

Research Article

Development, Quality Evaluation and Shelf Life Studies of Whey Guava Beverage

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Abstract

The utilization of guava pulp in the development of whey based beverage showed a great benefit to the dairy industry. The aim was the development of whey guava blended beverage. The ratio of whey and guava pulp that were utilized for the preparation of beverage is 67.5% whey and 20% guava pulp. Different processing time temperature combinations were given to it at 60°C, 65°C and 70°C. Samples were evaluated initially and after that at an interval of 15, 30, 45, 60, 75 and 90 days for sensory analysis including taste, color, aroma and overall acceptability, chemical and microbial analysis. It was found that whey guava beverages pasteurized for 65°C for 25 minutes was found to be best in terms of sensory quality after 45 days and pH, acidity, protein, total sugars and educing sugars found to be high than that of other samples. Effect of different temperatures, timings and storage periods on mean sensory score of whey guava beverage was significant and significant changes were observed in total sugars, reducing sugars, non reducing sugars, protein and vitamin C content.

Keywords: whey-guava blended juice, physicochemical, sensory and microbial characteristics and storage stability.

1. Introduction

A whey drink can replace much of the lost organics and in organics to the extracellular fluid. Whey, which is so rapidly assimilable, forms an ideal metabolic substrate. Whey drinks are light and refreshing but less acidic than fruit juices (Prendergast K, 1985). Whey from different sources might show variation in its chemical composition due to process and behavior of the product (Kulkarni *et al.*, 1987). Preeminence of whey as an excellent beverages base has been recognized as it is genuine thirst quencher, whey drinks are light refreshing healthful and nutritious but less acidic than fruit juices, and offers good profit margins (Ray *et al.*, 1953. Nikerson, 1978) Reported that whey has been used to improve the flavors, texture, appearance and shelf life of baked foods, dry mixes ice cream, sherbet, jams and beverages. The manufacture of whey based beverage requires the mixing of appropriate fruit juices and minimally processed whey with selection of suitable stabilizers and acidulants to develop acceptable whey based fruit beverages (Singh *et al.*, 2005). Guava is popularly known as “poor man’s apple” available in plenty at a low price during the season. It emits a sweet aroma which is pleasant sweet refreshing and a fleshy texture. Guava fruits are highly perishable in nature and they cannot be stored at room temperature for long time. Therefore to utilize the produce at the time of glut and save it from spoilage, the development of low cost

processing for guava fruit is needed. Five commercially grown winter cultivators for guava viz. ‘Allahabadi safeda’, ‘Lucknow-49’, ‘Red fleshed’, ‘Chikkidar’ and ‘Apple colour’. The pulp of ‘Allahabadi safeda’ had the highest TSS content followed by ‘Lucknow-49’, ‘Red fleshed’, ‘Apple colour’ and ‘Chikkidar’. The ascorbic acid showed decrease trend during 60 days of storage. The reduction in ascorbic acid content might be due to oxidation because of the presence of residual oxygen in glass bottles and this reduction can be minimized by eliminating oxygen during filling. The overall quality and acceptability of ‘Allahabadi safeda’ pulp was highest among all. But this quality and acceptability of pulp decreases slightly with increase in storage period due to decreasing in color, flavor, taste and texture. The decrease in organoleptic rating might be due to decrease in ascorbic acid content and pectin degradation (Chetan *et al.*, 1999) The enzyme treatment of guava puree was optimized for yield and clarity by first determining the most effective concentration, then varying both incubation time and temperature. (Thongsombat *et al.*, 2007) worked on the production of guava juice fortified with soluble dietary fiber as pectin extracted from guava cake (peel, pulp, seed). (Akesowan *et al.*, 2013) Showed response surface methodology (RSM) to investigate the effects of enzyme concentration (500-900 ppm) and incubation time (30-90 min) on viscosity of guava puree and pH, titratable acidity, clarity, yield, total soluble solid (TSS) and ascorbic acid of guava juice. Addition of guava adds nutritive value, flavour and meditational properties and show great

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potential for processing into valuable products. It is highly perishable in nature leading to spoilage during storage. This study will lead to the development of such a product using guava making it available at a very remunerative price during the season of processing. The aim of this research was to standardize whey guava beverage, evaluate the physicochemical characteristics and also to estimate the shelf life of the product.

2. Materials and methods

2.1 Material collection and sample preparation

Standardized milk was used for the preparation of good quality whey. Milk was heated at 80°C and milk was coagulated using 2% citric acid solution followed by continuous stirring resulted in complete coagulation of milk protein (casein). The liquid (whey) was filtered using muslin cloth and stored for further use. Fresh quality guava (Allahabad safeda) was chosen from the local market for the pulp extraction. Guava were peeled and cut into small pieces. The fruit pieces were grinded in a mixture and the pulp was then filtered through a double layered muslin cloth for a clear guava juice and stored.

2.2 Product development

The samples of whey and guava pulp were then optimised at different levels. The guava pulp so obtained were then mixed with water in 1:1 proportion and then passed through muslin cloth to get a clear liquid juice. Processing depends upon the addition of up to 250mg/l ascorbic acid to the fruit being milled or immediately after processing. This procedure prevents the oxidation of polyphenols a major cause of browning and a contributory cause of flocculation. This procedure prevents oxidation of polyphenols, a major cause of browning and a contributory cause of flocculation. Ascorbic acid also inhibits pectinolytic enzymes and maintains the fresh guava aroma, possibly by preventing oxidation of volatile aldehydes. The various blends of whey guava prepared using a constant sugar level of 12.2% and ascorbic acid of 0.3% were 82.5W:5G, 77.5W:10G, 72.5W:15G, 67.5W:20G, 62.5W:25G, 57.5W:30G, 52.5W:35G and 47.5W:40G. The treatments so prepared were thoroughly mixed and 1% stabilizer was also added finally. The treatments were heated to dissolve the added ingredients followed by filling into sterilized glass bottles then sealed. This type of whey guava beverage contains at least 20% fruit juice and 15% total soluble solids and also about 0.3% acid. It is highly energetic instant drink and is not diluted before serving.

2.3 Product thermal processing

The best rated sample after subjecting to sensory evaluation by trained panel members was selected for the thermal processing using various time temperature combinations. The sample selected was t_5 (67.5W:20G) for thermal processing. The combinations involved in processing were 60°C for 15, 20 and 35 minutes, 65°C for

15, 20 and 25 minutes and 70°C for 15, 20 and 25 minutes. The product pasteurized at 65°C for 25 minutes scored more than the other samples.

3. Analytical methods

3.1 Chemical and microbiological methods

TSS was measured using a hand refractometer of 0°-50° B. the pH of the beverages was determined using a digital pH meter. Titrable acidity was determined according to AOAC method. Reducing sugar, non-reducing sugar and total sugar were determined by method described by Ranganna. Ash and moisture content were determined according to AOAC method. Protein estimation was by pyne's method.

3.2 Biochemical, microbiological and sensory quality evaluation of the beverage during storage

The beverage samples prepared from an optimized 67.5:20 blend of whey and guava juice with addition of 12.2% sugar and 0.3% acid were processed and stored. The beverage samples so obtained were stored at refrigeration temperature (4°C) and analyzed for biochemical, microbiological and sensory attributes at an interval of 15 days (Shukla et al., 2013, Divya and Archana, 2009).

3.3 Sensory quality evaluation

The beverage samples were evaluated as described by (Luckowet et al., 2006) for their sensory characteristics namely color and appearance, taste, aroma and overall acceptability by a trained panels comprising of 15 panelists drawn from faculty members and post graduate students of the Department. The panelists were asked to record their observations on the sensory sheet based on a 9 point hedonic scale (9 and 1 points showing like extremely and dislike extremely).

3.4 Statistical analysis

Statistical procedures as described by (Snedecor and Cochran, 1977) were used to analyze the data for the interpretation of results. Mean, standard deviation and analysis of variance (ANOVA) were used to describe the results.

3.5 Sensory quality evaluation

The beverage samples were evaluated as described by (Larmond, 1977) for their sensory characteristics namely color and appearance, taste and flavor, body or consistency and overall acceptability by a trained panels comprising of 25 panelists drawn from faculty members and post graduate students of the Department. The panelists were asked to record their observations on the sensory sheet based on a 9 point hedonic scale (9 and 1 points showing like extremely and dislike extremely).

4.0 Results and Discussions

Table 1 Effect of different blends of whey and guava juice on sensory attributes of the beverage

S.A.	T0	T1	T2	T3	T4	T5	T6	T7	T8	T9
Colour	6.03	7.07	7.35	7.64	7.5	7.821	7.5	7.82	7.57	6.92
Taste	3.93	6.57	6.85	6.92	7.39	7.46	6.85	7.39	7.17	6.82
Aroma	6.39	7	7.24	7.14	7.64	7.92	7.61	7.46	7.6	6.78
Overall acceptability	7.25	7.75	6.67	6.95	7.79	7.87	7.41	7.83	7.29	7.04

Table 2 Effect of physicochemical characteristics on different treatments of whey guava beverage during storage

Physicochemical properties	Day	T0	T1	T2	T3	T4	T5	T6	T7	T8	T9
Protein	0	0.306	0.318	0.315	0.317	0.328	0.332	0.318	0.308	0.326	0.344
	15	0.305	0.317	0.313	0.316	0.326	0.33	0.316	0.308	0.323	0.342
	45	0.303	0.316	0.311	0.313	0.326	0.328	0.312	0.306	0.321	0.337
	60	0.301	0.312	0.309	0.31	0.322	0.325	0.308	0.304	0.318	0.332
	75	0.298	0.308	0.306	0.308	0.318	0.322	0.306	0.296	0.313	0.33
	90	0.296	0.306	0.303	0.305	0.316	0.314	0.303	0.293	0.306	0.327
Lactose	0	5.24	5.23	5.22	5.21	5.22	5.21	5.2	5.21	5.2	5.19
	15	5.12	5.15	5.16	5.17	5.16	5.17	5.18	5.19	5.18	5.17
	30	4.86	5.05	5.08	5.12	5.08	5.12	5.15	5.16	5.14	5.15
	45	4.52	4.91	4.96	5.05	4.96	5.05	5.11	5.11	5.08	5.12
	60	4.02	4.71	4.8	4.94	4.8	4.94	5.05	5.04	4.99	5.08
	75	3.87	4.43	4.61	4.78	4.6	4.78	4.97	4.93	4.86	5.02
Acidity	0	3.42	4.07	4.33	4.54	4.32	4.54	4.82	4.76	4.67	4.96
	15	1.37	1.31	1.35	1.24	1.35	1.27	1.36	1.4	1.32	1.26
	30	1.38	1.33	1.36	1.26	1.37	1.3	1.37	1.42	1.34	1.28
	45	1.39	1.36	1.38	1.27	1.38	1.31	1.38	1.43	1.35	1.31
	60	1.41	1.38	1.41	1.29	1.4	1.35	1.39	1.45	1.37	1.34
	75	1.43	1.4	1.42	1.31	1.42	1.37	1.41	1.46	1.38	1.37
pH	0	1.44	1.41	1.44	1.33	1.44	1.4	1.42	1.47	1.39	1.4
	15	1.46	1.43	1.46	1.37	1.47	1.42	1.44	1.49	1.42	1.42
	30	3.39	4.1	4.03	4.15	4	4.13	3.91	3.93	4.1	4.2
	45	3.92	4.07	4.01	4.13	3.92	4.1	3.86	3.9	4.05	4.17
	60	3.9	4.05	4	4.06	3.9	4.03	3.85	3.87	4.03	4.14
	75	3.86	4.03	3.96	4.02	3.86	4	3.84	3.86	4.01	4.1
Vitamin C	0	3.85	4	3.92	4	3.8	3.92	3.8	3.83	3.98	3.97
	15	3.83	3.87	3.9	3.96	3.78	3.87	3.78	3.8	3.96	3.92
	30	3.82	3.83	3.87	3.93	3.76	3.83	3.75	3.78	3.93	3.87
	45	36.86	35.82	32.78	28.83	34.67	30.67	26.76	33.67	26.85	24.85
	60	34.76	32.75	30.83	27.67	34.47	30.87	26.43	33.24	26.67	24.45
	75	32.74	27.83	27.57	25.75	32.92	28.65	25.67	32.78	25.36	23.62
Total Sugar	0	28.67	26.67	25.74	22.57	30.85	27.43	24.75	32.42	24.67	23.28
	15	25.54	24.72	21.65	20.68	28.84	25.28	22.56	30.78	22.84	21.57
	30	23.53	20.57	19.46	19.84	25.76	23.87	20.86	28.84	19.57	19.84
	45	20.87	16.68	17.82	17.55	20.77	19.75	18.75	23.78	16.38	16.74
	60	24.5	24.5	24.72	24.67	24.56	24.72	24.58	24.64	24.85	24.62
	75	24.48	24.49	24.7	24.64	24.54	24.71	24.57	24.63	24.84	24.61
Reducing sugar	0	24.46	24.48	24.69	24.63	24.51	24.7	24.55	24.62	24.83	24.58
	15	24.42	24.48	24.68	24.62	24.48	24.69	24.53	24.6	24.8	24.56
	30	24.38	24.46	24.66	24.62	24.45	24.68	24.5	24.58	24.78	24.53
	45	24.36	24.44	24.64	24.61	24.42	24.66	24.47	24.57	24.76	24.52
	60	24.32	24.42	24.61	24.6	24.4	24.63	24.44	24.55	24.73	24.5
	75	5.426	5.292	5.283	5.251	5.165	5.142	5.122	5.126	5.101	5.068
Non reducing sugar	0	5.44	5.306	5.294	5.268	5.176	5.158	5.137	5.134	5.112	5.077
	15	5.46	5.316	5.303	5.273	5.192	5.167	5.148	5.147	5.123	5.086
	30	5.465	5.326	5.313	5.28	5.208	5.175	5.159	5.158	5.136	5.095
	45	5.501	5.334	5.344	5.291	5.219	5.186	5.167	5.164	5.148	5.116
	60	5.580	5.342	5.341	5.312	5.231	5.197	5.181	5.176	5.153	5.135
	75	5.880	5.412	5.372	5.334	5.248	5.21	5.198	5.185	5.168	5.148
Bacterial count (cfu/ml)	0	19.07	19.21	19.44	19.42	19.4	19.58	19.46	19.51	19.63	19.55
	15	19.04	19.18	19.41	19.37	19.36	19.55	19.43	19.5	19.61	19.53
	30	19	19.16	19.39	19.35	19.32	19.53	19.4	19.47	19.58	19.49
	45	18.96	19.15	19.37	19.34	19.27	19.52	19.37	19.44	19.55	19.47
	60	18.88	19.13	19.31	19.33	19.23	19.5	19.33	19.42	19.52	19.41
	75	18.78	19.1	19.29	19.3	19.19	19.46	19.29	19.4	19.49	19.36
Yeast and mould count (cfu/ml)	0	18.44	19	19.24	19.27	19.15	19.42	19.24	19.37	19.45	19.35
	90	1250	1210	1220	1180	1150	1100	1120	1030	1010	970
Yeast and mould count (cfu/ml)	0	2920	2880	2850	2790	2720	2670	2660	2610	2570	2510
	90	0	0	0	0	0	0	0	0	0	0
Yeast and mould count (cfu/ml)	0	670	660	620	590	560	540	500	480	450	410
	90										

4.1 Proximate analysis

The total solids in whey, guava and probiotic whey based guava juice were 6.50, 9.73 and 20% respectively whereas titrable acidity was 0.4, 2.40, and 0.56 % lactic acid. Probiotic beverage (67.5W:20G) had 0.560% acidity, protein (0.357%), total soluble solids (20°B), reducing sugar (5.36 mg), non-reducing sugars (18.95 mg) and total sugar (25.303 mg). Similar results were seen in Shukla et al., (2013)

4.2 Standardization of whey guava beverage

Whey guava was prepared by using whey and guava pulp in the ratio of 2:1. The ratio of 67.5% (whey): 20% (guava) was found best for the formulation of the whey guava beverage. The product standardization was done by the sensory evaluation for sensory attributes namely color and appearance, aroma and overall acceptability. The highest score for color, taste, aroma and appearance was given to the beverage containing guava juice and whey in 8 different proportions i.e. 100W, 82.5W:5G, 77.5W:10G, 72.5W:15G, 67.5W:20G, 62.5W:25G, 57.5W:30G, 52.5W:35G and 47.5W:40G. The highest score was given to the T₅ (67.5W:20G) treatment. The mean score of this blend for color, taste, aroma and overall acceptability were 7.82, 7.46, 7.92 and 7.41 respectively (Table 1) Therefore, the 67.5w:20G blend of whey and guava juice was chosen for the further course of investigation.

Whey and guava juice blended in 9 different proportions and evaluated for sensory attributes namely colour, taste, aroma and overall appearance. The highest score for colour, taste, aroma and overall appearance was given to the beverage containing guava juice and whey in the ratio of 67.5:20. Therefore, the 67.5w:20g blend of whey and guava juice was chosen for further course of investigation. The blend differed significantly ($P < 0.05$) and rated best among other blend (Table 1).

The data on various physicochemical characteristics of various whey guava beverages are presented in Table 2. The pH of whey guava beverage varied from 3.39 – 4.15 and there was not much difference among the samples and pasteurization temperatures and timings did not affect the pH of beverage but during the storage period the pH of whey guava was slightly decreased (Divya and Archana, 2009) reported the similar result of whey guava beverage, where the pH ranged from 3.83 to 4.20. (Nirankar, 2004) reported that pH of whey protein enriched bael fruit juice beverage ranged from 3.93 to 3.95 with the slight increase in acidity during storage.

The total acidity of whey guava beverage varied from 1.24 to 1.49 percent and the pasteurizing temperatures and timings did not affect the acidity but during the storage period the acidity of whey guava beverage was increased slightly. (Sarvana, 2005) found an increase in acidity of whey guava RTS beverage during the storage of four months. (Singh, 1985) found an increase in guava RTS beverage during the storage of four months. the microbiological results were also significant for the increment in acidity of the beverage, due to the conversion

of lactose into lactic acid. The yeast and mould count was not that significant during the storage as the growth occurred was low which can be considered as negligible.

The protein content of control and whey guava beverage ranged from 0.296 to 0.306 and 0.293 to 0.344 respectively. The pasteurization temperature and timings did not affect the protein percentage of whey guava beverage to a greater extent. The processing conditions have influence over the parameters like protein and total solids i.e. whey proteins are more susceptible to heat treatment and are denatured at 70°C and above with reduction in pH. (Prendergast, 1985) developed a soft beverage from paneer whey guava and the percentage of protein was 0.31%. Whey proteins are of higher value than many other animal proteins (Devraj, 2005). Total sugar content of whey guava beverage ranged from 24.32 to 24.85 while reducing and non reducing sugar varied from 5.068 to 5.88 and 18.44 to 19.63. Significant effect was not seen till one and a half month subjected to pasteurization temperature and timing. Non reducing sugar decreased non-significantly during storage probably due to low hydrolysis of sucrose as shown by concomitant reduction in total sugars. Inversion of sucrose may occur during storage with a corresponding increase in the contents of the reducing sugars, glucose and fructose (Kornvalai, 2008).

Conclusion

Whey guava prepared by using whey and guava pulp in the proportion 67.5:20 (%) was found to be more acceptable as compared to the other treatments. It is therefore concluded that a good quality of guava beverage can be prepared by using whey from coagulated milk paneer. This beverage has high protein and vitamin C content; it will cost effective and will reach the weaker sections of consumer who are deprived of such nutrient enriched beverage. The beverage pasteurized for 65°C for 25 minutes was most acceptable compared to that beverage pasteurized at lower temperature for short time in respect of shelf life, bacterial count, yeast and mould count, colour, taste, aroma, overall acceptability and having the highest value of pH, protein, total sugars and reducing sugar contents among all samples.

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