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Studies on sensory evaluation of *paneer* whey beverage using strawberry (*Fragaria ananassa*) pulp

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Abstract

Paneer whey beverage prepared with strawberry pulp in different proportion of 100:0 (T₁), 98:6 (T₂), 96:8 (T₃) and 94:10 (T₄), respectively. The product obtained was subjected for Sensory evaluation and observed that the colour and appearance score for treatment T₁, T₂, T₃ and T₄ was 7.60, 6.80, 7.80 and 8.75, respectively. Flavour score was 5.75, 6.75, 7.95 and 8.55, respectively. Consistency score was 7.70, 8.40, 8.80 and 8.00, respectively. Taste score was 6.35, 7.35, 8.90 and 7.60, respectively. Overall acceptability scores for treatment 6.85, 7.33, 8.36 and 8.23, respectively. Score for flavour, colour and appearance, taste, body and texture and overall acceptability increase at limited extent and then gradually decreased. It was revealed that the level of strawberry pulp raised the acceptance for the product increased.

Keywords: Strawberry, sensory evaluation, whey beverage

Introduction

India is the largest milk producer across the world with a recorded production level of 198.4 million tonnes in 2019-20. Milk Production in the country increased by 5.70 per cent compare to previous year 2018-19. Milk availability per capita increased to 407 gm per day. Currently, 46 per cent of the total milk produced in the country is consumed as fluid milk and remaining 54 per cent is converting into different milk products.

Milk is a major source of dietary energy, high-quality protein and fat. It can make a significant contribution to meeting the required nutrient intakes of calcium, magnesium, selenium, riboflavin, vitamin B₁₂ and pantothenic acid. Milk from some animal species can also be a source of zinc and vitamins A, C, D and B₆. Bioavailability of some nutrients in milk, for example calcium is high compared with that in other foods in the diet. Milk and dairy products can be important in diversifying the diet. They are nutrient dense and provide high quality protein and micronutrients in an easily absorbed form that can benefit both nutritionally vulnerable people and healthy people when consumed in appropriate amounts.

Whey is the watery part of milk that remains after separation of curd / coagulated products that result from acid or proteolytic enzyme mediated coagulation of milk. It is major by-product of dairy industry, during manufacture of products like *paneer*, *channa*, *chakka*, cheese, casein, etc. In the manufacturing of these products, about 10-20 per cent portion of milk is recovered as the desired end product and remaining 80-90 per cent liquid portion is the whey. It is considered to be reliable source of number of high quality and biological active proteins, carbohydrates and minerals. In India, nearly 5 million tones whey is produced of which *chhana* and *paneer* whey contribute around 80 per cent of total whey (Gupta, 2008) [8] and majority of it is disposed off as a waste. These are two types of whey available, acid whey that is generated as a result of *paneer*, *chhana*, *chakka* and acid casein manufacture and rennet whey, which is produced during cheese manufacture. (Darade and Ghodake, 2012) [4].

Massive amount of whey are produced as a by-product during the production of *paneer*, *chhana*, *chakka*, and cheese. Pollution due to whey is a major issue so the utilization of whey in the production of beverages which contains almost all the nutrients of milk except casein and fat, thus making it highly nutritious and healthy way to deal this issue. Whey constitute 45-50 per cent of total milk solids, 70 per cent of milk sugar (lactose), 20 per cent of milk protein and 70-90 per cent of milk minerals and almost all the water soluble vitamins originally present in milk. *Paneer* whey is better suited for the preparation of whey beverage than cheese whey because it lacks acidity. Whey proteins are often the preferred source for ready-to-drink protein beverages because of their excellent nutritional qualities, bland flavour, ease of digestibility and unique functionality in beverage systems. (Chavan *et al*, 2015) [3].

Materials and Methodology

Collection of Milk

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

Collection of Strawberry

Strawberry was purchased from local market of Latur and pulp was prepared in laboratory.

Ingredients

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

Packaging Material

Glass bottles was used for packaging were purchased from local market of Latur city.

Equipment and accessories

Stainless steel vessels of requisite capacity, gas stove, fruit extractor (mixer grinder), muslin cloth, standard weight balance, thermometer and knives etc. were used for preparation of strawberry *paneer* whey beverage. Before using this material it was properly cleaned and washed with detergent solution. All the precautionary measures were considered during the conduct of trials to avoid contamination.

Chemicals and Reagents

Analytical grade (AR) or guaranteed grade (GR) reagents were used in the chemical analysis of whey beverage.

Treatment combinations (Plan of work)

For preparation of whey beverage by using strawberry (*Fragaria ananassa*) pulp, by adding sugar 8 per cent by weight of *paneer* whey and strawberry pulp as per the treatment combinations on weight basis were as follows:

T₁: 100 Parts of *Paneer* whey + sugar (@ 8 per cent)

T₂: 94 Parts of *Paneer* whey + sugar (@ 8 per cent) + 6 Parts of Strawberry pulp

T₃: 92 Parts of *Paneer* whey + sugar (@ 8 per cent) + 8 Parts of Strawberry pulp

T₄: 90 Parts of *Paneer* whey + sugar (@ 8 per cent) + 10 Parts of Strawberry pulp

The different levels were tried and compared with control (T₁).

Preparation of *Paneer* whey Beverage using strawberry pulp

The *paneer* whey beverage using strawberry pulp was prepared by using method of Pandiyan *et al.* (2011)^[12] with slight modification done by Kamate (2015)^[9].

Procedure for strawberry whey beverage

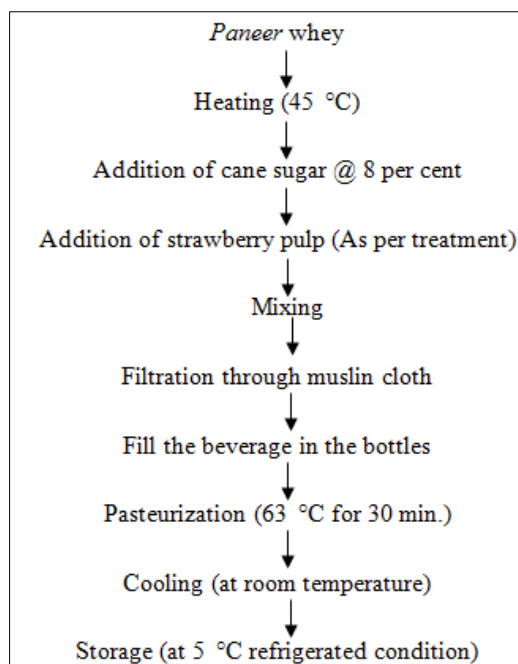


Fig 1: Flow chart for preparation of *Paneer* whey beverage using strawberry pulp (Kamate, 2015)^[9]

The *Paneer* whey was heated at 45 °C temperature. Then cane sugar @ 8 per cent was added and maintained in all treatment combinations. Then strawberry pulp was added in the *paneer* whey as per treatment combinations, after adding strawberry pulp mixed properly by stirred it well, there after filtration through muslin cloth was done, Then prepared strawberry whey beverage was filled in glass bottles and bottles were sealed and In-bottle pasteurization was done at 63°C temperature for 30 minutes. These bottled strawberry whey beverage cooled at room temperature and stored at refrigeration temperature at 5°C for further use.

Organoleptic evaluation of the product

The product so obtained was subjected to organoleptic evaluation by the panel of judges. It was evaluated for colour, flavour, consistency and taste. 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].

The score of various treatments in respect of colour, flavour, taste, consistency and overall acceptability was worked out. The data was analysed using Completely Randomized Design (CRD).

Sensory evaluation of Strawberry whey beverage

The sensory evaluation of food products is one of the most important elements in the development process, without which other impacts may be fruitful less. When a product reaches this level, the achievement is in the hands of the developers. A panel of five semi-expert judges used a 9-point hedonic scale to assess the acceptability of the whey beverage

in terms of sensory features such as colour and appearance, flavour, consistency, and taste/mouth feel. The received data were examined using a Completely Randomized Design (CRD). The results score obtained on account of this parameter are presented in Table 1 and graphical presentation in fig 2

Table 1: Organoleptic evaluation of Strawberry whey beverage

Treatment	Sensory Score (Mean Values of Replications)				
	Colour and appearance	Flavour	Taste/Mouth feel	Consistency	Overall acceptability
T ₁ (100:00)	7.60 ^b	5.75 ^d	6.35 ^c	7.70 ^d	6.85 ^b
T ₂ (94:06)	6.80 ^c	6.75 ^c	7.35 ^b	8.40 ^b	7.33 ^{ab}
T ₃ (92:08)	7.80 ^b	7.95 ^b	8.90 ^a	8.80 ^a	8.36 ^a
T ₄ (90:10)	8.75 ^a	8.55 ^a	7.60 ^b	8.00 ^c	8.23 ^a
'F' test	Sign.	Sign.	Sign.	Sign.	Sign.
S. E.±	0.075	0.095	0.12	0.076	0.36
C. D. at 5%	0.231	0.295	0.382	0.235	1.11

The values with different small letters superscripts row wise differ significantly at 5% level of significance.

Colour and appearance

In drink the colour and appearance are first impression of the developed products to attract the consumer which should be attractive and pleasant. The average score for colour and appearance secured by strawberry whey beverage is presented in Table 2.

Table 2: Colour and appearance of strawberry whey beverage

Replication Treatment	R ₁	R ₂	R ₃	R ₄	Mean
T ₁	7.60	7.40	7.80	7.60	7.60 ^b
T ₂	6.80	6.60	7.00	6.80	6.80 ^c
T ₃	7.80	7.60	8.00	7.80	7.80 ^b
T ₄	8.80	8.60	8.80	8.80	8.75 ^a
S.E.± 0.075	C. D. at 5% 0.231				

The values with different small letters superscripts row wise differ significantly at 5% level of significance.

Table 2 express the score secured by strawberry whey beverage in terms of colour and appearance. The calculated critical difference and treatment difference were tested at significance level of 5 per cent. The mean score range for colour and appearance was in between 6.80 to 8.75. The treatment T₄ was significantly (P<0.05) superior over treatments T₁, T₂ and T₃ while treatment T₁ was at par with T₃ but significantly (P<0.05) differ from treatments T₂ and T₄. Present study concluded that colour and appearance score for prepared whey beverage increased as per cent of added strawberry pulp in *paneer* whey was increased. Sensory judging panel suggested that increasing strawberry pulp in *paneer* whey was more appreciable and acceptable regarding colour and appearance score these results were matched with findings of Bhavsagar *et al.* (2010) [2] reported the average score for pineapple flavoured beverage were increased as the incorporation of the pineapple in whey was increased for colour and appearance i.e. 7.7, 7.6, 8.0 and 7.3 for treatment T₁, T₂, T₃ and T₄ respectively. Further, Landge and Gaikwad (2013) [10] studied preparation and sensory evaluation of whey beverage and observed that mean score appearance score for

different treatments i.e. 7.16, 6.83 and 7.5 for T₀, T₁ and T₂, respectively. Alane *et al.* (2017) [1] studied organoleptic evaluation of mango based whey beverage and noticed the score for colour ranges from 5.8 to 7.0.

Flavour

Flavour developed the desire to taste the product. Flavour means an overall integrated perception of taste and aroma associated with the product, the flavour score is tabulated in Table 3 for strawberry whey beverage.

Table 3: Flavour of strawberry whey beverage

Replication Treatment	R ₁	R ₂	R ₃	R ₄	Mean
T ₁	5.80	5.60	5.80	5.80	5.75 ^d
T ₂	6.80	6.60	6.80	6.80	6.75 ^c
T ₃	8.20	7.60	8.20	7.80	7.95 ^b
T ₄	8.40	8.60	8.40	8.80	8.55 ^a
S. E.± 0.095	C. D. at 5% 0.295				

The values with different small letters superscripts row wise differ significantly at 5% level of significance.

It was evaluated that the mean scores for flavour of beverage for treatments T₁, T₂, T₃ and T₄ were 5.75, 6.75, 7.95 and 8.55, respectively. The treatment T₄ was higher and significantly (P<0.05) superior over rest of the treatment, All the treatments was significantly (P<0.05) differ from each other. This might be due to increasing incorporation of strawberry pulp per cent in whey beverage, the results of findings were similar with Landge and Gaikwad (2013) [10] studied preparation and sensory evaluation of whey beverage. The score in respect of flavour ranged from 6.5 to 7.83. Satpute *et al.* (2016) [14] studied organoleptic evaluation of herbal beetroot whey beverage and noticed increasing flavour score trend ranges from 8.10 to 8.40. Further, Alane *et al.* (2017) [1] studied organoleptic evaluation of mango based whey beverage and noticed the score for flavour ranges from 5.8 to 6.7.

Taste/Mouth feel

The value recorded in respect of taste or mouth feel score of the finished product are shown in Table 4.

Table 4: Taste/Mouth feel of strawberry whey beverage

Replication Treatment	R ₁	R ₂	R ₃	R ₄	Mean
T ₁	6.00	6.60	6.00	6.80	6.35 ^c
T ₂	7.20	7.20	7.40	7.60	7.35 ^b
T ₃	8.80	9.00	9.00	8.80	8.90 ^a
T ₄	7.60	7.80	7.40	7.60	7.60 ^b
S. E. ± 0.12	C. D. at 5% 0.382				

The values with different small letters superscripts row wise differ significantly at 5% level of significance.

It was evaluated that the mean scores for taste or mouthfeel of beverage for treatments T₁, T₂, T₃ and T₄ were 6.35, 7.35, 8.90 and 7.60, respectively. The treatment T₃ was higher and significantly ($p < 0.05$) superior over rest of the treatment, the treatment T₂ and T₄ were at par with each other while significantly ($p < 0.05$) differ from T₁ and T₃. The results are in line with Dhamsaniya and Varshney (2013) [5] studied development and evaluation of whey based RTS beverage

from ripe banana juice and noted score for taste of finished products ranges from 3.08 to 7.83; Alane *et al.* (2017) [1] studied organoleptic evaluation of mango based whey beverage and noticed the score for taste or mouthfeel ranges from 5.71 to 6.7.

Consistency

The value recorded in respect of consistency score of the finished product are shown in Table 5.

Table 5: Consistency of strawberry whey beverage

Replication Treatment	R ₁	R ₂	R ₃	R ₄	Mean
T ₁	7.60	7.80	7.80	7.60	7.70 ^d
T ₂	8.60	8.40	8.20	8.40	8.40 ^b
T ₃	9.00	8.80	8.60	8.80	8.80 ^a
T ₄	8.00	8.00	7.80	8.20	8.00 ^c
S. E. ± 0.076	C. D. at 5% 0.235				

The values with different small letters superscripts row wise differ significantly at 5% level of significance.

It was found that the mean scores for consistency of beverage for treatments T₁, T₂, T₃ and T₄ were 7.70, 8.40, 8.80 and 8.00, respectively. The treatment T₃ was higher and significantly ($p < 0.05$) superior over rest of the treatment, All the treatments were significantly ($p < 0.05$) differ from each other. The findings were matches with Satpute *et al.* (2016) [14] reported that the average sensory score for consistency of herbal whey beverage in treatment T₁, T₂, T₃ and T₄ was 8.00, 8.35, 8.40 and 8.60, respectively. Further, Sthavarmath and

Puranik (2018) [15] studied that the development of pomegranate blended whey beverage and observed average sensory score for consistency of treatment T₁, T₂, T₃ and T₄ was 7.31, 7.60, 7.66 and 7.59, respectively.

Overall acceptability

Overall acceptability can be considered as a complex characteristic of food that determines its value or acceptability to consumer. The data obtained on overall acceptability of treatments and T₄ is tabulated in Table 6.

Table 6: Overall acceptability of strawberry whey beverage

Replication Treatment	R ₁	R ₂	R ₃	R ₄	Mean
T ₁	7.6	5.75	6.35	7.7	6.85 ^b
T ₂	6.8	6.75	7.35	8.4	7.33 ^{ab}
T ₃	7.8	7.95	8.9	8.8	8.36 ^a
T ₄	8.75	8.55	7.6	8	8.23 ^a
S. E. ± 0.36 C. D. at 5% 1.11					

The values with different small letters superscripts row wise differ significantly at 5% level of significance.

It was observed that the mean scores for overall acceptability of beverage for treatments T₁, T₂, T₃ and T₄ were 6.85, 7.33, 8.36 and 8.23, respectively. The overall acceptability score for treatment T₃ was higher over rest of the treatment. The treatment T₁ was significantly ($p < 0.05$) differ from T₃, T₄ and at par with T₂ while The treatments T₂, T₃ and T₄ are at par with each other.

The findings were in line with, Dhamsaniya and Varshney (2013) [5] studied development and evaluation of whey based RTS beverage from ripe banana juice and noted score for

overall acceptability of finished products ranges from 3.50 to 7.33. Alane *et al.* (2017) [1] studied organoleptic evaluation of mango based whey beverage and noticed the score for overall acceptability ranges from 5.71 to 6.7. Further, Gupta *et al.* (2017) [7] noted maximum and minimum score for overall acceptability was 8.3 and 7.4 for papaya pulp whey beverage. Overall acceptability was depending on added level of sugar and papaya pulp in whey. Mugale *et al.* (2018) [11] studied Sensory analysis of whey based mango beverage using betel leaves distillate and noted that scores for overall acceptability 7.8, 8.0, 8.5 and 8.0 for T₁, T₂, T₃ and T₄, respectively.

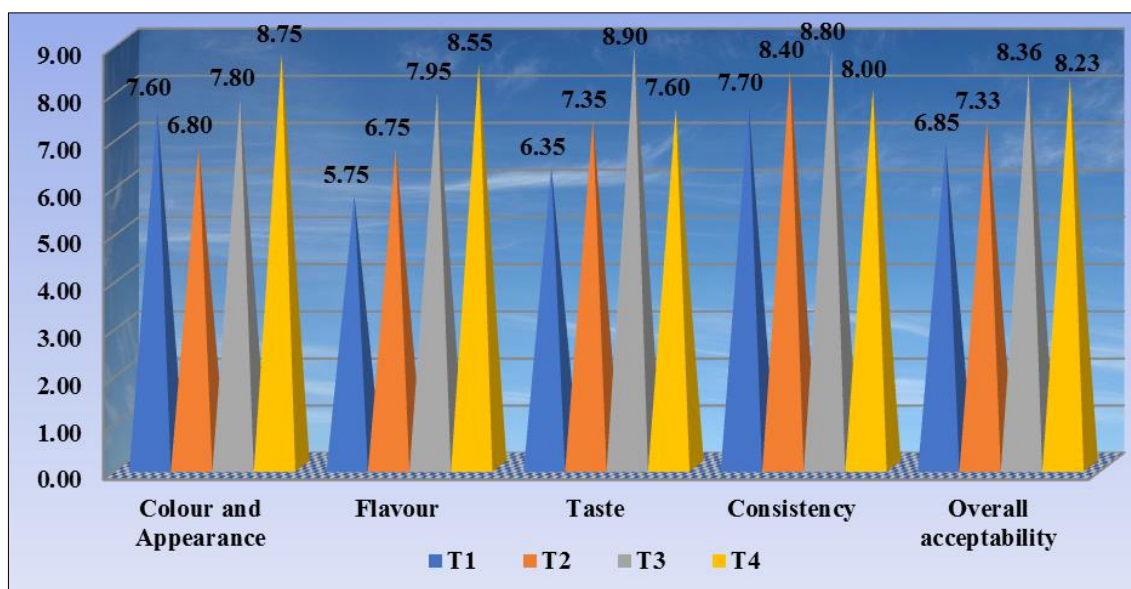


Fig 2: Graphical presentation for Sensory evaluation of Strawberry mixed *paneer* whey beverage

Conclusions

From present investigation it was observed that the strawberry pulp can be used for *paneer* whey beverage on the reason of Sensory evaluation of finished product. It was revealed that, the level of strawberry pulp raised the sensory score for flavour, colour and appearance, taste, body and texture and overall acceptability increase at limited extent and then gradually decreased. It was concluded that the strawberry pulp added in *paneer* whey beverage increased the acceptance of finished product.

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