing fiber enriched probiotic goat milk dahi.

2.3 Physicochemical analysis of probiotic goat milk *dahi*

The analysis of physicochemical characteristics (*e.g.*, fat, moisture, protein, total solids, crude fiber, ash and pH) of BCPP and developed functional *dahi* samples were determined according to AOAC (2000) and Rathaur *et al.* (2020). Estimation of whey syneresis of *dahi* was done as per Hassan *et al.* (2015).

2.4 Antioxidant and phenolic activity analysis of probiotic goat milk *dahi*

The antioxidant activity of BCPP and probiotic goat milk *dahi* was assessed by 2, 2 diphenyl-1-picryl hydroxyl (DPPH) free radical scavenging potentiality following the method of Brand-Williams's (1995) with slight modification. In brief, 80 mg/ml (w/v) solution of the sample was prepared with absolute methanol and placed in a shaker for 2 h, further centrifuged at 6000 rpm/10 min at 27°C. 2.5 ml supernatant was mixed with 5 ml 2 mM DPPH in methanol solution and vortexed. The solution was incubated for 30 min in dark conditions, and the absorbance of the sample and blank (80% Methanol solution) was measured at 517 nm. Antioxidant activity was calculated by the following equation, and results were expressed as % free radical scavenging activity.

Free radical scavenging activity (per cent) = (absorbance of control sample absorbance) / (absorbance of control) × 100

The total phenolic content was determined by the Folin-Ciocalteau method as described by Singh *et al.* (2022). The supernatants were diluted with six milliliters of distilled water and 0.5 milliliters of Folin-reagent Ciocalteu's. After 3 min of incubation, 1.5 ml of saturated Na_2CO_3 solution was added. A dark incubation period of 30 min was followed by the incubation of the mixes at 40°C. Gallic acid was used as a standard to measure absorbance at 760 nm in a UV-Spectrophotometer (Shimadzu, Japan). The data were expressed as µg gallic acid equivalents (GAE)/ml.

2.5 Sensory evaluation

The sensory parameters of the probiotic goat milk dahi were performed in the "Department of Dairy Science and Food Technology, BHU, Varanasi," following the method given by Patel *et al.* (2022) after slight modifications. Fifteen male and fifteen female judges were randomly chosen, which included faculty, research scholars, and postgraduate students. The judges were given instructions to familiarise themselves with the method prior to the sensory test. Individuals evaluated the sensory qualities of functional dahi stored at room temperature (25°C) using a 9-point hedonic scale. Each sample was assigned a degree of like on a scale of 1-9 (1: dislike extremely and 9: like extremely).

2.6 Changes in probiotic viability count during storage

The probiotic viability count was performed on MRS agar after performing appropriate dilution and conducted as per the method adopted by Meena *et al.* (2022). The probiotic count was enumerated in an interval of 3 days during storage in polypropylene plastic cups at refrigeration temperature below 5°C.

2.7 Statistical analysis

The experiment was carried out in triplicate to quantify the sensory, physicochemical, antioxidant, and phenolic properties of probiotic goat milk dahi. SPSS version 25 was used to determine the significance of differences between samples. Significance levels were decided at (p<0.05).

3. Results

3.1 Proximate analysis of black carrots pomace powder

The chemical composition, antioxidant, and phenolic content analysis of BCPP are shown in Table 1. The average composition of BCPP was moisture 5.04 ± 0.11%, fat 0.70 ± 001%, protein 7.60 ± 0.16%, ash 5.58 ± 0.13 %, crude fiber 14.00 ± 0.22%, % DPPH inhibition 63.41 ± 0.53%, TPC 2.43 ± 0.21 µg GAE/g, respectively.

Table 1: Proximate analysis of black carrot pomace powder

Components	Value
Moisture (%)	5.04 ± 0.11
Fat (%)	0.70 ± 0.01
Protein (%)	7.60 ± 0.16
Crude fiber (%)	14.00 ± 0.22
Ash (%)	5.58 ± 0.13
% DPPH inhibition	63.41 ± 0.53
TPC (µg GAE/g)	2.43 ± 0.21

All the values are expressed as Mean ± SD (n=3).

3.2 Physicochemical, antioxidant and phenolic activity of BCPP incorporated *dahi*

The chemical composition, antioxidant, and phenolic content of functional *dahi* are shown in Table 2. Highest pH was found in T_5 (6.83 ± 0.07) group and lowest in T_0 (4.90 ± 0.01) group, respectively. The acidity, fat, and protein value of the samples was significantly decreased with increasing levels of BCPP in *dahi*. Highest acidity, fat and protein value was found in T_0 group and lowest in T_5 group, respectively. The ash value of the sample was significantly increased with increasing levels of BCPP in *dahi*. Highest value of ash was found in T_5 (0.89 ± 0.01) group and lowest in T_0 (0.61 ± 0.01) group, respectively. The whey syneresis of BCPP incorporated *dahi* were significantly different in among groups. Highest crude fibre was found in T_5 (0.31 ± 0.01) and lowest in T_0 (0.05 ± 0.01) group, respectively.

Table 2: Effect of different levels of BCPP on physiochemical parameters of goat milk *dahi*

Parameter	pH	Acidity (Lactic acid %)	Fat (%)	Protein (%)	Ash (%)	Whey syneresis (%)	Crude fiber (%)
T_0	4.90 ± 0.01^{e}	0.78 ± 0.02^{a}	4.13 ± 0.02^{a}	3.63 ± 0.09^{a}	0.61 ± 0.01^{d}	76.16 ± 0.51^{a}	0.05 ± 0.01^{d}
T_1	5.21 ± 0.03^{d}	0.73 ± 0.03^{b}	4.09 ± 0.05^{ab}	3.62 ± 0.03^{a}	0.73 ± 0.02^{cd}	74.81 ± 0.25^{ab}	0.24 ± 0.03^{c}
T_2	5.42 ± 0.02^{cd}	0.67 ± 0.04^{bc}	4.02 ± 0.01^{b}	3.60 ± 0.05^{ab}	0.78 ± 0.03^{c}	74.05 ± 0.23^{bc}	0.26 ± 0.02^{b}
T_3	5.85 ± 0.06^{c}	0.65 ± 0.02^{c}	3.96 ± 0.04^{bc}	3.54 ± 0.12^{bc}	0.83 ± 0.05^{b}	73.59 ± 0.03^{cd}	0.26 ± 0.01^{b}
T_4	6.36 ± 0.08^{b}	0.62 ± 0.01^{cd}	3.87 ± 0.02^{bc}	3.50 ± 0.04^{b}	0.86 ± 0.02^{ab}	72.77 ± 0.23^{c}	0.30 ± 0.04^{a}
T_5	6.83 ± 0.07^{a}	0.59 ± 0.02^{d}	3.78 ± 0.06^{c}	3.42 ± 0.02^{c}	0.89 ± 0.01^{a}	70.44 ± 0.16^{d}	0.31 ± 0.01^{a}

$^{a, b, c, d, e}$Means bearing different superscript within a column differ significantly (p<0.05).

3.3 Antioxidant and total phenolic content of BCPP incorporated *dahi*

The antioxidant activity and total phenolic content (TPC) of BCPP-incorporated *dahi* are shown in Table 3. The % DPPH inhibition of BCPP incorporated *dahi* were (T_1 44.65 ± 2.09, T_2 45.04 ± 1.23, T_3 45.45 ± 1.89, T_4 46.58 ± 1.17, T_5 47.31 ± 2.12), respectively, and control *dahi* was (T_0 23.38 ± 1.75). The TPC of BCPP incorporated *dahi* were (T_1 6.48 ± 0.02, T_2 6.52 ± 0.01, T_3 7.11 ± 0.03, T_4 7.22 ± 0.02, T_5 7.27 ± 0.01), respectively, and control *dahi* was (T_0 6.45 ± 0.01).

3.4 Sensory evaluation of BCPP incorporated goat milk *dahi*

The sensory scores of all treatment samples is shown in Table 4. A slight difference in the sensorial properties was depicted between the control, and BCPP incorporated *dahi*. The color and appearance score values obtained demonstrated that *dahi* prepared using 0 per cent BCPP was found superior amongst all the treatments, which recorded the highest score (8.5 ± 0.32), followed by *dahi* with 1 per cent BCPP (8.1 ± 0.25). The lowest score was obtained by the product with 3 per cent BCPP (7.3 ± 0.33). The body and texture score was highest in T_1 (8.5 ± 0.15), followed by T_2 (8.3 ± 0.18).

Similarly, the flavor score was highest in T_1 (8.7 ± 0.24), followed by T_2 (8.5 ± 0.27), respectively. The composite BCPP incorporated *dahi* sample T_1 had a high mean score for mouthfeel (8.3 ± 0.14), followed by sample T_2 with a mean score of (8.1 ± 0.16). The lowest score was found in a *dahi* prepared with 3 per cent BCPP (7.3 ± 0.21). The overall acceptability score of treatments T_1 and T_2 was 8.4 ± 0.18 and 8.3 ± 0.23, respectively, which was higher than the other treatments.

Table 3: Effect of different levels of BCPP on antioxidant and phenolic content of goat milk *dahi*

Treatments	% DPPH inhibition	Total phenolic content (µg GAE/ml)
T_0	23.38 ± 1.75^{d}	6.45 ± 0.01^{d}
T_1	44.65 ± 2.09^{c}	6.48 ± 0.02^{cd}
T_2	45.04 ± 1.23^{bc}	6.52 ± 0.01^{c}
T_3	45.45 ± 1.89^{b}	7.11 ± 0.03^{b}
T_4	46.58 ± 1.17^{ab}	7.22 ± 0.02^{ab}
T_5	47.31 ± 2.12^{a}	7.27 ± 0.01^{a}

All the values are expressed as Mean ± SD (n=3);$^{a, b, c, d, e}$ Means bearing different superscript within a column differ significantly (p<0.05).

Table 4: Effect of different levels of BCPP on sensory attributes of goat milk *dahi*

Treatment	Color and appearance	Body and texture	Flavour	Mouthfeel	Overall acceptance
T_0	8.5 ± 0.32^{a*}	8.0 ± 0.21^{c}	8.2 ± 0.14^{c}	8.1 ± 0.17^{b}	8.2 ± 0.11^{bc}
T_1	8.1 ± 0.25^{b}	8.5 ± 0.15^{a}	8.7 ± 0.24^{a}	8.3 ± 0.14^{a}	8.4 ± 0.18^{a}
T_2	7.9 ± 0.18^{bc}	8.3 ± 0.18^{b}	8.5 ± 0.27^{b}	8.1 ± 0.16^{b}	8.3 ± 0.23^{b}
T_3	7.8 ± 0.22^{c}	8.1 ± 0.27^{bc}	8.1 ± 0.19^{c}	7.9 ± 0.26^{bc}	8.1 ± 0.22^{bc}
T_4	7.5 ± 0.29^{cd}	7.8 ± 0.30^{cd}	7.8 ± 0.21^{d}	7.6 ± 0.18^{c}	7.7 ± 0.29^{c}
T_5	7.3 ± 0.33^{d}	7.6 ± 0.39^{d}	7.7 ± 0.28^{d}	7.3 ± 0.21^{d}	7.4 ± 0.32^{d}

All the values are expressed as Mean ± SD (n=3); $^{a, b, c, d, e}$ Means bearing different superscript within a column differ significantly (p<0.05).

Table 5: Changes in probiotic count during storage

Storage period (days)	Total probiotic count (log CFU/g) - Control sample	Total probiotic count (log CFU/g) - 1% BCP *Dahi*
0	8.95 ± 0.13^{aA}	8.74 ± 0.11^{aB}
3	8.89 ± 0.09^{bA}	8.63 ± 0.17^{bB}
6	8.81 ± 0.07^{cA}	8.37 ± 0.16^{cB}
9	8.72 ± 0.11^{dA}	8.21 ± 0.13^{dB}
12	7.54 ± 0.17^{eA}	7.74 ± 0.07^{eB}
15	5.76 ± 0.18^{fA}	6.09 ± 0.09^{fB}

All the values are expressed as Mean ± SD (n=3); superscripts in small letters ($^{a, b, c, d, e, f}$) are the significant difference among column; whereas A and B denote significant differences among columns.

3.5 Changes in probiotic viability during storage

The results of probiotic count in *dahi* (control) and 1% BCPP *dahi* are tabulated in Table 5. The probiotic counts at 0 day was observed 8.95 ± 0.13 and 8.74 ± 0.11 log CFU/g in control sample and 1% BCP incorporated *dahi*. After it, the probiotic count decreased significantly in the interval of 3 days. After 15 days the counts in control sample reached below 6 log CFU/g, which is below the recommended level. However, in fortified *dahi* the counts were more than 6 log CFU/g up to 15 days (6.09 ± 0.09 CFU/g).

4. Discussion

The nutritional quality of carrot powder supplements has been reported to be high in crude protein, dietary fiber, iron, calcium and beta-carotene (Singh and Kulshrestha, 2008). The present results showed that crude fiber (14.0%), protein (7.60%), and ash (5.58%) value was highest in BCPP compared to other component. It was found that moisture, protein, fat, crude fiber, and ash in carrot pomace powder were approximately 5.7 %, 6%, 0.8%, 32.4%, and 5.8%, respectively, on a dry basis (Ying *et al*., 2021). The present findings are in accordance with the results of Kausar *et al.* (2018) in the case of carrot pomace powder which reported 6.24% moisture, 9.45% fiber, 1.80% fat, and 5.90% ash. A similar type of result was found by Shyamala and Prakash, (2015) in the case of carrot pomace powder, which reported 6.54% moisture, 14.75% fiber, 2.12% fat, and 5.12% ash. The maturity of the carrots in commercial operations can contribute to differences in composition. Carrots pomace powder contained an appreciable amount of ash and dietary fiber, and it improved the mineral and fiber content. The DPPH content of BCPP in the current research recorded was around 63.53%, while the TPC value was 2.43 µg GAE/ml on a dry basis. Our DPPH value is higher than the values reported in the study conducted by John *et al.*, (2017), which ranged from 7.45 to 34.9%. The above findings are in accordance with the results of Kamel *et al.* (2023) in the case of carrot pomace powder, which reported 64.45% DPPH and 203.6 mg/100, respectively, on a dry basis.

Physiochemical properties of food (such as flavor, optical, rheological and stability) are indicators of food sensory, quality, and safety. As well as being essential for food preservation and food quality assessment, understanding the physiochemical properties of foods is important for consumers' health. The pH, ash and fiber contents significantly increased in probiotic goat milk *dahi* with increasing levels of BCPP. The acidity, fat, protein and whey syneresis content significantly decreased in probiotic goat milk *dahi* with increasing levels of BCPP. According to the results, *dahi* containing BCPP had a higher pH than plain *dahi*, which is probably due to the high initial pH of carrots pomace powder. This result agreed with Sharifi *et al.* (2023). Titratable acidity and pH are two interrelated concepts in food analysis that deal with acidity (Tyl and Sadler, 2017). Ahmad *et al*. (2016) reported that different levels of carrots pomace powder increased ash, fiber content, and decreased fat and protein content of wheat flour compared to the control sample. Another result from Parveen *et al.* (2017) demonstrated that different levels of carrot pomace powder increased ash and fiber content and decreased the fat and protein content of fiber-enriched biscuits. El-Dardiry (2022) also reported a similar trend for the production of Frozen Bio-Yoghurt by varying the amount of carrot pomace powder used. The increased ash content may be attributed to the high percentage of mineral content present in BCPP. The decrease in protein level may be attributed to the low protein content of the BCPP. The incorporation of BCPP reduced the amount of oil absorption and thus led to a reduction in fat content (Baljeet *et al*., 2014).

The antioxidant and phenolic contents were increased by the incorporation of different levels of BCPP in *dahi*. This can be attributed to the carotenoid concentration of BCPP. As a result, the findings of this study show that the antioxidant activity of enriched *dahi* is regulated by constituent bioactive compounds. According to Ahmed *et al*. (2016), the % DPPH inhibition in of cookies increased by adding carrot pomace. In addition to fiber, black carrots contain polyphenol compounds, including nonacylated anthocyanins and phenolic acids (Netzel *et al.*, 2020). Furthermore, black carrots provide significant amounts of polyphenols, which can be used in food products (Kamiloglu *et al.*, 2017).

One of the most crucial considerations in the creation of a new product is sensory assessment. Its primary goal is to determine whether and to what extent the product fits consumer expectations and whether it piques their attention (Kultys and Moczkowska-Wyrwisz, 2022). With the increasing level of BCPP in the formulation, the sensory scores for color and appearance of *dahi* decreased. It might be due to the dark black color of carrot powder. However, the *dahi* prepared with 1% BCPP was superior to other treatments with respect to body and texture, flavor, mouth feel, and overall acceptability. This may be due to BCPP's peculiar vegetable taste imparted on the *dahi* by BCPP. It has been demonstrated that fiber acts as a stabilizer, improving the sensory quality of fermented dairy products with regards to their texture, flavor, and mouthfeel (Rafiq *et al.*, 2020). The score decreased with increasing levels of more than 1% BCPP in the formulation, attributed to a slightly bitter taste due to the high polyphenol content of BCPP. The present result accordance with Issar *et al.* (2017), who reported that apple pomace extract used as a fiber source in the preparation of yoghurt, demonstrated satisfactory sensorial qualities with 5%, increasing levels of apple pomace more than 5% disagreed by judges.

The initial probiotic count in fresh *dahi* was found more than 6 log CFU/g, which is more than recommended level. But there is reduction in bacterial count during storage. The decreasing trend in the survival of probiotic bacteria might be due to increase in acidity, production of toxic metabolites, exhaustion of nutrients, reduction in O_2 level and production other antibacterial substances (Kieps and Dembczynski, 2022). The results of study are in accordance with stored probiotic lassi powder (Rawat *et al.*, 2022) and probiotic butter milk powder (Ahlawat *et al.*, 2022).

5. Conclusion

According to the results of this investigation, BCPP can be used as a valuable source of fiber in the production of extremely nutritious *dahi*. It is expected that 1% BCPP provides higher-quality *dahi* with admissible physical and sensory properties. All other treatments, however, were also satisfactory in terms of fiber, mineral, and antioxidant properties. The findings of this investigation can be used to create healthy fiber-enriched dairy products. It is also suggested that black carrots pomace powder *dahi* be commercially available for all groups of people, particularly children.

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Conflict of interest

The authors declare no conflicts of interest relevant to this article.

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