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PROCESS STANDARDIZATION FOR PREPARATION OF WHEY BEVERAGE ADDED WITH JAMUN (*SYZYGIUM CUMINI*) JUICE

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ABSTRACT

The main objectives of this research work were, to optimize levels of jamun juice and sugar, to study sensory, physico-chemical of whey beverage samples. Initially, pre-experimental trials were conducted to decide the levels of jamun juice and sugar to prepare acceptable whey beverage. The data generated during the course of this investigation was statistically analyzed using Completely Randomized Design (CRD) with three replications. On the basis of results of sensory evaluation, the most acceptable three levels of jamun juice (6, 9 and 12 per cent) and two levels of sugar (8 and 10 per cent) were selected for experimental trials. It was observed that, all sensory attributes viz., colour and appearance, flavour, consistency and overall acceptability of fresh whey beverage under different treatment combinations were significant. The treatment T4 (8.51) had maximum colour and appearance score and treatment T0 (7.86) had the lower colour and appearance. Treatment T4 (8.38) had maximum flavour score and treatment T0 (7.7) had lower score. Treatment T2 (8.33) had maximum consistency score and treatment T0 (7.94) had lower score and the treatment T4 (8.33) had maximum overall acceptability score and treatment T0 (7.83) had lower overall acceptability score, respectively. The average chemical compositions of fresh whey beverage samples prepared under different treatment combinations ranged from 0.41 to 0.50 per cent fat, 0.34 to 0.45 per cent protein, 3.38 to 4.51 per cent reducing sugars, 0.20 to 0.37 per cent acidity, 12.25 to 12.48 per cent total sugars, 4.41 to 4.54 pH, 0.64 and 0.71 per cent ash and 13.84 to 13.94 per cent total solids, respectively.

Keywords: Paneer whey, jamun juice, beverage and physico-chemical parameters.

Introduction

Whey has been considered as an important food medium for thousands of years. It is rich source of carbohydrates (Lactose 4-5 %), minerals 0.60 per cent (Ca, P, Na, Mg etc.) and whey proteins lactalbumin (22 % of whey protein), lactoglobulin (59 % of whey protein), serum albumin-6 per cent of whey protein and water-soluble vitamin i.e., B complex (Ghosh and Singh, 1997 and Parekh, 1997).

According to its average composition, whey has approximately 93 per cent water and contains about 50

per cent of total solids present in the milk of which lactose is the main constituent. Whey proteins constitute less than 1 per cent of dry matter (Beucler *et al.*, 2006). Most compositional differences are in contents of calcium, phosphates, lactic acid and lactate present in much higher amounts in acid whey. Whey proteins are the constituents which put whey into spotlight on the dairy products market. Whey proteins include several thermosensitive fractions like β -lactoglobulin, α -lactalbumin, bovine serum albumin, immunoglobulins and thermostable fraction of proteose peptones.

Jamun fruit is full of medicinal properties. It has antioxidants, antibacterial, polyphenols, cardiovascular properties, so it is called medicinal fruit. Jamun fruits are universally accepted to be very good for medicinal purpose especially for curing diabetes because of its effect on the pancreas. The fruit, its juice and seed contain a biochemical called “Jamboline” which is believed to check the pathological conversion of starch into sugar in case of increased production of glucose. The fruit or fruit juice should be taken with salt every morning for two to three months in its season. The use of the fruit in this manner in every season will affect radical cure from the various diseases (Joshi, 2001).

Materials and Methods

The investigation was undertaken in the laboratories of Animal Husbandry and Dairy Science, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist- Ahmednagar (MS), India during the year 2022-2023. All the raw materials sugar, jamun juice etc were collected from the local market of Rahuri.

Preparation of paneer whey

To prepare paneer whey, start by good quality fresh milk was procured and then strained through muslin cloth. The milk was transferred to stainless steel vessel and brought to boil by heating. The vessel was then removed from the fire. The coagulant was added slowly and stirred to have uniform mixing. Then the mass was poured over stretched piece of clean muslin cloth over another vessel to drain of the whey and press in paneer presser to remove excess whey from mass. The clear drained whey was collected in the vessel. The yellowish green whey was then used for preparation of whey beverage.

Preparation of whey beverage

The whey beverage samples were prepared by using procedure prescribed by Dhamsaniya and Varshney (2013) with slight modification. The yellowish green paneer whey was taken in a clean stainless-steel vessel and then added jamun juice and sugar as per the treatments. Mix the ingredients thoroughly. Heat the mixture to around 45°C. Subsequently, cool it down to room temperature. Perform pasteurization by heating the mixture to 63°C for 30 minutes. Once pasteurized, cool the beverage to room temperature. Finally, store the prepared whey beverage drink in a refrigerator at 6±1°C for optimum

freshness. This process ensures a delicious and safe paneer whey-based beverage infused with the goodness of jamun juice.

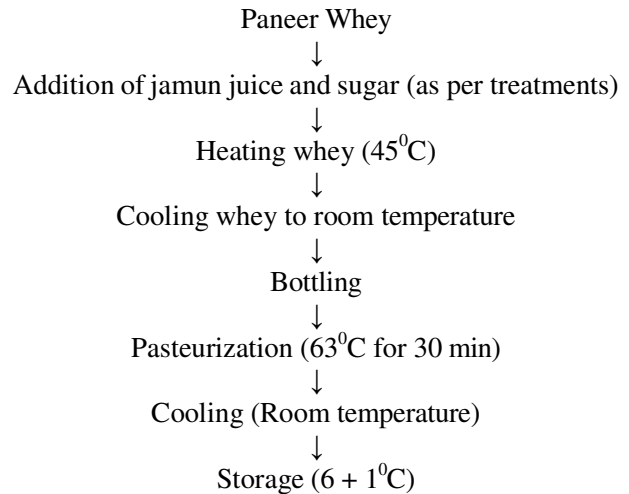


Fig. 1 : Flow diagram for preparation of whey beverage

Result and Discussion

Sensory quality of fresh whey beverage samples

The sensory quality of freshly prepared whey beverage samples is summarized in table 1

Colour and appearance

The colour and appearance of whey beverage significantly ($P<0.05$) influenced due to addition of different levels jamun juice in *paneer* whey. All the treatments significantly ($P<0.05$) differed among themselves. The colour and appearance score for the treatments T0, T1, T2, T3, T4, T5 and T6 was 7.86, 8.15, 8.07, 8.40, 8.51, 8.30 and 8.22, respectively. The treatments T4 had maximum colour and appearance score as compared to other treatments. The treatment T0 had lower colour and appearance score. The effect of jamun juice and sugar on colour quality of whey beverage was noticed as colour change from light purple to purple.

Similar findings were reported by Bhavsagar *et al.* (2010) prepared fruit beverage from chhana whey by adding 5, 10 and 15 per cent pineapple juice and recorded the average colour and appearance score as 7.64. Singh *et al.* (2014) worked on whey guava beverage and noted the sensory score for colour as 6.02 to 7.82 in the different blends studied.

Table 1: Sensory score of fresh whey beverage samples (Sensory score out of 9)

Treatments	Colour and Appearance	Flavour	Consistency	Overall Acceptability
T0	7.86 ^g	7.70 ^f	7.94 ^f	7.83 ^d
T1	8.15 ^e	8.05 ^e	8.27 ^b	8.15 ^{cd}
T2	8.07 ^f	8.15 ^d	8.33 ^a	8.18 ^c
T3	8.40 ^b	8.30 ^b	8.01 ^e	8.23 ^b
T4	8.51 ^a	8.38 ^a	8.10 ^d	8.33 ^a
T5	8.30 ^c	8.16 ^d	8.15 ^c	8.20 ^c
T6	8.22 ^d	8.25 ^c	8.23 ^b	8.23 ^b
S.E.	0.005	0.006	0.016	0.012
CD at 5 %	0.017	0.019	0.048	0.038

Flavour

The flavour score for the treatments T0, T1, T2, T3, T4, T5 and T6 was 7.70, 8.05, 8.15, 8.30, 8.38, 8.16 and 8.25, respectively. The flavour of jamun juice whey beverage samples prepared using different levels of jamun juice significantly ($P < 0.05$) affected due to addition of jamun juice in the *paneer* whey. The treatment T4 (9 %) had most acceptable flavour score as compared to other treatments. All the treatments were significant ($P < 0.05$) among themselves. Treatments T2 and T5 were at par with each other while significantly different from other treatments. From the above result it was seen that with addition of jamun juice, flavour of whey beverage increased.

The score recorded for flavour of jamun juice whey beverage was comparable with the finding of below mentioned research workers. Prasad *et al.* (2001) observed the highest favour of mango whey beverage contained 12 per cent sugar and 20 per cent pulp. Satpute *et al.* (2018) studied on preparation of herbal whey-based beverage using menthol and

reported scores for flavour of herbal whey beverage in treatments T1, T2, T3 and T4 was 8.10, 8.40, 8.50 and 8.60, respectively.

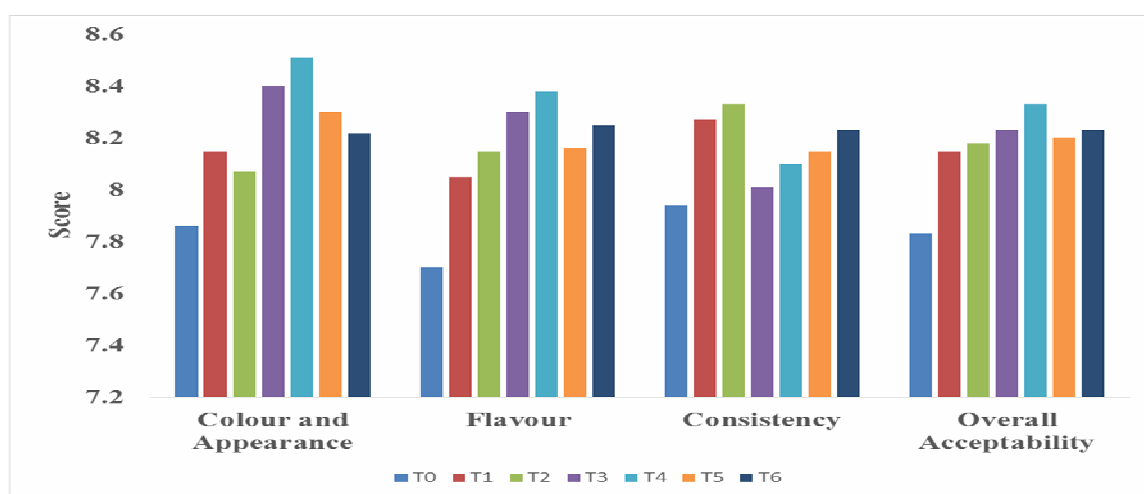
Consistency

The consistency score for the treatments T0, T1, T2, T3, T4, T5 and T6 was 7.94, 8.27, 8.33, 8.01, 8.10, 8.15 and 8.23, respectively. The consistency of jamun juice whey beverage prepared using different levels of jamun juice significantly ($P < 0.05$) changed due to addition of different levels of jamun juice in *paneer* whey. All the treatments significantly ($P < 0.05$) influenced among themselves.

The score recorded for consistency of jamun juice whey beverage was comparable with the finding of below mentioned research workers. Satpute *et al.* (2018) studied on preparation of herbal whey-based beverage using menthol and reported consistency of herbal whey beverage in treatments T1, T2, T3 and T4 was 8.0, 8.35, 8.40 and 8.60, respectively.

Overall acceptability

The overall acceptability score for the treatments T0, T1, T2, T3, T4, T5 and T6 was 7.83, 8.15, 8.18, 8.23, 8.33, 8.20 and 8.23, respectively. The overall acceptability of jamun juice whey beverage samples prepared using different levels of jamun juice significantly ($P < 0.05$) influenced due to addition of jamun juice in *paneer* whey beverage. Treatment T0 and T1 were also at par with each other as like treatment T1 and T2. The treatment T4 (9 %) had better overall acceptability as compared to other treatments. All the treatments significantly ($P < 0.05$) differed among themselves.

**Fig. 2 :** Sensory score of fresh whey beverage samples.

The score recorded for consistency of jamun juice whey beverage was comparable with the finding of below mentioned research workers. Karle (2001) observed *Channa* whey beverage adding 10, 15, 20 per cent beetroot whey pulp having highest overall acceptability and Dande *et al.* (2018) studied on overall acceptability of whey beverage by using different levels of grape fruit juice and reported overall acceptability score of whey beverage in the treatments T1, T2, T3 and T4 was 8.62, 8.33, 7.58 and 6.96, respectively.

Chemical quality of fresh whey beverage samples

The freshly prepared whey beverage samples were chemically analysed for fat, protein, reducing sugar, total solids, ash, acidity and pH value. The values of chemical constituents are presented in table 2.

Fat

The values of fat content of freshly prepared jamun juice whey were 0.50, 0.48, 0.47, 0.45, 0.44, 0.42 and 0.41 per cent, for treatment T0, T1, T2, T3, T4, T5 and

T6 respectively. The fat content in jamun juice whey beverage significantly ($P < 0.05$) differed due to addition of jamun juice. The fat content decreased as the level of jamun juice increased. The treatment T6 had the lowest fat content (0.41), whereas the treatment T0 had highest fat content (0.50) per cent. Treatment T1 and T2 at par with each other as like treatment T3 and T4 at par with each other. The mean values showed decreasing trend. This was due to less fat content in jamun juice 0.30 per cent per 100ml.

The results of fat content in the present investigation were comparable with the finding following research workers. Singh *et al.* (1994) studied the development of whey based beverage and observed that the fat in different fruit beverage varied from 0.46 to 0.38 per cent.

Table 2 : Chemical composition of fresh whey beverage samples

Treatment	Fat (%)	Protein (%)	Total solids (%)	Ash (%)	Acidity (%)	pH	Reducing Sugar (%)	Total Sugar (%)
T0	0.50 ^a	0.45 ^a	13.84 ^f	0.64 ^d	0.20 ^f	4.55 ^a	3.38 ^f	12.25 ^a
T1	0.48 ^b	0.42 ^b	13.85 ^e	0.65 ^{cd}	0.27 ^{ef}	4.52 ^b	4.42 ^e	12.30 ^a
T2	0.47 ^b	0.40 ^c	13.87 ^d	0.66 ^c	0.29 ^c	4.50 ^c	4.43 ^e	12.34 ^{ab}
T3	0.45 ^c	0.39 ^d	13.89 ^c	0.67 ^c	0.31 ^{de}	4.47 ^c	4.45 ^d	12.38 ^b
T4	0.44 ^c	0.37 ^e	13.92 ^b	0.69 ^{ab}	0.33 ^b	4.45 ^f	4.47 ^c	12.42 ^{bc}
T5	0.42 ^d	0.36 ^f	13.92 ^b	0.70 ^a	0.35 ^{cd}	4.43 ^d	4.49 ^b	12.44 ^{bc}
T6	0.41 ^d	0.34 ^g	13.94 ^a	0.71 ^a	0.37 ^a	4.41 ^g	4.51 ^a	12.48 ^{cd}
S.E.	0.005	0.006	0.005	0.006	0.016	0.076	0.005	0.021
CD at 5 %	0.017	0.018	0.016	0.019	0.049	0.23	0.017	0.064

Protein

The protein content of jamun juice whey beverage significantly ($P < 0.05$) influenced due to addition of jamun juice. The protein content of whey beverage samples were significant ($P < 0.05$) among themselves. As the addition of jamun level of juice in the whey there was decreased in the protein content in the whey beverage samples. The maximum protein content was observed in T0 (0.45 %). The protein content was decreased due to the less amount of protein in jamun juice 0.71 per cent.

The results of protein content in the present investigation were comparable with the finding following research workers. Kesarkar (2002) reported protein content of pineapple flavoured paneer whey

beverage as 0.51 – 0.44 per cent. Also Surwase (2017) reported 0.94-0.84 per cent protein in custard apple blended herbal whey drink.

Total solids

The values for the total solids content of jamun juice whey were 13.84, 13.85, 13.87, 13.89, 13.92, 13.92, 13.94 per cent for the treatments T0, T1, T2, T3, T4, T5 and T6 respectively. The total solids contents of whey samples significantly ($P < 0.05$) differed due to addition of jamun juice. All the treatments significantly ($P < 0.05$) differed among themselves. Treatment T4 and T5 at par with each other. The value of total solids content for treatment T6 was maximum 13.94 per cent.

The results of total solid content in the present investigation were comparable with the finding following research workers. Mohamed *et al.* (2014) studied physico-chemical and microbiological properties of papaya functional whey beverage and noted the TS content 18 per cent. And Panghal *et al.*

(2017) utilization of dairy industry waste-whey in formulation of papaya RTS beverage and reported the total solids was found to increase from 15.20 ± 0.35 to 18.15 ± 0.18 . This is due to water replacement with whey as whey contains water, milk solids, lactose, proteins and minerals.

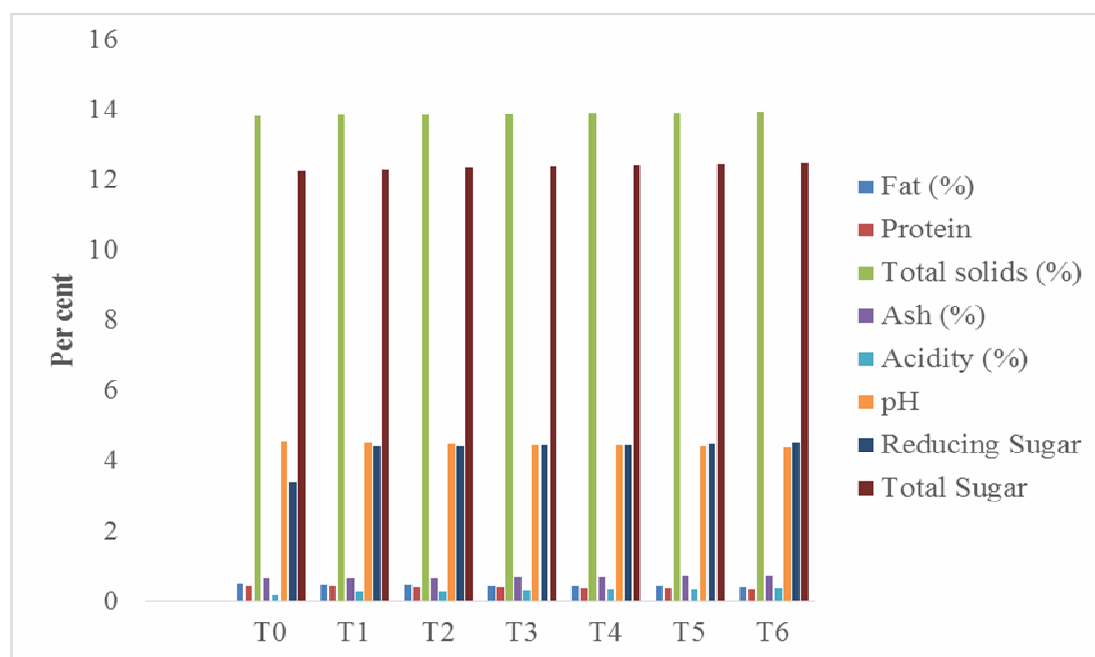


Fig. 3 : Chemical composition of fresh whey beverage samples

Ash

The ash content ranged from 0.64 to 0.71 per cent. The values of ash content in the freshly prepared jamun juice whey beverage samples were 0.64, 0.65, 0.66, 0.67, 0.69, 0.70, 0.71 per cent T0, T1, T2, T3, T4, T5 and T6 respectively. The ash content of whey beverage samples significantly ($P < 0.05$) influenced due to addition of jamun juice in the whey. Treatment T5 and T6 at par with each other as like treatment T2 and T3 at par with each other. The ash content of whey beverage samples was significant among themselves. Ash content increased with increasing the levels of jamun juice.

The values recorded in ash content in the present investigation were comparable with below mentioned research. Devi *et al.* (2017) development, chemical analysis and sensory evaluation of whey based pineapple juice beverages and reported the highest average value of ash content was obtained in the treatment T1P3 (0.32 %) and the lowest average value of ash content was obtained in the treatment T5P1 (0.22 %) and T5P2 (0.22 %). The ash content increased with increased in whey and water ration and

also with increased in fruit juice percent.

Acidity (%)

The acidity of jamun juice whey beverage significantly ($P < 0.05$) influenced due to addition of jamun juice. The values of acidity of jamun juice whey beverage were 0.20, 0.27, 0.29, 0.31, 0.33, 0.35, 0.37 per cent T0, T1, T2, T3, T4, T5 and T6 respectively. The maximum acidity 0.37 per cent was observed in the whey beverage sample prepared with 15 per cent (T6) jamun juice whey beverage. Treatment T0 and T1 at par with each other. The value of acidity in the whey beverage was increased as the level of jamun juice increased. The mean values showed increasing trend. This was due to acidity content in jamun juice 0.87 per cent per 100 mL.

The above results were comparable with the findings of following researchworkers. Darade (2016) reported lactic acidity 0.74-0.78 per cent LA in whey potato fermented product. Prashant *et al.* (2018) development of fruit enriched whey beverage and reported the acidity of control was 0.22 per cent LA whereas pineapple juice blended whey was 0.32, 0.34, 0.35 and 0.36 per cent LA at 15, 20, 25 and 30 per cent

blending of pineapple juice to whey beverage respectively and for orange juice blended whey beverage it was 0.25, 0.26, 0.27 and 0.28 per cent LA at 15, 20, 25 and 30 per cent blended respectively. As well as Satpute *et al.* (2018) studied on preparation of herbal whey based beverage using menthol and reported the average acidity was 0.37, 0.36, 0.35 and 0.34 per cent for treatment T₁, T₂, T₃ and T₄, respectively.

pH

pH value of whey beverage samples prepared with addition of jamun juice is presented in Tables 4.5. The pH values for the treatment T₀, T₁, T₂, T₃, T₄, T₅ and T₆ were 4.55, 4.52, 4.50, 4.47, 4.45, 4.43 and 4.41 respectively. The pH values of whey beverage significantly ($P < 0.05$) declined due to addition of jamun juice. The maximum decline in pH value (4.41) was observed in whey beverage prepared using 15 per cent jamun juice.

The above results were comparable with the findings of following research workers. Bhavsagar *et al.* (2010) reported the pH values of pineapple flavoured beverage from *chhana* whey as 3.91 to 3.89.

Reducing sugar

The reducing sugar content in the whey beverage samples were significant. The values of reducing sugar content of jamun juice whey beverage samples were 3.38, 4.42, 4.43, 4.45, 4.47, 4.49 and 4.51 per cent for the treatment T₀, T₁, T₂, T₃, T₄, T₅ and T₆ respectively.

Similar result reported by Gagrani *et al.* (1987) reported 4.20 per cent reducing sugar in whey beverage with orange, pineapple, guava and mango fruits.

Total sugar

The values for the total sugar content of jamun juice whey beverage were 12.25, 12.30, 12.34, 12.38, 12.42, 12.44, 12.48 per cent for the treatment T₀, T₁, T₂, T₃, T₄, T₅ and T₆ respectively. Treatment T₀ and T₁ at par with each other as like treatment T₄ and T₅ at par with each other. The value of total sugar content of treatment T₆ was maximum (12.48 %).

Present investigation was comparable with the finding below mentioned researchers. Sharma *et al.* (1995) reported 13.5 % total solids in whey based carrot juice and buffalo milk *paneer* whey.

Conclusion

The sensory superior fresh whey beverage had chemical composition 0.44, 0.37, 13.92, 0.69, 0.33, 4.45, 4.47 and 12.42 per cent fat, protein, total solid,

ash, acidity, pH, reducing sugar and total sugar respectively.

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Conflict of interest

The authors have not any conflict of interest to declare.

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