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Effect of addition of bottle gourd (*Lagenaria siceraria*) extract in paneer whey on sensory parameters of paneer whey beverage

HR Tidake, AT Shinde, AN Khatare, RB Kurumkar and DK Dukare

Abstract

The present research was undertaken with object to study effect of addition of bottle gourd (*Lagenaria siceraria*) extract in paneer whey on sensory parameters of paneer whey beverage. The paneer whey beverage prepared by using paneer whey and bottle gourd extract in proportion 100:00 (T₁), 70:30 (T₂), 60:40 (T₃) and 50:50 (T₄). The obtained product was subjected for sensory evaluation for treatments T₁, T₂, T₃ and T₄ by using 9 point hedonic scale and observed score for colour and appearance (8.04, 8.08, 8.01 and 7.90), flavour (8.18, 8.21, 8.11 and 7.91), taste (8.22, 8.28, 8.18 and 7.03), consistency (8.04, 8.14, 8.02 and 7.87) and overall acceptability (8.23, 8.73, 7.61 and 7.40). The result indicate that sensory score for colour and appearance, flavour, taste, consistency, overall acceptability of treatment 70:30 (T₂) was more acceptable over control (T₁) as well as treatments T₃ and T₄ respectively.

Keywords: Bottle gourd extract, sensory parameters, paneer whey

Introduction

India stands first in milk production across the world contributing 24 percent of global milk production. The recorded milk production of India for the year 2021-2022 is 221.06 million tonnes (Anonymous, 2022)^[1].

Whey is a valuable by-product from dairy industries obtained during manufacture of cheese, *chhana*, paneer, casein and *shrikhand* and is not being utilized to its full extent, on the other hand whey presents interesting nutritional value as food supplement and its discard is increasingly frowned upon by environmentalists. It is a major output of cheese industry. It carries precious nutrients like lactose, whey protein, minerals, and vitamins. These nutrients have an indispensable value in human dietary requirement (Prendergast, 1985^[14] and Mathur *et al.*, 1988^[11]). Currently, total world production of whey is approximately 85 million tonnes in which India contributes approximately 2, 80, 000 tonnes of the total global production (Shukla *et al.*, 2004^[17], Raju *et al.*, 2005^[15] and Mishra, 2008^[12]). Whey disposal is a serious problem for dairy industry. In order to reduce pollution load, whey should be treated to obtain commercial products (Gupta and Nair, 2010)^[4].

The bottle gourd contains moisture, protein, fat, carbohydrate, fibre, ash, and energy (94.5 ± 0.06 gm, 1.2 ± 0.06 gm, 0.2 ± 0.02 gm, 3.75 ± 0.03 gm, 0.7 ± 0.01 gm, 0.5 ± 0.01 gm, and 15 ± 0.12 Cal on dry weight basis), respectively. The bottle gourd edible part has niacin, ascorbic acid, potassium, calcium, and phosphorus 0.3, 12, 87, 12, and 37 mg respectively. Potassium is available in more percent after phosphorus and calcium (Hanif *et al.*, 2006)^[7].

Bottle gourd has high percent of water thus don't let human body to dehydrate, rich source of calcium and vitamins (C and K), shows cooling effect on human body and even act as a good laxative. It Provide relief to patients affected by heart problems, urinary disorders and insomnia. It also suggested for its properties like anti-diabetic and aphrodisiac. Bottle gourd pulp is helpful in overcoming cough, night blindness, constipation and also acts as antidote against certain poisons. Its pulp is a suitable substitute for people suffering from lactose intolerance and useful in managing many diseases like cardiac disorders, hepatic diseases and ulcer. Its high potassium content manages blood pressure of hypertensive patients. Also helpful in losing weight quickly because it is low in fat and cholesterol and provides high dietary fiber (Gupta *et al.*, 2022)^[5].

Materials and Methodology

Collection of Buffalo milk

Buffalo milk was procured from local market of Latur city of Natural Milk Pvt. Ltd., Latur having 6.0 percent fat and 9 percent SNF.

Collection of Bottle gourd

Fresh bottle gourd was purchased from local market of Latur city.

Ingredients: Sugar

Good quality, clean, crystalline, white cube sugar was purchased from local market of Latur city.

Chemicals

Analytical reagents (AR) were used in the analysis of prepared whey beverage.

Packaging Materials

Glass bottles were used for packaging and storage of prepared whey beverage.

Equipment and accessories

Stainless steel vessels of requisite capacity, standard weight balance, thermometer, gas stove, muslin cloth, glass rod, mixer (grinder), Whatman no.1 filter paper, knives etc. were used for preparation of whey beverage. Before using this material, it was properly cleaned and washed with detergent solution. All the precautionary measures were taken during the conduct of trials to avoid contamination.

Methodology

Procedure for preparation of paneer whey

The buffalo milk (6 percent fat and 9 percent SNF) was heated in stainless steel vessel to 86 °C for 15 minute and cooled to 76 °C. After the cooling this hot milk was acidified by addition of 1 percent citric acid solution with continuous stirring so coagulation of milk protein took properly, followed with filtration of obtained product through muslin cloth, solid part used as paneer and drained liquid portion as paneer whey which collected in vessel.

Procedure for preparation of bottle gourd extract

Prior to preparation of bottle gourd extract, fresh bottle gourd had procured from local market of Latur. Then bottle gourd wash with clean water and peeled off, after that cut into flakes with separation of seed from it followed by grinding the flakes and filtration of bottle gourd pulp through muslin cloth and collect bottle gourd extract in beaker.

Procedure for preparation of paneer whey beverage blended with bottle gourd (*Lagenaria siceraria*) extract

The paneer whey beverage blended with bottle gourd extract was prepared as per the method of Kamate, (2015) ^[9] with little modifications. The paneer whey was heated to 45 °C with addition of 9 percent sugar and bottle gourd extract as per the treatment combinations. Then this mixture was heated to 105 °C for 5 minutes, filtered the product through muslin cloth, filled in the glass bottle and sealed. The bottle pasteurization with finished product was carried at 63 °C for 30 minutes and stored at 4 °C.

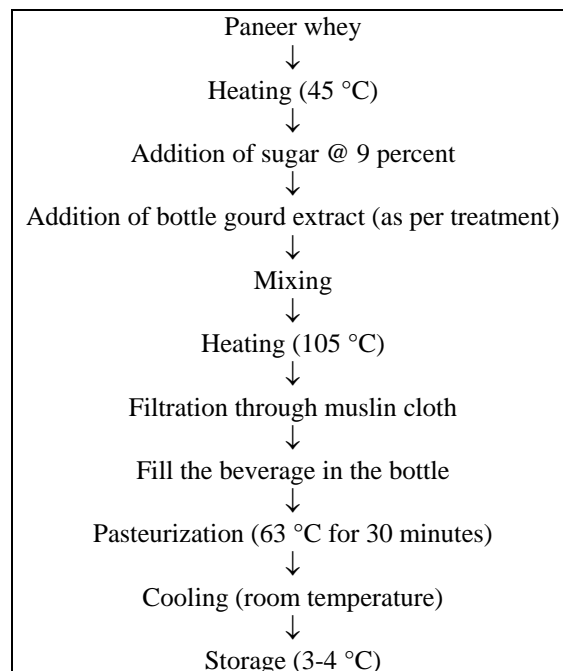


Fig 1: Flow chart for preparation of paneer whey beverage blended with bottle gourd (*Lagenaria siceraria*) extract (Kamate, 2015) ^[9]

Treatment Combination

For preparation of paneer whey beverage blended with bottle gourd (*Lagenaria siceraria*) extract, by using 9 percent sugar to the weight of paneer whey and bottle gourd extract as per treatment combination were finalized on weight basis as follows:

T₁ - 100 parts of paneer whey

T₂ - 70 parts of paneer whey and 30 parts of bottle gourd extract

T₃ - 60 parts of paneer whey and 40 parts of bottle gourd extract

T₄ - 50 parts of paneer whey and 50 parts of bottle gourd extract

Sensory evaluation

Sensory evaluation of control and prepared paneer whey beverage was carried out by semi trained panel of 5 judges using 9 point hedonic scale for colour and appearance,

flavour, taste, consistency and overall acceptability. Score card was provided to all judges, comparing “9-point hedonic scale” developed by Quarter Master Food and container Institute, U.S.A. (Gupta, 1976)^[6].

Statistical Analysis

The data obtained was analysed statistically by using Completely Randomized Design (CRD) as per Panse and Sukhatme (1967)^[13]. The significance of the result was evaluated on the basis of critical difference. In all four replication was carried out

Result and Discussion

Sensory evaluation of paneer whey beverage blended with bottle gourd (*Lagenaria siceraria*) extract

Sensory evaluation of control and whey beverage blended with bottle gourd extract was carried out by semi- trained panel of 5 judges using 9 point hedonic scale. The sensory attributes such as colour and appearance, flavour, taste, consistency and overall acceptability was studied and data obtained were analyzed by using completely randomized block design (CRD). The scores given by judges for different sensory parameters were recorded and subsequently discussed as follows.

Table 1: Sensory evaluation of paneer whey beverage blended with bottle gourd extract

Treatment	Sensory score (Mean values of Replications)				
	Colour and appearance	Flavour	Taste	Consistency	Overall acceptability
100:00 (T ₁)	8.04 ^b	8.18 ^b	8.22 ^b	8.04 ^b	8.14 ^b
70:30 (T ₂)	8.08 ^a	8.21 ^a	8.28 ^a	8.14 ^a	8.29 ^a
60:40 (T ₃)	8.01 ^c	8.11 ^c	8.18 ^c	8.02 ^c	8.09 ^c
50:50 (T ₄)	7.90 ^d	7.91 ^d	7.03 ^d	7.87 ^d	7.91 ^d
F -Test	Sign	Sign	Sign	Sign	Sign
S. E. ±	0.005	0.0048	0.005	0.008	0.007
C. D. at 5%	0.017	0.015	0.017	0.024	0.023

The values with different superscripts differ significantly at 5 percent level of significance

Colour and appearance score of paneer whey beverage blended with bottle gourd extract

The mean score for colour and appearance for control (T₁)

and paneer whey beverage blended with bottle gourd extract 30, 40 and 50 percent (T₂, T₃ and T₄) was given in Table 2.

Table 2: Colour and appearance score of paneer whey beverage blended with bottle gourd extract

Treatment	Replication	R ₁	R ₂	R ₃	R ₄	Mean
	T ₁		8.04	8.05	8.04	8.03
T ₂		8.09	8.07	8.08	8.06	8.08 ^a
T ₃		8.02	8.01	8.00	8.02	8.01 ^c
T ₄		7.90	7.88	7.89	7.91	7.90 ^d
S. E. ± 0.005						
C. D. at 5% 0.017						

The values with different superscripts differ significantly at 5 percent level of significance.

The colour and appearance score for control and whey beverage blended with bottle gourd extract T₂, T₃ and T₄ are 8.04, 8.08, 8.01 and 7.90 respectively.

The result indicated that addition of bottle gourd extract in paneer whey decreased in colour and appearance score significantly towards higher level of addition of bottle gourd extract in whey at 40 percent (T₃) and 50 percent (T₄) level. However Colour and appearance score for T₂ was highest and differ significantly from control T₁ (8.04) as among treatments T₃ (8.01) and T₄ (7.90).

The results of present study similar with Sonawane, (2011)^[18] who reported that addition of bottle gourd pulp in *kulfi* at 3, 6 and 9 percent and resulted decreased in colour and appearance score 7.81, 7.26, 7.24 and 7.53 for treated sample and control.

Kamate, (2015)^[9] who reported that addition of beetroot extract in paneer whey at 15, 20 and 25 percent resulted in reduction in colour score from 8.50, 8.20, 8.10 and 8.00 for treated sample and control. Similarly Satpute *et al.* (2018)^[16] reported addition of beetroot extract and *mentha* extract in paneer whey decreased in colour from 8.60, 8.30, 8.00 and 8.10 for treated sample and control.

Flavour score of paneer whey beverage blended with bottle gourd extract

The average flavour score for control (T₁) and paneer whey beverage blended with bottle gourd extract 30, 40 and 50 percent (T₂, T₃ and T₄) was presented in Table 3.

Table 3: Flavour score of paneer whey beverage blended with bottle gourd extract

Treatment	Replication	R ₁	R ₂	R ₃	R ₄	Mean
	T ₁		8.18	8.16	8.17	8.19
T ₂		8.21	8.20	8.22	8.20	8.21 ^a
T ₃		8.10	8.11	8.10	8.11	8.11 ^c
T ₄		7.90	7.92	7.91	7.90	7.91 ^d
S. E. ± 0.0048						
C. D. at 5% 0.015						

The values with different superscripts differ significantly at 5 percent level of significance.

The flavour score for control and whey beverage blended with bottle gourd extract T₂, T₃ and T₄ are 8.18, 8.21, 8.11 and 7.91 respectively.

The result indicated that addition of bottle gourd extract in paneer whey decreased in flavour score significantly towards higher level of addition of bottle gourd extract in whey at 40 percent (T₃) and 50 percent (T₄) level. The flavour score for T₂ (8.21) was highest differ significantly from control (8.18) and treatments T₃ (8.11) and T₄ (7.91).

The results of present study are in agreement with Sonawane, (2011) [18] who reported that addition of bottle gourd pulp in *kulfi* at 3, 6 and 9 percent decreased flavour score 8.43, 8.33 7.54 and 8.40 for treated sample and control. Gaikwad, (2010)

[3] who reported that addition of sapota pulp at 5, 10 and 15 percent in whey resulted that decrease in flavour score from 8.05, 7.82, 7.70 and 7.42 for treated sample and control. Similarly Ingale *et al.* (2009) [8] reported addition of custard apple pulp in whey decreased in flavour score 7.0 to 6.8 respectively.

Taste score of paneer whey beverage blended with bottle gourd extract

The mean taste score for control (T₁) and paneer whey beverage blended with bottle gourd extract 30, 40 and 50 percent (T₂, T₃ and T₄) was given in Table 4.

Table 4: Taste score of paneer whey beverage blended with bottle gourd extract

Treatment \ Replication	R ₁	R ₂	R ₃	R ₄	Mean
T ₁	8.20	8.23	8.21	8.22	8.22 ^b
T ₂	8.29	8.27	8.2	8.29	8.28 ^a
T ₃	8.19	8.17	8.18	8.19	8.18 ^c
T ₄	7.02	7.01	7.03	7.04	7.03 ^d
S. E. ± 0.005 C. D. at 5% 0.017					

The values with different superscripts differ significantly at 5 percent level of significance.

The taste score for control and whey beverage blended with bottle gourd extract T₂, T₃ and T₄ are 8.22, 8.28, 8.18 and 7.03 respectively.

The result indicated that addition of bottle gourd extract in paneer whey decreased in taste score significantly towards higher level of addition of bottle gourd extract in whey at 40 percent (T₃) and 50 percent (T₄) level. The taste score for T₂ (8.28) improved and differ significantly from control (8.22) and treatments T₃ (8.18) and T₄ (7.03).

The results similar with Sonawane, (2011) [18] who reported that addition of bottle gourd pulp in *kulfi* at 3, 6 and 9 percent and resulted decreased in taste score 8.64, 8.42 7.78 and 8.54

for treated sample and control. Gaikwad, (2010) [3] and Landge *et al.* (2020) [10] who reported that addition of sapota pulp in whey and bael fruit pulp in whey beverage found that score for taste decreased from 8.30 to 8.00 and (8.16 ± 0.75) to (1.58 ± 0.47) for treated sample.

Consistency score of paneer whey beverage blended with bottle gourd extract

The average consistency score for control (T₁) and paneer whey beverage blended with bottle gourd extract 30, 40 and 50 percent (T₂, T₃ and T₄) was presented in Table 5.

Table 5: Consistency score of paneer whey beverage blended with bottle gourd extract

Treatment \ Replication	R ₁	R ₂	R ₃	R ₄	Mean
T ₁	8.02	8.06	8.04	8.05	8.04 ^b
T ₂	8.14	8.13	8.12	8.15	8.14 ^a
T ₃	8.00	8.02	8.04	8.03	8.02 ^b
T ₄	7.87	7.86	7.89	7.86	7.87 ^d
S. E. ± 0.008 C. D. at 5% 0.024					

The values with different superscripts differ significantly at 5 percent level of significance.

The consistency score for control and whey beverage blended with bottle gourd extract T₂, T₃ and T₄ are 8.04, 8.14, 8.02 and 7.87 respectively.

The result indicated that addition of bottle gourd extract in paneer whey decrease in consistency score significantly towards higher level of addition of bottle gourd extract in whey at 40 percent (T₃) and 50 percent (T₄) level. The consistency score of T₂ (8.14) was highest and differ significantly from control (8.04) as well as treatment T₃ (8.02) and T₄ (7.87).

The results similar with Sonawane, (2011) [18] who reported that addition of bottle gourd pulp in *kulfi* at 3, 6 and 9 percent

and resulted decreased in body and texture score 8.83, 7.76, 6.80 and 7.80 for treated sample and control. Gaikwad, (2010) [3] who reported that addition of sapota pulp at 5, 10 and 15 percent in whey resulted that decrease in consistency score from 8.65, 7.50, 7.45 and 8.20 for treated sample and control.

Overall acceptability score of paneer whey beverage blended with bottle gourd extract

The mean overall acceptability score for control (T₁) and paneer whey beverage blended with bottle gourd extract 30, 40 and 50 percent (T₂, T₃ and T₄) was given in Table 6.

Table 6: Overall acceptability score of paneer whey beverage blended with bottle gourd extract

Replication Treatment	R ₁	R ₂	R ₃	R ₄	Mean
T ₁	8.12	8.15	8.14	8.13	8.14 ^b
T ₂	8.29	8.30	8.29	8.27	8.29 ^a
T ₃	8.10	8.11	8.06	8.10	8.09 ^c
T ₄	7.92	7.90	7.91	7.90	7.91 ^d
S. E. ± 0.007					
C. D. at 5% 0.023					

The values with different superscripts differ significantly at 5 percent level of significance.

The overall acceptability score for control and whey beverage blended with bottle gourd extract T₂, T₃ and T₄ are 8.14, 8.29, 8.09 and 7.91 respectively.

The result indicated that addition of bottle gourd extract in paneer whey decrease in overall acceptability score significantly towards higher level of addition of bottle gourd extract in whey at 40 percent (T₃) and 50 percent (T₄). Overall acceptability of treatment T₂ (8.29) was more than control (8.14) as well as T₃ (8.09) and T₄ (7.91).

The results similar with Sonawane, (2011) [18] who reported that addition of bottle gourd pulp in *kulfi* at 3, 6 and 9 percent and resulted decreased in overall acceptability score 8.43, 7.94, 7.34 and 8.07 for treated sample and control. Gaikwad, (2010) [3] who reported addition of sapota pulp in whey, decreased overall acceptability from 8.03-7.65 and 7.53 of treated sample and control. Similarly Landge *et al.* (2020) [10] and Dhagde *et al.* (2021) [2] who reported that addition bael fruit pulp in whey beverage and addition of banana extract with 0.1 lemon grass distillate in whey and found that decrease in overall acceptability 8.80±0.10 to 6.58±0.61 and 8.55 to 7.90 respectively.

Conclusion

From the present study it was concluded that addition of bottle gourd extract at 30, 40 and 50 percent level in paneer whey was found suitable on the basis of sensory evaluation. The sensory score of control and paneer whey beverage blended with bottle gourd extract, it was observed that addition of bottle gourd extract at 30 percent level improved all sensory parameters such as colour and appearance (8.08), flavour (8.21), taste (8.28), consistency (8.14) and overall acceptability (8.29) over control (T₁) as well as treatments T₃ and T₄ respectively.

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