

Preparation and quality characteristics of carbonated beverage prepared by profiteered, ultra filtered acidic whey with different fruit juices

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Abstract

The present investigation can through a light on utilization of the acidic whey (which is a by-product of the dairy industry) for the preparation of beverages. A process for preparation of carbonated acidic whey beverage by blending with different types of fruit juices at various levels of concentration has been standardized. In the present study the highly acceptable 12.0% sugar level was used as beverage base. The acidic whey (shrikhand whey) beverage base was blended with three different types of fruit juices *i.e.* mango, orange and pineapple at different levels of concentrations *i.e.* 18.0, 20.0, 22.0 and 24.0%. The unclarified and prefiltered acidic whey (shrikhand whey) beverage base with 22% unclarified mango juice, orange juice and pineapple juice concentration scored higher overall acceptability *i.e.* 8.23, 7.96 & 8.26 respectively. The ultrafiltered acidic whey (shrikhand whey) beverage base with 22% pineapple juice was found to be the best among all prepared beverage. The selected beverages were carbonated at three different levels of carbonation *i.e.* 25, 30, 35 psi at $4 \pm 1^\circ\text{C}$ temperature and were subjected to organoleptic evaluation. The unclarified mango beverage scored higher *i.e.* 8.33 at 25 psi. The prefiltered orange flavoured beverage scored higher *i.e.* 8.10 at 35 psi. The ultrafiltered pineapple flavoured beverage scored highest *i.e.* 8.53 at 30 psi, for overall acceptability than that of unclarified mango and prefiltered orange flavoured acidic whey (shrikhand whey) beverages.

Keywords: Ultrafiltered, Prefiltered, Unclarified, Carbonated

Introduction

Milk and milk products (butter, ghee, khoa, cheese, paneer, shrikhand, ice-cream) are popular food items in all over world but rapid changes in socio-economic status and increase urbanization leads to the static milk consumption tendency. Therefore, dairy industries are now looking for new products which can be prepared from byproducts (contain valuable milk solids) [1, 2].

The major by-products of the dairy industry are skim milk, butter milk and whey. The utilization of these by-products has not only increased the availability of functional food but has also increased the commercial viability of these products.

Whey can be defined as the opaque, greenish, yellow, watery fluid obtained as a by-product when milk is coagulated either by acid or rennett for the preparation of chhana, paneer, cheese, casein and shrikhand. It contains many nutrients like whey proteins, lactose, thiamine, riboflavin, vitamin B6, Vitamin C, calcium and phosphorus except casein and fat [3]. The whey solids has excellent functional properties such as solubility, gel formation, emulsification, water binding, whipping etc. which can be potentially utilized for the production of lactose, alcohol, organic acid, protein recovery and as dried powder in various bakery products, dried infant food, beverages, dried soup, frozen desserts, dry mixes etc. [3, 4, 5]. It can also be utilized in the preparation of ethanol, wine, acetic acid, dairy gels, lactose based sweeteners, whey syrups, crackers, vegetable soups etc. [6].

The present scenario of whey indicates that out of 85 million tones of global production 40% is still disposed as raw in to sewage which leads to serious environmental pollution due to high biological oxygen demand (3,00,000 – 5,00,000 ppm) [7]. There is a approx estimate that more than 3 million tones of whey is produced in country while more than 2 lakh tones of it containing valuable nutrients which are dumped in to gutter [8]. A study indicates that treating 5 lakh litres of whey in sewage would cost \$10,000 per day for primary treatment and \$14,500 for tertiary treatment [9]. In India, cheese whey accounts for the major part of the total whey production *i.e.* nearly about 95 per cent. About 80 per cent of total whey produced is obtained from chhana, paneer and shrikhand production [10]. In our country, 12 lakh tones of chhana production yield about 8 million tones of whey per year [11]. The various whey processing methods (condensation, drying and fermentation) found to be uneconomical and energy consuming [12]. Beverages are considered to be

alcoholic or non-alcoholic nourishing drink which can be consumed by the people of all age groups.

Most dairy beverages are alcoholic or non-alcoholic that provides energy, regulates body temperature, prevents dehydration, quenches thirst and removes physiological tension [13, 10]. Many plain, carbonated and alcoholic whey beverages has been successfully developed and marketed all over the world. There are various whey beverages already have achieved success in India (Whevit, Acidowhey), Europe (Rivellia: a deproteinized, fermented whey beverage), Switzerland (whey champagne), Poland (Kwas), Netherland (Taksi, Yor), Japan (Milfull plain) and U.S.S.R (Bodrost) market. Recently whey and partially hydrolyzed lactose syrup based and whey and herbal extract containing non fermented nutritious soft drink has been developed [14, 10, 15, 16]. There are very few literatures are available on carbonated fruit flavoured beverage. So, the present investigation has been designed to develop a nutritious carbonated beverage by utilizing acidic whey and fruit juices.

Materials and methods

Raw materials

Milk, fresh mango, pineapple and orange juices were procured from the local market while freeze dried starter culture of *Streptococcus thermophilus* and *Lactobacillus bulgaricus* was obtained from National Dairy Research Institute (NDRI), Karnal.

Preparation, clarification and ultrafiltration of acidic whey (shrikhand whey)

Standardized milk (6.0% fat) was heated upto 85°C for 10 minutes then cooled to 28-30°C. After cooling 2.0% starter culture was added in the mixture and incubate at 30°C for 15-16 hours. For the complete whey drainage, curd was firstly broken then hanged and gently squeezed for 8-10 hours. The fresh acidic whey (shrikhand whey) was passed two times through the cream separator (New Dairy Engineering & Trading Company Private Limited, Delhi) at high speed to remove the residual fat. The acidity of defatted whey was adjusted to 0.8% by citric acid. The acidic whey was deproteinized (precipitation of proteins) by keeping undisturbed for 5-6 hours after heating at 98°C for 15 minutes. The whey was passed through the cotton pad and double folded muslin cloth (Cheese layer) to get the suspended free product. The whey was filtered through vaccum filter (Millipore, Stirred Cell Model -8200) by using Whatman filter paper No. 41 to get clarified acidic whey. The clarified acidic whey was prefiltered by passing through 'Microfiber Glassfilter and Mixed Esters of Cellulose' by applying vaccum to get clear, fat free, greenish yellow coloured

whey. The prefiltered acidic whey (shrikhand whey) was subjected to ultrafiltration by using Millipore ultrafiltration unit (Polyether Sulphone Biomax Ultrafiltered Disc' having 'Nominal Molecular Weight Limit' (NWML) of 300 KD and diameter of 63.5 mm). The final obtained acidic whey (shrikhand whey) was sparkling and clear in appearance.

In the same manner fresh mango, pineapple and orange juices were prefiltered by passing through 'Microfiber Glass Filter and Mixed Esters of Cellulose' by applying vaccum and further it was subjected to ultrafiltration by using Millipore Stirred Cell Ultrafiltration Unit.

Preparation of whey beverage base and fruit flavoured beverage

Unclarified acidic whey, prefiltered acidic whey and ultrafiltered acidic whey were used for preparation of beverage base. The acidity level in all types of whey was kept constant at 0.8%. Sugar was added at the level of 8, 10, 12 and 14% in the form of sugar syrup. Then, it was pasteurized and cooled to below 50°F temperature. Thus, the prepared whey bases were subjected to organoleptic evaluation. The optimum whey beverage bases was subjected to the preparation of whey based fruit beverages (mango, orange and pineapple juices) at 18, 20, 22 and 24% concentration. Similarly, prefiltered whey, prefiltered fruit juices, ultrafiltered whey and ultrafiltered fruit juices were prepared (Figure 1). The optimized beverages with respect to sugar and fruit juice level were carbonated at three different pressures of 25, 30 and 35 psi at 4±1°C temperature. The carbonated whey beverage was stored at refrigeration temperature till it was subjected to further studies.

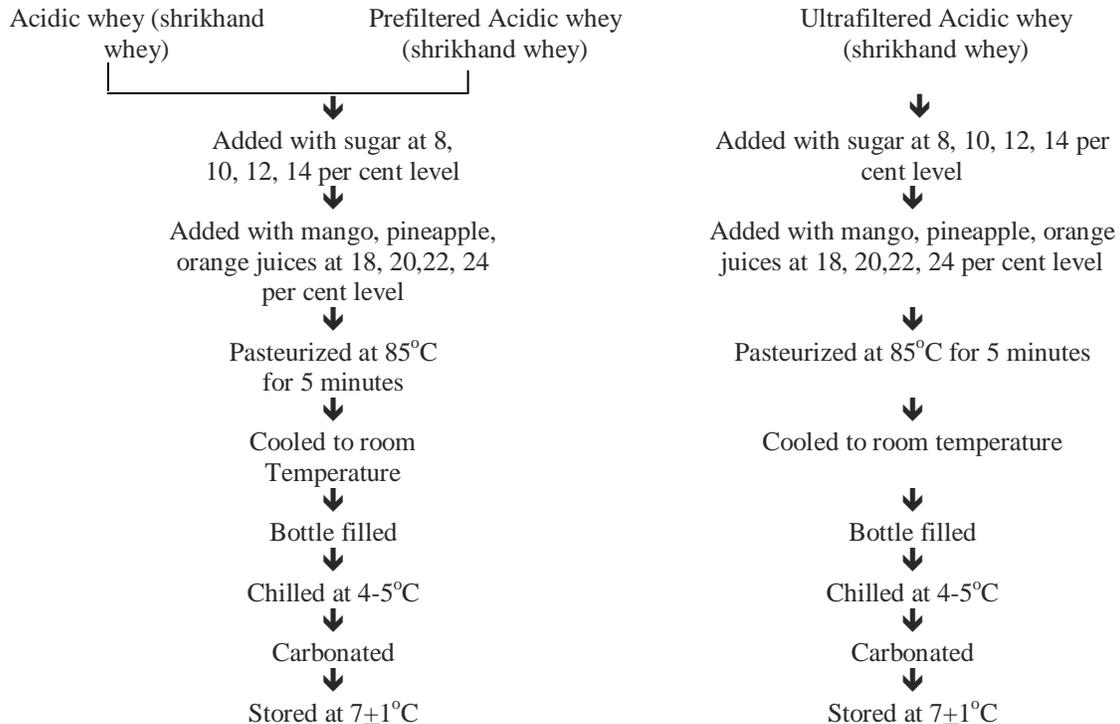
Physico-chemical and organoleptic evaluation of beverage

The beverages were subjected to organoleptic evaluation for appearance, colour, taste, aroma, consistency, mouth feel and overall acceptability by semi trained panelists on 9 point hedonic scale [17]. The different physical properties *i.e.* color (by Lovibond Tintometer), specific gravity, viscosity (by using 'Haake's Roto Viscometer,' RV-20 Model (Germany), total solids, sedimentation percent and turbidity has been analysed in acidic whey and its beverages. The proximate composition, titrable acidity and lactose content were determined as per the procedure described in AOAC [18] and Kanwar and Chopra [19] respectively. The nutritional aspects of acidic whey beverage like calcium, phosphorous determined by using Flame Photometer as per the method described by Tondon [20] while ascorbic acid and vitamin A content was determined as per the

procedure cited in Raganna [21] and by HPLC (High Performance Liquid Chromatography) as described

by Suzanne Nielsen [22].

Figure 1: Flow sheet for fruit flavoured whey beverage



Statistical analysis

The data obtained for various characteristics were compiled, tabulated and statistically analyzed by completely randomized design as per the method given by Panse and Sukhatme [23] in order to draw a meaningful conclusion.

Results and discussion

Changes in physical properties of acidic whey (shrikhand whey) due to prefiltration and ultrafiltration

The physical properties *viz.* colour, specific gravity, viscosity, sedimentation and turbidity of different types of acidic whey are mentioned in **Table 1**. After prefiltration and ultrafiltration the colour and specific gravity of unclarified acidic whey was decreased. The reduction in specific gravity is may be due to the removal of large size particles during the process of filtration. Due to presence of higher amount of fat and protein the viscosity of the unclarified acidic whey was much higher than that of prefiltered and ultrafiltered acidic whey. The negligible amount of constituents present after prefiltration and ultrafiltration which leads to the similar decrease in sedimentation values from 7.52%

to 3.20% and 1.52%. In the same manner the decrease in turbidity percent was observed due to minimum presence of constituents having less adverse effect on the transmission of light. The results are in accordance with the findings reported in ultrafiltered acidic whey with pineapple juice [24].

Changes in proximate composition prefiltration and ultrafiltration of acidic whey

The proximate composition of acidic whey, prefiltered acidic whey and ultrafiltered acidic whey are depicted in **Table 1**. After prefiltration and ultrafiltration the total solids, protein, lactose and ash content was decreased. The reduction in protein content was mainly due to the deportinization during ultrafiltration process while reduction in fat content is due to reseparation and filtration of acidic whey. The results showed that acidity of clarified acidic whey was higher in comparison to unclarified acidic whey it may be due to the more conversion of lactose in to lactic acid. The results are comparable to the findings reported by Kulkarni [25], Jadhav [26] and Khamrui and Rajorhia [27] in acidic whey. The similar observations has been found out in pineapple juice after filtration [28].

Table 1. Physico-chemical properties of unclarified, prefiltered and ultrafiltered acidic whey

Parameters	Unclarified		Clarified	
	Acidic whey (shrikhand whey)	Prefiltered acidic whey (shrikhand whey)	Ultrafiltered acidic whey (shrikhand whey)	
Colour	0.3 R + 1.3 Y	0.1 R + 1 Y	0.1 R + 1 Y	
Specific gravity	1.030	1.017	1.015	
Viscosity (cp)	3.48	3.10	1.24	
Sedimentation (%)	7.52	3.20	1.52	
Turbidity (%)	100.00	87.00	4.00	
Moisture	93.43	94.04	94.38	
Total solids	6.57	5.96	5.62	
Fat	0.20	---	---	
Protein	0.65	0.36	0.29	
Lactose	4.90	4.85	4.78	
Ash	0.76	0.52	0.50	
Acidity	0.70	0.81	0.81	
pH	4.50	4.36	4.36	

Standardization of acidic whey beverage with fruit juices

Unclarified, prefiltered and ultrafiltered acidic whey were used to standardize the beverage base with respect to levels of sugar on the basis of sensory evaluations. It has been found out that the higher value for overall acceptability were recorded for 12% sugar level in all whey (shrikhand whey) beverage base. Thus, the results of the present study are in accordance with the results of Shaikh *et al.* [12]. The effect of levels of pineapple juice on the sensory quality of unclarified, prefiltered, ultrafiltered acidic whey (shrikhand whey) beverage is shown in **Table 2**. The results clearly showed that pineapple juice at 22% level of concentration scored highest. The average score for aroma was found to be 7.00, 6.83 and 8.00 for unclarified, prefiltered and ultrafiltered acidic whey beverage respectively. The highest score of 8.10 *i.e.* 'liked very much' was obtained to the ultrafiltered acidic whey beverage as compared to unclarified and prefiltered having 6.53 and 6.46 scores respectively. It can be observed from **Table 2** that overall acceptability score for ultrafiltered acidic whey beverage was superior *i.e.* 8.26 to that of unclarified and prefiltered acidic whey beverage. Suresha and Jayaprakasha [24] reported that pineapple flavour whey permeate beverage was found to be most acceptable and had highest mean overall acceptability score of 8.65 *i.e.* 'liked very much'. The results were also found to be statistically significant for all parameters of sensory quality. Shaikh *et al.* [12] observed that overall acceptability

score of 8.06 for pineapple flavoured whey beverage and also reported that this beverage was better than orange flavoured beverages.

Acidic whey beverage from pineapple juice

The results of the present study are in close confirmation with those reported by Gagrani *et al.* (1987). The results were also found to statistically significant and the level of concentration of fruit juice had significant effect on all parameters of sensory quality irrespective of type of acidic whey (Shrikhand whey) used. Shaikh *et al.* [12] recorded 7.60 scored for overall acceptability of orange flavoured whey beverage. Gagrani *et al.* [29] recorded average mean score of 7.06 for orange flavoured whey beverage with 25% level of concentration. The results of the present findings are comparable to those mentioned above.

Physical properties of acidic whey (shrikhand whey) beverage

The beverage adjudged as a best for each fruit juice was selected for further studies. The beverage from mango flavoured unclarified acidic whey (shrikhand whey) [A], orange flavoured prefiltered acidic whey (shrikhand whey) [B] and pineapple flavoured ultrafiltered acidic whey (shrikhand whey) [C] were used for further studies with respect to physical, chemical and nutritional aspects. The physical properties viz. colour, specific gravity, viscosity, sedimentation, turbidity of selected acidic whey (shrikhand whey) beverage were determined and tabulated in **Table 3**. It can be noted that the colour of unclarified mango flavoured acidic whey

(shrikhand whey) beverage was 1R+13Y, for prefiltered orange flavoured acidic whey (shrikhand whey) beverage was 1.4R+14.1 and for ultrafiltered pineapple flavoured acidic whey (shrikhand whey) beverage was 1Y+0.1B. The 'Y' value of unclarified mango flavoured and prefiltered orange flavoured acidic whey (shrikhand whey) beverage was higher than ultrafiltered pineapple flavoured acidic whey (shrikhand whey) beverage. It is due to higher β -carotene content of it. The specific gravity values (**Table 3**) were in the range of 1.072 to 1.057 with higher value of unclarified mango flavoured acidic whey (shrikhand whey) beverage and lowest value of ultrafiltered pineapple flavoured acidic whey (shrikhand whey) beverage. This variation is due to the difference in the total solids content of the beverages. From **Table 3** it can be observed that viscosity of unclarified mango flavoured acidic whey (shrikhand whey) beverage was higher than that of prefiltered orange flavoured and ultrafiltered pineapple flavoured acidic whey (shrikhand whey) beverage. Sedimentation value of unclarified mango flavoured, prefiltered orange flavoured and ultrafiltered pineapple flavoured acidic whey (shrikhand whey) beverage was 12.00, 8.00 and 4.00% respectively. The lowest value was found in ultrafiltered pineapple flavoured acidic whey (shrikhand whey) beverage due to negligible amounts of constituents responsible for sedimentation value. The per cent turbidity of ultrafiltered pineapple flavoured acidic whey (shrikhand whey) beverage was only 5%. It is very much lower than that of unclarified mango flavoured and prefiltered orange flavoured beverage due to decrease in protein content during ultrafiltration process which increased the clarity of beverage (**Table 3**). The specific gravity and viscosity value for ultrafiltered pineapple flavoured acidic whey (shrikhand whey) beverage reported by Suresha and Jayaprakash [24] are in accordance with results of present study. The viscosity values of unclarified acidic whey (shrikhand whey) beverage are in close agreement with the results of Sikder *et al.* [30].

Proximate composition of acidic whey (shrikhand whey) beverage

The proximate composition of unclarified mango flavoured, prefiltered orange flavoured and ultrafiltered pineapple flavoured acidic whey (shrikhand whey) beverage is depicted in **Table 3**. It can be noted from **Table 3** that the unclarified mango flavoured acidic whey (shrikhand whey) beverage contained 17.50% total solids *i.e.* highest compared to that of prefiltered orange flavoured and ultrafiltered pineapple flavoured acidic whey (shrikhand whey) beverage. It is due to higher protein and fat content in unclarified mango beverage. **Table 3** further indicated that the protein content of the unclarified mango flavoured acidic whey beverage was higher *i.e.* 2.80 per cent than that of prefiltered orange flavoured and ultrafiltered pineapple flavoured acidic whey beverage. It is because of the deproteinization operation carried out during prefiltration of ultrafiltration process. It can be further observed from **Table 3** that fat content of unclarified mango flavoured acidic whey beverage was only 0.24% but there was on fat in prefiltered and ultrafiltered beverage. It is because of defatting of the acidic whey and process of filtration which removed the fat to a greater extent. It can be observed from the **Table 3** that the acidity of unclarified and clarified acidic whey (shrikhand whey) beverage was in the range of 0.40 to 0.31% with the corresponding pH in the range of 4.70 to 4.46. **Table 3** indicated that there is little variation in lactose content of unclarified mango flavoured, prefiltered orange flavoured and ultrafiltered pineapple flavoured acidic whey (shrikhand whey) beverage. The ash content of the beverage also varies accordingly. The results of the ultrafiltered, pineapple flavoured acidic whey (shrikhand whey) beverage in present study are well comparable with those reported by Suresha and Jayaprakash (2003). They reported that total solids, total protein, lactose and ash content of pineapple flavoured ultrafiltered whey permeate beverage were 15.97, 0.28, 5.01 and 0.56% respectively. The results of unclarified mango flavoured acidic whey (shrikhand whey) beverage in present study are in accordance with Sikder *et al.* [30].

Table 2. Effect of levels of pineapple juice on sensory quality of acidic whey (shrikhand whey) beverage

Type of acidic whey (Shrikhand whey)	Fruit juice (%)	Appearance (%)	Colour	Taste	Aroma	Consistency	Mouthfeel	Overall acceptability
Unclarified	18	5.85	5.85	5.85	5.95	5.80	5.95	5.90
Prefiltered	18	5.90	5.75	5.95	5.75	5.95	5.75	5.95
Ultrafiltered	18	6.00	5.95	6.00	5.80	6.10	5.85	6.01
Unclarified	20	5.95	6.10	5.95	6.15	6.00	5.85	6.00
Prefiltered	20	6.00	6.23	6.15	6.03	6.25	5.85	6.06
Ultrafiltered	20	6.35	6.3	6.25	6.13	6.40	6.15	6.33
Unclarified	22	6.26	6.83	6.83	7.00	6.53	6.53	6.43
Prefiltered	22	6.86	7.50	6.70	6.83	6.86	6.46	6.60
Ultrafiltered	22	7.10	8.30	8.10	8.00	8.06	8.10	8.26
Unclarified	24	6.16	6.43	6.20	6.26	6.43	6.09	6.23
Prefiltered	24	6.46	7.03	6.36	6.56	6.66	6.06	6.36
Ultrafiltered	24	6.70	7.56	6.96	6.23	7.10	7.00	6.53
SE	NS	0.07	0.06	0.07	0.11	0.10	0.11	0.04
CD@5%	--	0.22	0.21	0.22	0.33	0.33	0.34	0.14

Table 3. Physico-chemical properties of acidic whey (shrikhand whey) beverage

Physical properties	Unclarified	Clarified	
	A	B	C
Colour	1R + 13Y	1.4R + 14.1Y	1Y + 0.1B
Sp. gravity	1.072	1.060	1.057
Viscosity (cp)	1.520	1.355	1.252
Sedimentation (%)	12.00	8.00	4.00
Turbidity (%)	100.00	92.00	5.00
Moisture	82.50	83.60	84.10
Total solids	17.50	16.40	15.90
Fat	0.24	---	---
Protein	2.80	1.25	0.25
Lactose	3.60	3.38	3.20
Ash	0.60	0.55	0.42
Sugar	12.00	12.00	12.00
Acidity	0.40	0.33	0.31
pH	4.70	4.48	4.46
Calcium (ppm)	359.2	360.05	401.80
Phosphorus (mg/100g)	250.0	250.00	255.00
Vit. C (mg/100g)	9.00	17.83	10.85
Vit. A (IU/100g)	727.15	393.164	686.785

Nutritional quality of acidic whey (shrikhand whey) beverage

The nutritional quality of unclarified mango flavoured, prefiltered orange flavoured and ultrafiltered pineapple flavoured acidic whey (shrikhand whey) beverage is depicted in **Table 4**.

The results in **Table 3** shows that the calcium content of ultrafiltered pineapple flavoured acidic whey (shrikhand whey) beverage was highest *i.e.* 401.8 ppm followed by prefiltered orange flavoured acidic whey beverage and unclarified mango flavoured acidic whey beverage *i.e.* 360.5 mm and 359.2 ppm

respectively. It is revealed from **Table 3** that the phosphorus content of ultrafiltered pineapple flavoured acidic whey beverage was highest *i.e.* 255 mg/100g followed by prefiltered orange flavoured

acidic whey beverage and unclarified mango flavoured acidic whey beverage *i.e.* 250 mg/100g and 250 mg/100, respectively. The ascorbic acid content of prefiltered orange flavoured acidic whey

Table 4. Effect of level of carbonation on sensory quality of selected acidic whey (shrikhand whey) beverage

Acidic whey (shrikhand whey) beverage	Carbonation level (psi)	Appearance (%)	Colour	Taste	Aroma	Consistency	Mouthfeel	Overall acceptability
A	25	8.06	8.20	8.16	8.10	8.20	8.36	8.33
	30	8.06	8.20	7.06	6.93	6.96	7.10	7.06
	35	7.86	8.20	6.83	6.96	6.86	6.83	6.73
B	25	8.00	8.03	7.13	7.03	6.56	6.93	6.86
	30	8.00	8.03	7.50	7.53	7.73	7.76	7.56
	35	8.06	8.03	8.13	8.20	8.10	8.00	8.10
C	25	7.90	7.80	7.66	7.00	7.53	7.86	7.83
	30	8.33	8.30	8.26	8.16	8.33	8.53	8.53
	35	7.90	7.86	7.70	7.53	7.53	7.93	7.90
SE	--	0.08	--	0.12	0.09	0.11	0.05	0.05
CD @ 5%	--	0.25	--	0.35	0.27	0.34	0.15	0.17

(shrikhand whey) beverage was higher than that of other beverages *i.e.* 17.83 mg/100g. The high value of ascorbic acid is mainly due to the higher content of ascorbic acid in orange juice as compared to that of mango and pineapple juice. From **Table 3**, it is revealed that the vitamin A content of unclarified mango flavoured acidic whey (shrikhand whey) beverage was higher *i.e.* 727.15 IU/100g followed by ultrafiltered pineapple flavoured acidic whey (shrikhand whey) and prefiltered orange flavoured beverage *i.e.* 686.785 IU/100 g and 393.164 IU/100 g respectively.

Changes in sensory parameters due to carbonation of acidic whey beverage

The selected unclarified mango flavoured (A), prefiltered orange flavoured (B) and ultrafiltered pineapple flavoured (C) acidic whey (shrikhand whey) beverages were carbonated at a pressure of 25, 30, 35 psi at $4 \pm 1^\circ\text{C}$ temperature. The effect of levels of carbonation on sensory quality of these beverages is depicted in **Table 4**. The data in **Table 4** indicates that effect of carbonation on all sensory parameters of beverage except colour was significant. It can also be seen from **Table 4** that score for appearance parameter of sensory quality is higher for ultrafiltered pineapple flavoured acidic whey (shrikhand whey) beverage at 30 psi than unclarified mango flavoured and prefiltered orange flavoured acidic whey (shrikhand whey) beverage at 25 psi and 35 psi respectively. It is due to the tingling air bubbles in ultrafiltered pineapple flavoured acidic whey

(shrikhand whey) beverage which add to the sparkling appearance. From **Table 4** it could be observed that the taste of carbonated unclarified mango flavoured acidic whey (shrikhand whey) beverage at 25 psi pressure level was higher whereas it goes on decreasing as the pressure level was increased. It further indicates that prefiltered orange flavoured and ultrafiltered pineapple flavoured acidic whey (shrikhand whey) beverage obtained higher score for taste parameter at 35 psi and 30 psi respectively. It is due to the tingling taste at these pressure levels which was 'liked extremely' by the judges. It can be further stated from **Table 4** that amongst all the various acidic whey (shrikhand whey) beverages prepared, the highly acceptable acidic whey (shrikhand whey) beverage was ultrafiltered pineapple flavoured acidic whey (shrikhand whey) beverage with a highest score of 8.53 at a pressure of 30 psi. The results of the present study are in close agreement with those of the results reported by Suresha and Jayaprakasha [24].

Conclusion

The unclarified acidic whey (shrikhand whey) beverage base with 22% unclarified mango juice and prefiltered acidic whey (shrikhand whey) beverage base with 22 per cent orange juice concentration was found to be acceptable while ultrafiltered acidic whey (shrikhand whey) beverage base with 22% pineapple

juice concentration was found to be superior amongst all. In addition to this ultrafiltered pineapple flavoured beverage scored highest *i.e.* 8.53 at 30 psi, for overall acceptability than that of unclarified mango flavoured and prefiltered orange flavoured acidic whey (shrikhand whey) beverages.

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