American Journal of Food Technology

ISSN 1557-4571

Academic Journals Inc.

www.academicjournals.com

American Journal of Food Technology 5 (2): 121-129, 2010
ISSN 1557-4571

Development and Storage Studies on Whey-Based Banana Herbal (*Mentha arvensis*) Beverage

Ritika B. Yadav, Baljeet.S. Yadav and Navneet Kalia
Department of Food Science and Technology,
Chaudhary Devi Lal University, Sirsa-125055, India

Abstract: This study was carried out on the development and storage of Whey-Based Banana Herbal (WBBH) beverage with the incorporation of *Mentha arvensis* extract (0 to 4%). The amount of banana juice and sugar were fixed at 10 mL and 8 g, respectively per 100 mL of the beverage. Whey quantity varied from 72 to 84 mL for each 10 mL of the beverage depending upon the concentration of *Mentha* extract. The storability of the beverage was studied at 7±1°C for 20 days. The organoleptic scores and overall acceptability of the beverage improved with increase in *Mentha* extract from 0 to 2%. Addition of 3 and 4% *Mentha* extract decreased the beverage quality as beverage scored lower organoleptic scores. Acidity and reducing sugar content increased while pH decreased during storage. The overall acceptability of the beverage was desirable up to 15 days of storage at refrigeration temperature. Beverage prepared from banana juice and whey in combination with edible extract of herbal medicinal plants like *Mentha arvensis* will not have only excellent nutritional properties but will also posses therapeutic, prophylactic, antibacterial and organoleptic properties.

Key words: Herbal beverage, whey, banana, *Mentha arvensis*, sensory quality

INTRODUCTION

Whey is a nutritious byproduct from cheese, *Chhana* and *Paneer* industry containing valuable nutrients like lactose, proteins, minerals and vitamins etc., which have indispensable value as human food. Regulations for preventing disposal of untreated whey and recognition of the value of whey components accelerated in the late 20th century. It resulted in to unraveling the secrets of whey proteins and other components and established a sound basis for their nutritional and functional value (Smithers, 2008). Whey constitutes 45-50% of total milk solids, 70% of milk sugar (lactose), 20% of milk proteins and 70-90% of milk minerals and most importantly, almost all the water soluble vitamins originally present in milk (Horton, 1995). In India, it is estimated that about 100 million kg of whey is annually derived as a by product which may cause substantial loss of about 70,000 tones of nutritious whey solids (Parekh, 2006). In addition, it is adding Biological Oxygen Demand (BOD) load to effluent (approx 35,000 to 45,000 mg L^{-1}). However, Rao and Salooza (1990) reported several methods for efficient disposal of whey such as treatment of whey prior to disposal in sewage or utilization/conversion of whey for several whey based product or by products. Considerable work has been done throughout the world to utilize whey for production of Whey Protein Concentrate (WPC), whey powder, lactose, lactic acid, whey paste etc (Panesar *et al*., 2007).

Corresponding Author: Ritika B. Yadav, Department of Food Science and Technology, Chaudhary Devi Lal University, Sirsa (Haryana), India

The conversion of whey into beverages through fermentation or without fermentation is one of the most attractive avenues for the utilization of whey for human consumption. Beverages based on fruit and milk products are currently receiving considerable attention as their market potential is growing. Besides being delicious, these beverages are highly nutritious. In terms of functionality, whey protein enhances protein content of beverage while improving its quality. The production of a beverage from whey butter cheese and acerola juice has been shown to have good commercialization potential, uniting the benefits provided by the former with those of latter, including the ingestion of essential amino acids and increasing the vitamin C content, resulting in a product of differentiated nutritive value (Cruz *et al*., 2009). Singh *et al.* (1999) attempted to develop a soft beverage from paneer whey and guava. Sikder *et al*. (2001) formulated different blends of whey beverages by using various levels of mango pulp (8-12%) with 0.04% acidity. Whey-based mango herbal beverage prepared with 2% *Mentha* extract has been found to exhibit highest overall acceptability on the day of preparation as well as after 30 days of storage (Sirohi *et al*., 2005). Selected characteristics of whey-fortified banana beverages stored at 4, 20, 30 and 40°C were monitored at specific time intervals over a 60-day storage period. The sensory characteristics of the whey-banana beverage stored at 4°C were studied and the product was a sour, sweet, smooth beverage, with distinctive banana flavor and minimum off-flavor (Ernest *et al*., 2005).

After citrus, banana is the most important fruit in the world trade. Banana is known for its ability to provide instant energy. A large quantity of unmarketable surplus fruit is available in all the banana growing regions. Very few processed products are marketed, primarily due to difficulty in retaining the characteristics color, flavor and texture of banana during processing. Beverage prepared from banana juice and whey in combination with edible herbal medicinal plant extract of *Mentha arvensis* will not have only excellent nutritional properties but will also posses therapeutic, prophylactic, antibacterial and organoleptic properties. Herbal extract of *Mentha arvensis* has preventive and curative value. It is used to treat sour throat, gastric problems and other problems related to gastrointestinal tract. It also act as a good appetizer, acceptable to consumer and at the same time make the product more palatable.

It has been proposed in the past to utilize whey in the formulation of a nutritious beverage, but this has not been so practical because the results have not been satisfactory in view of its high acidity rate, resulting in its poor taste characteristics. Therefore, a significant objective of the present study is to develop a beverage that not only is whey based, but which also exhibits desirable taste characteristics. The *Mentha* extract not only modifies taste and flavor characteristics of the beverage, but it also acts as natural preservative, therefore, minimizing the need of chemical or artificial preservatives. The present study was conducted to utilize the whey for the formulation of a new product using banana and *Mentha* extract having nutritional and medicinal values.

MATERIALS AND METHODS

The study was carried out in year 2009. The raw materials such as double toned milk (Vita brand), banana, *Mentha arvensis* (green leaves) and sugar were purchased from the local market.

Preparation of Banana Juice

The ripe bananas were washed and peeled. The pulping was done by hand pulper and pulp was preheated to 65°C for 30 min in a water bath (Roy *et al*., 1991). The pulp was pressed through a muslin cloth to extract the juice. The banana juice was kept at a refrigeration temperature (7±1°C) until used.

Preparation of Milk Whey and *Mentha* Extract

The milk was heated in a stainless steel vessel to 84°C. The hot milk was acidified by adding citric acid (2%) followed by continuous stirring resulting in complete coagulation of milk protein (casein). The liquid (whey) was filtered using muslin cloth. *Mentha* extract was prepared from fresh leaves. The leaves were washed, ground in a mixer grinder and filtered using muslin cloth.

Preparation of WBBH Beverage

Whey Based Banana Herbal (WBBH) beverages were prepared with the addition of *Mentha* extract following the method followed by Sirohi *et al.* (2005). For the preparation of 100 mL of herbal beverage, whey amount varying from 78 to 82 mL was added with 10 mL of banana juice and 0 to 4% of *Mentha* extract (Table 1). The whey, banana juice and sugar were mixed in the given amount, preheated to 45°C before mixing *Mentha* extract (Fig. 1). The beverages obtained were filtered and filled into presterilized glass bottles (200 mL) and sealed. Pasteurization of filled bottles was done in boiling water for 30 min (Lal *et al.*, 1998) and cooled to room temperature.

Storage Studies

Bottles containing beverages were stored at refrigerated temperature (7±1°C) for 20 days. Samples were drawn at intervals of 5 days and evaluated for physico-chemical and organoleptic properties.

Physico-Chemical Analysis

The milk, banana juice, whey and herbal beverage were analyzed for their different physico-chemical properties. Total soluble solids were determined with an sErma hand

Table 1: Recipe for the preparation of 100 mL of WBBH beverage

Treatments	Banana juice (mL)	Sugar (g)	*Mentha arvensis* extract (mL)	Whey (mL)
P_0	10	8	-	82
P_1	10	8	1	81
P_2	10	8	2	80
P_3	10	8	3	79
P_4	10	8	4	78

P_0 is control beverage

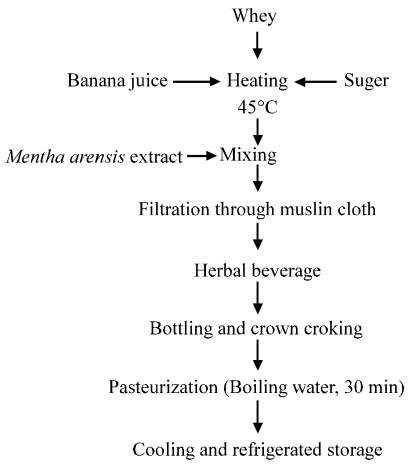

Fig. 1: Flow chart for preparation of WBBH beverage

refractometer (0-32°C) and the values were expressed as °Brix. Total acidity was calculated in terms of lactic acid for whey and citric acid for banana juice and herbal beverage by titrating against 0.1N NaOH according to AOAC (1995) method. The reducing and total sugars were determined by the method as described by Ranganna (1986). Protein content was determined by Kjeldahl method for nitrogen estimation, using factor of 6.38 for conversion of nitrogen into protein (BIS, 1961). Fat content was determined by Gerber centrifuge method (BIS, 1977).

Sensory Analysis of Beverage

The sensory analysis was performed on a 9-point hedonic scale by a panel of 10 semi trained members. The beverage samples prepared with the varying levels of *Mentha* extract were subjected to sensory evaluation by a panel of 10 members. The beverage samples were evaluated for color, appearance, flavor, taste and overall acceptability. The evaluation was done at an interval of 5days during the storage period of 20 days.

Statistical Analysis

Data obtained were subjected to statistical analysis to find out the effect of different levels of *Mentha* extract and storage period on physico-chemical and sensory characteristics of the product. The data were analyzed statistically in a split plot Completely Randomized Design (CRD) with main plot as five levels of *Mentha* extract with three replications. The storage period was considered as split plot factor with five levels randomized with each main plot. The following statistical model was followed:

$$Y_{ijk} = \mu+P_i+S_j+(PxS)_{ij}+E_{ijk}$$

where, Y_{ijk} is Response of study variable due to effect of ith *Mentha* extract level (P_i) kept up to j^h storage period (S_j) factor in the kth replication (i= 0,1,2,3,4; j = 0,1,2,3,4; k = 1,2,3). μ is General mean. E_{ijk} is Error associated with the variables due to the effect of Ith *Mentha* extract level (P_i) and jth storage period (S_j) in the kth replication.

RESULTS AND DISCUSSION

Physico-Chemical Characteristics of Whey and Banana Juice

The banana juice and whey were analyzed for their physicochemical properties. The use of water was substitute by whey in the beverage preparation. As shown in Table 2, whey showed 7.37 °Brix TSS, 5.5 pH, 0.004% fat, 0.32% acidity (measured as percent lactic acid) and 0.17% protein. The banana juice showed 15.33 °Brix TSS, 4.9 pH, 0.43% acidity (measured as percent citric acid) and 17.6% total sugar.

Effect of *Mentha* Extract Concentration and Storage Period on Physico-Chemical and Sensory Characteristics of WBBH Beverage

The TSS content of freshly prepared beverage samples of P_0 (control), P_1, P_2, P_3 and P_4 was measured as 13.87, 14.3, 14.2, 14.0 and 14.1 °Brix, respectively (Table 3). It was observed that the concentration of *Mentha* extract did not affect the TSS content of beverages appreciably. The value of TSS for different concentration levels of *Mentha* extract were comparable and did not increase or decrease with the increasing levels of extract. Beverage prepared with *Mentha* extract and stored at 7±1°C was analyzed at 5 days interval. Table 3

Table 2: Physico-chemical characteristics of banana juice and whey

Characteristics	Mean ±SD
Whey	
TSS (°Brix)	7.37±0.16
pH	5.51±0.02
Acidity (% LA)	0.32±0.003
Fat (%)	0.004±0.001
Protein (%)	0.17±0.005
Banana juice	
TSS (°Brix)	15.33±0.15
pH	4.90±0.06
Acidity (% CA)	0.43±0.02
Total Sugar (%)	17.61±0.05

CA: Citric acid, LA: Lactic acid, SD: Standard deviation

Table 3: Effect of treatment (*Mentha arvensis* concentration) and storage period on TSS (°Brix), acidity (%) and pH of WBBH beverage

	TSS (°Brix)						Acidity (%)						pH					
Storage period (days)	P_0	P_1	P_2	P_3	P_4	Mean for B	P_0	P_1	P_2	P_3	P_4	Mean for B	P_0	P_1	P_2	P_3	P_4	Mean for B
0	13.87	14.30	14.20	14.00	14.10	14.09	0.50	0.38	0.32	0.35	0.36	0.38	5.23	5.50	5.37	5.60	5.67	5.47
5	14.00	14.40	14.20	14.10	14.10	14.16	0.54	0.42	0.37	0.38	0.40	0.42	5.20	5.40	5.30	5.50	5.50	5.38
10	14.10	14.60	14.30	14.20	14.20	14.28	0.56	0.45	0.39	0.40	0.45	0.45	5.27	5.40	5.20	5.30	5.20	5.27
15	14.20	14.80	14.40	14.40	14.30	14.42	0.57	0.48	0.45	0.42	0.46	0.48	4.93	5.30	5.20	5.13	5.10	5.13
20	14.27	14.80	14.60	14.50	14.50	14.53	0.58	0.48	0.46	0.45	0.48	0.49	4.90	5.10	5.07	5.07	4.90	5.01
Mean for A	14.09	14.58	14.34	14.24	14.24		0.55	0.44	0.40	0.40	0.43		5.11	5.34	5.23	5.32	5.27	

Effect	TSS (°Brix) CD	TSS (°Brix) SEM±	Acidity (%) CD	Acidity (%) SEM±	pH CD	pH SEM±
Treatment (A)	0.012	0.004	0.006	0.002	0.041	0.014
Storage (B)	0.012	0.004	0.006	0.002	0.041	0.014
A×B	0.027	0.009	0.013	0.005	0.091	0.032

shows that the storage period had statistically significant effect on the TSS of the beverages ($p<0.05$). The TSS of the beverages increased gradually with the advancement of storage period in all the five concentration levels of *Mentha* extract. The highest value of TSS was recorded to be 14.80 °Brix at the end of 20 days of storage for the beverage containing 1% *Mentha* extract. The effect of *Mentha* extract concentration on average TSS values of different beverages during storage was also significant except between P_3 and P_4 levels. The interaction effect between *Mentha* extract concentration and storage period was also significant ($p<0.05$). Barwal *et al.* (2005) also observed an increase in the TSS of the developed bitter gourd RTS drink during storage. However, the results of the present study in regard to TSS are in contradiction with the results of study by Kumar and Manimegalai (2005), who observed no change in the TSS of whey-based papaya RTS beverage during a storage period of 90 days. The possible reason for increase in TSS in the present study might be due to use of different fruit crops as banana has higher starch content in comparison to papaya, which may undergo hydrolysis in to monosaccharides and other soluble sugars during storage period (Mayer, 1960).

Acidity of fresh beverages P_0 (control), P_1, P_2, P_3 and P_4 was 0.50, 0.38, 0.32, 0.35 and 0.36%, respectively (Table 3). The effect of storage period on the acidity of beverages was found to be significant and the mean value of 0.38% for acidity in case of freshly prepared beverages increased to 0.49% in the samples stored for 20 days. No significant increase in the acidity was observed when *Mentha* extract concentration was increased from 2 to 3% and the mean values of acidity during storage for P_2 and P_3 were similar. The interaction effect of

Mentha extract concentration and storage period on acidity was significant ($p<0.05$). The increase in acidity with storage period was recorded in all the treatments. The increase in acidity was due to conversion of lactose to lactic acid and formation of organic acid by ascorbic acid present in banana juice. This increase might also have been attributed to polyphenols present in *Mentha* extract and their degradation. The conversion of proteins into amino acids during storage is also possible. The results are in agreement with the findings reported by Soliman *et al.* (1995) and Sikder *et al.* (2001).

The pH values were also not affected due to variation in concentration levels of *Mentha* extract. The pH value for freshly prepared beverage samples of P_0, P_1, P_2, P_3 and P_4 were 5.23, 5.5, 5.37, 5.6 and 5.67, respectively (Table 3). As shown in Table 3, the storage period had a significant decreasing effect on the pH of the beverages with a mean value of 5.47 for freshly prepared beverages and 5.01 for beverages stored for 20 days. The *Mentha* extract concentration also affected the pH of the beverages significantly ($p<0.05$); however, a no definite increasing or decreasing trend was observed. The interaction effect of *Mentha* extract concentration and storage period on pH was also significant ($p<0.05$). With the increase in storage period, the pH of all treatments decreased. This fact is in accordance with the results obtained for acidities of different beverage samples as with increase in acidity pH correspondingly decreases. This may be due to the production of organic acids and amino acids due to the action of ascorbic acid on sugar and protein content of the beverages. Lactose and proteins are converted into lactic acid and amino acids leading to increase in acidity and decrease in pH of beverages. Similar results have also been reported by Kalra *et al.* (1991) and Sikder *et al.* (2001) for mango RTS.

The total sugar content of freshly prepared beverage samples of P_0, P_1, P_2, P_3 and P_4 were 17.12, 17.44, 17.36, 17.48 and 17.11, respectively (Table 4). The storage period had no significant effect on the total sugar content of beverages and the mean value of 17.30% for freshly prepared beverages remained almost same after 20 days of storage (17.31%). The results are in agreement with those of Sirohi *et al.* (2005), who also observed no variation in the total sugars content during the storage of whey-based mango herbal beverage. However, the results of the present study are in contradiction with those of Barwal *et al.* (2005) and Kumar and Manimegalai (2005), who observed a decrease in the total sugars content during storage of RTS from bitter gourd and whey-based papaya RTS, respectively. However, the storage period in these studies was much higher i.e., 180 and 90 days, respectively which could have favored the Maillard reaction and other chemical reaction of sugars with acids during the storage resulting in decrease in total sugar content. The effect

Table 4: Effect of treatment (*Mentha arvensis* concentration) and storage period on total sugars and reducing sugars content of WBBH beverage

	Total sugars						Reducing sugars					
Storage period (days)	P_0	P_1	P_2	P_3	P_4	Mean for B	P_0	P_1	P_2	P_3	P_4	Mean for B
0	17.12	17.44	17.36	17.48	17.11	17.30	4.523	4.450	4.350	4.360	4.310	4.399
5	17.16	17.41	17.35	17.48	17.15	17.31	4.780	4.570	4.510	4.547	4.517	4.585
10	17.16	17.43	17.35	17.49	17.14	17.31	5.037	4.733	4.650	4.720	4.767	4.781
15	17.15	17.42	17.36	17.51	17.15	17.32	5.263	5.057	5.017	5.100	5.150	5.117
20	17.16	17.43	17.34	17.47	17.16	17.31	5.427	5.300	5.230	5.337	5.320	5.323
Mean for A	17.15	17.43	17.35	17.48	17.14		5.006	4.822	4.751	4.813	4.813	
Effect	CD	SEM±					CD	SEM±				
Treatment (A)	NS	0.006					0.012	0.004				
Storage (B)	0.018	0.006					0.012	0.004				
A×B	NS	0.014					0.029	0.010				

NS: Not significant

of *Mentha* extract concentration was significant on the total sugar content of the beverages ($p<0.05$). The total sugar content of 17.15% in the control sample (P_0) increased to 17.48%, when *Mentha* extract concentration was increased to 3% (P_3). The interaction effect of *Mentha* extract concentration and storage period on the total sugar content was non-significant.

The reducing sugar content of the beverages increased during storage period. The increase in reducing sugars during storage might be due to hydrolysis or inversion of non-reducing sugars to reducing sugars (Aruna *et al*., 1997; Srivastava, 1998). Similar observations have also been reported by Sethi (1992) for lime-ginger cocktail and Krishnaveni *et al.* (2001) for jackfruit beverages.

Effect of *Mentha* Extract Concentration and Storage Period on Sensory Characteristics of WBBH Beverage

The storage period significantly decreased the color ratings of the beverage ($p<0.05$) and the mean value of 7.70 for color for the freshly prepared beverage decreased to 5.48 after 20 days of storage (Table 5). The *Mentha* extract concentration had a significant effect on color at 4% level ($p<0.05$) with 1% level of *Mentha* extract concentration showing maximum liking for color in beverage. The interaction effect of the storage period and *Mentha* extract concentration was non-significant. The appearance of the beverages was affected significantly with storage and it decreased to a value of 5.52 after 20 days from initial value of 7.38 (Table 5). The interaction effect of storage period and *Mentha* extract concentration was non-significant on the appearance. The taste and flavor decreased significantly with storage period and the mean values of 7.50 and 7.58 for flavor and taste, respectively in the freshly prepared beverage decreased to 5.20 and 4.76 after 20 days of storage (Table 6). The decrease in the flavor score during storage could be possibly due to loss of volatile aromatic substances (Thakur and Barwal, 1998). The effect of *Mentha* extract concentration on the flavor and taste was significant and at 4% level of concentration, it decreased the flavor and taste significantly after a significant increase in taste and flavor up to a level of 2% ($p<0.05$).

The overall acceptability of the beverage during 20 days storage period decreased significantly from 7.61 to 5.22 and the product was slightly desirable up to 15 days having a value of 6.00 for overall acceptability (Table 6). The increase in *Mentha* extract concentration increased overall acceptability significantly up to 2% level and after further increase in its concentration, overall acceptability decreased.

Table 5: Effect of treatment (*Mentha arvensis* concentration) and storage period on color and appearance of WBBH beverage

	Color						Appearance					
Storage period (days)	P_0	P_1	P_2	P_3	P_4	Mean for B	P_0	P_1	P_2	P_3	P_4	Mean for B
0	7.60	8.20	8.30	7.40	7.00	7.70	7.50	7.70	7.90	7.00	6.80	7.38
5	7.60	8.00	8.00	7.20	6.60	7.48	7.40	7.40	7.60	7.00	6.60	7.20
10	6.80	7.00	7.00	6.80	6.20	6.76	7.00	7.00	7.20	6.40	6.20	6.76
15	6.20	6.40	6.30	6.15	6.10	6.23	6.40	6.60	6.60	5.40	5.40	6.08
20	5.40	5.60	5.30	5.40	5.40	5.48	5.80	5.80	5.60	5.20	5.20	5.52
Mean for A	6.72	7.04	6.98	6.59	6.26		6.82	6.90	6.98	6.20	6.04	
Effect	CD	SEM±					CD	SEM±				
Treatment (A)	0.281	0.100					0.338	0.121				
Storage (B)	0.281	0.100					0.3381	0.121				
A×B	NS	0.224					NS	0.269				

NS: Not significant

Table 6: Effect of treatment (*Mentha arvensis* concentration) and storage period on flavor, taste and overall acceptability of WBBH beverage

Storage period (days)	Flavor						Taste						Overall acceptability					
	P_0	P_1	P_2	P_3	P_4	Mean for B	P_0	P_1	P_2	P_3	P_4	Mean for B	P_0	P_1	P_2	P_3	P_4	Mean for B
0	7.20	8.10	8.30	7.50	6.40	7.50	7.60	8.10	8.10	7.20	6.90	7.58	7.50	8.02	8.32	7.34	6.86	7.61
5	6.60	7.60	7.40	6.80	6.20	6.92	7.00	7.60	7.40	6.40	6.20	6.92	7.20	7.68	7.62	6.94	6.52	7.19
10	6.00	6.80	6.60	6.20	6.00	6.32	6.20	6.60	6.60	5.60	5.40	6.08	6.60	6.96	6.88	6.36	6.04	6.57
15	6.00	6.20	6.40	6.10	6.00	6.14	6.10	6.30	6.20	5.80	5.60	6.00	6.50	6.20	6.08	5.80	5.46	6.00
20	5.10	5.30	5.50	5.10	5.00	5.20	5.00	5.00	5.40	4.20	4.20	4.76	5.36	5.48	5.40	4.96	4.92	5.22
Mean (A)	6.18	6.80	6.84	6.34	5.92		6.38	6.72	6.74	5.84	5.66		6.63	6.87	6.86	6.28	5.96	
Effect	CD	SEM±					CD	SEM±					CD	SEM±				
Treatment (A)	0.320	0.114					0.260	0.093					0.222	0.079				
Storage (B)	0.320	0.113					0.260	0.093					0.222	0.079				

CONCLUSION

From the results of the present study, it can be concluded that a whey based banana herbal beverage can be prepared successfully with the incorporation of 2% *Mentha* extract. The beverage can be stored at refrigeration temperature without adding any chemical preservative with desirable consumer acceptability up to 15 days. The product can prove a nutritionally as well as organoleptically desirable beverage with agreeable taste, energy providing due to whey proteins and banana juice in it. Product developers seeking out whey's functional and nutritional attributes 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

AOAC, 1995. Official Methods of Analysis. 6th Edn., Association of Official Analytical Chemists, Washington, DC., USA.

Aruna, K., V. Vimla, N. Giridhar and D.G. Rao, 1997. Studies on preparation and storage of nectar prepared from papaya (*Carica papaya* L.). Beverage Food World, 24: 29-32.

BIS., 1961. IS:1479, Part-II. Methods of Test for Dairy Industry. Chemical Analysis of Milk. Indian Standards Institution, BIS., New Delhi.

BIS., 1977. IS:1224, Part-II. Determination of fat by Gerbers method Milk Products. Indian Standards Institution, BIS., New Delhi.

Barwal, V.S., T.K. Singh and Alkesh, 2005. Studies on processing and development of ready-to-serve drink from bittergourd fruit. J. Food Sci. Technol., 42: 217-220.

Cruz, A.G., A.S.S. Ana, M.M. Macchione, A.M. Teixeira and F.L. Schmidt, 2009. Milk drink using whey butter cheese (*Queijo manteiga*) and acerola juice as a potential source of vitamin C. Food Bioprocess Tech., 2: 368-373.

Ernest, K., S. Robert and W. Louise, 2005. Storage stability and sensory analysis of UHT-processed whey-banana beverages. J. Food Qual., 28: 386-401.

Horton, B.S., 1995. Whey processing and utilization. Bull. IDF., 308: 2-6.

Kalra, S.K., D.K. Tandon, N. Garg and B.P. Singh, 1991. Quality evaluation of some market drinks. Indian Food Packer, 45: 40-53.

Krishnaveni, A., G. Manimegalai and R. Saravanakumar, 2001. Storage stability of jack fruit RTS beverage. J. Food Sci. Technol., 38: 601-602.

Kumar, S. and G. Manimegalai, 2005. Studies on storage stability of whey based papaya juice blended RTS beverage. J. Food Sci. Tech., 42: 185-188.

Lal, G., G.S. Siddappa and G.L. Tandon, 1998. Preservation of Fruits and Vegetables. Indian Council of Agricultural Research, New Delhi.

Mayer, L.H., 1960. Food Chemistry. 3rd Edn., AVI Publication Co., Westport, CT.

Panesar, P.S., J.F. Kennedy, D.N. Gandhi and K. Bunko, 2007. Bio-utilization of whey for lactic acid production. Food Chem., 105: 1-14.

Parekh, J.V., 2006. Emerging new technologies in the dairy industry in India. http://www.fnbnews.com/article/detarchive.asp?articleid=19393§ionid=40.

Ranganna, S., 1986. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd Edn., McGraw-Hill Publishing Co. Ltd., New Delhi.

Rao, D.V. and M.K. Salooza, 1990. Whey-a nutritive pollutant. Pollution Management Symposium, Mysore.

Roy, L.G., G. Mukherjee and S.K. Majumdar, 1991. Production of lactic acid from potato fermentation. Ind. J. Exp. Biol., 29: 681-681.

Sethi, V., 1992. Preparation and storage study of lime ginger cocktail at room and low temperature. Beverage Food World, 19: 51-52.

Sikder, B., K. Sarkar, P.R. Ray and P.K. Ghatak, 2001. Studies on shelf-life of whey-based mango beverages. Beverage Food World, 28: 53-54.

Singh, W., C.M. Kapoor and D.N. Srivastava, 1999. Standardization of technology for the manufacture of guava- whey beverage. Ind. J. Dairy Sci., 52: 268-270.

Sirohi, D., S. Patel, P.L. Choudhary and C. Sahu, 2005. Studies on preparation and storage of whey-based mango herbal *Pudina* (*Mentha arvensis*) beverage. J. Food Sci. Technol., 42: 157-161.

Smithers, G.W., 2008. Whey and whey proteins-From gutter-to-gold. Int. Dairy J., 18: 695-704.

Soliman, M.A., E.A. Emave and A.E. Okasha, 1995. Studies on the browning inhibitors in banana butter-milk and whey beverages. Egy. J. Dairy Sci., 23: 11-29.

Srivastava, J.S., 1998. Comparative study of RTS drinks prepared from *Dashehari* and *Banganpalli* mangoes. Indian Food Packer, 52: 38-40.

Thakur, K.S. and V.S. Barwal, 1998. Studies on preparation and evaluation of squash from unmarketable kiwi fruit. Indian Food Packer, 52: 26-27.