

Research Article

Physicochemical Properties of Whey Based Mosambi and Carrot Mixed Herbal Beverage

Fozia Hameed*, Anurag Verma, Saurabh Singh and Avanish Kumar

Sam Higginbottom Institute of Agriculture, Technology and Science, Naini, Allahabad, UP 211007, India

Abstract

The study was aimed to formulate a delicious and nutritious whey based Ready-To-Serve beverage by using mosambi juice, carrot juice, sugar and mint. This investigation was designed to analyze sensory properties of mint incorporated nutritious whey drink. Mint was used as a natural flavoring agent. In the preparation of the beverage the volume of the mosambi juice (10 ml), carrot juice (10 ml) and sugar (8 g) was kept constant while the proportion of mint extract and whey was varied from 0-4 ml and 68-72 ml per 100 ml of the prepared beverage, respectively. The screening of beverage samples was done on the basis of their quality parameters. Analysis of the treatments showed a significant difference ($p \leq 0.05$). The organoleptic scores of the beverages improved as the proportion of the mint increased from 0-2 ml and the proportion of the whey decreased from 72-69 ml. Further, increase in the mint concentration and decrease in the whey concentration did not improve the organoleptic score. As a result of various studies 2 ml mint, 70 ml whey, 10 ml mosambi juice, 10 ml carrot juice and 8 g sugar powder obtained the average sensory score of 8.5, which was the highest among the all other beverages prepared with different concentration of mint and whey. The developed RTS beverage could be recommended for the large scale production at industrial level.

Keywords: Whey RTS beverage, mosambi juice, carrot juice, mint, Quality evaluation

*Correspondence

Author: Fozia Hameed
Email: s.fozia011@gmail.com

Introduction

Whey is a greenish yellow, semi translucent milk serum that separates from the curd during the process of cheese making. It is one of the major problematic disposals for dairy industry because of high Biological Oxygen Demand (BOD) value [1] and its stringent environmental regulatory acts. Whey or milk plasma consists of 45 to 50% of total milk solids, 70% of milk sugar, 20% of milk proteins, 70 to 90% of milk minerals and almost all water-soluble vitamins present originally in milk. Whey protein comprises of four major protein fractions such as beta-lactoglobulin (~65%), alpha-lactalbumin (~25%), bovine serum albumin (~8%) and immunoglobulins (~2%) [2] and four minor fractions including lactoferrin, lysozyme, lactoperoxidase and glyco macro peptides [3]. Whey protein contains essential amino-acids and branched-chain amino-acids such as isoleucine, leucine and valine which are important in tissue growth and repair, regulation of muscle protein synthesis and glucose homeostasis [4]. Lactose, one of the essential constituents of whey dry matter, also possesses beneficial effects such as stimulation of peristaltic activities in the digestive tract, alleviation of calcium and phosphorus absorption and establishment of lightly acidic environment in the gut which inhibits the growth and expansion of pathogens [4]. Water-soluble vitamins like riboflavin, folic acid and cobalamine are also found in whey in significant amount [5].

Nowadays whey is formulated to prepare various valued products such as infant formulas [4], food supplements for exercise performance and enhancement [3, 6], soups and beverages [3] that are rich in nutritional and functional properties, rather being considered as a waste product. From a functional perspective, whey proteins are appropriate for beverage formulation as it has a fresh, neutral taste and good solubility. Numerous attempts have been made to use whey for successful production of fruit whey based beverages. [7] formulated whey based strawberry RTS beverage, [8] developed whey based water melon beverage and studied the sensory analysis, [9] formulated a whey beverage by using different levels of grape fruit juice and studied overall acceptability.

The mosambi fruit is processed commercially into various forms mainly juice, frozen concentrates, squash and RTS drinks which provide 45 kcal, moderate quantity of vitamin C, potassium, bioflavonoid and folic acid and essential items of breakfast. It is refreshing, thirst quenching and energizing drink that improves health and nutritional requirements [10]. Carrot, on the other hand, one of the popular root vegetables, is the most important source of dietary carotenoids. It is highly nutritional, and an important source of β -carotene besides its appreciable amount of

vitamins and minerals, often used for juice production [11]. Carrot contain good amount of dietary fibre which has laxative effect and aids in digestion and absorption of nutrients and prevents constipation. The use of Mint is gaining importance not only because of its use for aroma and flavour characteristics, but also because of its potential health benefit [12]. Mint has been reported to have pharmacological effect such as antimicrobial, anti-inflammatory, antispasmodic, anticancer and analgesic. It contains minerals like Ca, K, Na, Mg, P and Fe, as well as Vitamin A, C, K, folic acid, thiamine, riboflavin and niacin [13]. To the best of our knowledge, optimization of whey and mint with mosambi juice and carrot juice has not been formulated till date. Thus the resultant whey based beverage is an interesting and innovative product in the developing market as functional foods which can be used as a tool by the food processors to produce a high quality beverage product.

Materials and Methods

Toned milk for the preparation of whey, mosambi, carrot, sugar and mint were purchased from the local market. All the chemicals used were of analytical grade.

For preparing the whey, milk was heated to 80 °C for 10 minutes, coagulated using 2g/kg citric acid followed by continuous stirring which results in the complete coagulation of the milk protein (casein). After separation, the whey was filtered using muslin cloth. For preparing the mosambi juice, the fruits were peeled off and the seeds were removed manually. The juice was then extracted in a juice extractor and filtered through the muslin cloth. Similarly for the preparation of carrot juice, the carrots were thoroughly washed, peeled and juice was extracted. The resultant juice was then filtered using a muslin cloth. The fresh mint was properly washed and then ground to form a paste. The paste was then filtered using a muslin cloth.

Preparation of the formulated beverage

The blended beverages were prepared using whey, extracted juice (mosambi and carrot), mint and ground sugar. In all the formulations, whey and mint was added at different proportions as shown in the **Table 1**. The ground sugar powder was added at the rate of 8 gram per 100 ml. The prepared beverages were filtered and filled into glass bottles (200 ml) and sealed by crown corking. Then, the bottles were sterilized at 121°C for 10 min followed by cooling at room temperature.

Table 1 Selected proportions of mosambi juice, carrot juice, mint extract, sugar and milk whey in the preparation of 100 ml beverage

Treatment	Mosambi juice (ml)	Carrot juice (ml)	Mint extract (ml)	Milk whey (ml)	Sugar powder (g)
T ₀	10	10	0	72	8
T ₁	10	10	1	71	8
T ₂	10	10	2	70	8
T ₃	10	10	3	69	8
T ₄	10	10	4	68	8

Analytical tests

The determination of pH was carried out using a digital pH meter, Titratable acidity was determined according to the [14]. Total soluble solids were measured using a hand refractometer of 0-32 °B.

Sensory evaluation

Formulated beverages of various combinations were chilled before evaluation. A trained panel evaluated the sensory characteristics such as color, appearance, taste, flavor, body, consistency and overall acceptability as described in detail by [15] with some modifications.

Results and Discussion

The finished product was subjected for the analytical tests *viz.* pH, TSS, acidity. The results obtained were presented in **Table 2**.

Table 2 Effect of treatment (Mint extract concentration) on the pH, TSS (°Brix) and acidity (%) of whey based RTS beverage

Treatments	pH	TSS (°Brix)	Acidity (%)
T ₀	5.57	14.35	0.47
T ₁	5.80	14.80	0.35
T ₂	5.67	14.20	0.28
T ₃	6.00	14.10	0.25
T ₄	6.17	14.10	0.23
C.D(p≤0.05)	0.10	0.08	0.02

Effect on pH

The pH value for freshly prepared whey based mosambi and carrot mixed herbal beverage samples of T₀ (control), T₁, T₂, T₃ and T₄ were 5.57, 5.80, 5.67, 6.00 and 6.17, respectively (Table 2). It was also observed that as the quantity of Mint extract in the beverage increased, pH of the herbal beverage also increased. Similar results have also been reported by [16] for freshly prepared WPBH (whey-based pineapple (*Ananas comosus*) and bottle gourd (*Lagenaria siceraria*)) beverage samples as 4.99, 4.96, 5.01, 5.02 and 5.01, respectively with incorporation of mint extract (0 to 4 per cent). The slight variation may be due to different ingredients used but generally observed acceptable in all types of drinks.

Effect on TSS

The TSS content of freshly prepared whey based mosambi and carrot mixed herbal beverage samples of T₀ (control), T₁, T₂, T₃ and T₄ was measured as 14.35, 14.80, 14.20, 14.10 and 14.10 °Brix respectively (Table 2). It was observed that the concentration of mint extract did not affect the TSS content of whey based mosambi and carrot mixed herbal beverage appreciably and the values of TSS for different concentration levels of mint extract were comparable, although this effect was statistically significant (p≤0.05). Similar results have also been reported by [16-17].

Effect on Acidity

Acidity of whey based mosambi and carrot mixed herbal beverage samples of T₀ (control), T₁, T₂, T₃ and T₄ was 0.47, 0.35, 0.28, 0.25 and 0.23 % respectively (Table 2). A slight but statistically significant (p≤0.05) change in the values of acidity was observed when Mint extract concentration was increased from 0 to 4%. This might be due to the low per cent of acidity in the mint i.e. 0.33 per cent. The acidity recorded in the present investigation were in agreement with the findings reported by [17].

Effect on sensory characteristics

The finished product from all the treatment combinations was served to the trained panel comprising of 7 judges. The panelists were asked to record their observations on the sensory sheet based on a 9 point Hedonic scale (ranging from 1: dislike extremely to 9: like extremely). All formulas were prepared in triplicate and these triplicate scores were averaged for each panelist. It is worthwhile to note that the order of tasting these formulae was randomized to avoid any bias. The scores given for various parameters for the sensory evaluation were compiled, analyzed and results were presented in **Figure 1**.

It was observed from Figure 1 that the panelists, on average, prefer the formulas with 8% sugar, 2 per cent mint extract, 70 per cent whey, 10 per cent mosambi juice and 10 per cent carrot juice (T₂) for flavor, taste, consistency and overall acceptability. The panelists also appreciate T₃ and T₄ for the sweetness, but less for the consistency. All treatment combinations studied were found to be significant (p≤0.05) with each other. Sensory analysis of the treatments showed a significant difference (p≤0.05) among the treatments for colour, taste, flavor, consistency and overall acceptability. The effect of Mint extract concentration on the flavor and taste was significant and at 4% level of concentration, it decreased the flavor and taste significantly (p≤0.05). However, the score in respect of flavor ranged from 7.0 to 8.5 for T₂.

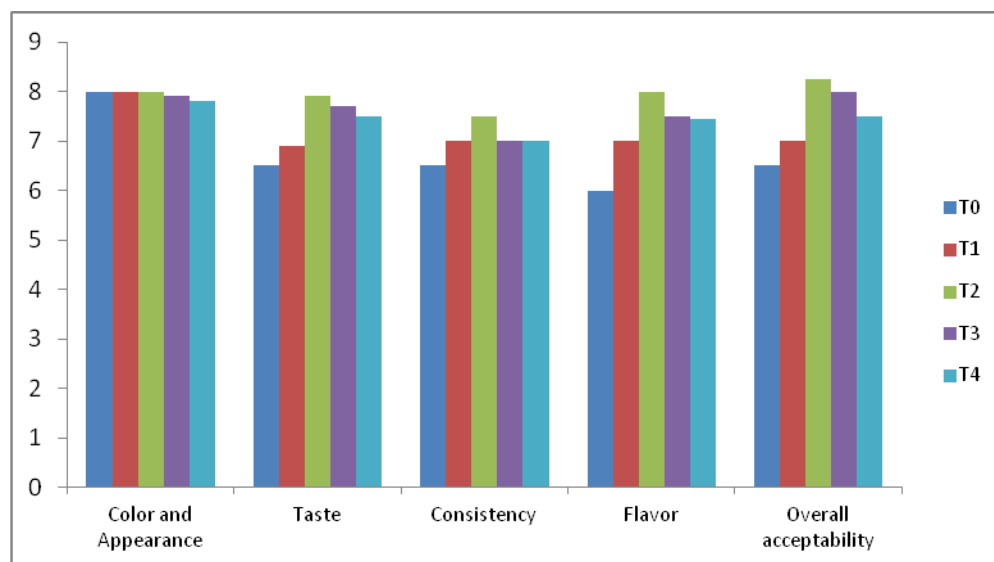


Figure 1 Sensory analysis of whey based mosambi and carrot mixed herbal beverage for various treatments

Conclusion

Nowadays dairy industries are looking for new product ideas and technologies to meet the ever increasing consumer requirement for healthy foods and to increase the profitability. Especially for developing countries, product development using whey as a water replacement with added nutrition can be used as an excellent source of good quality protein. Further, the addition of herbs increase the nutritional and medicinal properties of the drink and made the drink more acceptable to the consumers. It was concluded from the present study that a whey based mosambi and carrot mixed herbal beverage can be prepared successfully with the incorporation of 2% Mint extract. The product can prove a nutritionally as well as organoleptically desirable beverage with agreeable taste, energy providing due to whey proteins in it. Product developers seeking out functional and nutritional attributes of whey to tap the tremendous growth opportunities in the beverage industry can move forward for the development of such herbal beverages based upon whey and other fruits.

References

- [1] Divya and Kumari, A, Effect of different temperatures, timings and storage periods on the physico-chemical and nutritional characteristics of whey-guava beverage. *World Journal of Dairy and Food Sciences*, 2009, 4, 118-122.
- [2] Flores-Andrade, E., Pascual-Pineda, L.A., Jim´enez, M. and Beristain, C.I, Effect of whey protein-sucrose in the osmotic dehydration of apple. *Revista Mexicana de Ingenieria Quimica*, 2013, 12, 415-424.
- [3] Marshall, K, Therapeutic applications of whey protein. *Alternative Medicine Review*, 2004, 9, 136-156
- [4] Irena, J., Rajka, B. and Ljubica, T, Wheybased beverages- a new generation of dairy products. *Mljekarstvo*, 2008, 58, 257-274.
- [5] Sakhale, B. K., Pawar, V. N. and Ranveer, R. C, Studies on the development and storage of whey based RTS beverage from mango cv. kesar. *Journal of Food Processing Technology*, 2012, 3, 1000148.

- [6] Morris, P. E. and FitzGerald, R. J, Whey proteins and peptides in human health. In: Whey Processing, Functionality and Health Benefits, C.I. Onwulata, P.J. Huth (Eds.), Wiley- Blackwell, Ames, Iowa, 2008, pp 285-343.
- [7] Panghal, A., Dhull, N., Navnidhi and Khatkar, B. S, Whey Based Strawberry Ready to Serve (RTS) Beverage. Beverage and Food World, 2009, 36 (4), 28-30.
- [8] Punnagaiarasi, A., Elango, A. and Karthikeyan, N, Sensory analysis of whey-based watermelon Beverage. International Journal of Science, Environment and Technology, 2017, 6 (5), 3191 – 3195.
- [9] Dande, K. G., Biradar, G. S., Dadge, A. V., Swami, P. S. and Sangve, P. D, Studies on Overall Acceptability of Whey Beverage by using Different Levels of Grape Fruit Juice. International Journal of Animal Science, 2018, 2(1): 1015.
- [10] Syed, H. M., Pawar, S. M., Jadhav, B. A. and Salve, R. V, Studies on preparation and qualities of sweet orange based products. Carpathian J. Food Sci. Technol., 2011, 3: 32-42.
- [11] Demir, N., Acar, J., K. and Bahceci, K.S, Effects of storage on quality of carrot juices produced with lactofermentation and acidification. Eur Food Res Technol., 2004, 218:465–468.
- [12] Chawla, S. and Thakur, M, Overview of Mint (*Mentha L*) as a Promising Health-Promoting Herb. International Journal of Pharmaceutical Research and Development, 2013, 5(6); Aug.073-080/097-9446.
- [13] Raghavan, S, Handbook of spices, Seasonings and Flavorings, Second edition, CPC Press (2006) p. 133.
- [14] AOAC, Association of Official Analytical Chemists, Official Method of Analysis, 15th ed., Washington, DC and Arlington, VA, 2000.
- [15] Poste, L. M., Mackie, D. A., Butler, B. and Larmond, E, Laboratory Methods for Sensory Analysis of Foods, (1991), Agriculture Canada Publication 1864/E.
- [16] Baljeet, S. Y., Ritika, B. Y. and Sarita, R, Studies on Development and Storage of Whey-Based Pineapple (*Ananas Comosus*) and Bottle Gourd (*Lagenaria Siceraria*) Mixed Herbal Beverage. International Food Res. J., 2013, 20, 607-612.
- [17] Yadav, R. B., Yadav, B. S. and Kalia, N, Development and storage studies on whey-based banana herbal (*Mentha arvensis*) beverage. American Journal of Food Technology, 2010, 5: 121-129.

© 2021, by the Authors. The articles published from this journal are distributed to the public under “**Creative Commons Attribution License**” (<http://creativecommons.org/licenses/by/3.0/>). Therefore, upon proper citation of the original work, all the articles can be used without any restriction or can be distributed in any medium in any form.

Publication History	
Received	01.12.2020
Revised	15.03.2021
Accepted	24.03.2021
Online	28.05.2021