

## STUDIES ON PHYSICO-CHEMICAL CHARACTERISTICS OF ORANGE BASED PANEER WHEY BEVERAGE

Wadatkar H.V.,\* Chavan S.D., Shelke R.R. and Kahate P.A.

Department of Animal Husbandry and Dairy Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth,  
Akola, (M.S.)-444104

Email: [hrshlwdtkr07@gmail.com](mailto:hrshlwdtkr07@gmail.com)

Received-05.08.2020, Revised-26.08.2020

**Abstract:** Whey is a nutritious by product obtained from paneer, channa, cheese containing valuable nutrients like lactose, proteins, minerals and vitamins etc., which have indispensable value as human food. The orange flavoured paneer whey beverage was prepared with the addition of different level of whey, sugar and orange juice. The paneer whey beverage was prepared by using different levels of orange juice@ 10, 15, 20, 25 and 30 per cent with 8 per cent sugar. The overall acceptability of paneer whey beverage prepared with 25 per cent orange juice level was significantly superior and more acceptable than other levels of orange juice. Also formulations were prepared was studied for the chemical analysis on an average the orange flavoured paneer whey beverage of treatment T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub> and T<sub>5</sub> contained fat 0.49, 0.45, 0.41, 0.33 and 0.23 per cent, protein 0.42, 0.49, 0.54, 0.58 and 0.65 per cent, total sugar 14.48, 15.10, 15.58, 15.89 and 16.19 per cent, acidity 0.49, 0.53, 0.57, 0.62 and 0.65 per cent, pH 4.71, 4.56, 4.33, 4.12 and 3.93, respectively. The percentage of fat and pH content of the product decreased with increasing level of orange juice but the percentage of protein, total sugar and acidity content increased with increasing level of sugar.

**Keywords:** Paneer whey, Orange juice, Beverage

### INTRODUCTION

Whey is the largest and highly nutritious important by product of the dairy industry, it is obtained during the manufacture of casein, cheese, paneer, channa and shrikhand. Whey protein comprises of four major protein fractions and six minor protein fractions. Major protein fractions include beta-lactoglobulin (65%), alpha-lactalbumin (25%), bovine serum albumin (8%) and immunoglobulins (2%) (Flores-Andrade *et al.*, 2013). Minor fractions include lactoferrin, lysozyme, lactoperoxidase and glyco macro peptides (Walzem *et al.*, 2002; Marshall, 2004). The predicted value of whey production in India is estimated at 4.84 million tonnes per annum. The *chhanna* and *paneer whey* give the major contribution (about 80 per cent) in total whey production (Naik *et al.*, 2009). whey contains 45-50 per cent of total milk solids, 70 per cent of milk sugars, and 20 per cent of milk proteins, 70-90 per cent of milk minerals and almost all water soluble vitamins present in milk. It is one of the major problematic disposals for dairy industry because of high Biological Oxygen Demand (BOD) value ranging from 39,000 to 48,000 ppm (Divya and Kumari, 2009) and its stringent environmental regulatory acts. Pollution due to whey is a big problem thus utilization of whey for the production of beverages, soft drinks and wines are some of the solutions to minimize the intensity of pollution problem (Parekh, 2006).

Nutritive benefits of whey can be utilized with fruit juice, pulp or concentrate in the development of a value added beverage. This would be the most logical and economical way of utilization of whey

nutrients in human food chain (Goyal and Gandhi, 2009). Beverages based on fruits and milk products are currently receiving considerable attention as their market potential is growing. Besides being delicious, these beverages are highly nutritious. At present fruit beverages are generally synthetic flavoured, bottled and sold in the market. If this could be substituted with fruit juice and dairy whey, it will be more beneficial to the consumers, dairy industries and beverage manufacturers as well as fruit growers (Sakhale *et al.* 2012). Orange juice is used since the acidic flavor of whey is compatible with citrus flavors and particularly orange. Oranges constitute a significant source of antioxidants (mainly vitamin C), polyphenol compounds (hydroxyl cinnamic acid and flavanones), phyto-chemicals (hesperidins and narigenin) and various vitamins and minerals. These components exhibit therapeutic properties such as anti-inflammatory, antihypertensive, diuretic, analgesic and hypolipidemic activities (Klimczak *et al.*, 2007). Therefore, keeping in view of the nutritional and functional attributes of orange juice, potential of whey to be used in nutritious and health promoting beverages, the present study was undertaken with an objective to develop a value added orange based whey beverage.

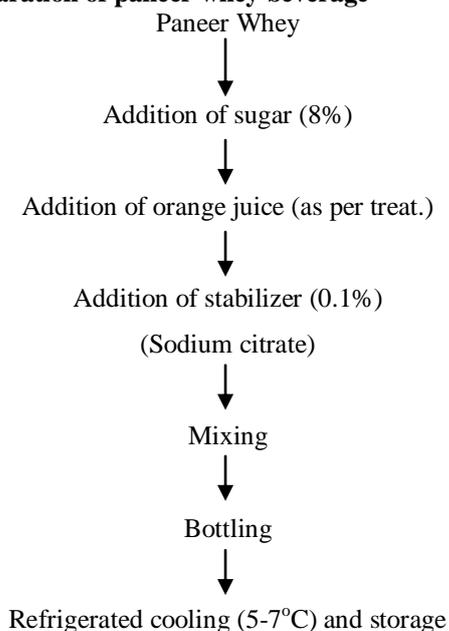
### MATERIALS AND METHODS

Good quality fresh buffalo milk was procured and then strained through muslin cloth. The fat content in milk ranged from 6 per cent. The milk was transferred to stainless steel vessel and heated to about 90°C. The vessel was then removed from the fire and cooled to 72°C. The coagulant *i.e.* citric acid

\*Corresponding Author

solution @ 1.5 per cent was added slowly till complete coagulation of milk. Then the mass was poured over stretched piece of clean muslin cloth over another vessel to drain the whey. The clear drained whey was collected in the vessel. The yellowish green whey was then used for the preparation of whey beverage. After getting whey 8% sugar and Orange juice were added. The products were filled in sterilized bottles and then cooled and stored in refrigerator at 5-7°C.

#### Preparation of paneer whey beverage



#### Treatment details

T<sub>1</sub> : 90% paneer whey + 10% orange juice,  
 T<sub>2</sub> : 85% paneer whey + 15% orange juice,  
 T<sub>3</sub> : 80% paneer whey + 20% orange juice  
 T<sub>4</sub> : 75% paneer whey + 25% orange juice.  
 T<sub>5</sub> : 70% paneer whey + 30% orange juice.  
 Sugar level kept constant *i.e.* @ 8% (w/v) of final product.

The product so obtained was subjected to organoleptic evaluation by the panel of judges. It was evaluated for flavour, colour and appearance, consistency and overall acceptability on 9-point hedonic scale (Gupta, 1976 and BIS, 1971). Chemical composition *i.e.* fat, protein, total sugar,

acidity and pH were estimated by adopting the standard procedure. The results obtained were analyzed by Randomized Block Design as per the method given by Panse and Sukhatme (1967) with five treatments and four replications.

## RESULTS AND DISCUSSION

The result obtained from the present investigation are presented below.

#### Overall acceptability

It is observed from Table 1 that, the mean score for overall acceptability for treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub> and T<sub>5</sub> were 8.10, 8.31, 8.59, 8.85 and 7.85, respectively. The average score for treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> were more than T<sub>5</sub>. The overall acceptability of paneer whey beverage was significantly affected by addition of orange juice in whey beverage preparation. Paneer whey beverage with 25 per cent orange juice in treatment T<sub>4</sub> was significantly superior in respect of acceptability of overall treatments. Paneer whey beverages prepared under all treatments were acceptable as score was more than 7. Paneer whey beverage with treatment T<sub>4</sub> obtained highest score and significantly superior due to its flavour, colour and appearance and consistency. The good colour, peculiar flavour and proper consistency observed in this Paneer whey beverage were appreciated by the panel of five judges. It indicates that blending of beverage with orange juice more than 25 per cent (T<sub>4</sub>) level decreases the score of overall acceptability which might be due to high intensity of flavour, dark colour and consistency. Similar results were reported by Chatterjee *et al.* (2015) formulated ready to drink whey based orange beverage and its storage stability. They prepared nine blend formulations by varying the dry matter of whey, orange juice and sugar content. Based on sensory evaluation of the drinks, the optimal formulation is found to be significant have a ratio of 3:2 for cane sugar whey and orange juice flavoured by an addition of 8% sugar (w/v) and 0.1% stabilizer. Bothe (2013) reported the sensory score for overall acceptability of whey based mango herbal beverage in treatment T<sub>2</sub> showed higher score 8.24, while treatment T<sub>0</sub> scored minimum score 7.68 and the similar results were obtained in the present investigation.

**Table 1.** Sensory evaluation of paneer whey beverage with orange juice

Treatments	Sensory attribute			
	Score			
	Flavour	Colour and appearance	Consistency	overall acceptability
T <sub>1</sub>	8.06	8.04	8.21	8.10
T <sub>2</sub>	8.28	8.33	8.35	8.31
T <sub>3</sub>	8.51	8.62	8.66	8.59
T <sub>4</sub>	8.75	8.91	8.84	8.85
T <sub>5</sub>	7.88	7.70	7.98	7.85

Result	Sig	Sig	Sig	Sig
SE(+)	0.07	0.09	0.05	0.04
C.D. at (5%)	0.21	0.28	0.16	0.13

**Table 2.** Chemical composition of paneer whey.

Constituent per cent				
Fat	Protein	Reducing Sugar	Acidity	pH
0.48	0.47	4.43	0.18	5.32

The average chemical composition of paneer whey utilized for whey beverage preparation contain fat 0.48 per cent, protein 0.47 per cent, reducing sugar 4.43 per cent, 0.18 per cent acidity and pH 5.32.(Table 2).

**Table 3.** Chemical composition of orange juice.

Constituent per cent				
TSS	Reducing Sugar	Total sugar	Acidity	pH
9.13	2.24	6.46	0.69	4.35

The orange juice contains TSS (°Brix) 9.13, reducing sugar 2.24 per cent, total sugar 6.46 per cent, acidity 0.69 and pH 4.35. (Table 3)

### Chemical Composition of paneer whey beverage

Paneer whey beverage prepared with different levels of orange juice were analyzed for fat, protein, total sugar, acidity and pH. (Table 4)

**Table 4.** Chemical analysis of paneer whey beverage with orange juice

Treatments	Composition per cent				
	Fat	Protein	Total Sugar	Acidity	pH
T1	0.49	0.42	14.48	0.49	4.71
T2	0.45	0.49	15.10	0.53	4.56
T3	0.41	0.54	15.58	0.57	4.33
T4	0.33	0.58	15.89	0.62	4.12
T5	0.23	0.55	16.19	0.65	3.93
Result	Sig	Sig	Sig	Sig	Sig
SE(+)	0.01	0.01	0.09	0.09	0.05
C.D. at (5%)	0.03	0.04	0.28	0.28	0.15

### Fat

It is observed from Table 4 that, the mean fat percentage was 0.49, 0.45, 0.41, 0.33 and 0.23 for treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub> and T<sub>5</sub>, respectively. It indicates that, the highest fat content 0.49 per cent was recorded in the treatment T<sub>1</sub> with 10 per cent blending of orange juice, while the lowest fat content 0.23 per cent was recorded in the treatment T<sub>5</sub> with 30 per cent blending of orange juice in the paneer whey. The average fat content in the whey beverage was significantly affected due to addition of orange juice. Fat content in whey beverage was decreased as the proportion of orange juice in whey beverage increased. The fat content in the finished product was decreased due to the less amount of fat content in orange juice *i.e.* 0.18 %. The result of present investigation are similar to the Raut (2007) They reported fat content in whey beverage as 0.25 per cent.

### Protein

The mean protein content in paneer whey beverages was 0.42, 0.49, 0.54, 0.58 and 0.65 per cent in treatment T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub> and T<sub>5</sub>, respectively. The paneer whey beverage with 30 per cent orange juice

(T<sub>5</sub>) had highest protein content (0.65 %) while, paneer whey beverage prepared with 10 per cent orange juice (T<sub>1</sub>) had lowest (0.42 %) protein content. Protein content in orange juice was 0.94 per cent due to this protein content in juice paneer whey beverage recorded more protein percentage with an increasing level of orange juice. Similar results were observed Babar *et al.* (2008). They recorded protein percent in paneer whey as 0.54 per cent.

### Total Sugar

The average total sugar content of paneer whey beverage by blending with different levels of orange juice were 14.48, 15.10, 15.58, 15.89 and 16.19 per cent for treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub> and T<sub>5</sub>, respectively. It indicates that, the paneer whey beverage with 30 per cent orange juice T<sub>5</sub> had highest total sugar content (16.19%) while, paneer whey beverage prepared with (10%) orange juice T<sub>1</sub> had lowest (14.48%) total sugar content. The average total sugar content in whey beverage was significantly affected due to addition of orange juice. This is might be due to high per cent of total sugar content in orange juice. The result obtained in present investigation is similar to the Sakhale *et al.* (2012). They observed that, the

total sugar content was 11.09, 12.14 and 11.50 g per cent for beverage combinations C<sub>1</sub>, C<sub>2</sub> and C<sub>3</sub>, respectively.

#### Acidity

The mean acidity per cent of paneer whey beverage by blending with different levels of orange juice were 0.49, 0.53, 0.57, 0.62 and 0.65 per cent for the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub> and T<sub>5</sub>, respectively. It indicates that, the highest acidity 0.65 per cent was recorded in the treatment T<sub>5</sub> with 30 per cent blending of orange juice, while the lowest acidity 0.49 per cent was recorded in the treatment T<sub>1</sub> with 10 per cent blending of orange juice in the paneer whey. The increase in acidity may be due to the acidic nature of both ingredients and also the addition of orange juice in respective treatment with higher titratable acidity than paneer whey. The acidity recorded in the present investigation was less with the results observed by Raut (2007). they reported that the mean titratable acidity of orange juice chhana whey beverage was 0.36 per cent.

#### pH

The average pH of paneer whey beverage by blending with different levels of orange juice was 4.71, 4.56, 4.33, 4.12 and 3.93 for the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub> and T<sub>5</sub>, respectively. The result indicates that the highest pH content 4.71 was recorded in the treatment T<sub>1</sub> with 10 per cent blending of orange juice, while the lowest pH content 3.93 was recorded in the treatment T<sub>5</sub> with 30 per cent blending of orange juice in the paneer whey. This is due to production of organic acids and amino acids lead to an increase in acidity there by a decrease in pH. The result obtained in present investigation is near about similar with Ahmed *et al.* (2011) studied the chemical composition of fresh whey based mango beverage contained 4.86 pH.

#### CONCLUSION

The overall acceptability of paneer whey beverage prepared with 25 per cent orange juice level was significantly superior and more acceptable than other levels of orange juice. The chemical composition showed that in term of percentage, fat as well as pH decreased while, protein, total sugar and acidity increased with increasing levels of orange juice in paneer whey.

#### REFERENCES

Ahmed, E. I., Mamoun, O. A. and Asmahan, A. A. (2011). Microbial and chemical evaluation of whey-based mango beverage. *Advance J.Food Sci. and Technol.* **3** (4): 250-253.  
 Babar, R. B., Salunkhe, D. D., Chavan, K. D. and Thakare, V. M. (2008). Utilization of pomegranate juice for the preparation of chakka whey beverage. *J. Dairying, Foods & H.S.* **27** (2): 87-93.

BIS (1971) **IS: 6273, Part-II**: Guide for sensory evaluation of foods. Methods and Evaluation Cards. Bureau of Indian Standards, Manak Bhavan, Delhi.  
 Bothe, M. S. (2013). Studies on preparation of whey based mango herbal (lemongrass) beverage. Msc.(Agri.) thesis (unpub), M.P.K.V., Rahuri. (M.S.).  
 Chatterjee, G., De Neve, J., Dutta, A. and Das, S. (2015). Formulation and statistical evaluation of a ready-to-drink whey based orange beverage and its storage stability. *Revista Mexicana de Ingenieria Quimica*, **14** (2): 253-264.  
 Divya and Kumari, Archana (2009). Effect of different temperatures, timings and storage periods on the physico-chemical and nutritional characteristics of whey-guava beverage. *World J. of Dairy & Food Sci.* **4** (2): 118-122.  
 Flore-Andrade, E., Pascual-Pineda, L.A., Jimenez, M. and Beristain, C.I. (2013). Effect of whey protein –sucrose in the osmotic dehydration of apple. *Revista Mexicana de Ingenieria Quimica*, **12**: 415-424.  
 Goyal, Nupur and Gandhi, D. N. (2009). Comparative analysis of Indian paneer and cheese whey for electrolyte whey drink. *World J. Dairy & Food Sci.* **4** (1): 70-72.  
 Gupta, S. K. (1976). Sensory evaluation in food. *Indian Dairyman*. **28** (8): 2931.  
 Klimczak, M., Malecka, M., Szlachta, A. and Gliszczyńska-Swigło, A. (2007). Effect of storage on the content of polyphenols, vitamin C and the antioxidant activity of orange juices. *Journal of Food Composition and Analysis* **20**, 313-322.  
 Marshall, K. (2004). Therapeutic applications of whey protein. *Alternative Medicine Review* **9**, 136-156.  
 Naik, Y. K., Khare, A., Choudhary, P. L., Goel, B. K. and Shrivastava, A. (2009). Studies on physico-chemical and sensory characteristics of whey based watermelon beverage. *Asian J. Research Chem.* **2** (1): 57-59.  
 Panse, V.G. and Sukhatme, P.V. (1967). Statistical methods for Agriculture Workers. 2<sup>nd</sup> Edn. ICAR, New Delhi.  
 Parekh, J. V. (2006). Emerging new technologies in dairy industry in India.  
 Raut, H. K. (2007). Utilization of orange juice for the preparation of chhana whey beverage. M.sc.(Agri.) thesis submitted to Dr.PDKV. Akola. (MS).  
 Sakhale, B. K., Pawar, V. N. and Ranveer, R. C. (2012). Studies on the Development and Storage of Whey based RTS Beverage from Mango cv. Kesar. *J Food Process Technol.* **3** (3): 148-152.  
 Walzem, R. L., Dillard, C. J. and German, J.B. (2002). Whey components: millennia of evolution create functionalities for mammalian nutrition: what we know and what we may be overlooking. *Critical Reviews in Food Science and Nutrition* **42**, 353-375.