

Effect of Blending Apple Juice on the Sensorial characteristics of Whey Beverage during Storage

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ABSTRACT: The goal of the current investigation is to utilize acid whey obtained after *channa/paneer* manufacturing to turn into products that have the potential to provide extra value to the users. The viability of mixing apple juice in whey at different ratios (apple juice 0-50%) and its effect on organoleptic characteristics were explored during refrigerated storage. The parameters measured were color, appearance, flavour, texture (consistency), and overall acceptability. There is a significant impact ($p < 0.05$) of the incorporation of apple juice on the sensorial quality of apple-whey beverages. The result revealed that the sensory panelist highly preferred the apple juice: whey ratio (50:50). The product sensory scores were satisfactory until 45 days, beyond that the product quality deteriorated significantly ($p < 0.05$).

Keywords: Apple, whey, colour and appearance, flavour, consistency, Overall acceptability.

INTRODUCTION

Chhana/panner is the heat and acid-coagulated product (Arora *et al.*, 2019a; 2021) and whey is a greenish-yellow liquid produced as a by-product during their production. About 5 million tonnes of whey is generated in India, with *channa* and *paneer* whey accounting for roughly 80% of overall whey (Gupta, 2008), and the majority of it is discarded as waste. Whey consists of appreciable quantities of total milk solids, lactose, milk proteins, minerals, and vitamins (Horton, 1995). Proteins in whey are high in absorption capacity as well as it contains sulfur-containing amino acids for instance valine, leucine, and isoleucine, boosting tissue development and maintenance, muscle strength, and body makeup (Arora *et al.*, 2019b). Whey proteins are functionally suitable for beverage preparation because they have a fresh, neutral taste. In the production of whey beverages suitable quantities of fruit juices, minimally processed whey along with adequate levels of stabilizers and acidulants are combined together to formulate a quality product (Singh *et al.*, 2005).

Fruit juice beverages are thought to be easy carriers for transporting and delivering whey proteins into human meals. Apple fruit stands second as a fruit of choice consumed the world over (Drogoudi and Pantelidis 2011) and is a storehouse of many phenolic compounds essential for good health (Wolfe *et al.*, 2003).

Despite several bio-actives, apple contains insignificant proteins and is deficient in minerals like potassium and calcium (Lee, 2012). Several studies have been

conducted to formulate whey-based fruit juice mixes with different ratios based on the sensory profile (Djuric *et al.*, 2004). The poor sensory profile of whey beverages is still challenging for consumer acceptance. Our study explores the level of apple juice that can be added to whey thereby a tastier healthier variant can be made. Also, apples are nutritionally rich and the juice made could have the potential to use as a blend for utilizing the nutritionally rich by-product of milk. Thus, utilizing apple and whey can be a novel idea. The commercialization and popularization of such drinks may yield economic benefits.

MATERIAL AND METHODS

Materials. Double-toned milk of the Amul brand was obtained from the local market. Apple juice of brand real active was brought from the local market. Apple blended whey beverage was packaged and stored in glass bottles with crown closures (200 mL). These were procured from the local market.

Methods. The double-toned milk was heated to 95°C and cooled down to 70°C. Thereafter, citric acid @ 2.0 percent solution was added to the milk. After the formulation of the coagulum, the contents were kept undisturbed. Whey is strained through a neat and clean muslin cloth. The greenish-yellow clear whey is kept undisturbed for 2 min. The whey thus obtained is again heated (100°C) for 5 minutes so that the remaining protein curdles and, after settling, is decanted (Fig. 1). The whey thus obtained is then suitably blended with sugar-free apple juice in the concentrations T1-20%,

T2-30%, T3-40%, and T4-50%. To this, about 8 % of sugar is added and heated to 85° C for 2 minutes. Whey containing 8% sugar was served as control. The blended beverage is then filled in a pre-sterilized small 200 ml capacity glass bottle leaving head space. The bottle is pasteurized in a vat. After cooling the bottles are kept under refrigeration and were analyzed for sensory acceptability after 15 days for two months.

Chemical analysis of whey and apple juice: The acidity was determined as per the procedure described in ISI, 18 (part XI) 1981. Lactose was estimated in whey by the Lane Eynon method as described in ISI (1981). The protein, fat content and carbohydrate content, and ash content of the raw material were estimated by standard procedures as referred to in AOAC (2000). pH value of fruit juice and whey was analyzed by a digital pH meter (Labindia).

Sensory Analysis: Postgraduate students and staff members from the department of Food Science and Technology, PSPS Govt PG College for Women, Gandhi Nagar, Jammu, composed of a semi-trained panel evaluated the blends of whey apple juice for organoleptic characteristics such as colour, aroma, taste, texture (consistency) and overall acceptability. A 15-day interval was used to examine the product. For conducting the sensory evaluation of the developed beverages, Pimentel *et al.* (2016), a 9-point Hedonic rating approach was used.

Statistical Method. Systat, statistical analysis software was used to perform an analysis of variance (ANOVA) on the data generated for the current study. The 60-day storage period and various treatments (N=3 and control) were compared using the critical difference (CD) at the 5% level of significance (at 15 days intervals).

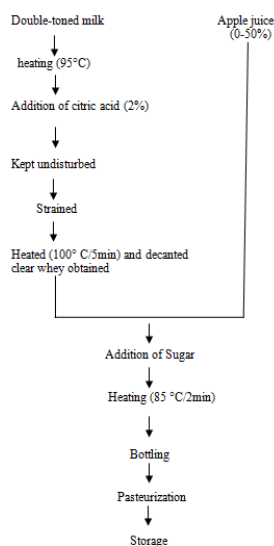


Fig. 1. Flow diagram for the manufacture of Apple blended Whey Beverage.

RESULT AND DISCUSSION

Physico-Chemical Characteristics of Whey and Apple Juice. As presented in Table 1, the apple juice showed a high concentration of moisture (89.83%) and sugar (10.96%). The results showed ash content of

(0.70%), protein (0.00%), fat (0.00%). The titratable acidity composition was 0.38%, while the pH was 4.90, as presented in Table 1. The whey showed a high concentration of moisture (93.4%) and lactose as a carbohydrate (4.90%). The results showed ash content was 0.60%, and protein and fat content were observed as 0.64% and 0.03%, respectively. The titratable acidity was calculated as 0.41, while the pH was 4.30.

Table 1: Physico-Chemical characteristics of Whey and Apple juice.

Parameters	Whey	Apple juice
Moisture (%)	93.4 +0.05	89.83 +0.08
Fat (%)	0.03±0.01	-
Protein (%)	0.64 +0.03	-
Fruit Sugars (%)	-	10.96+0.05
Lactose (%)	4.9+0.02	-
Ash content (%)	0.6+0.01	0.7+0.05
Acidity	0.41+0.02	0.38+0.02
pH	4.3+0.02	4.9+0.03

n=3, Values are Mean±sd

Changes in organoleptic quality during storage:

Eight different samples of a varying proportion of whey and apple juice were taken and coded as C, T1, T2, T3, and T4 respectively. The TSS of the samples was kept constant *viz.* 8°Bx. Then the formulations having a different proportion of whey and apple juice were kept for 2 months and subjected to sensory evaluation for various parameters.

Effect on Colour and Appearance. The color and appearance scores of whey apple beverages are shown in fig 2. Statistical analysis revealed that the addition of apple juice significantly ($p<0.05$) affected the visual scores of the blends. The developed beverage varied from light green to pale greenish in appearance with apple juice added to the whey. The appearance scores of the whey: apple juice blend @50:50 was found to be superior to the other samples with the highest mean score of 7.4. Devi *et al.* (2017) reported an increase in the sensory score for the color of beverage while increasing the pineapple juice content in the preparation of whey-based pineapple juice. Zaman *et al.* (2016); Nagadevi and Puraikalan (2015) also reported a similar result of an increasing score for the color. It was also observed that with increasing storage interval there is a significant ($p<0.05$) decline in sensory score among all the samples.

Effect on Flavour. Like other parameters, apple juice variation has a significant effect on the flavor scores at a 5% level of significance. The average sensory score, for different formulations from sensory assessment, was given in Fig. 3. The samples were significantly different from the control samples. An increase in juice concentration led to an increase in the flavor scores significantly. However, the scores declined at the end of the storage period for all samples. Devi *et al.* (2017) reported an increase in the sensory score for the taste of beverage while increasing the pineapple juice content in the preparation of whey-based pineapple juice. Zaman *et al.* (2016); Nagadevi and Puraikalan (2015) stated that the taste was widely accepted for the increased juice content.

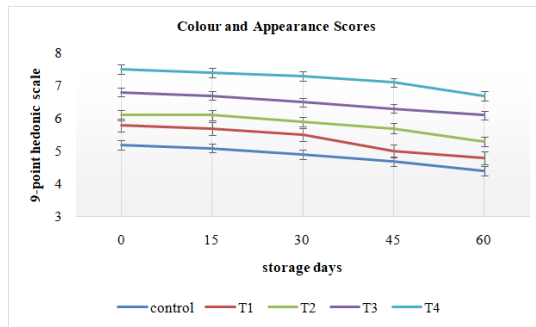
Effect on Texture (Consistency). Like other parameters, juice variation has a significant effect on the body at a 5% level of significance. The mean sensory score, from sensory evaluation, given to the different samples is given in figure (Fig 4). With the increase in storage interval, there is a decline in texture scores among all the samples which was measured in terms of the consistency of the beverage. Results of control vary significantly from other samples containing juice. A decrease in texture score during storage might be due to co-polymerization, the interaction between phenolics, the degradation of colloidal particles and protein, and pectin and phenolics complexing upon storage (Wilson and Burns, 1983).

Effect on Overall Acceptability. Overall acceptance is the foremost factor for accepting the sample. The sensory score from the sensory evaluation of the four

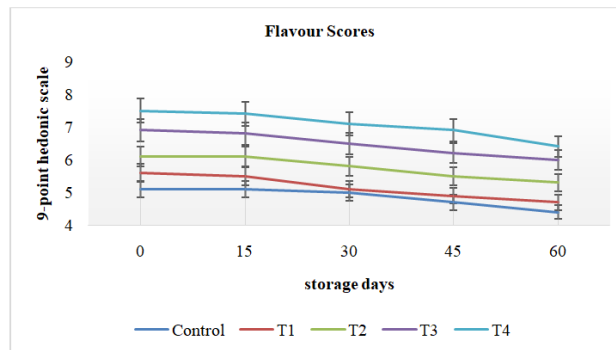
different samples including control without juice is depicted in Fig 5. Sample 4 in sensory evaluation (overall acceptance) scored the highest.

Devi *et al.* (2017) reported an increase in the sensory score for the overall acceptability of beverage while increasing the pineapple juice content in the preparation of whey-based pineapple juice. Nagadevi and Puraikalan (2015); Zaman *et al.* (2016) concluded a similar result stating that the overall acceptability of the product with increased fruit juice content scored best.

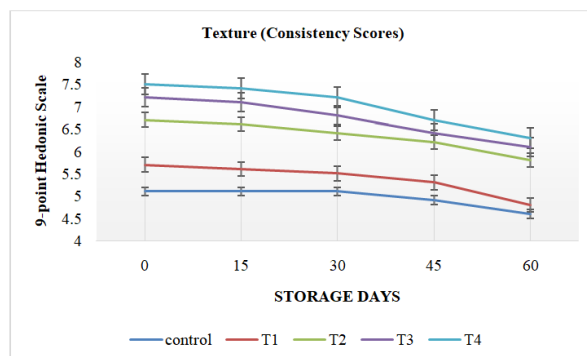
A decrease in the colour, consistency, and flavor scores of beverages might have resulted in a decline in overall acceptability scores during storage. The results conformed with that of Yadav *et al.* (2010); Sakhale *et al.* (2012) in other whey-based beverages based on banana and mango, respectively.



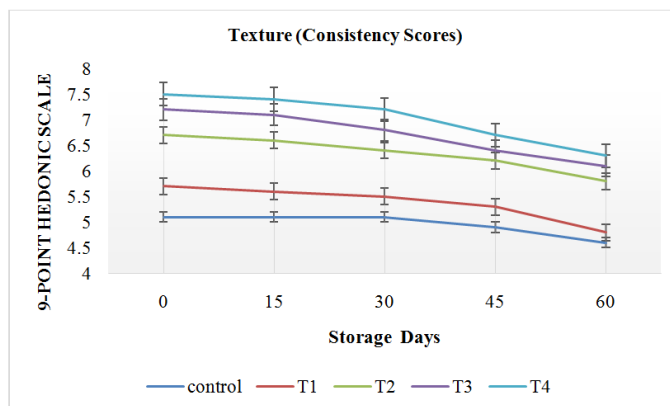
Treatments -C-0%, T1-20%, T2-30%, T3-40%, T4-50%. = Apple juice @ 0 %, 20%, 30%, 40% 50 % level
Fig. 2. Changes in colour and appearance scores of apple juice blended whey beverage during storage.



Treatments -C-0%, T1-20%, T2-30%, T3-40%, T4-50%. = Apple juice @ 0 %, 20%, 30%, 40% 50 % level
Fig. 3. Changes in flavour scores of apple juice blended whey beverage during storage.



Treatments -C-0%, T1-20%, T2-30%, T3-40%, T4-50%. = Apple juice @ 0 %, 20%, 30%, 40% 50 % level
Fig. 4. Changes in Texture (consistency) scores of apple juice blended whey beverage.



Treatments -C-0%, T1-20%, T2-30%, T3-40%, T4-50%. = Apple juice @ 0 %, 20%, 30%, 40% 50 % level

Fig. 5. Overall acceptability (consistency) scores of apple juice blended whey beverage.

CONCLUSION

In the present study the addition of apple juice in various concentrations significantly impacted the overall acceptability of developed beverages. Our findings suggest that apple juice up to 50% level was effective in the formulation of whey beverage in terms of sensory scores compared to the lesser concentrations. The beverage can be kept well for about one month under refrigeration thereafter there is a decline in sensory scores. Further research can be done on the bending of other fruits and the addition of stabilizers to improve the consistency of such beverages.

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Conflict of Interest. None.

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