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Effect of Different Temperatures, Timings and Storage Periods on the Physico-Chemical and Nutritional Characteristics of Whey-Guava Beverage

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Abstract: Attempts were made to develop a soft beverage from paneer whey and guava pulp which pasteurized at different temperatures and timings for estimating its shelf-life. In the preparation of beverages the volume of guava pulp (25%), sugar (10%) and paneer whey (65%) were kept constant while the pasteurization temperatures and timings were varied from 60°C-70°C for 15-35 minutes. The prepared beverages were evaluated for their physico- chemical properties and organoleptic qualities every 15 days till 45 days. Effect of different temperatures, timings and storage periods on the mean sensory sources of whey-guava beverage was significant and significantly changes were observed in total sugars, reducing sugars, non reducing sugars and vitamin C during the storage period. However, whey-guava beverages pasteurized at 70°C for 35 minutes was found to be best in terms of sensory quality after 45 days and pH, acidity, protein, total sugars and reducing sugars found to be high than that of the other samples.

Key words: Whey · Whey beverage · Storage · Sensory characteristics

INTRODUCTION

Whey is that portion of milk which is obtained after the coagulation of milk protein casein with some coagulating agent. The coagulating agent may be citric acid lactic acid added as the pure chemical reagents or produced by the action of microorganisms when allowed to grow in the milk. It contains about half of the milk solids, most of the lactose about one fifth of the proteins, most of the vitamins and minerals. About 3 million tonnes of whey produced in India containing about 2 lakh tonnes of valuable milk nutrients. Disposal of whey possesses a serious problem of environmental pollution due to the presence of high organic matter. Biological oxygen demand (BOD) of whey varies from 39,000 to 48,000 ppm, which is roughly 200 times more as treat the whey before disposal, which is found to be uneconomical. Obviously, development of any process for its economical utilization would be of great benefit to the dairy industry. At this stage, product diversification using whey as a infrastructure replacer of water without much change in the existing infrastructure is quite feasible. Market demand for beverages is growing all over the world and India is no exception to it. Whey beverages have been recognized as a genuine thirst quencher, light, refreshing, healthful and nutritious [1]. Whey based fruits beverages are more suitable for health as compared to other drinks [2]. Whey and its biological components has proven its effects in treatments of servical chronic diseases like cancer, cardiovascular, HIV etc. As it is nutritionally too rich it can also be used in beverages infant Geriatric and Atheletic food [3].

Additional of guava which adds excellent nutritive value, flavour and meditional properties and show great potential for processing into valuable products. It is useful in survey, digestion and cough. The fruit is available in plenty during the season of production which causes glut in the market. In addition to this fruit are highly perishable in a nature and there is a lot of spoilage in rainy season guava due to insect and rain. So the fruit is available at a very remunerative price during the season of processing.

MATERIALS AND METHODS

Preparation of Whey: Paneer whey was utilized for the development of whey based guava beverage. The paneer whey was obtained during the manufacture of paneer.

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Milk was heated at 80°C and milk was coagulating using 9% citric acid solution as coagulant. To precipitate proteins whey was heated to 80°C at pH 4 and then was filtered and stored under refrigerated condition until use.

Preparation of Guava Pulp: Put all the guava's in the water path and selected those guava's which were half dipped the water. Then we cut the selected fruits in small pieces. After this we weight the fruits and then added water in the ratio (1:1). We then put it in the mixer and mixed it well. Then we got the guava pulp, to which we finally refined by passing it through the muslin cloth. Finally we collected the clear guava pulp.

Product Development: Whey (65%) was heated to dissolve sugar (10%) thereafter, guava pulp (25%) was thoroughly mixed with the above mixture and then finally we added guar gun (0.05%), SO_2 (including potassium Meta bi sulphite 100 ppm) (1.5%) preservative, sodium alginate (1%) stabilizer. Heat the mixture at 80°C for 15 minutes. After this the whole mixture was filtered, after this the beverage was filled into glass bottles which were sterilized at 121°C for 10 minutes, then sealed. Then we did pasteurized at 63°C for 15 minutes, 25 minutes, 35 minutes for control and 60°C for 15 minutes, 25 minutes, 35 minutes : 65°C for 15 minutes, 25 minutes, 35 minutes; 70°C for 15 minutes, 25 minutes and 35 minutes, for treatments.

Microbial Analysis: Microbial analysis was done by pour plate method (Robert Koch. In this technique, successive dilution of the inoculums (serially diluting the sample) were added into sterile Petri plates to which was poured melted and cooled (42-45C) Nutrient agar medium (NAM) and thoroughly mixed by rotating the plates which was then allowed to solidify. After incubation (37°C for 24 h.), the plates were examined for the presence of individual colonies growing throughout the medium. The pure colonies which were of different size, shape and colour. Different type of colony was transferred by streak plate method onto fresh NAM plate for further study.

Streak Plate Method: The sample was streaked by triple streaking method with sterilized loop on NAM plates. The plates were then incubated at 37°C for 24 h. After 24 h isolated colonies were picked up randomly and subcultured on NAM plates for the isolation of pure culture.

Chemical Analysis: Total acidity was calculated in terms of lactic acid for whey and citric acid for guava pulp by titrating against 0.1 N sodium hydroxide according to the AOAC [4] method, whereas pH was measured directly using a micro processor based pH meter (century). Reducing sources, non-reducing sugars and total sugars were estimated by Lane and Eyan method [5]. Ascorbic acid content of guava pulp and beverage was determined by the 2, 6 dichlorophenol indophenol titrimetric method (AOAC, 1995). Protein was determined by semi micro Kjeldahl method using Kjel -plus digestion and distillation system BIS, [6].

RESULTS AND DISCUSSION

The data on sensory scores of various whey-guava beverage combinations are presented in Table 1. The results revealed that colour, taste, flavor texture and overall acceptability of the treatment T_3t_3 (70°C for 35 minutes) ranged between scores like very much and like much. Among the other treatments of whey-guava beverage has slightly lower scores as compared to treatment T_3t_3 (70°C for 35 minutes): though it was at lower rate due to low temperature and timing. Low pasteurization temperature and timing of samples did show decrease in various organoleptic characteristics but differences were significant.

The data on various physico-chemical characteristics of various whey-guava beverages are presented in Table 2. The pH of whey guava beverage varied from 3.83 to 4.20 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 beverage was slightly decreased Ashish Kumar Singh and Nirankar Nath [7] reported that pH of whey protein enriched Beal fruit juice beverage ranged from 3.93 to 3.95.

The total acidity of whey-guava beverage varied from 1.27 to 1.45 percent and pasteurization temperatures and timings did not affect the acidity but during the storage period the acidity of whey-guava beverage was slightly increased. Singh, A.K. [8] Found and increase in acidity of guava R.T.S. and nectar during storage of four months. The protein of whey-guava beverage varied from 0.290 to 0.343 percent and pasteurization temperatures and timings did not affect the protein percentage of whey-guava beverage Wazir Singh [9] developed a soft beverage from paneer whey and guava and the percentage of protein was 0.31%. Total sugar content of various treatments of

Table 1: Sensory Scores of Various Treatment of Whey-guava Beverage Sensory Scores (MAX 9.0)

		Treatments																	
Treatments	Storage	T_0t_1	T_0t_2	T_0t_3	T_1t_1	T_1t_2	T_1t_3	T_2t_1	T_2t_2	T_2t_3	T_3t_1	T_3t_2	T_3t_3	S.E. Temp	S.E. Storage	S.E. Timing	C.D. Temp	C.D. Storage	C.D. Timing
Colour	0 days	7.60	8.03	8.16	8.0	7.73	8.0	8.13	7.46	7.70	8.43	8.66	8.80	0.06	0.06	0.05	0.24*	0.24*	0.24*
	15 days	7.73	7.73	7.13	7.23	7.20	7.26	7.33	6.86	7.16	7.55	7.66	7.86						
	30 days	6.33	6.73	6.50	6.73	6.20	6.26	6.33	5.86	6.10	6.26	6.80	6.86						
	45 days	5.93	5.73	5.23	6.0	5.20	5.40	5.53	5.26	5.30	5.86	5.66	6.16						
Tastes	0 days	8.03	8.13	8.03	7.63	7.50	7.50	8.06	7.86	7.80	8.14	8.15	8.26	0.11	0.11	0.10	0.49*	0.49*	0.42*
	15 days	7.34	7.33	7.06	7.20	6.30	7.20	7.30	7.10	6.73	7.33	7.20	7.45						
	30 days	6.23	6.53	6.26	6.20	6.13	5.70	6.40	6.43	6.10	6.53	6.83	6.86						
	45 days	5.63	5.70	5.60	5.70	6.13	5.90	6.10	5.80	5.96	5.45	5.93	6.73						
Flavour	0 days	8.06	8.0	8.16	8.0	8.16	8.03	8.16	7.93	7.80	8.35	8.45	8.96	0.13	0.13	0.11	0.55*	0.55*	0.48*
	15 days	7.50	7.43	7.66	7.20	7.73	7.53	7.43	7.13	7.0	8.0	8.16	8.23						
	30 days	6.06	6.13	6.33	5.96	6.10	6.13	6.63	6.33	6.36	6.68	6.76	6.86						
	45 days	5.16	5.50	5.56	5.03	5.10	5.03	5.23	5.33	5.40	5.40	5.80	6.66						
Texture	0 days	8.46	7.86	8.23	8.06	8.33	7.40	7.86	8.13	7.73	8.30	8.76	8.83	0.72	0.72	0.66	2.99*	2.99*	2.74*
	15 days	7.93	7.50	7.76	7.56	7.83	7.40	7.60	7.33	7.73	8.13	7.93	8.76						
	30 days	6.84	6.90	7.30	7.06	7.33	7.0	7.06	7.23	7.26	7.40	7.26	8.33						
	45 days	6.20	6.40	6.70	6.83	6.76	6.70	6.76	6.63	6.66	6.96	6.93	7.83						
Over all acceptability	0 days	8.36	8.13	8.36	8.33	8.36	8.56	8.20	8.26	8.46	8.60	8.76	8.83	0.07	0.07	0.06	0.31*	0.31*	0.26*
	15 days	7.96	7.56	8.03	7.90	7.73	8.26	7.43	7.70	7.96	8.31	8.35	8.50						
	30 days	7.43	7.06	7.10	7.06	7.26	7.43	6.90	7.20	7.20	7.48	7.53	7.63						
	45 days	6.43	6.26	6.23	6.40	6.46	4.46	6.10	6.30	6.20	6.40	6.53	6.63						

*= Significant

Table 2 : Effect of Storage Period on Physico-chemical Characteristics of Different Treatments of Whey-guava Beverage

		Treatments																	
Treatments	Storage	T_0t_1	T_0t_2	T_0t_3	T_1t_1	T_1t_2	T_1t_3	T_2t_1	T_2t_2	T_2t_3	T_3t_1	T_3t_2	T_3t_3	S.E. Temp	S.E. Storage	S.E. Timing	C.D. Temp	C.D. Storage	C.D. Timing
pH	0 days	3.86	3.90	4.10	3.90	4.13	4.03	4.10	4.0	3.90	4.06	3.93	4.20	0.02	0.02	0.02	0.11*	0.10*	0.09*
	15 days	3.86	3.93	4.06	3.93	4.06	4.0	4.13	3.93	3.86	4.10	3.90	4.16						
	30 days	3.83	3.93	4.03	3.90	4.03	4.0	4.03	3.9	3.86	4.03	3.86	4.13						
	45 days	3.83	3.86	3.83	3.83	3.96	3.96	4.06	3.86	3.86	4.0	3.93	4.0						
Acidity	0 days	1.37	1.27	1.34	1.32	1.25	1.36	1.36	1.36	1.28	1.40	1.32	1.27	0.028	0.028	0.024	0.11*	0.11*	0.10*
	15 days	1.38	1.28	1.35	1.33	1.26	1.37	1.38	1.38	1.30	1.40	1.34	1.29						
	30 days	1.39	1.29	1.37	1.35	1.27	1.38	1.39	1.39	1.32	1.45	1.35	1.31						
	45 days	1.40	1.31	1.39	1.36	1.29	1.40	1.40	1.40	1.34	1.45	1.36	1.32						
Protein	0 days	0.303	0.326	0.306	0.316	0.313	0.316	0.326	0.330	0.316	0.306	0.323	0.343	0.00260	0.00260	0.0022	0.010*	0.010*	0.0093*
	15 days	0.303	0.320	0.306	0.316	0.311	0.313	0.326	0.330	0.316	0.306	0.323	0.343						
	30 days	0.293	0.320	0.300	0.316	0.313	0.303	0.316	0.323	0.313	0.296	0.313	0.330						
	45 days	0.290	0.310	0.296	0.303	0.306	0.303	0.316	0.313	0.310	0.293	0.306	0.323						
Total sugars	0 days	24.45	24.50	24.53	24.50	24.70	24.64	24.54	24.45	24.71	24.59	24.62	24.85	0.030	-	0.0026	0.126*	-	0.1095*
	15 days	24.24	24.49	24.52	24.49	24.69	24.69	24.53	24.24	24.44	24.58	24.61	24.84						
	30 days	24.43	24.48	24.51	24.48	24.68	24.62	24.51	24.42	24.69	24.56	24.60	24.83						
	45 days	24.42	24.46	24.49	24.48	24.66	24.61	24.50	24.40	24.68	24.55	24.58	24.80						
Reducing sugars	0 days	5.253	5.426	5.426	5.293	5.253	5.293	5.326	5.486	5.446	5.436	5.293	5.503	0.029	0.0029	0.0025	0.012*	0.012*	0.0010*
	15 days	5.266	5.440	5.443	5.306	5.270	5.303	5.343	5.496	5.460	5.450	5.306	5.526						
	30 days	5.276	5.460	5.453	5.316	5.280	5.313	5.353	5.506	5.466	5.460	5.316	5.540						
	45 days	5.286	5.460	5.463	5.326	5.290	5.323	5.363	5.516	5.476	5.470	5.326	5.550						

*= Significant Table 2-Continued

Table 2: Continued

Treatments	Storage	Treatments T_0t_1	T_0t_2	T_0t_3	T_1t_1	T_1t_2	T_1t_3	T_2t_1	T_2t_2	T_2t_3	T_3t_1	T_3t_2	T_3t_3	S.E. Temp	S.E. Storage	S.E. Timing	C.D. Temp	C.D. Storage	C.D. Timing
Non-reducing sugars	0 days	19.20	19.08	19.11	19.21	19.45	19.35	19.21	19.08	19.26	19.15	19.33	19.34	0.028		0.024	0.116*		0.1011*
	15 days	19.18	19.05	19.11	19.19	19.40	19.33	19.19	19.01	19.24	19.13	19.30	19.31						
	30 days	19.15	19.03	19.08	19.16	19.37	19.31	19.16	18.91	19.22	19.10	19.28	19.29						
	45 days	19.13	19.00	19.03	19.15	19.34	19.29	19.14	18.88	19.20	19.08	19.26	19.25						
Vitamin C	0 days	27.80	26.40	26.10	28.00	27.50	27.00	26.80	26.30	26.00	25.00	24.60	24.20	0.30	0.17	0.24	0.96*	0.77*	0.88*
	15 days	26.3	25.00	24.90	26.00	26.30	25.80	25.20	25.00	24.80	23.80	22.80	22.30						
	Bacterial count/ml	1235	1345	1296	1600	1540	1460	1240	1355	1395	1185	1165	1047	14.08	SE=14.08*				
	Yeast and mold count/ml	595	575	545	800	760	720	650	600	570	520	494	465	54.26	SE=54.26*				

*= Significant

whey-guava beverage ranged from 24.24 to 24.85 while reducing and non-reducing sugars ranged from 5.253 to 5.303% and 18.88 to 19.45% respectively. Pasteurization and storage for one and half months did not affect total sugars and increase in reducing sugars was significant. However, non-reducing sugars decreased non-significantly ($P< 0.05$) during the storage period probably due to low hydrolysis of sucrose as shown by concomitant reduction in total sugars. Ascorbic acid ranged from 22.3 to 27.8 during the storage period. Storage of juices resulted in significant ($P< 0.05$) losses of ascorbic acid. Total bacterial count and yeast and mould count of various treatments of whey-guava beverage was between 1047 to 1600/ml and 465 to 800/ml, which reduced to negligible level on pasteurization and remained stable during the entire storage period. The contamination of juice with bacteria may result from wide spread presence in the air as well as contamination from the extracting machine and utensils used.

CONCLUSION

From the studies it can be concluded that the beverage pasteurized at (70°C for 35 minutes, high temperature for long time was most acceptable comparable to that beverage pasteurized at lower temperature for short time in respect of shelf life, bacterial count, yeast and mould count, colour, flavour, texture, overall acceptability and having highest value of pH, protein, total sugars and reducing sugars content among all samples.

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