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Studies on preparation and storage stability of whey based mango herbal beverage

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Abstract

A whey-based mango herbal beverage was prepared with addition of ginger extract ranging from 0.5 – 5ml (v/v). Quantity of mango pulp and sugar were 10 gm and 8 gm, respectively per 100 ml of the beverages. Whey quantity varied from 82 to 86 ml for each 100 ml of beverage depending on the quantity of ginger extract. Attempts were made to avoid separation of beverages with addition of 0.05% guar gum powder. Prepared beverages filled in sterile PET bottles and evaluated for storage stability at 7±1 °C. The organoleptic scores and overall acceptability of beverage found highest to refrigerated stored sample as compared to the sample which stored at room temperature. TSS, viscosity, pH and reducing sugar increased while acidity, total sugar and reducing sugar decreased during storage. Fresh beverage had highest overall acceptability, which was stored refrigerated. It contains mango 10 gm, sugar 8gm, whey 82ml, 0.5% ginger extract and 0.05% guar gum. An increasing trend was observed in Yeast & moulds, total plate count, *E. coli* during storage period of 30 days.

Keywords: Storage stability, based mango herbal beverage, *E. coli*

1. Introduction

Whey is the liquid left after Milk has been coagulated and strained. It is by-product of cheese and Paneer manufacturing industries having many commercial uses. It contains many valuable nutrients like lactose, proteins, minerals and vitamins etc., which have crucial value as human food. Whey contains 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. Whey solids are not utilized beneficially and an enormous quantity of whey is being drained out globally, which poses a serious damage to environment because of its high biological oxygen demand (BOD) of 35,000 to 50,000 ppm (Yadav *et al.* 2010) [8]. In spite of the recent technologies have been evolved, full utilization of whey has not yet achieved in India. The disposal technologies and effective use of whey as a dairy waste is subject of growing importance in view of the increasing prominence on environmental and economic aspects (Sirohi, 2005) [10].

Of late, there is an enormous increase in research on whey. Numbers of reviews are available on the preparation of whey based beverages. Y. K. Naik *et al.*, (2009) [6] conducted studies on physico-chemical and sensory characteristics of whey based water melon beverages. Ritika B. Yadav (2010) [8] formulated whey based banana herbal (*Mentha arvensis*) beverages with 10 ml banana juice, 8 gm sugar, 0 to 4% *Mentha arvensis* and 72 to 84 ml of whey. Sirohi D. (2005) [10] studied the preparation and storage of whey based herbal pudina (*Mentha arvensis*) beverage by formulating with 0 to 4% pudina extract, 15 gm mango pulp and 8 gm sugar and 73 to 77 ml of whey. Sakhale B.K. (2012) [9] attempted to develop whey based RTS beverages from mango cv. kesar.

Herbal extract of ginger has preventive and curative medicinal value. It is used to treat nausea caused by sickness, health problem associated with inflammation, such as arthritis, bronchitis and ulcerative colitis. Also ginger oil is used in the treatment of fractures, rheumatism, arthritis, bruising, carbuncles, nausea, hangovers, travel and sea sickness, colds and flu, sores on the skin, cough, sore throat, diarrhea, fever etc. It also acts as a good appetizer, acceptable to consumer and the same time makes the product more palatable. Mango is one of the most popular, nutritional tropical fruit. It has excellent flavour and fragrances, delicious taste and high nutritional value

There is no systematic study reported in the available literature on standard manufacturing methods, storage studies and sensory characteristics of whey mango based herbal beverages.

Whey beverage prepared with mango and ginger will not only have magnificent nutritional but also possess therapeutic, prophylactic and antibacterial properties. The main objective of this study was to utilise the whey for formulation of beverage having high nutritional and medicinal value and to study physico-chemical, microbial properties and storage stability.

Materials and methods

The mango pulp of different brand available in the market was procured. Chhana whey was obtained during chhana

production prepared from standardized milk of different brand available in market which contains 4.5% fat and 8.5% solids-not-fat (SNF). The whey is prepared by coagulating standard milk using 2% citric acid. Whey was filtered by 125 μ ISI sieves and stored at refrigerated condition. Ginger extract was prepared from fresh ginger procured from local market. It was washed and grinded in mixer and collected by pressing. Ginger extract thus obtained was stored in refrigeration for the use.

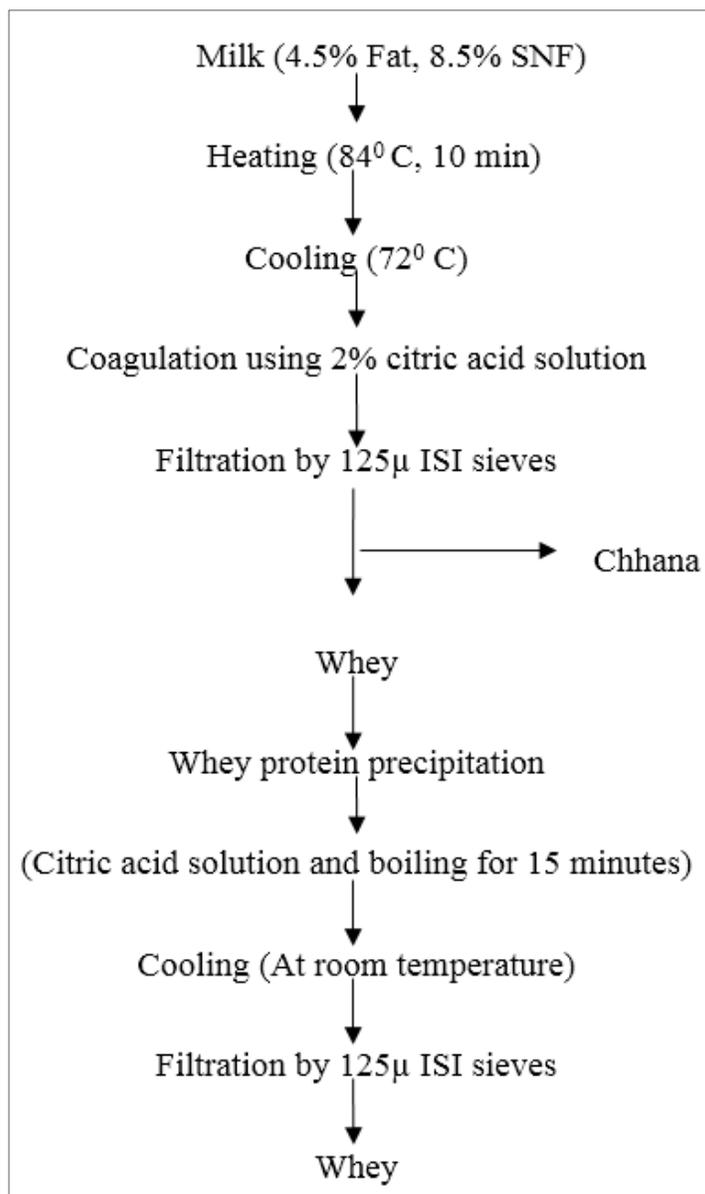


Fig 1: Flow Chart for Preparation of Whey

Preparations of whey-based mango herbal beverages

Preparation of whey-based mango herbal beverage was prepared using method described by (Sirohi *et al.*, 2005) ^[10]. With the addition of optimum ginger extract 0.5% concentration. A process flowchart for the preparation of whey based mango herbal beverages is given in fig. 2. The

recipe for the preparation of 100 ml beverages with optimized concentration of ginger extract and different proportion of mango pulp ranging from 5 to 10% is given in Table 01. The beverages obtained were filtered and filled into sterile PET bottles and sealed by capping and then stored at refrigerated temperature.

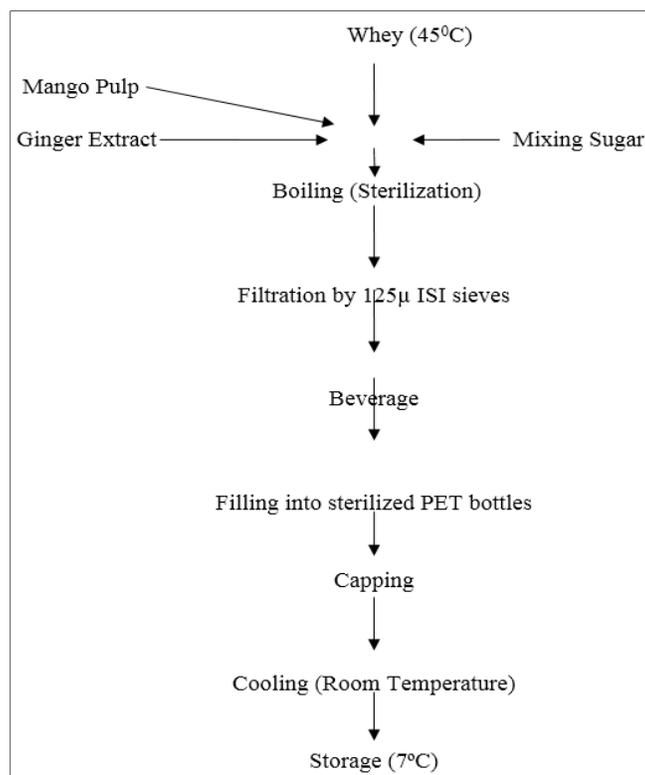


Fig 2: Flow Chart for Preparation of Whey Beverages

Table 1: Recipes for preparation of 100 ml beverages

Sample No.	Whey (ml)	Mango pulp (gm)	Sugar (gm)	Ginger Extract (ml)	Guar Gum (%)	Storage temp. (°C)	Remarks
S ₁	87	5	8	0.5	0.05	30 (RT)	Spoiled after 4 days
S ₂	87	5	8	0.5	0.05	7±1	Not spoiled up to 30 days
S ₃	85	7	8	0.5	0.05	30 (RT)	Spoiled after 4 days
S ₄	85	7	8	0.5	0.05	7±1	Not spoiled up to 30 days
S ₅	82	10	8	0.5	0.05	30 (RT)	Spoiled after 4 days
S ₆	82	10	8	0.5	0.05	7±1	Not spoiled up to 30 days

Storage studies

Beverages were stored at refrigerated temperature. Sample were drawn at intervals of 5 days up to 30 days and evaluated for physico-chemical, microbial count and sensory scores.

Physico-chemical analysis

Physico-chemical analysis of mango pulp, whey and beverages were done for different parameters as described below:-

Total Soluble solids (TSS) content was determined with a Erma hand refractometer (Erma, Japan 0-32° brix) and expressed as °Brix. pH was determined by digital laboratory pH meter. Total acidity was determined in terms of citric acid for whey, mango pulp and beverages by titration against 0.1N NaOH solution according to Method given by (Ranganna, 1986) [7]. Specific gravity was determined by specific gravity bottles. Viscosity beverages was measured using ford cup expressed in second. Moisture content was calculated by standard method (AOAC, 1999) [1]. Reducing sugar, non-reducing sugar and total sugars were estimated by Lane-Eynon method. Ascorbic acid content of mango pulp, whey and beverages were determined by the 2, 6-Dichlorophenol-indophenol titrimetric method (Ranganna, 1986) [7]. Black and brown specks of mango pulp were determined by laboratory method. Yeast & mould, total plate count and *E. coli* for

mango pulp, whey and beverage were evaluated (Ismail *et al.*, 2011) [5] and expressed as cfu/ml.

Sensory evaluation

Beverage samples prepared with 0.5% ginger extract, 10% mango pulp, 0.05% guar gum and 82% whey. The beverage was analyzed organoleptically by 10 member trained panel on 9 point hedonic scale with respect to appearance, color, flavor, texture, taste, aftertaste and overall acceptability stored at room temperature and refrigerated temperature.

Result and discussion

Present investigation was an attempt to develop whey based mango herbal beverage with different proportions of ingredients (7, 5 and 10%) mango pulp, 8gm sugar, 82 to 87% whey, 0.5% ginger extract and 0.05% gaur gum. The efforts have been made to study storage stability, separation, microbial evaluation, physiochemical and sensory characteristics. The formulated beverages neither contain any artificial flavoring coloring nor any chemical preservatives.

The physicochemical characteristics of mango pulp were evaluated. The results are recorded in Table 02. Pulp contains about 79.48% moisture, while other parameters like TSS 26 brix, pH 4.1, acidity 0.80%, ash 0.99, specific gravity 1.0329, density 1032 kg/m³, black and brown specks 1-2 per grams respectively.

Total sugar 15.75%, reducing sugar 2.43%, non-reducing sugar 13.14%, ascorbic acid (vit.C) of the pulp was 85.704 mg per 100 gm.

Table 2: Physicochemical characteristics of Mango pulp, Whey and Whey Beverage

S. No	Parameters	Mango	Whey	Whey beverage
1	Moisture (%)	79.48	90.51	84.605
2	TSS (^o Brix)	26	6.6	15
3	pH	4.1	4.9	4.62
4	Acidity (%)	0.80	0.26	0.23
5	Ash (%)	0.99	0.86	1.001
7	Specific gravity	1.0329	1.0245	1.04
8	Density (Kg/m ³)	1032.97	1024.50	1040
9	Black specs (per gram)	1	-	-
10	Brown specs (per gram)	2	-	-
11	Total sugar (%)	15.75%	3.29	11
12	Reducing sugar (%)	2.43%	2.17	2.20
13	Non-reducing sugar (%)	13.14%	1.12	8.80
14	Ascorbic acid (mg/100)	85.704	10.2	42.85

Whey extracted was evaluated for its physicochemical characteristics. The results are presented in Table 02. Whey contains about 90.51% moisture while other parameters like TSS 6.6 ^o Brix, pH 4.9, acidity 0.26%, ash 0.86%, viscosity 11.23 sec., specific gravity 1.0245, density 1024.53, total sugar 3.29 and reducing sugar 2.17, non-reducing sugar 1.12, and ascorbic acid content of whey was 10.2 mg/100 gm.

The fresh beverage was evaluated for physical, chemical & microbiological characteristics of whey beverages are presented in Table 02. The fresh Beverage contains 84.605% moisture, TSS 15^o brix and pH 4.62, acidity 0.23%, ash 1.001%, viscosity 12.32 sec., specific gravity 1.04, density 1041 kg/m³. Other nutrients parameters like total sugar 11%, reducing sugar 2.20%, and non-reducing sugar 8.80%, ascorbic acid content 42.85 mg. The microbiological parameters like yeast & molds 20/ml, total plate count 30/ml, *E. coli* were nil.

Sensory evaluation of whey based mango herbal beverages

Data in Table 03 show the average sensory scores of different quality attributes and overall acceptability for whey based mango herbal beverages. It was observed that sample S₆ was recorded highest (6.7) overall acceptability scores and for

other parameters like appearance (6.8), colour (7), flavour (6.7); texture (6.8) and taste (6.7), after taste (6.2) were also found. So the sample S₆ was organoleptically better than other samples.

Table 3: Organoleptic Evaluation of Mango Whey Based Beverages

S. No	Parameters	S ₁	S ₂	S ₃	S ₄	S ₅	S ₆
1	Appearance	6	6	6.14	6.4	6.6	6.8
2	colour	5.8	6.14	6.28	6.6	6.6	7
3	Flavour	5.28	5.07	5.14	6.2	6.4	6.7
4	Texture	6.14	5.28	5.14	5.8	7.4	6.8
5	Taste	5.71	5.32	5.14	6.4	6.1	6.7
6	Aftertaste	5.07	5	5.21	6.2	5.8	6.2
7	Overall acceptability	5.42	5	5.07	6.3	6.1	6.7

Storage studies of whey based mango herbal beverages

Beverage were prepared with ginger extract and stored at temperature 7±1 ^oC were analyzed for 30 days with 5 days interval. The data in Table 04 indicated the storage studies results. Gradually increasing trend was observed in beverage during storage period. The highest value of TSS was recorded to be 17.2^o Brix at the end of 30 days. Increase in TSS might be due to the solubilization of insoluble portion of the product (pulp constituents) in the presence of acids (ascorbic and citric) during storage as reported by (Ismail *et al.*, 2011) [5] and (Yadav *et al.* 2010) [8]. The increase in viscosity was recorded during storage period. The highest value of viscosity was recorded to be 13.50 sec. at the end of 15 days. Increase in viscosity might be due to the solubilization of insoluble portion of the product (pulp constituents) due to presence of acids (ascorbic and citric) during storage. The pH of beverage decreases during the storage period, lowest value of pH was recorded to be 4.15 on last day of study. The acidity of beverages changes during storage and was found to be increases from initial value 0.24% to the final value of 0.32% after 30 days. These results of pH and acidity supported by (Ismail *et al.*, 2011) [5] and (Yadav *et al.* 2010) [8]. A decreasing trend was observed in total sugar the lowest value was observed in reducing sugar the highest value of reducing sugar 3.8% was recorded. Non reducing sugar was decreased. Increase in reducing sugar may be due to the conversion of sugar into reducing sugar in presence of citric acid as reported (Hassan *et al.*, 2015) [3], (Yadav *et al.*, 2010) [8] and (Ismail *et al.*, 2011) [5].

Table 4: Physico-chemical and Microbiological Changes during storage period

S. No	Parameters	Days						
		1	5	10	15	20	25	30
1	TSS(0Bx)	15	15	16.2	16.5	16.9	17	17.2
2	Viscosity	12.32	12.53	12.52	12.58	13.2	13.30	13.50
3	pH	4.69	4.71	4.58	4.50	4.34	4.36	4.15
4	Acidity	0.24	0.24	0.25	0.25	0.27	0.30	0.32
5	Total Sugar	11.00	11.95	12.22	11.00	9.16	8.53	7.85
6	Reducing Sugar	2.2	2.6	3.2	3.6	3.5	3.7	3.8
7	TPC	30	50	88	122	200	246	276
8	Yeast and Mold count	20	42	60	78	120	168	200
9	E-coli	NA	NA	NA	NA	NA	NA	NA

Microbial Analysis

Microbial analysis were Performed, which includes yeast and mold count, total plate count, *E. coli* and It was found to be 30 cfu/ ml, 20 cfu/ml of TPC and Yeast and mold count respectively for fresh sample. Similarly the sample was analyzed after 30 days storage and was found to be 276

cfu/ml Total Plate count, 200 cfu/ml Yeast and Mold count and nil *E. coli* was found absent in both samples of fresh & stored sample. These results are in close conformity with the results supported by (Hassan *et al.*, 2015) [3], (Ismail *et al.*, 2011) [5].

Conclusion

Optimization of the formulation of Whey based mango herbal beverage on Mango pulp, whey and Ginger extracts was addressed in this study. Results concluded that, whey can be found suitable for the development of whey based mango herbal beverages with acceptable sensory characteristics. Beverage with nutrients and better shelf life could be developed by addition of whey up to certain extent. Prepared beverage have excellent color, flavor and stability was estimated to be high which means that mango pulp masks unpleasant taste of whey successfully. The increase in both fruit and sucrose concentration might improve the characteristics of the blends. The overall acceptability of the product manufactured was assessed using sensory evaluation technique and was found to be acceptable.

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