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Study on sensory evaluation of whey-based beverage using mulberry and peach juice

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Abstract

The investigation entitled “Study on Sensory Evaluation of Whey based Beverage using Mulberry and Peach Juice” was conducted in the laboratory of Department of Animal Husbandry and Dairying, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (208002). The investigation evaluated factors including two fruit types (A1-mulberry and A2- Peach), four juice levels (10,20,30, & 40 %) and three sugar levels (5, 10 and 15 %). The prepared samples were stored at a refrigerated temperature of 5°C for 0, 10, 20, and 30 days. The effects of various attributes on the quality of fruit juice-based whey beverage were analysed, specifically assessing sensory characteristic such as flavour, colour & appearances, sweetness and overall acceptability. Among the physical qualities, the highest flavour score recorded for mulberry juice (A1) at 7.312. Regarding sugar levels, the maximum flavour score observed in C2 (10 % sugar level). The maximum sweetness recorded in mulberry juice (A1). Similarly, the maximum sweetness was scored in the (C2 10% sugar level) that is 7.141. The appearance of the colour was highest scored in the mulberry juice (A1) with represented as 7.214. The maximum over all acceptability was recorded in mulberry juice (A1) with scored as 7.151. in case of sugar level, the maximum acceptability observed in C2 (10 % sugar level) which as 7.250. The study revealed that the physical quality of drink, 10% sugar level (C2) & 30% mulberry juice (B3) was found better as compared to the other treatment combination.

Keywords: Paneer whey, fruit juice (mulberry & peach), sugar, preservative (potassium metabisulphite)

1. Introduction

The dairy industry is one of the largest food industries worldwide. In the dairy industry, a significant volume of whey is generated during the paneer manufacturing process. In local sweetmeat production units in India, a huge amount of whey is not processed for preservation and is discarded locally, which increases the BOD level of wastewater. Whey is not only a good source of protein, but it is also significantly rich in minerals and lactose. Whey and casein are the two main proteins present in milk. During the

manufacture of paneer, casein coagulates to form the cheese curd, while milk fats become entrapped within the casein complex. The remaining liquid components, including whey proteins, minerals, and lactose form the liquid whey by-product. Although the whey that is released is approximately 90% water and contains only about 0.6% protein, processes such as ultrafiltration and ultracentrifugation can convert raw liquid whey into whey concentrate, which contains about 90% protein (Huffman, 1996) [6].

Nutritional and chemical composition of whey per 100 g	
Lactose	5.1g
Fat	0.5g
Protein	0.40g
Ash	470 mg
Water	93.6g

Source: Outlines of dairy technology book (Sukumar De.)

Whey, the yellow-green fluid component of milk also known as paneer serum, is produced during the coagulation of milk with proteolytic enzymes or acids after the curd has

been separated. Due to disposal difficulties caused by its high biological oxygen demand and high organic content, it was long regarded as a significant dairy waste product for

many years (Esfanjani *et al.*, 2015) [4]. Whey proteins are currently used for their bioactive components and are acknowledged as a viable nutritional source. Whey has a substantial connection to the dairy sector and is employed in a numerous commercial food products due to its rich nutritional profile. Whey proteins have gained immense popularity due to their exceptional nutritional value and significance in human nourishment. Numerous studies conducted over the past decade have underscored their indispensable role in the human diet. According to a joint technical report published by the Food and Agricultural Organization (FAO) and the World Health Organization (WHO) in 1985, whey proteins possess high digestibility and comprise a complete protein profile. The superior nutritional quality of whey proteins can be attributed to their elevated concentration of essential amino acids such as lysine, tryptophan, isoleucine, and threonine. This results in a higher Protein Efficiency Ratio (PER) for whey proteins (3.2) compared to casein (2.6) (Kumar *et al.* 2018) [7]. Whey's chemical composition varies depending on the processing method used to produce it (Minj and Anand, 2020) [9].

Mulberry- mulberry is a plant under family moraceae and genus morus. Mulberries contain iron, vitamins, protein etc. eating them may help reduce cholesterol, blood sugar and cancer risk. *Morus nigra* is commonly known as black mulberry, shatut (India), kara dut (Turkey) and shah-toot (Iran).

Chemical composition of black mulberry

Parameter	Value
Moisture (%)	87.40
Total Solids (%)	12.60
Total Soluble Solids (%)	08.23
Protein (%)	01.23
Fat (%)	01.25
Ash (%)	03.48
Titrateable acidity (%)	00.65
pH values (%)	03.70
Anthocyanin (%)	65.40

Peach: Peaches are consumed fresh or canned, with yellow-fleshed peaches being especially rich in vitamin A. Peach juice is a sweet, nutrient-dense beverage extracted from ripe peaches. Because peaches contain high amount of pulp, the juice is often processed as a puree to retain its signature smooth texture and fibre. It is widely valued for its antioxidant properties and high vitamin content.

2. Material and Methods

2.1 Materials

Mainly included the ingredients required for optimization of compositional and processing parameters of whey beverage with different fruit juices. The following material were used for the present investigation.

Whey: Fresh whey was collected after preparation of paneer in the Department of Animal Husbandry & Dairying, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. The whey was collected in a clean, sterilized stainless steel bucket while taking all necessary hygienic precautions.

Sugar: Commercial grade white crystalline cane sugar was used as a sweetening agent, which was obtained from the local market in kanpur city. It was ensured that the sugar was free from dust, dirt and other foreign impurities.

Milk vessels: All the vessels used for the processing and preparation of whey drink thoroughly cleaned manually before using in the laboratory.

Mulberry and peach fruits: Ripe fruits of mulberry (*M. nigra*) were harvested from trees in horticulture garden of C S A University, Kanpur. A good quality peach fruits was obtained from the market after ensuring their market quality.

Glass wares: The beaker and measuring cylinder with a capacity of 500 ml. and 250 ml, respectively were used for standardization of whey. Vessels, butyrometer, pipettes, automatic tilt measures lock stopper etc were properly cleaned before use.

Muslin cloth: To remove visible dirt, dust and foreign matter from the whey was strained through a fresh muslin cloth.

Equipment: The following equipment was used for the preparation of chhana whey included a gas stove, muslin cloth, stainless steel pan, stainless steel ladle, stainless steel plate and a stainless steel knife

2.2 Methods

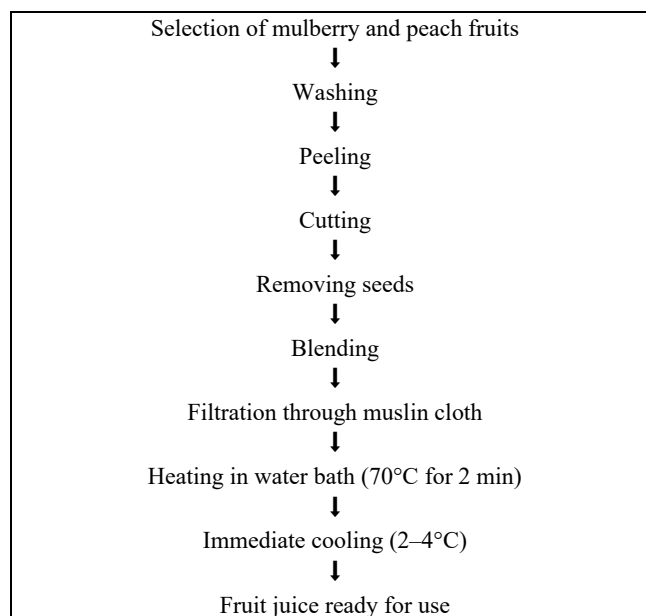
Preparation of mulberry and peach juice

a1) Mulberry fruits (*Morus nigra*)

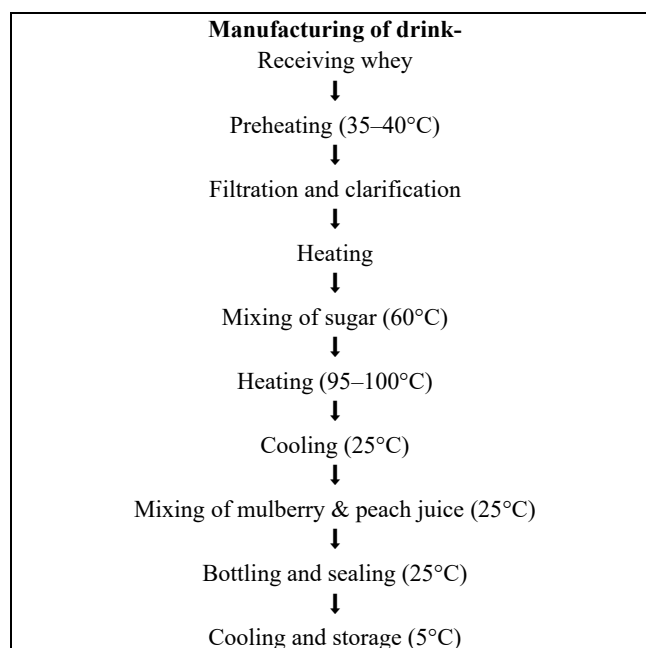
The mulberry fruits were initially washed thoroughly with potable water to remove any surface impurities. After washing, the juicing process broke down the arils, releasing the vibrant, ruby-red mulberry juice. To ensure clarity, the extracted juice was passed through a sterile muslin cloth, which helped to filter out the seeds and remaining pulp. The filtered juice was collected in a clean, transparent glass bowl, ensuring a pure and smooth consistency.

a2) Peach juice (*Prunus persica*)

The preparation of peach juice began with the thorough washing and rinsing of fresh peach fruits using potable water to ensure cleanliness and hygiene. After washing, the fruits were peeled using a sterile stainless-steel knife to remove the outer skin. The peeled peach fruits were then cut into small pieces using the knife. These pieces were placed into a clean electric blender for homogenization. The blending process helped to extract the juice efficiently, ensuring a smooth consistency. The homogenized juice was then filtered through a sterile muslin cloth to remove any remaining pulp or solid particles. The clean juice was collected in a clean, transparent glass bowl, ready for further processing or blending with whey.



Flow diagram 1: Showing preparation of mulberry and peach juice



Flow diagram 2: Development to whey-based beverage using mulberry & peach juice

2.3 Examination of whey drink

Sensory evaluation

A panel of five Judges conducted the sensory evaluation of the beverage samples. According to Maroney (1975) ^[14], samples were graded using a 9-point hedonic scale. The

samples were assessed for sensory factors, such as flavor, colour and appearance, sweetness and overall acceptability. Evaluation form for the numerical test of beverage quality attributes the samples were scored for quality aspects using the grade description and scoring system describe below.

Table 2: Total treatments in hedonic scale

Sensory parameter	Perfect score	Whey based beverage using mulberry and peach juice			
		A1B1C1D1	A1B1C1D2	A1B1C1D3	A1B1C1D4
Flavour	9				
Colour & appearance	9				
Sweetness	9				
Overall acceptability	9				

Table 3: Hedonic score

Hedonic rating	Score
Excellent	9
Very Good	8
Good	7
Fair	6
Neither good nor bad	5
Slightly undesirable	4
Poor	3
Very Poor	2
Unacceptable	1

3. Result and Discussion

The present investigation entitled “Study on Sensory Evaluation of Whey based Beverage using Mulberry and Peach Juice” was carried out in the Department of Animal Husbandry and Dairying, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. In order to evaluate the effects of different factors like two types of fruit juices (mulberry juice-A1, peach juice-A2), four levels of juices (10 percent-B1, 20 percent-B2, 30 percent-B3 and 40 percent-B4), three sugar levels (5 percent-C1, 10 percent-C2, 15 percent-C3) and four storage periods (0 Day-D1, 10 Days-D2, 20 Days-D3 and 30 Days-D4) on sensory attributes (flavour, colour and appearance, sweetness and overall-acceptability). The experimental data was analyzed using a factorial experiment in Completely Randomized

Design (CRD). The results and their interpretations for various attributes are discussed systematically below.

Sensory quality

3.1 Flavour

The flavour of a fruit juice based whey beverage is one of its most important quality attributes and should be free from any off flavours. Excessive acidity and curdling are undesirable characteristic in a whey based beverage. It must also be free from foreign material, bitterness, saltiness or any other off flavour. The flavour profile of the fruit juice based whey beverage as affected by different experimental factor (A, B, C & D) is presented in Table 4 with critical difference shown in Table 5. These tables and figure no. 1 revealed the following facts.

Table 4: Effect of fruit juices (A), levels of fruit juices (B), sugar levels (C) and storage period (D) on the flavour score of whey beverage

	B1	B2	B3	B4	C1	C2	C3	D1	D2	D3	D4	Mean
A1	7.336	7.183	7.577	7.152	7.375	7.452	7.110	7.772	7.475	7.158	6.844	7.312
A2	7.108	7.036	6.958	6.666	6.833	7.093	6.900	7.466	7.100	6.783	6.419	6.942
B1					7.087	7.429	7.150	7.683	7.388	7.083	6.733	7.221
B2					7.204	7.125	7.000	7.600	7.272	6.977	6.588	7.109
B3					7.250	7.487	7.066	7.744	7.400	7.105	6.822	7.267
B4					6.875	7.050	6.804	7.450	7.088	6.716	6.383	6.909
C1								7.533	7.287	6.941	6.654	7.103
C2								7.762	7.404	7.175	6.750	7.272
C3								7.562	7.170	6.795	6.491	7.004
Mean	7.22	7.109	7.267	6.909	7.104	7.272	7.005	7.619	7.287	6.97	6.631	

Table 5: (A, B, C & D) and its critical difference

	A	B	C	D	A×B	A×C	A×D	B×C	B×D	C×D
SE(d)	0.0123	0.0174	0.0174	0.0174	0.02	0.0213	0.0246	0.0301	0.0348	0.0301
SE(M)	0.0087	0.0123	0.0123	0.0123	0.02	0.0151	0.0174	0.0213	0.0246	0.0213
CD at 5%	0.0243	0.0320	0.0320	0.0343	0.05	0.0485	0.0485	0.0640	0.0595	0.0595
CD at 1%	0.0453	0.0297	0.0297	0.0640	0.04	0.0555	0.0784	0.0687	0.0906	0.1109

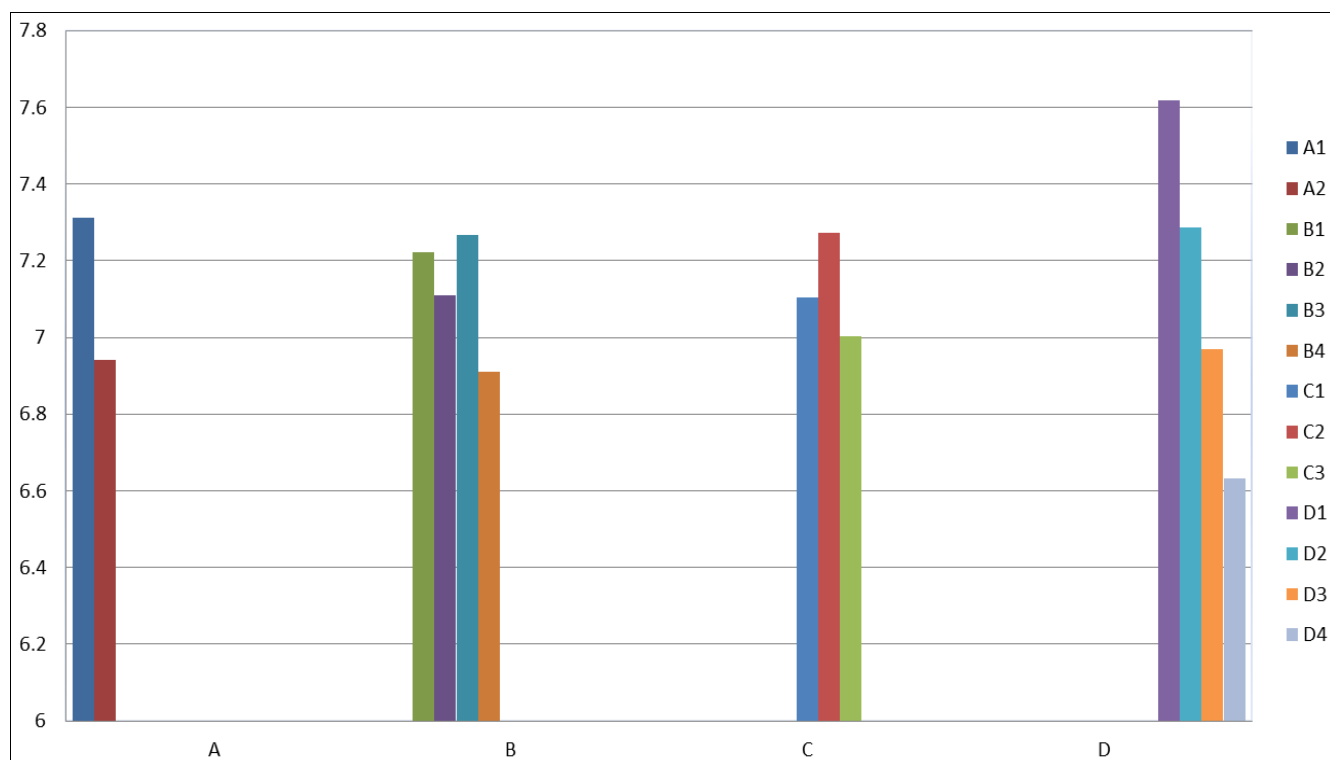


Fig 1: Effect of fruit juices (A), levels of fruit juices (B), sugar levels (C) and storage period (D) on the flavour score of a whey beverage

From Table 4, comparing the means of different levels across all factors revealed the following observations: The highest mean flavor score (7.267) was found in whey beverage sample with 30% fruit juice level (B3), followed by B1 (10% fruit juice level) with a score of 7.22 overall. The flavor score exhibited an increasing trend as the fruit juice concentration increased in the whey based beverage. Effect of storage periods (D) on flavor score of whey based beverage. It was observed that the maximum flavour mean score (7.619) obtained in fresh sample (D1), followed by D2. The minimum flavor score (6.631) was recorded in D4 sample. The flavor score decreased as the storage periods increased.

The flavour results recorded in the present investigation were comparable with the findings of the following researchers. Landge *et al.* (2013) [8] reported flavor score for whey beverage in the ranges of 6.5 to 7.83, while Gupta *et al.* (2014) [5] reported flavor score for fruit based carbonated whey beverages ranging between 6.8 to 7.8.

From Table 4 representing the interactions between the type of fruit juices and different levels of fruit juices (A×B), it was observed that the fruit juice based whey beverage prepared from mulberry fruit juice with 30% fruit juice (A1×B3) showed the maximum score (8.200), while the minimum flavour score (6.100) was noted in A2×B4 sample.

Regarding the effect of treatment combinations of the type of fruit juice and different levels of sugar (A×C), the maximum flavour score (7.090) was observed when the sample was prepared with mulberry fruit juice and 10% sugar (A1×C2), followed by A1×C3 with a score of 6.970 and A2×C2 with a score of 6.960, while the minimum

flavour score (6.800) was noted in the A2×C4 sample.

From the interaction between fruit types and storage period (A×D), the highest flavour score (8.140) was recorded in fresh samples prepared with mulberry fruit juice (A1×D1). The next highest flavour score (8.110) was recorded in the samples prepared with peach fruit juice (A2×D1).

From the interaction between juice levels and sugar level (B×C), the highest flavour score (7.154) was occurred in the sample prepared with 30% fruit juice and 10% sugar (B3×C2), followed by B2×C2 and B4×C2, while the minimum score (6.685) was obtained in the B1×C1 sample.

From the interaction between sugar levels and storage period (C×D), the maximum flavour score (7.762) was recorded in the fresh sample prepared with 10 % sugar level (C2×D1), and the minimum score (6.491) was obtained from C3×D4 sample. The results recorded in the present investigation for flavour were comparable with the findings of Prasad *et al.* (2001) [11], who prepared a whey-based mango beverage and noted an average sensory score for flavour in the range of 6.23 to 8.76.

3.2 Colour and appearance

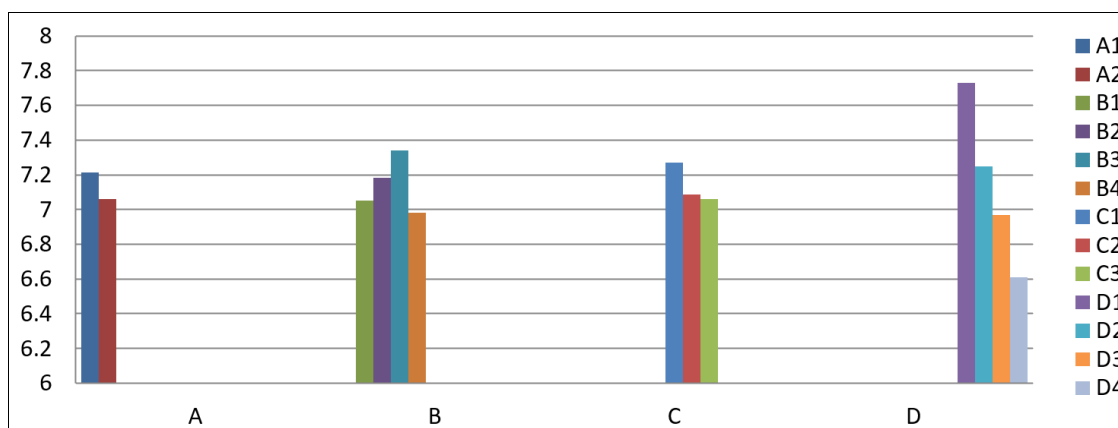
The colour and appearance of fruit juice based whey beverage should be pleasing, attracting and uniform, without showing any sign of visible foreign matter. The colour of whey beverage prepared from mulberry juice ranged from bright red to red and the colour of whey beverage prepared from peach juice ranges from bright yellow to yellow. The effect of different factors on colour and appearance is presented in Table 6 and Critical Difference Table 7 (A, B, C & D). The data presented in Figure no. 2 reveal the following facts.

Table 6: The effect of fruit juice type (A), juice level (B), sugar levels (C) and storage period (D) on the colour and appearance score of fruit juice-based whey beverage

	B1	B2	B3	B4	C1	C2	C3	D1	D2	D3	D4	Mean
A1	7.105	7.230	7.383	7.141	7.247	7.289	7.108	7.772	7.386	7.019	6.683	7.214
A2	6.997	7.133	7.300	6.822	7.291	6.885	7.012	7.683	7.113	6.916	6.538	7.062
B1					7.233	7.050	6.870	7.633	7.194	6.866	6.511	7.051
B2					7.320	7.179	7.045	7.711	7.311	7.022	6.683	7.181
B3					7.387	7.362	7.275	7.866	7.583	7.150	6.766	7.341
B4					7.137	6.758	7.050	7.700	6.911	6.833	6.483	6.981
C1								7.800	7.408	7.087	6.783	7.269
C2								7.783	7.083	6.945	6.537	7.087
C3								7.600	7.258	6.870	6.512	7.06
Mean	7.051	7.181	7.341	6.981	7.269	7.087	7.06	7.727	7.249	6.967	6.61	

Table 7: (A, B, C & D) and its critical difference

	A	B	C	D	AB	AC	AD	BC	BD	CD
SE(d)	0.0506	0.0716	0.0716	0.0716	0.10	0.0876	0.1012	0.1239	0.1431	0.1239
SE(M)	0.0358	0.0506	0.0506	0.0506	0.07	0.0620	0.0716	0.0876	0.1012	0.0876
CD at 5%	0.0998	0.1316	0.1316	0.1411	0.19	0.1996	0.1996	0.2633	0.2444	0.2444
CD at 1%	0.1862	0.1222	0.1222	0.2633	0.17	0.2280	0.3224	0.2823	0.3723	0.4560

**Fig 2:** The effect of fruit juice type (A), fruit juice level (B), sugar level (C) and storage period (D) on colour and appearance score of fruit juice-based whey beverage

From Table 6, which presents the mean values for the different levels of all factors, the following observations were made: The highest colour and appearance score (7.383) was observed in the beverage sample containing A1 (mulberry juice) at the B3 juice level, while the minimum score (6.822) was recorded in the A2 (peach juice) sample. The colour and appearance score showed an increasing trend with higher levels of juices in whey beverage. Regarding the effect of different sugar levels (C) on the colour and appearance score of fruit juice based whey beverage, the highest score (7.269) was observed in C1 (5% level of sugar) samples, followed by C2 (10% sugar), while the minimum score (7.06) was noted in C3 (15% sugar) sample.

Evaluating the effect of storage periods (D) on the colour and appearance of fruit juice based whey beverage, the fresh sample (D1) achieved the highest score (7.727) followed by (D2). Conversely, the lowest score (6.61) was recorded at 30 days of storage (D4). As the storage period increased, the colour and appearance quality of product decreased, indicating that quality deteriorated over time.

Regarding the interaction between fruit juice type and

storage period (A×D), the highest colour and appearance score (7.772) was observed in fresh mulberry juice samples (A1×D1). Followed closely by fresh peach juice samples (A2×D1) with a score of 7.683. Conversely, the lowest score (6.538) was found in A2×D4.

For the interaction between juice levels and sugar levels (B×C), the maximum colour and appearance score (7.387) was observed in sample prepared with 30% fruit juice and 5% sugar (B3×C1) followed by B3×C2 whereas the minimum score (6.758) was occurred in sample B4×C2 (40% fruit juice and 10% sugar).

Regarding the interaction between juice levels and storage period (B×D), fresh samples with 30% fruit juices (B3×D1) achieved the highest score (7.866) while the minimum colour and appearance score (6.483) noted in B4×D4 sample.

Similarly, for the interaction between sugar level and storage period (C×D), the highest colour and appearance score (7.800) was observed in fresh sample prepared with 5% sugar (C1×D1) whereas the lowest score (6.512) obtained in sample from C3×D4.

3.3 Sweetness

The sweetness of the fruit juice based whey beverage should be pleasing. The effects of various factors (A, B, C & D). on

sweetness are presented in Table 8 and its Critical Difference Table 9. Furthermore, the data shown in Figure no. 3 reveal the following key finding.

Table 8: Effect of fruit type (A), juice level (B), sugar level (C) and storage period (D) on the sweetness score of fruit juice-based whey beverage

	B1	B2	B3	B4	C1	C2	C3	D1	D2	D3	D4	Mean
A1	7.150	7.150	7.277	6.991	7.218	7.318	6.889	7.808	7.358	6.891	6.511	7.141
A2	7.058	7.119	7.155	6.752	7.004	7.293	6.766	7.538	7.191	6.877	6.477	7.02
B1					7.162	7.275	6.875	7.700	7.283	6.900	6.533	7.104
B2					7.166	7.287	6.950	7.750	7.350	6.888	6.550	7.134
B3					7.229	7.525	6.895	7.761	7.383	7.066	6.655	7.216
B4					6.887	7.137	6.591	7.483	7.083	6.683	6.238	6.871
C1								7.679	7.350	6.916	6.500	7.111
C2								7.850	7.462	7.125	6.787	7.306
C3								7.491	7.012	6.612	6.195	6.827
Mean	7.104	7.134	7.216	6.871	7.111	7.305	6.827	7.673	7.274	6.884	6.494	

Table 9: (A, B, C & D) and its critical difference

	A	B	C	D	A×B	A×C	A×D	B×C	B×D	C×D
SE(d)	0.0183	0.0259	0.0259	0.0259	0.04	0.0317	0.0366	0.0448	0.0518	0.0448
SE(M)	0.0129	0.0183	0.0183	0.0183	0.03	0.0224	0.0259	0.0317	0.0366	0.0317
CD at 5%	0.0361	0.0476	0.0476	0.0511	0.07	0.0722	0.0722	0.0953	0.0885	0.0885
CD at 1%	0.0674	0.0442	0.0442	0.0953	0.06	0.0825	0.1167	0.1021	0.1347	0.1650

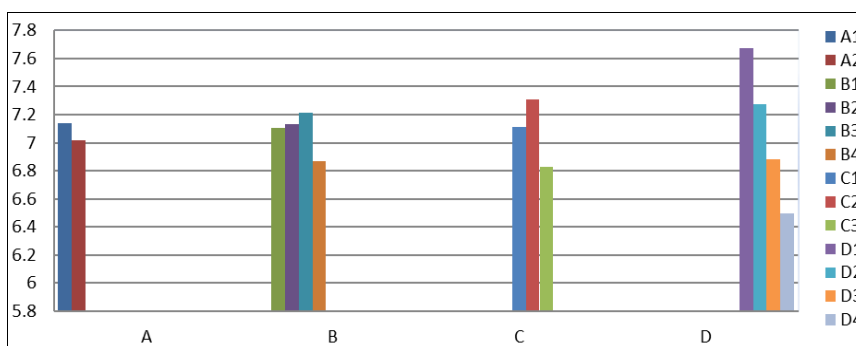


Fig 3: Effect of fruit type (A), juice level (B), sugar level (C) and storage period (D) on the sweetness score of fruit juice based whey beverage

From Table 8 evaluating the interactions between type of fruit juices and different levels of fruit juices (A×B), the sample prepared from mulberry fruit juice with 30% level of fruit juice (A1×B3) showed the maximum sweetness score (7.277), while the minimum sweetness score (6.752) was noted in A2×B4 sample.

Among the treatment combination of type of fruit juices and different levels of sugar (A×C), the maximum sweetness score (7.318) was observed in samples prepared with 10 % mulberry fruit juice and 10 % levels of sugar (A1×C2) and the minimum sweetness score (6.766) was noted in A2×C3 sample.

Evaluating the interaction between type of fruit juices and storage period (A×D), the highest sweetness score (7.808) was recorded in fresh samples prepared with mulberry fruit juice (A1×D1), while the lowest sweetness score (6.477) was found in A2×D4.

From interaction between different levels of fruit juices and sugar levels (B×C), the maximum sweetness score (7.525) was observed in sample prepared with 30% level of fruit

juice and 10% level of sugar (B3×C2), and the minimum score (6.591) obtained in sample prepared with 40% level of fruit juice and 15% sugar level (B4×C3).

Evaluating the interaction between different levels of fruit juices and storage period (B×D), the highest sweetness score (7.761) was observed in fresh samples prepared with 30% level of fruit juice (B3×D1), while the lowest sweetness score (6.238) was found in B4×D4.

From the interaction between sugar levels and storage period (C×D), it was observed that the maximum sweetness score (7.850) was recorded in fresh sample prepared with 10% level of sugar (C2×D1), and the minimum score (6.195) was obtained from C3×D4 sample.

3.4 Overall-acceptability

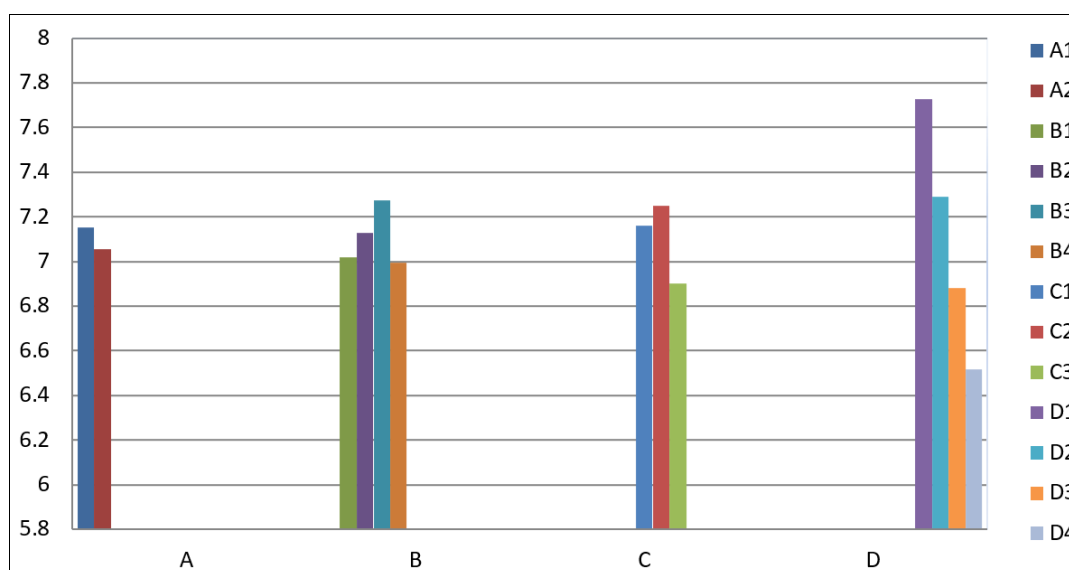
The overall acceptability of fruit juice based whey beverage as affected by different factors (A, B, C & D) has been presented in Table 10 and its Critical Difference Table 11 (A, B, C & D). The data presented by Figure no. 4 which revealed the following facts.

Table 10: The effect of fruit juices (A), levels of fruit juices (B), levels of sugar (C) and storage period (D) on overall acceptability score of fruit juice based whey beverage

	B1	B2	B3	B4	C1	C2	C3	D1	D2	D3	D4	Mean
A1	7.144	7.147	7.372	6.941	7.168	7.300	6.985	7.683	7.327	6.986	6.608	7.151
A2	6.891	7.111	7.180	7.044	7.154	7.202	6.814	7.769	7.250	6.780	6.427	7.056
B1					7.008	7.162	6.883	7.666	7.233	6.761	6.411	7.017
B2					7.200	7.208	6.979	7.788	7.366	6.877	6.483	7.128
B3					7.387	7.466	6.975	7.816	7.405	7.127	6.755	7.275
B4					7.050	7.166	6.762	7.633	7.150	6.766	6.422	6.992
C1								7.750	7.366	6.958	6.570	7.161
C2								7.875	7.462	7.008	6.658	7.25
C3								7.554	7.037	6.683	6.325	6.899
Mean	7.017	7.129	7.276	6.992	7.161	7.25	6.899	7.726	7.288	6.882	6.517	

Table 11: (A, B, C & D) and its critical difference

	A	B	C	D	A×B	A×C	A×D	B×C	B×D	C×D
SE(d)	0.0140	0.0198	0.0198	0.0198	0.03	0.0243	0.0280	0.0343	0.0396	0.0343
SE(M)	0.0099	0.0140	0.0140	0.0140	0.02	0.0172	0.0198	0.0243	0.0280	0.0243
CD at 5%	0.0276	0.0364	0.0364	0.0391	0.05	0.0553	0.0553	0.0729	0.0677	0.0677
CD at 1%	0.0515	0.0338	0.0338	0.0729	0.05	0.0631	0.0893	0.0782	0.1031	0.1263

**Fig 4:** The effect of fruit juices (A), levels of fruit juices (B), sugar level (C) and storage period (D) on overall acceptability score of fruit juice based whey beverage

From Table 10, which presents the mean scores for different levels of all factors, several key observations were made. The highest overall acceptability score (7.151) was recorded for the beverage sample containing mulberry juice (A1) followed by peach juice (A2) sample score 7.056.

Regarding the effect of sugar levels (C) on the overall acceptability score of the fruit juice based whey beverage, the highest mean score (7.250) was observed in C2 (10% sugar) sample and minimum score (6.899) was recorded in C3 (15% sugar) sample.

Regarding the effect of storage periods (D) on the overall acceptability score of fruit juice based whey beverage, the highest score (7.726) was obtained in fresh sample (D1) followed by D2. The lowest overall acceptability score (6.517) was observed in D4 sample. Overall acceptability score decreases with increasing storage duration.

Furthermore, Table 10 shows the mean interactions between

different types of fruit juices and their respective levels (A×B). Fruit juice based whey beverage prepared from mulberry juice with a 30% juice level (A1×B3) showed the maximum score (7.372), while the minimum overall acceptability score (6.891) was recorded in A2×B1 sample.

Among the treatment combinations of different types of fruit juices and sugar levels (A×C), the maximum overall acceptability score (7.300) was observed in samples prepared with mulberry juice and 10% sugar (A1×C2), while the minimum overall acceptability score (6.814) was recorded in A2×C3 sample.

Regarding the interaction between fruit juice type and storage period (A×D), the highest overall acceptability score (7.769) was observed in fresh samples prepared with peach fruit juice (A2×D1). Closely followed by fresh samples prepared with mulberry fruit juice (A1×D1) with a score of 7.683.

For the interaction between fruit juice levels and sugar levels (B×C), the maximum overall acceptability score (7.466) was recorded in samples prepared with 30% fruit juice and 10% sugar (B3×C2) whereas the minimum overall acceptability score (6.762) was obtained in B4×C3 sample.

Regarding the interaction between fruit juice levels and storage period (B×D), the highest overall acceptability score (7.816) was recorded in fresh sample prepared with 30% fruit juice (B3×D1) while the minimum overall acceptability score (6.411) was noted in the B1×D4 sample.

Regarding the interaction between sugar levels and storage period (C×D), the maximum overall acceptability score (7.875) was observed in fresh sample prepared with 10% sugar (C2×D1) while the minimum score (6.325) was obtained in the C3D4 sample. These results are in line those reported by Aher (2007) who observed overall acceptability scores ranging from 7.31 to 7.95 for papaya whey beverage. similarly, Landge *et al.* (2013) ^[8] reported the overall acceptability score ranging from 6.61 to 7.50 for whey beverage. Gupta *et al.* (2014) ^[5] reported overall acceptability scores between 7.0 & 8.2 for fruit based carbonated whey beverage.

4. Conclusion

The data obtained from the sensory evaluation of whey drink, prepared from paneer whey-using different fruit types, juice levels and sugar concentrations-indicated that the overall acceptability of fruit juice-based whey drinks was found better in the sample prepared using paneer whey with addition of 30ml fruit juice and 10% sugar per 100ml drink.

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References

1. Aher PV. Studies on whey based papaya pulp ready to serve beverage. Parbhani: Marathwada Agricultural University; 2007.
2. Baljeet SY, Ritika BY, Sarita R. Studies on development and storage of whey-based pineapple (*Ananas comosus*) and bottle gourd (*Lagenaria siceraria*) mixed herbal beverage. Int Food Res J. 2013;20(2):607-612.
3. Dhumale VV. A study on utilization of channa whey for preparation of beverage by using Nagpur mandarin (*Citrus reticulata*) juice. Parbhani: Vasantrao Naik Marathwada Krishi Vidyapeeth; 2016.
4. Esfanjani *et al.* J Food Eng. 2015;165:155. DOI:10.1016/j.jfoodeng.2015.06.002.
5. Gupta A, Pareek N, Sengar R. A study on preparation of healthy fruit based carbonated beverage using whey and orange juice. Asian J Dairy Food Res. 2014;33(1):5-8.
6. Huffman LM. Processing whey protein for use as a food ingredient. Food Technol. 1996;50(2).
7. Kumar *et al.* Whey protein and its utilization in food products. J Pharmacogn Phytochem. 2018.
8. Landge SN, Gaikwad SM. Studies on preparation and sensory evaluation of whey beverage. Int J Food Agric Vet Sci. 2013. ISSN: 2277-209.
9. Minj S, Anand S. Whey proteins and its technology applications. Food Rev Int. 2020;38(4):513-526.
10. Naik YK, Khare A, Choudhary PL, Goel BK, Shrivastava A. Studies on physico-chemical and sensory characteristics of whey based watermelon beverage. Asian J Res Chem. 2009;2(1):57-59.
11. Prasad K, Sharma HK, Mahajan D, Jaya. Studies on utilization of whey-based mango beverage. Beverage Food World. 2001;28(11):31-32.
12. World Health Organization. WHO technical report series no. 724. Geneva: World Health Organization; 1985.
13. Yadav RB, Yadav BS, Kalia N. A study on development and storage studies on whey-based banana herbal (*Mentha arvensis*) beverage. Am J Food Technol. 2010:1-9.
14. Maroney J. Sensory evaluation using the 9-point hedonic scale; 1975.