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DEVELOPMENT AND STANDARDIZATION OF WHEY BASED GUAVA JUICE

[1]Raut S. P. [2]Sangale A.S. [3]Tonde A. B.*

[1]Student, Saikrupa College of Food Technology, Ghargaon
[2]Student, Saikrupa College of Food Technology, Ghargaon
[3]Assistant Professor, Saikrupa College of Food Technology, Ghargaon
Food Process Technology, SCFT, Ghargaon
Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar (MS), India.

Abstract : Guava fruit is rich in dietary fibers and water-soluble vitamins. Guava has excellent flavour and nutritive value adds to the present potential for development of beverage like ready to serve. Whey is waste utilization of dairy industry which is rich in protein. A study was undertaken to supply an appropriate as prefer guava juice with proper suspension of fruit pulp. The five different composition of guava fruit juice and whey are (S_0 juice 100%, S_1 juice 90% whey 10%, S_2 juice 80% whey 20%, S_3 juice 70% whey 30%, S_4 juice 60% whey 40%) with constant TSS and 0.3% acidity. Sodium benzoate is used as preservative. The organoleptic properties of juices were evaluated by semi trained panelist consisting of 10 panelists members. The result showed that color, flavour, taste, consistency and overall acceptability of sample S_3 containing 11.32 ºBrix of TSS 70% juice and 30% whey got higher score, other samples were moderately acceptable. After 12 weeks of storage period of S_0, S_1, S_2, S_3 and S_4 sl ightly changed in TSS and acidity.

Key words **– TSS, Preservative, Consistency, Organoleptic Properties, Quality Attributes.**

I. INTRODUCTION

Guava (*Psidium guajava*) *Myrtaceae* family is widely grown everywhere the tropics and sub-tropics though origin of guava (Mitra and Bose, 1990). Guava is popularly known as “poor man apple” available at low price during the season (Mahendr an, 2010). Guava is a usually marketed as "super-fruits" which includes a considerable nutritional importance in terms of vitamins A and C. The higher content of vitamin C (ascorbic acid) in guava is a power house in combating free radicals and oxidation that are key enemies that cause many degenerative diseases. The high content of vitamin A in guava plays a crucial role in maintaining the standard and health of eyesight, skin, teeth, bones and therefore the mucus membranes (Dattatreya *et al*., 2012). Guava fruit is generally consumed as fresh as a dessert fruit or in processed form as puree, juice, concentrate, jam, jelly, toffee, fruit flakes, squash, syrup, nectar, powder, wine, vinegar, able to use snacks, drinks and dehydrated canned products (Lalit *et al*., 2014). In general, both white and pink flesh guava fruits have good value for fresh consumption. Pink varieties are be tter suited to beverage preparation due to their attractive colour. An exotic red flesh guava variety, with high acidity, attractive colour and good flavour was earlier identified because the staple for production of RTS beverage (Tiwari and Dinesh, 2001).

Guava fruit consists of 20% peel, 50% flesh portion and 30% seed core. The fruit has an appreciable amount of minerals like phosphorus (23 – 37 mg/100 g), calcium (14 - 30 mg/100 g), iron (0.6 - 1.4 mg/100g) (Paul and Goo, 1983; Bose and

Mitra, 1999). The fresh guava includes a short period of time (one week), for its high moisture content (Singh *et al.*, 1990). The main contain of guava fruit is as follows.

Table no 1:-Nutritional content of guava fruit (Paul and Goo, 1983; Bose and Mitra, 1999).

Sr.No.	Parameter	%
1	Moisture	74-84
2	Dry matter	13-26
3	Protein	0.8-1.5
4	Fat	0.4-0.7
5	Ash	0.5-1.0
6	Vitamin C	299 mg/100gm

Whey is that the basic by product of cheese manufacturing. Although there are variety of cheese, all cheeses need to und ergo the identical basic processes. Finally, the cheese curd is braked up, separating an expensive cloudy liquid from the solid curd and this liquid cloudy water is known as whey (Senarathna *et al.*, 2009).

A whey drink can replace much of the lost organics and inorganics to the extracellular liquid substance. Whey, which is so rapidly assimilable, forms a perfect metabolic substrate. Whey drinks are light and refreshing but less acidic than fruit juices (Pendergast K, 1985). The conversion of whey into beverage is one amongst the foremost attractive attempts for utilization of whey for human consumption because it's a thirst quencher, light and refreshing, less acidic than fruit juices, has physiological state and nutritional qualities and also it provides a decent ratio (Singh *et al*., 2014).

Whey may be a fluid by-product resulting from the precipitation of proteins within the milk of the cheese industry. it's a greenish-yellow and semi-translucent liquid that recognized as a dilute nutrient stream accounting for 85-95% of the milk volume (Oliveira *et al*., 2018).It consists of 45 to 50% of total milk solids, 70% of lactose, 20% of milk proteins, 70 to 90% of milk minerals and the majority the water-soluble vitamins originally present in milk (Kinsellan, 1984; Horton, 1995). Whey proteins are one among the most effective quality food proteins having a high protein efficiency ratio, stable below pH 4 and a less chalky mouth feel compared to other protein sources, making it a perfect protein source in developing value-added functional beverages (Beristain *et al.*, 2006).

Need for Development of Whey Based Beverage

Using cheese whey as a beverage in human nutrition, especially for therapeutic purposes. Prescribed whey for an assortment of human ailments. The market dynamics is driven on the basis of five key factor groupings: increased concentration in the global beverages market; diverging functional beverage trends worldwide; flavor innovations; product differentiation; and cross-category innovations. Whey beverages are manufactured and formulated keeping in consideration the nutritional values, biological and functional properties. (Chavhan R.S.*et al*., 2015).

Whey is used on larger amounts due to the following reasons:

a) Whey is having a broad range of solubility i.e. from pH 3-8.
b) Whey is having a bland flavor and on many occasion they can act as carrier for the aroma compounds.
c) Addition of whey increases the viscosity of beverages and it also improves the mouthfeel.
d) Whey can be also used to solve the problems associated with cloudiness of tropical fruit juices and produce a cloud stable juice (Chavhan R.S. *et al*., 2015).

II. MATERIALS AND METHODS

***Guava Fruit*:**

Ripe guava fruits (Psidium guajava) were bought from Shrigonda market.

***Preparation of Guava Juice*:**

Guava fruits washed with water and weigh the fruits. Selected fruits were peeled and cut it into small pieces and juice is extracted by using juice extractor then juice is filter through muslin cloth to get the guava pulp. The water was added with the proportion of 1:1 (Bhat F.M. and Singh R., 2014).

***Preparation Of Whey*:**

Standardized milk was used for preparation of excellent quality whey. The milk was heated at 80ºC and for the coagulation of milk 2% citric acid solution was used with continuous stirring was resulted in compete coagulation of milk protein (casein) afterward liquid whey was filtered through muslin cloth (Singh D. *et al*., 2014).

Development and formulation of whey based guava juice

The whey based guava juice were developed and prepared by blending of whey and guava juice with different proportions such as S_o (100% guava juice), S_1 (90% of guava juice, 10% of whey), S_2 (80% of guava juice, 20% of whey), S_3 (70% of guava juice, 30% of whey) and S_4 (60% of guava juice, 40% of whey) rep. The sugar 11% and 350 ppm sodium benzoate was added in the juices by heating to 65 ℃. Thus prepared juice were filled in PET bottles 200ml leaving 2.5 cm headspace sealed airtight. Then store in refrigerated temperature.

Formulations of whey based guava juice

Table no .2 Formulations of whey based guava juice

Sr.no.	Ingredients	Sample 1	Sample 2	Sample 3	Sample 4
1	Guava juice	90 ml	80 ml	70 ml	60 ml
2	Whey	10 ml	20 ml	30 ml	40 ml
3	Sugar	12gm	12.3gm	12.5gm	13gm
5	Sodium benzoate	350ppm	350ppm	350ppm	350ppm

Chemical Analysis

Determination of pH

The pH of the product was determined by using digital pH meter. (Bhat F.M and singh, 2014).

Determination of TSS

Total soluble solids content in fresh and stored product was determined by using hand refractometer of range 0-32º Brix (AOAC 2010).

Determination of titratable acidity

The titratable acidity was calculated in the terms of lactic acid of whey it can be determined by using titration method described in Asian manual of food analysis (Chakraborty I. and Athmaselvi K.A 2014).

Determination of ascorbic acid

The ascorbic acid was determined by using titration method 2,6-dichlorophenol indophenols dye (Ranganna, 2001).

Determination of Fat content

The sample was weighed (5 g) accurately in thimble and defatted with petroleum ether (40-60°C) in Soxhlet extraction apparatus. The resultant ether extract was evaporated and fat content was calculated (A.O.A.C, 2000).

Formula Determination of Fat content

$$\%Fat = \frac{\text{Final weight}}{\text{Initial Weight}} \times 100$$

Determination of protein content

The protein was determined by Micro-Kjeldahl method using sample was digested with concentrated sulfuric acid (H_2SO_4) with catalyst mixture for 3-4 h at 100°C. Then it was distilled with 40 % NaOH and liberated ammonia was trapped in 4 % boric acid and titrated with 0.1 N HCl using mixed indicator (Methyl red: Bromocresol green: 1:5). The percent nitrogen was calculated and percent protein was estimated in the sample by multiplying with factor 6.25 (A.O.A.C, 2000).

Formula for determination of protein content

% protein= % nitrogen x 6.25

Determination of Carbohydrate content

Total carbohydrates in the samples were estimated by hydrolysis method as described in AOAC (1984).

Formula for determination of carbohydrate.

Total carbohydrate (%) = Dextrose % X 0.9

Microbial Analysis

Microbiological analysis of whey based guava juice by the following method of Harrigan (1998). The samples were prepared by 10 fold serial dilution and the total plate and yeast, mould count was estimated by using nutrient agar as medium. The colonies were counted by using colony counter.

Sensory Evaluation

Quality of whey based guava juice was evaluated for sensory characteristics (Color, Taest, Consistency, Flavour & Overall acceptability) during storage on 9 point hedonic scale rating by a semi trained panellist members.

III. RESULTS

The research was conducted to study the quality parameter of whey based guava juice by physico-chemical and sensory parameter during storage period. The five different proportions of juices were prepared by using guava juice and whey.

Nutritional analysis

The sample S3 (70% guava juice, 30% whey 0.3% acidity, 11.32ºbrix) has got high ratings score during sensory evaluations, so only sample no 3 was taken for a nutritional analysis. The results of nutritional analysis are shown in table no 3.

RESULTS OF CHEMICAL ANALYSIS

Table no. 3 Results of Nutritional Analysis

Sr. No.	Test Parameters	Results (g/100gm)
1.	Moisture	85.27
2.	Ash	0.38
3.	Total Fat	0.08
4.	Protein	1.2
5.	Carbohydrates	14.16
6.	Total Sugar	11.87
7.	Reducing Sugar	5.45
8.	Invert Sugar	8.75
9.	Energy Value	57.80 Kcal/100gm

The nutritional composition of product was determined. The moisture content in whey based guava juice is 85.27 g/100g. The ash content in whey based guava juice is 0.38 g/100g. The total fat content in whey based guava juice is 0.08 g/100g. The protein content in whey based guava juice was calculated result is 1.2 g/100g. The carbohydrate content obtained in whey based guava juice is 14.46 g/100g. The total sugar in whey based guava juice is found 11.87 g/100g. The reducing sugar in whey based guava juice is found 5.45 g/100g. The invert sugar in whey based guava juice is 8.75 g/100g. The energy value of whey based guava juice is 57.80 Kcal/100gm.

Table No. 4. Effect on TSS, Acidity and pH during storage period.

			Storage Period (Days)					
Parameters	**Samples**	**0**	**15**	**30**	**45**	**60**	**90**	**Mean**
TSS	S_0	11.20	11.23	11.26	11.29	11.31	11.32	**11.27**
	S_1	11.26	11.30	11.38	11.44	11.46	11.52	**11.39**
	S_2	11.22	11.28	11.35	11.40	11.42	11.49	**11.36**
	S_3	11.32	11.37	11.45	11.47	11.53	11.61	**11.45**
	S_4	11.35	11.41	11.49	11.53	11.57	11.68	**11.50**
	Mean	**11.27**	**11.32**	**11.38**	**11.42**	**11.45**	**11.52**	
%Acidity (as Lactic Acid)	S_0	0.86	0.87	0.89	0.93	0.93	0.95	**0.90**
	S_1	0.20	0.23	0.25	0.28	0.29	0.32	**0.26**
	S_2	0.26	0.28	0.31	0.34	0.37	0.40	**0.31**
	S_3	0.31	0.32	0.35	0.38	0.39	0.39	**0.35**
	S_4	0.37	0.39	0.41	0.43	0.43	0.47	**0.41**
	Mean	**0.40**	**0.41**	**0.44**	**0.47**	**0.48**	**0.50**	
pH	S_0	6.20	6.19	6.16	6.14	6.13	6.11	**6.15**
	S_1	3.50	3.49	3.47	3.46	3.44	3.43	**3.46**
	S_2	3.91	3.89	3.87	3.86	3.83	3.81	**3.86**
	S_3	4.32	4.30	4.28	4.27	4.25	4.23	**4.27**
	S_4	4.56	4.54	4.53	4.51	4.50	4.49	**4.52**
	Mean	**4.49**	**4.48**	**4.46**	**4.45**	**4.43**	**4.41**	

Effect on total soluble solids

The whey based guava juice was analysed and the obtained results are presented in table no.4. The TSS was slightly increased. The differences are obtained in results at the end of 90 days of storage period which indicates that the samples were stable during storage at the temperature 4℃.

Effect on titratable acidity

The increase in acidity was due to conversion of lactose to lactic acid and formation of organic acid reported by sikder *et al.*, (2001) , Ritika *et al.*, (2010). The preserved whey based guava juice quite stable during storage period of 90 days and which confirmed that the product remains fresh.

Effect on pH

The pH of whey based guava juice is present in table no. 4. The pH of whey based guava juice varied from 6.25 to 3.43 and there was not much difference in combination of whey and guava juice affects on the pH of whey based guava juice was slightly decrease (Divya and Archana 2009). In the table No. 4 noticed that decrease of pH value due to acid production during storage reported by sikder *et al*., (2001) and Ritika *et al*., (2010).

Microbiological analysis

Table no. 5 Effect on Microbiological analysis

	Storage period (Week)	Yeast and Mold (log cfu/g)	TPC (log cfu/g)
S_0	0	00	00
	2	00	00
	4	00	00
	8	4.12	5.61
	12	5.31	6.44
S_1	0	00	00
	2	00	00
	4	00	00
	8	5.12	5.41
	12	5.87	6.13
S_2	0	00	00
	2	00	00
	4	00	00
	8	4.95	5.32
	12	5.89	5.98
S_3	0	00	00
	2	00	00
	4	00	00
	8	4.41	4.52
	12	5.13	5.41
S_4	0	00	00
	2	00	00
	4	00	00
	8	4.78	4.93
	12	5.32	5.81

The result shown that the storage period was highly significant on the microbial count of whey based guava juice. The microbial status of the whey based guava juice showed value of yeast and mould count of S_0 (5.31log CFU/g), S_1 (5.31 log CFU/g), S_2 (5.87 log CFU/g), S_3 (5.13log CFU/g) and S_4 (5.32 log CFU/g) respectively. The storage period on the microbial count of the whey based guava juice revealed that the microbial count gradually increased with increment in storage period.

The total plate count of bacteria increased after completion of (84) days storage it reached as follows S_0 (6.44 log CFU/g), S_1 (6.13 log CFU/g), S_2 (5.98 log CFU/g), S_3 (4.52 log CFU/g) and S_4 (5.81log CFU/g).

However, lower microbial load was observed in S_3 (70% of guava juice, 30%of whey 11.32ºBrix 0.31% acidity) i.e. 4.41 to 5.13 CFU/gm. Yeast and mould 4.52 to 5.41 TPC. The result clearly indicated the presence of antimicrobial potential due to addition of preservatives.

Organoleptic properties of whey based guava juice

Table no. 6 Average sensory ratings scores of whey based guava juice

	Colour	Flavour	Test	Consistency	Overall Acceptability
S_0	8.4	8.4	8.8	8.6	7.6
S_1	7.6	7.8	7.8	7.6	7.6
S_2	8.4	7.6	7.8	8.2	7.8
S_3	8.2	8.4	8.8	8.6	8.8
S_4	8.3	7.8	7.8	8	7.8

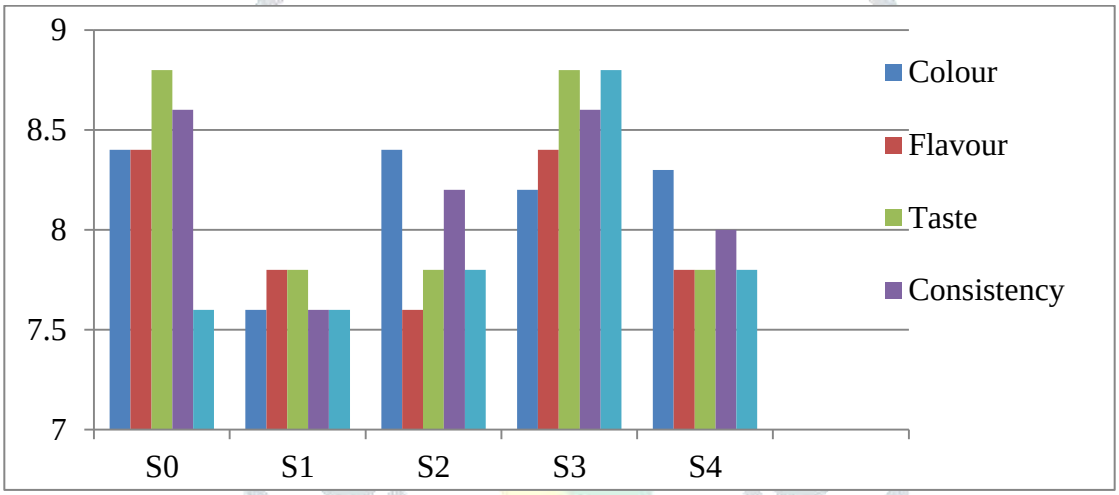

Fig. no. 1 Organoleptic properties of whey based guava juice

The five juices were judged by a semi trained panel of 10 judges. The mean score for color, taste, flavour, consistency and overall acceptability of the sample were evaluated and mean score of the responses are presented in the table no. 6.

Juice sample S_3 has shown the better colour, flavour, consistency and acceptability tan the S_1, S_2, S_4 juice (as shown in fig no 1). The flavour of juice of S_3 was most preferred than other juices. In comparison of flavour, juice S_3 were better than juices S_1, S_2 and S_4. According to the panellist members, flavour of sample S_2 was more acceptable. Consistency of the juice S_3 was most preferred and significantly different than the other juices. Among all sample of juices, taste of S_3 were most preferred than other sample. So the S_3 sample was significantly most preferred than other sample (S_1, S_2, S_4).

IV. DISCUSSION

Maximum increase in TSS was noticed in sample S_3 (70% of guava juice, 30% of whey 11.32ºBrix 0.31% acidity) and S_4 (60% of guava juice, 40%of whey 11.35ºBrix 0.37% acidity). Whey based guava juice shows decreased in pH throughout 90 days of storage period. Maximum decreased in pH was observed in sample S_2 (80% of guava juice, 20% of whey, 11.22ºBrix, 0.22% acidity) i.e. 3.91 to 3.81. Minimum decrease in pH was noticed in sample S_1 (90% of guava juice, 10% of whey, 11.26ºBrix, 0.20% acidity) i.e. 3.50 to 3.43. The obtain results are accordance with sikder *et al*., (2001) and Ritika *et al*., (2010). With the pH ssdecreased the acidity increased, the minimum increases in acidity was observed in the sample S_3 (70% of guava j

uice, 30% of whey 11.32ºBrix 0.31% acidity) i.e. 0.31 to 0.39 and maximum increase in acidity was noticed in the sample S_2 (8 0% of guava juice, 20% of whey, 11.22ºBrix ,0.22% acidity) i.e 0.26 to 0.40 during 90 days of storage period. Whey based guav a juices were prepared with different combination of whey and guava juice was found completely free from spoilage due to effective processing of the product and appropriate storage conditions .

So from the quality evaluation of whey based guava juice it was observed that preserved the quality and sensory parameter of whey based guava juice during the storage period of 90 days. The minimum physico-chemical quality attributes were deteriorated in the juice due to the addition of preservative. These juices provide this preservative effect might be due to their antimicrobial properties as described by Al-Zoreky (2009) and Fratianni *et al*., (2007).

V. CONCLUSION

It can be concluded from the present experiment that we can utilize the whey based guava juice for preparation of ready to serve drink. The preparation of whey based guava juice with the sample no. 3 consisting 70% of guava juice, 30% of whey, 11.32 % TSS, 0.31 % titratable acidity was significantly best over the rest of samples and can be stored successfully for 3 months of storage period at refrigerated temperature.

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