IJASRM
International Journal of Advanced Scientific Research and Management, Vol. 2 Issue 8, August 2017.
www.ijasrm.com
ISSN 2455-6378

Effects of Time-Temperature treatments on the sensory, nutritional and microbiological properties of whey based guava beverage during storage periods

Farhan Mohiuddin Bhat*[1], Rongen Singh [2] and Charanjeet Singh Riar [3]

[1,3] Sant Longowal Institute of Engineering & Technology Longowal
Sangrur, Punjab India

[2] Sam Higginbottom Institute of Agriculture, Technology and Sciences,
Allahabad, UP, India

Abstract:
Research was carried on the formulation, nutritional assessment and shelf life studies of whey based guava beverage, which will be economical and environmentally friendly for dairy and pollution controlling agencies. This development of energy drink will be of great benefit to the dairy and cheese industry. The formulated product was given different treatments of time and temperatures for determining the desirable characteristics regarding its nutritional parameters and shelf life. The proportion of whey and guava pulp for the formulation was determined after several trials to be 67.5 and 20 % v/v. The different pasteurization treatments were given to it at 60^{o}C, 65^{o}C, and 70^{o}C for 15, 25 and 35 minutes, after which the best quality was assessed by sensory, nutritional and storage studies. Among the different time-temperature combinations the treatment given at 65^{o}C for 25 minutes was analyzed to be the appreciable. Samples were analyzed for sensory, nutritional and microbiological analysis after regular intervals of 15, 30, 45, 60, 75, and 90 days. The results depicted an increasing trend in TSS, acidity, reducing sugar and a decreasing trend in the pH, lactose and ascorbic acid. Microbial counts were enumerated by using standard methods.
Keywords: Whey, guava pulp, chemical analysis, microbiological quality.

Practical application

The utilization of whey in the formulation of instant drinks provide essential minerals and proteins to the weaker and poorer sections of society at a lesser price. The blending of guava in the preparation of whey beverage enhances vitamin C content besides lacerative sensory characteristics. The major advantage of utilizing whey in the beverage making proved beneficial in reducing the disposal problems associated with whey and reduces the severe environmental complication in both terrestrial and aquatic biomes.

1. Introduction

Whey is the liquid by product in curdled milk and in cheese and paneer manufacturing units. Technology associated with processing of whey are at an increasing pace due to its several commercial uses as energy boosters in sports persons, body building enhancer in weightlifters, structural agents in some edible packaging films and in various miscellaneous purposes. Whey contains about 50% of the original milk solids originally present in milk and possess higher amount of organic matter (6-7%) comprising of fat, protein, sugar, minerals and water soluble vitamins. Whey has been associated with a major environmental problem as a pollutant, which results in the framing of regulations for their disposal by

environmentalists. Researchers have revealed the functional and health benefits of whey and whey components in numerous volumes. They determined the role of whey and its components for their nutritional, physiological, epidemiological and functional benefits (*Lobo et al. 2007*; *kolida and Gibson 2008*). Whey constitutes 45-50% of total milk solids, 70-90% minerals present in milk, 20% milk proteins (65% of beta-lactoglobulin, 25% alpha-lactaalbumin, 8% of serum albumin, and trace amounts of glycomacropeptide, bovine serum albumin, lactoferin, immunoglobulins, and phospholipoproteins), 70% lactose, and almost all the water soluble vitamins present in the milk. The water soluble vitamins include 40-70% of vitamin B12; 55 -75% of vitamin B6 and pantothenic acid;70-80% of riboflavin and biotin; 80-90% of thiamine, nicotinic acid, folic acid and ascorbic acid (*zadow 1992*). Whey proteins possess biological value (100) in excess of casein, beef, soy protein and also contains higher amount of sulphur containing amino acids such as cysteine and methionine.whey is an excellent source of electrolytes such as potassium and sodium, which is having an important role in maintaining osmotic equilibrium of body by retaining water and in preventing from diarrhea. Zinc and magnesium has been found in trace amounts (*Zadow 1992).*Lactose present in whey helps in the absorption of these mg and zinc ions (*Ziegler and Fomon 1983*). In India is an increasing potential for the production of whey from milk and milk products due to its consumption at a large scale (*Sukumar 2002*), and about two million tons of nutritious whey solids are generated per annum .this consists of about 130,000 tones of valuable milk nutrients (*Khamrui and Rajorhia 1998*). Moreover, it is adding Biological oxygen demand of approximately 35,000 to 45,000 mg/l to the effluent, which is considered to be 200 times more than before its disposal. Therefore technology associated with its processing would be of great benefit to the dairy processing industries. Whey based beverages have been marked as a thirst quencher, refreshing drink, energy provider, laxative, besides nutritious. Whey blended fruit drinks are much better for health in comparison to other drinks. Whey with its bioactive components have been associated in treatments of cervical chronic diseases like cancer, cardiovascular, HIV etc. due to its excellent nutritional properties it can be used in formulation of infant Geriatric drinks and Athletic drinks. Researchers have done lot of efforts for the formulation of whey into beverages either by fermentation or without fermentation for human consumption as a delicious ready to drink beverage. (*Reddy et al. 1987; Singh et al. 1999; parrondo et al. 2000*).

Guavas possess a strong, sweet, pleasant fragrance and are rich in vitamins A and C, folic acid, besides dietary minerals including potassium, copper and manganese. Guavas have generally low-calorie profile of essential nutrients, and a single guava fruit possess four times the content of vitamin C than an orange. Guavas are rich in carotenoids and polyphenols like (+)-gallocatechin, leucocyanidin, guaijaverin, and amritoside. Which are the major classes of antioxidant pigments and give them relatively high antioxidant values. Guava's were used as a formulated agent in whey beverages due its desirable attributes like are cholesterol and sodium free, low in fat and calories. It also is rich source of vitamin, carotenoids (vitamin A), folate, potassium, fiber, calcium and iron. Guavas addition contributes excellent nutritional value, pleasant flavor and meditational characteristics. (*Zietemann and Roberto 2007*). It acts as a resistant against cough and aids in digestion process. As the fruit is available in abundance during production season, are highly perishable in a nature, the fruit is available at a very remunerative price.

2. Material and Methods

2.1. Collection of milk samples: Milk samples for whey production were obtained from institute's dairy plant maintained at Department of Animal Husbandry and Food and Dairy technology

2.2. Whey separation: whey was obtained from standardized milk by coagulating milk with 2% citric acid solution at 80^{o}C under continuous stirring and then draining the whey from the remaining chakka by filtering through cheese cloth.

2.3. Standardization and pasteurization of whey: standardization of whey was done by maintaining it to a predefined acidity level of 0.6 to 0.7 per cent by diluting with water and then subjected to heat treatment at 80^{o}C by boiling water bath in order to ensure microbial destruction. This was followed by cooling at room temperature.

2.4. Processing of guava pulp: clean and fresh guavas were peeled and diced into pieces fallowed by mixing with water in equal proportion containing250 mg/l ascorbic acid in order to prevent 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 mixture was than grinded in a mixer fallowed by filtration through a muslin cloth.

2.5. Development of whey guava beverage.

Whey (67.5%) sugar (12.2%) and citric acid (0.3%) were heated at 45^{o}C so as to dissolve properly. guava pulp (20%) was mixed thoroughly with the above mixture and stabilizer sodium alginate (1%) was finally added. Heat treatment at 80°C for15 minutes was given to the mixture fallowed by filtering and filling into glass bottles, sterilized at 121°C for 10 minutes. The processing steps are indicated in the flow sheet diagram given in table 1. The prepared beverage was then pasteurized at 60°C, 65°C and 70°C for 15 minutes, 25 minutes, 35 minutes each. The processed whey guava beverage contains 20% guava juice, 15% total soluble solids and about 0.3 % acid. It is an instant energetic drink and is consumed without dilution.

2.6 Storage studies.

The storage of whey based guava beverage were analyzed for physic-chemical, sensory and microbiological properties for 90 days by storage under refrigeration. The juice was evaluated at regular interval of 15 days.

3. Microbiological analysis

3.1. Standard plate count. 1 ml of the whey-guava beverage was transferred aseptically with a sterile pipette to the test tube no1. The pipette was discarded and the culture was diluted 10 times to 10^{-1}.1 ml sample from test tube no 1 was transferred to test tube no 2 with a fresh pipette. The culture was thus diluted 100 times to 10^{-2}.this procedure was repeated up to 10^{-6} dilution. From 10^{-3} dilution 1 ml of suspension was taken and transferred into the plates. This procedure was repeated for10^{-4}, 10^{-5}, 10^{-6}. The temperature of the molten agar was checked to assure the temperature was 45^{o}C. Using sterile techniques the agar was poured into 8 different plates and the plates were rotated gently to ensure uniform distribution of the cells in the medium. Once the agar has solidified; the plates were incubated in an inverted position for 24-48 hours at 37^{o}C.

4. Chemical analysis

Total soluble solids in the prepared beverage was analyzed by Refractometer and acidity measured as percentage of lactic acid and ascorbic acid in whey and guava in the formulated beverage by titration method as given by AOAC (1995).The Ph of the product was determined by using digital pH meter. Reducing sugar was estimated by fallowing the procedure of Lane and Eyan (Ranganna 1986). The ascorbic acid was determined by 2, 6 dichlorophenol indophenols titration method (AOVC 1996). 2, 6 dichlorophenol indophenols is an alkaline solution blue in color reduced by ascorbic acid to colourless form. Lactose in whey guava beverage was calculated by Lane and Eynon method. Fat was determined by Gerber method. Protein content was determined by kjeldahl nitrogen method (BIS 1961).

5. Results and discussion

The experiments were conducted to study the preparation, quality evaluation and shelf life studies of whey-guava beverage. Studies on quality were based on physicochemical characteristics (protein, lactose content, vitamin C content, fat and mineral content) and sensory characteristics during storage periods. Sensory evaluation of the samples including color, taste, flavor and overall acceptability were done on 9 point hedonic scales are presented in Table 1.

IJASRM
International Journal of Advanced Scientific Research and Management, Vol. 2 Issue 8, August 2017.
www.ijasrm.com
ISSN 2455-6378

Table 1: Effect of various treatments on the sensory score of Whey- Guava beverage (Max 9.0)

Treatments	Storage	**Treatments……** T_O	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
Color	**0 Days**	7.5	8	8	8.25	8	8.25	8	8.25	8	7.5
	15 Days	7	7.75	8	8	8	8.25	8	8.25	8	7.5
	30 Days	6.5	7.5	7.75	8	7.75	8	7.75	8	7.75	7
	45 Days	6	7	7.5	7.75	7.5	8	7.75	8	7.75	7
	60 Days	5.5	6.75	7	7.5	7.5	7.75	7.5	7.5	7.5	6.75
	75 Days	5	6.5	6.75	7	7	7.5	7	7.5	7	6.5
	90 Days	4.75	6	6.5	7	6.75	7	6.5	7.25	7	6.25
Taste	**0 Days**	6.5	7.5	8	7.5	8.5	8.75	7.75	8.25	8.25	7.75
	15 Days	6	7.25	7.5	7.5	8	8	7.5	8	8	7.5
	30 Days	5	7	7.25	7	7.5	7.5	7.25	7.75	7.5	7
	45 Days	4	6.5	6.75	7	7.5	7.5	6.75	7.5	7.25	6.75
	60 Days	3	6.25	6.5	6.75	7	7.25	6.5	7	6.75	6.5
	75 Days	2	6	6	6.5	6.75	7	6.25	6.75	6.5	6.25
	90 Days	1	5.5	6	6.25	6.5	6.25	6	6.5	6	6
Flavor	**0 Days**	7.5	8	8.25	8	8.25	8	8.75	7.75	8	7.75
	15 Days	7	7.5	8.25	8	8.25	8	8.75	7.5	8	7.5
	30 Days	6.5	7.25	8	7.75	8	7.5	8.5	7.25	7.75	7
	45 Days	6	6.75	7.75	7.5	8	7.25	8.5	7	7.5	7
	60 Days	5.5	6.5	7.5	7.5	7.5	7.25	8	7	7.25	6.76
	75 Days	5	6	7	7	7.5	7	7.75	6.75	7	6.5
	90 Days	4.5	5.5	7	7	7.25	7	7.5	6.5	7	6.25
Overall acceptability	**0 Days**	8.5	8.5	7.5	7.5	8.25	8.5	8	8.25	8	7.5
	15 Days	8	8.25	7	7.5	8	8.25	8	8.25	7.75	7.5
	30 Days	7.5	8	6.75	7	8	8	7.5	8	7.5	7
	45 Days	7	7.5	6.5	7	7.75	8	7.25	8	7.25	7
	60 Days	6.5	7.25	6.25	6.5	7.5	7.75	7	7.5	6.75	6.75
	75 Days	6	7	6	6.25	7.25	7.5	6.75	7.25	6.5	6.5
	90 Days	5.5	6.75	6	6	7	7.25	6.5	7	6.25	6

	S.E Temp	S.E Storage	S.E Timing	C.D Temp	C.D Storage	C.D Timing
Color	0.06	0.06	0.05	0.24*	0.24*	0.24*
Taste	0.11	0.11	0.1	0.48*	0.48*	0.43*
Flavor	0.13	0.13	0.11	0.55*	0.55*	0.58*
Overall Acceptability	0.07	0.07	0.06	0.31*	0.31*	0.25*

*= Significant

IJASRM
International Journal of Advanced Scientific Research and Management, Vol. 2 Issue 8, August 2017.
www.ijasrm.com
ISSN 2455-6378

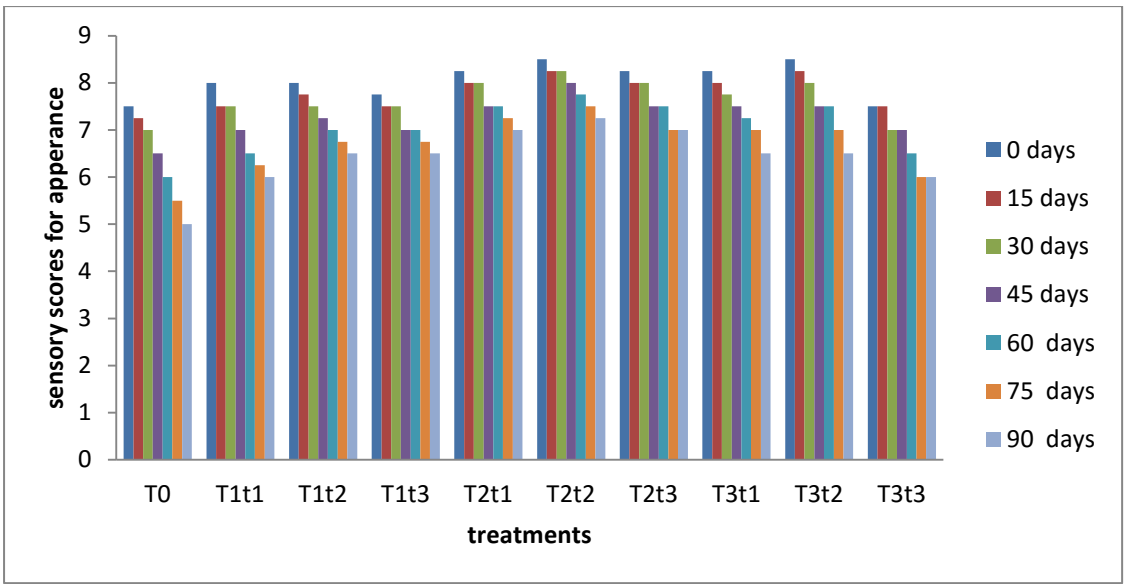

Figure 1: Effects on the appearance of whey-guava beverage during shelf life study.

Storage periods significantly decreased the sensory properties like color, flavor and overall acceptability.the appreciated property of the prepared beverage was minimal changes in appearance upon storage as revealed from **Figure 1**.Storage period results in the loss of volatile aromatic substances from the beverage as reported by Thakur and Bharwal (1998). The properties of whey – guava beverage were determined by storage material, storage condition and constituents of beverage. The storage studies were conducted at an interval of 15 days up to 90 days. The ratio of 67.5% (Whey):20% (guava juice) was found best for the formulation of whey-guava beverage. The product standardization was done by a panel of judges with the help of nine point hedonic scale. The products were pasteurized at 60^{o}C, 65^{o}C and 70^{o}C for 15, 25 and 35 minutes. Similar temperature combinations were given by Divya and Archana (2009). The protein content of control and experimental beverages of whey-guava beverage varied from 0.306 to 0.298 and 0.318 to 0.330 (Table 2) respectively, and pasteurization temperatures and timings did not affect the protein percentage of whey –guava beverage to a greater extent. Wazir Singh *et al*. (1999) developed a soft beverage from paneer whey and guava and the percentage of protein was 0.31%. The lactose content of control and experimental beverage varied from 5.24 to 3.42 and 5.15 to 4.88 (Table 2) respectively. Lactose is largely removed in the whey during paneer making. Lactose content was higher in cheese whey, which is a limitation of cheese whey as a base for whey beverages against lactose intolerance. During acid precipitation, more highly ionized calcium was produced which leads to higher calcium quantities in paneer whey. This was conceptualized by Wong *et al*. in 1978 and later confirmed by Padmavati *et al*. (2007).

The PH of control and experimental beverage varied from 4.10 to 3.83 and 3.93 to 3.87, (Table 2) and there was not much difference among the samples and pasteurization at different temperatures and timings did not affect the acidity, pH of whey guava beverage was reduced slightly during storage period. But during the storage the acidity of control and experimental whey – guava beverage varied from 1.37 to 1.46 and 1.31 to 1.42 (Table 2). The acidity of whey-guava beverage was slightly increased due to increase in lactic acid and amino acids from lactose and protein present in whey as confirmed by Sikder *et al.* (2001) for mango RTS . Singh (1985) found and increase in acidity of guava R.T.S. and nectar during storage of four months. This was also evidenced by Farhan and Rongen, (2014)

The vitamin C in mg/100g of control and experimental beverage varied from 36.86 to 20.87 and 35.82 to 18.68 (Table 3). Storage of juices resulted in significant losses of ascorbic acid. Variation can also be created by differences in processing methods. The extent of loss is primarily a function a function of storage temperature and time. Total sugar content of various treatment of Whey – guava beverage ranged from 24.36 to 24.85, while reducing and non –reducing sugars ranged from 5.251 to 5.578 and 12.45 to 19.36 (Table 3). Pasteurization and storage for one and half months did not affect total sugars and increase in reducing sugars was significant.this is in conformity with Sirohi *et al*.2005, who found that Total sugar content in whey-based mango herbal beverage did not show significant variation with storage. Increase in

reducing sugars may be due to inversion of non-reducing sugar to reducing sugar as reported by Srivastava, 1998 and Aruna *et al*, 1997. However, non-reducing sugars decreased non-significantly during the storage period probably due to low hydrolysis of sucrose as shown by concomitant reduction in total sugars. Similar results have been reported by Krishnaveni *et al*. (2001) for jackfruit beverages.

Table 2: Effect of various treatments and storage periods on the physico-chemical characteristics of whey-Guava beverage.

Treatments……..……

Treatments	Storage	T_O	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
Protein	**0 Days**	0.306	0.318	0.315	0.318	0.328	0.332	0.318	0.308	0.326	0.344
	15 Days	0.305	0.317	0.313	0.316	0.326	0.33	0.316	0.308	0.323	0.342
	30 Days	o.303	0.316	0.311	0.313	0.326	0.328	0.312	0.306	0.321	0.337
	45 Days	0.301	0.312	0.309	0.31	0.322	0.325	0.308	0.304	0.318	0.332
	60 Days	0.298	0.308	0.306	0.308	0.318	0.322	0.306	0.296	0.313	0.33
	75 Days	0.296	0.306	0.303	0.305	0.316	0.314	0.303	0.293	0.306	0.327
	90 Days	0.293	0.303	0.3	0.303	0.312	0.31	0.301	0.288	0.302	0.324
Lactose	**0 Days**	5.24	5.23	5.24	5.22	5.24	5.21	5.22	5.23	5.21	5.22
	15 Days	5.12	5.15	5.16	5.14	5.14	5.15	5.16	5.18	5.17	5.19
	30 Days	4.86	5.05	5.1	5.05	4.88	5.11	5.1	5.13	5.14	5.15
	45 Days	4.52	4.97	5.02	4.98	4.53	5.03	5.05	5.08	5.1	5.12
	60 Days	4.02	4.89	4.94	4.89	4.04	4.96	4.99	5.04	5.04	5.04
	75 Days	3.87	4.83	4.85	4.81	3.89	4.87	4.93	4.99	4.96	4.97
	90 Days	3.42	4.72	4.78	4.72	3.45	4.8	4.87	4.94	4.88	4.88
Acidity	**0 Days**	1.37	1.31	1.24	1.35	1.34	1.35	1.27	1.4	1.32	1.26
	15 Days	1.38	1.33	1.26	1.36	1.36	1.37	1.3	1.42	1.34	1.28
	30 Days	1.39	1.36	1.27	1.38	1.38	1.38	1.32	1.43	1.35	1.31
	45 Days	1.41	1.38	1.29	1.41	1.39	1.4	1.35	1.45	1.37	1.34
	60 Days	1.43	1.4	1.31	1.42	1.41	1.42	1.37	1.46	1.38	1.37
	75 Days	1.44	141	1.33	1.44	1.42	1.44	1.4	1.47	1.39	1.4
	90 Days	1.46	1.43	1.37	1.46	1.44	1.47	1.42	1.49	1.42	1.42
pH	**0 Days**	4.1	3.93	4.15	4.03	4.13	4	3.91	4.1	3.93	4.2
	15 Days	4.07	3.93	4.13	4.01	4.1	3.92	3.86	4.05	3.9	4.17
	30 Days	4.05	3.91	4.06	4	4.03	3.9	3.85	4.03	3.87	4.14
	45 Days	4.03	3.86	4.02	3.96	4	3.86	3.85	4.01	3.86	4.1
	60 Days	4	3.85	4	3.92	3.92	3.8	3.8	3.98	3.83	3.97
	75 Days	3.87	3.83	3.96	3.9	3.87	3.78	3.78	3.96	3.8	3.92
	90 Days	3.83	3.82	3.93	3.87	3.83	3.76	3.75	3.93	3.78	3.87

	S.E Temp	S.E Storage	S.E Timing	C.D Temp	C.D Storage	C.D Timing
Protein	0.0025	0.0025	0.0032	0.011*	0.011*	0.0094*
Lactose	0.027	0.0028	0.0025	0.013*	0.013*	0.011*
Acidity	0.027	0.027	0.025	0.12*	0.12*	0.10*
pH	0.03	0.03	0.02	0.11*	0.10*	0.08*

*=Significant

Total bacterial count and yeast and mold count of various treatments of whey-guava beverage was between 24753 to 28350/ml, and 423 to 973/ml, (Table 3) which reduced to negligible level on pasteurization and remained stable during the entire storage period.

IJASRM

International Journal of Advanced Scientific Research and Management, Vol. 2 Issue 8, August 2017.

www.ijasrm.com

ISSN 2455-6378

Table 3: Effect of various treatments and storage periods on the physico-chemical characteristics of whey-Guava beverage.

Treatments……

Treatments	Storage	T_O	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
Vitamin C	**0 Days**	36.86	35.82	32.78	28.83	34.67	30.67	26.76	33.67	26.85	24.85
	15 Days	34.76	32.75	30.83	27.67	34.47	30.87	26.43	33.24	26.67	24.45
	30 Days	32.74	27.83	27.57	25.75	32.92	28.65	25.67	32.78	25.36	23.62
	45 Days	28.67	26.67	25.74	22.57	30.85	27.43	24.75	32.42	24.67	23.28
	60 Days	25.54	24.72	21.65	20.68	28.84	25.28	22.56	30.78	22.84	21.57
	75 Days	23.53	20.57	19.46	19.84	25.76	23.87	20.85	28.84	19.57	19.84
	90 Days	20.87	18.68	18.82	19.55	23.77	21.75	19.78	27.78	18.38	18.74
Total Sugars	**0 Days**	24.57	24.52	24.72	24.67	24.56	24.72	24.58	24.64	24.85	24.62
	15 Days	24.48	24.49	24.7	24.64	24.54	24.71	24.57	24.63	24.84	24.61
	30 Days	24.46	24.48	24.69	24.63	24.51	24.75	24.52	24.62	24.83	24.58
	45 Days	24.42	24.48	24.68	24.62	24.48	24.69	24.53	24.6	24.88	24.56
	60 Days	24.38	24.46	24.66	24.62	24.45	24.68	24.58	24.58	24.87	24.53
	75 Days	24.36	24.44	24.64	24.61	24.42	24.66	24.57	24.57	24.76	24.52
	90 Days	24.32	24.42	24.61	24.6	24.4	24.63	24.54	24.55	24.73	24.5
Reducing Sugars	**0 Days**	5.426	5.292	5.251	5.283	5.324	5.387	5.437	5.426	5.284	5.493
	15 Days	5.442	5.306	5.268	5.296	5.34	5.406	5.443	5.434	5.291	5.504
	30 Days	5.458	5.314	5.273	5.303	5.351	5.414	5.448	5.45	5.306	5.526
	45 Days	5.464	5.324	5.28	5.312	5.363	5.425	5.457	5.46	5.317	5.541
	60 Days	5.501	5.334	5.291	5.324	5.374	5.436	5.471	5.471	5.328	5.552
	75 Days	5.523	5.342	5.312	5.341	5.382	5.445	5.483	5.483	5.342	5.564
	90 Days	5.542	5.412	5.334	5.372	5.413	5.531	5.497	5.496	5.351	5.578
Non – Reducing Sugars	**0 Days**	19.32	19.33	19.45	19.36	19.32	19.12	19.27	19.27	19.34	19.35
	15 Days	19.17	19.33	19.4	19.33	19.3	19.03	19.28	19.25	19.31	19.33
	30 Days	18.37	19.26	19.36	19.3	19.27	18.97	19.25	19.22	19.29	19.3
	45 Days	17.5	19.2	19.3	19.2	19.22	18.8	19.2	19.18	19.2	19.26

IJASRM International Journal of Advanced Scientific Research and Management, Vol. 2 Issue 8, August 2017.
www.ijasrm.com
ISSN 2455-6378

	3			7		6	2		6	
	15.4	19.1		19.2		18.7	19.1		19.2	
60 Days	6	2	19.22	4	19.18	2	8	19.15	2	19.23
	14.4	19.0				18.6	19.1		19.1	
75 Days	3	8	19.13	19.2	19.12	3	2	19.1	8	19.19
	12.4	19.0		19.1		18.5	19.0		19.1	
90 Days	5	1	19.03	5	19.8	2	6	19.06	5	19.15
	TNT	TNT		2796		2653	2526		2543	
Bacterial count/ml	C	C	28350	0	27463	7	0	26875	2	24753
Yeast & mold count/ml	973	952	871	835	743	652	613	597	487	423

	S.E Temp	S.E Storage	S.E Timing	C.D Temp	C.D Storage	C.D Timing
Vitamin C	0.31	0.17	0.25	0.95*	0.77*	0.87*
Total Sugar	0.031	-	0.027	0.125*	-	0.1085*
Reducing Sugar	0.028	0.0028	0.0025	0.013*	0.013*	0.0011*
Non Reducing Sugar	0.027	-	0.025	0.115*	-	0.1011*

*= Significant

Pharmalogical properties

Whey protein acts as an essential source of amino acids and has a key role in reducing the risks of diseases such as heart disease and cancer. Whey contains branched-chain amino acids (BCAAs) in abundance, which acts to fuel muscles in athletic and working persons by synthesizing proteins. Whey contains amino acid leucine in abundance, which has a main role in maintaing the transcription of protein synthesis. Leucine may recover the degeradation in body quickly by synthesizing proteins and act as a cushion aganist stress. Whey protein contains cysteine, an amino acid used for glutathione. Actually, this amino acid is not used for the manufacture of glutathione, researchers have revealed that whey protein consumed in large amounts increase cellular glutathione levels. Which is an antioxidant that protects the body against damage from free radical and some toxins, and experimentations performed in animals have established that milk proteins might reduce the risk of cancer.

Whey protein represents an excellent protein of choice for age groups. It provides a number of health benefits and is essential in various physiological activities like weight management, immune support, sports nutrition, bone health, and general wellness. Researchers discover the novel properties associated with whey protein and its associated amino acids and discover their applications in various delicious drinks, variety of beverages, protein supplements and fortification practices. Beverages based on whey proteins act as a nutritional supplement, comes derived from the natural proteins originally found in milk. Of the various kinds of protein found in foods, the University of California reports that whey is one of the most digestible forms available. People drink whey protein for numerous reasons, depending on their health goal. Because everyone's nutritional needs vary depending on their personal lifestyle,

The various benefits associated with the whey beverages are as follows:

Enhanced Immunity

Drinking whey protein boosts the levels of the antioxidant glutathione in your body, reported by McKinely Health Center and the University of Illinois. That can help improve the strength and response of your immune system. In the long run, that may result in lower levels of sickness.

Reduced Blood Pressure

In a November 2010 study published in the "International Dairy Journal," determined the effects that regular intake of a whey supplement drink had on the blood pressure of 71 students ages 18 to 26 at Washington State University. The researchers found an average six-point reduction in the students' blood pressure. Each beverage contained 28 g of whey protein.

Increased Muscle Recovery after Exercise

After you work out, your muscles need amino acids and nutrients to quickly recover and rebuild with minimal amounts of pain and discomfort. The faster your muscles get these nutrients, the better. Of the various forms of protein supplements that can help during your post-workout recover, whey protein's amino acids and complex nutrients get absorbed much faster than other forms of protein popular among athletes, such as casein.

Improved Body Composition

Drinking whey protein daily may help improve your body's lean composition in several ways. For example, it delivers muscle-building protein without excess fats and carbohydrates, leading to leaner and biggest muscles. Professional athletes should consume 0.5 g of whey protein per pound of body weight, and bodybuilders, should consume 0.8 g per pound of body weight.

Weight Loss

Whey protein is rich with leucine, a branched-chain amino acid. It contains more of this acid than eggs or soy. Leucine may help promote fat loss while simultaneously preserving muscle tissue of body. (McKinley Health Center).

1.1 Improved Bone Strength

Whey protein beverages aren't just high in protein; they also often have high levels of calcium due to the dairy origins of the whey. Together, the protein and mineral may help increase your bone density. MayoClinic.com suggests consuming 40 mg of whey protein, combined with milk for six months or more for better bone density.

Multivariate analysis

In the research done on the formulation of whey-guava beverage, the PCA has been performed on the results obtained to achieve the reduction of values but ensuring the maximum number of variables presented in experimental work. The Eigen value along with % total variance and cumulative % are given in table 4.The loading factors for the first three components (PCs) are given in Table 5. The first three principal components accounted to 74.91% of the variance in the analysis of stored beverages, with first, second and third principal components (PC1, PC2, PC3) depicted 32.66 %, 22.26 % and 19.97 % of the variance, respectively. From the data of loading matrix presented Table 4, it depicted that 32.67% variability represented by (factor1) was positively correlated with variables viz. protein and reducing sugars. (Figure 2). The second component (PC2=22.27%) showed positive correlation with vitamin C and PH. The third component (PC3=19.98 %) was negatively correlated with reducing sugar as evidenced from figure 3. This might be due to increased storage periods resulting in the degradation of sugars.

Table-4. Principal component analysis

Total variance explained				
PC	**Eigen Value**	**% Total Variance**	**Cumulative Eigen value**	**Cumulative %**
1	1.960088	32.66813	1.960088	32.6681
2	1.335996	22.26660	3.296084	54.9347
3	1.198702	19.97837	4.494786	74.9131

Table-5 Principal component analysis, loading of the first three components

	Principal components		
Factors loading	1	2	3
Protein	0.794179	-0.193468	-0.244284
Lactose	0.483956	0.567597	0.025297
Acidity	-0.780742	-0.260039	-0.301064
pH	0.212750	0.563008	-0.636279
Vitamin C	-0.654485	0.597021	-0.252676
Reducing Sugar	0.109461	-0.485147	-0.760954

IJASRM International Journal of Advanced Scientific Research and Management, Vol. 2 Issue 8, August 2017.
www.ijasrm.com
ISSN 2455-6378

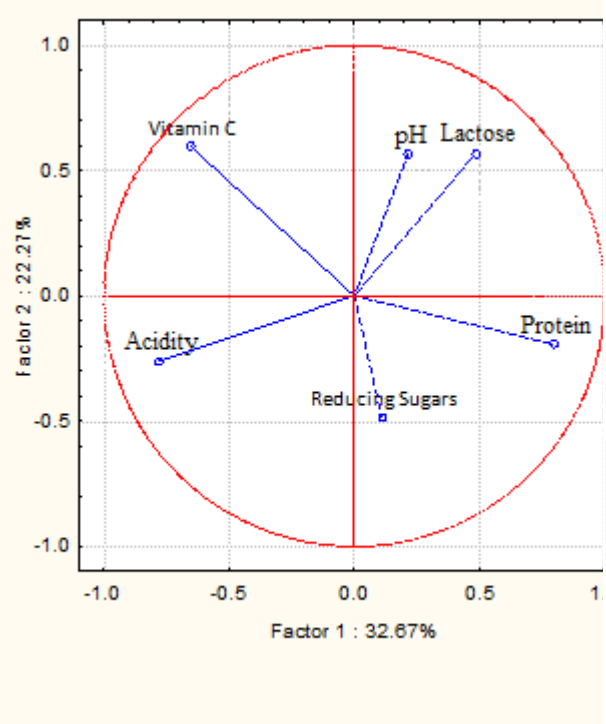

Figure 2. Projections of the variables on the factor plane for whey-guava beverage

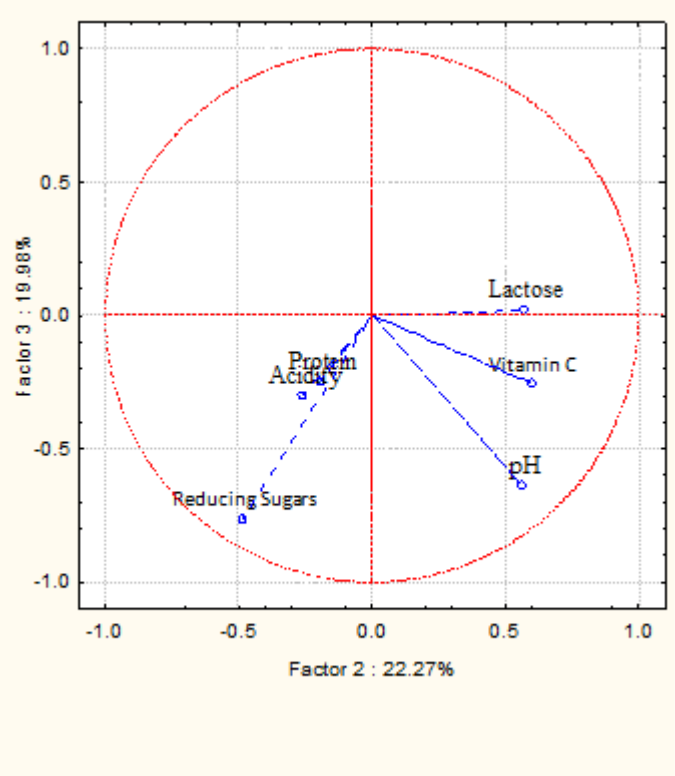

Figure 3 Projections of the variables on the factor plane for whey-guava beverage

6. Conclusion

Whey-guava beverage having the basic constituents whey and guava pulp in the proportion of 67.5:20 (%) was assessed the best formulation in comparison to other recipie formulation, due to appreciable sensory characteristics color, flavor, aroma, taste, mouth feel and overall acceptability. Whey from paneer sources was found to have better results for the preparation of whey- guava beverage, as it have better mineral composition than whey from other sources. This beverage has health and neutraceutical properties due to its high mineral, protein and vitamin C content. It is having the property of economically feasiblity to all section of society and to malnutrition persons as it serves a delicious nutritive beverage for them. The most beneficial use in utilizing whey in beverage formulation apart from its nutritional value is the prevention of environment against the hazardous pollution caused by draining of whey in stream leading to increasing BOD level. This beverage is regarded as regimen for man of all section irrespective of nature, time, place or age.

References

[1] AOAC. Official Methods of Analysis. 6th Edn. Association of Official Analytical Chemists, Washington DC, USA. (1995)
[2] AOVC. Methods of Vitamin Assay, pp 306–312, Association of Vitamin Chemists Inc. Interscience Publishers, New York (1996).
[3] Aruna, K. V., Vimla. N., Giridhar. and Rao, D. G, Studies on preparation and storage of nectar prepared from papaya (Carica papaya L).Beverage Food World. 24: 29-32, (1997).
[4] Bhat, F. M. and Singh, R. Preparation, Quality Evaluation and Shelf Life Studies of Whey-Guava Beverage. World Journal of Agricultural Sciences.10: 141-145, (2014).
[5] BIS. Methods of Test for Dairy Industry. Chemical Analysis of Milk. Indian Standards Institution. BIS, New Delhi (1961).
[6] Divya, S., Rongen, S. and Farhan, B. Development, Quality Evaluation and Shelf Life Studies of Whey Guava Beverage. International Journal of Current Engineering and Technology, 2347 – 5161(2014).
[7] Divya. and Archana, K, Effect of Different Temperatures, Timings and Storage Periods

on the Physico-Chemical and Nutritional Characteristics of Whey-Guava Beverage. World Journal of Dairy & Food Science. 4: 118-122 (2007).
[8] Khamrui and Rajorhia, Making profit from whey by utilizing valuable milk nutrients present in whey. Indian Dairyman. 8:13-18 (1998).
[9] Kolida, S. and Gibson, G. R, The prebiotic effect: review of experimental and human data, pp. 69–92. Gibson, G.R., Roberfroid, M.B. (Eds.), Handbook of prebiotics. CRC Press, Boca Raton, (2008)
[10] Kornvalai. P., Wasna, J., Withawat, M. and Siriphan, T. Minimization of sucrose lossess in sugar industry by Ph and temperature optimization. Malaysian journal of analytical sciences. 12: 513-529 (2008).
[11] Krishnaveni, A., Manimegalai, G. and Saravanakumar, R. Storage stability of jack fruit RTS beverage. Journal of Food Science & Technology, 38: 601-602 (2001).
[12] Lobo, A. R., Colli, C., Alvares, E.P., and Filisetti, T. M. C. Effects of fructans-containing yacon (Smallanthus sonchifolius Poepp & Endl.) flour on caecum mucosal morphometry, calcium and magnesium balance, and bone calcium retention in growing rats. British Journal of Nutrition. 97: 776–785, (2007).
[13] Padmavathi, T. K., Thangaraju,P. and Subramaniam, V. S. Comparative analysis ofcheese and channa whey. Tamilnadu J. Vet. Animal Sci.3, 74-77 (2007).
[14] Parrondo, J, Garacia, L. A. and Diaz, M. Production of an alcoholic beverage by fermentation of whey permeate with klyveromyces fragalis: aroma composition. Journal Institute of Brewing. 106: 377-382, (2000).
[15] Ranganna, S. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd Edn, McGraw-Hill Publishing Co.Ltd, New Delhi (1986).
[16] Reddy, G. J., Rao, B. V., Reddy, K. S. and Venkayya, D. Development of whey beverage. Indian Journal of Dairy Science. 40: 445-450, (1987).
[17] Sikder, B., Sarkar, K., Ray, P. R. and Ghatak, P. K. Studies on shelf life of whey-based mango beverages. Beverage Food World. 28:53-54, (2001).
[18] Singh, A. K. Studies on preparation and storage of guava (Psidium guajava L.) beverage. M.Sc. Thesis, N.D. Univ. of Agric. And Tech., Faizabad (1985).
[19] Singh, W., Kapoor, C. M. and Srivastava, D. N. Standardization of technology for the manufacture of guava-whey beverage. Indian Journal of Dairy Sciences.52: 268-270, (1999).
[20] Sirohi, D., Patel, S., Choudhary, P. L. and Sahu, C. Studies on preparation and storage of whey-based mango herbal pudina beverage. Journal of Food Science & Technology. 4: 157-161, (2005).
[21] Srivastava, J. S. Comparative study of RTS drinks prepared from Dashehari and Banganpalli mangoes. Indian Food Packer. 52:38-40, (1998).
[22] Thakur, K. S. and Barwal, V. S. Studies on the preparation and evaluation of squash from unmarketable kiwi fruit. Indian Food Packer. 52:26-27, (1998).
[23] Wazir, S. Standardization of technology for the manufacture of guava whey beverage. Journal of Dairy Science. 52:268-2711, (1999).
[24] Wong, N. P., Lacroix, D. L. and Mcdonough, F. E. Minerals in whey and whey fractions. Journal of Dairy Science.61: 1700-1703, (1978).
[25] Zadow, J. C. Whey and lactose processing. pp. 133–156. Elsevier Applied Science, London (1992).
[26] Ziegler, E. E. and Fomon, S. J. Lactose enhances mineral absorption in infancy. J Pediatr. Gastroenterol, 2:288-294, (1983).
[27] Zietemann, C. and Roberto, S. R. Production of guava nursery plants (Psidiumguajava L.) on different substrates. Revista Brasileira de Fruticultura. 29:137–142, (2007).