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Effect of blending of protein and β-carotene on physico chemical and organoleptic properties of guava fruit bar

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Abstract
This study was to investigate the effect of blending of protein and β-carotene on quality of Guava fruit bar by adding different concentration of protein sources like Skim milk powder and Defatted soy flour for protein enrichment and Carrot puree for β-carotene. In this Study seven guava fruit bars were prepared as per FPO specifications by adding defatted soy flour (DFS), skim milk powder (SMP) and carrot puree in different concentrations. The seven samples of fruit bar were dried in solar powered cabinet dehydrator (SDM-50) for 48 hours. The physico-chemical characters, organoleptic qualities & microbial counts were recorded initially in seven fruit bar recipes. The guava fruit bar with composition of 84% pulp, 6% Skim milk powder (SMP) and 10% carrot puree had maximum TSS, reducing sugars, total sugars and preferred moisture content (16-20%) with minimum acidity. The next best was guava fruit bar with composition of 86% guava pulp, 4% SMP (Skim milk powder) and 10% carrot puree. Initially no yeast or moulds were recorded in any of the freshly prepared fruit bars. these two fortified fruit bars viz., guava fruit bar with composition of 84% pulp, 6% Skim milk powder (SMP) and 10% carrot puree, guava fruit bar with composition of 86% guava pulp, 4% SMP (Skim milk powder) and 10% carrot puree got better score in sensory evaluation.

Keywords: Blending, protein, β-carotene, physico chemical, organoleptic properties, guava fruit bar

Introduction
Guava fruits are used both for fresh consumption and processing purposes. In recent years, guava cultivation has become popularity due to increasing international trade, nutritional value & value added products. The fresh fruits have limited shelf life (6-8 days) which limits strategic selling of fresh guava fruit. Under these conditions guava growers fail to get attractive returns and nearly 20-25 percent of produce goes as ravage (Nidhi and Matthew, 2006) [17]. Therefore, it is necessary to utilize the fruit for making different products to increase its availability over an extended period and to stabilize the price during the glut season. The guava bar is widely accepted product of guava, but it is deficient in protein. Due to high content of quality protein in soy flour (55 percent) and in SMP (36 g/100 g) these two protein sources were used and also for enriching the fruit bar with β-carotene content, carrot puree was used because it contains 2546.6IU of vitamin-A per one cup (228) of mashed carrot, by using these sources in different concentrations seven fruit bars were prepared, fruit bar with 100% pulp kept as control. The physico-chemical characters, organoleptic qualities & microbial counts for these fruit bars were evaluated initially.

Materials: Fruit bars being principally made out of pulp of Allahabad dsafeda guava fruits and chemicals like potassium metabisulfate, citric acid, pectin and liquid glucose were procured from the local market of Hyderabad (Telangana) India.

Method: 15 kg of Allahabad Safeda fruits were used for extraction of pulp for fruit bar preparation. The fruits were washed in clean tap water. Then the fruits were dipped in hot water for 5 min at 90 ^{0}C. The blanched fruits were kept in cool water for some time and cut into pieces. By using junior pulp extractor/Fruit miller, guava pulp was extracted. The seed was separated from pulp by sieve installed in the fruit pulp extractor. From 15kgs fruits of Allahabad safeda variety of guava, 13kgs of pulp was extracted (92.5% pulp recovery). 2kgs of carrots are used for making carrot puree. Initially carrots were washed thoroughly. Then peeled with potato peeler.

After cutting of these carrots into small pieces steam blanching was done. Then these pieces were grinded by adding water to prepare carrot puree. Solar dehydration method was used for preparation of guava fruit bar. Solar Powered Solar Air Dryer of model SDM-50 with loading capacity of 50kgs of wet pulp was used for preparation of fruit bar. The fruit pulp from this variety were blended at different proportions by using three concentrations of Skim milk powder (2%, 4%, 6 %,) defatted soy flour (4%, 5%, 6%) and carrot puree (10%). The pulp was loaded in aluminium trays and kept in SDM-50 solar dryer for drying. The treatment combinations are given below in table.

Treatment combinations

Treatments	Allahabad Safeda guava pulp (%)	Skim milk powder (%)	Defatted Soy flour (%)	Carrot puree (%)
T_1 (control)	100	-	-	
T_2	88	2	-	10
T_3	86	4	-	10
T_4	84	6	-	10
T_5	86	-	4	10
T_6	85	-	5	10
T_7	84	-	6	10

Table 1: Physico-chemical characteristics of fresh guava pulp cv. 'Allahabad Safeda'.

Parameters	Allahabad safeda
Moisture content (%)	91.79
TSS (°Brix)	7.72
Acidity (%)	0.19
PH	5.00
Reducing sugars (%)	2.30
Total sugars (%)	3.37
Ascorbic acid(mg 100 g^{-1})	71.84
β-carotene (µg 100 g^{-1})	343.94

Quality evaluation of fortified fruit bars

Physico-chemical characteristics

The highest moisture content of 25 percent was recorded in guava-soy fruit bar with composition of 84 percent guava pulp + 6 percent defatted soy flour + 10 percent carrot puree (T_7) while the lowest of 7.56 percent was recorded in control i.e. fruit bar with 100 percent guava pulp (T_1). In general there was an increase in moisture content in all fortified fruit bars with addition of 10 percent carrot puree when compared to control (unfortified fruit bar). However, the highest moisture retention (25 percent) in guava-soy fruit bar with 86 percent pulp + 6 percent DFS + 10 percent carrot puree (T_7) was attributed to high water binding capacity of DFS which is retaining higher moisture content in product. Similar results have been reported by Aleem Zaker *et al.* (2012) [1] in composite flour based biscuits.

The highest TSS of 65.33°B was recorded in guava-SMP fruit bar with 84 percent pulp + 6 percent SMP + 10 percent CP (T_4) which was on par with T_3 (86 percent pulp + 4 percent SMP +10 percent CP) (64.70°B). The lowest TSS of 60.66°B was observed in T_1 i.e. control (100Percent pulp). In the present study, the TSS of control (100 percent pulp) fruit bar might have decreased due to avoid of SMP, DFS and CP. The guava- SMP fruit bar with the composition of 84 percent pulp + 6 percent SMP + 10 percent carrot puree (T_4) was recorded highest TSS which might be due to acid hydrolysis of polysaccharides especially gums and pectin into soluble sugars. The results of present investigation are in accordance with the findings of Baramanray *et al.*, (1995) [5] in evaluation of guava (*Psidium guajava* L.) hybrid for making nectar.

In this study, the titrable acidity of guava fruit bar decreased from T_1 to T_7. The maximum acidity was recorded in fruit bar prepared with 100 percent guava pulp; however it decreased in blended fruit bars. As the proportion of defatted soy flour (DFS) increased in guava pulp, the titrable acidity decreased significantly due to dilution of acidic factor of the fruit with the addition of the flour. Similarly the acidity in fruit bar was reduced by addition of carrot puree in different proportion. The results of present investigation are in accordance with the findings of Anju *et al.* (2014) [2] in peach-soy fruit leather.

Significant differences were found among the treatments regarding the pH of fruit bars. The highest pH of 4.30 was recorded in Guava-DSF fruit bar with composition of 84 percent pulp+ 6 percent DSF + 10 percent carrot puree (T_7) which was on par with pH of guava -DSF fruit bar with 85 percent pulp + 5 percent DSF + 10 percent carrot puree (T_6) i.e. 4.14 and guava -DSF fruit bar with 86 percent pulp+ 4 percent DSF + 10 percent carrot puree (T_5) (4).The lowest pH of 3.50 was observed in control i.e. 100 percent pulp (T_1). As a result of increasing acidity, a significant decrease in pH of guava fruit bar was noticed. Similar results of pH were reported in pineapple leather by Phimpharian *et al.* (2011), mango leathers by Azeredo *et al.* (2006) [3], pawpaw and guava leathers by Babalola *et al.* (2002) [4] and Apple leathers by Natalia *et al.* (2012) [14].

Table 2: Effect of blending with different concentrations of skim milk powder, defatted soy flour and carrot puree on moisture content (%), TSS (°Brix), acidity (%) and P^H of guava fruit bar

Treatment		Moisture (%)	TSS (°Brix)	Acidity (%)	P^H
T_1	Control (100% pulp)	7.56	1.13	3.50	60.66
T_2	88%pulp+2%SMP+10% CP	16.20	1.10	3.60	63.33
T_3	86%pulp+4%SMP+10% CP	18.00	1.04	3.70	64.70
T_4	84%pulp+6%SMP+10% CP	19.60	1.00	3.80	65.33
T_5	86%pulp+4%DSF+10% CP	20.30	0.86	4.00	61.33
T_6	85%pulp+5%DSF+10% CP	21.00	0.84	4.14	61.90
T_7	84%pulp+6%DSF+10% CP	25.00	0.79	4.30	62.63
S.Em±		1.07	0.53	0.06	0.10
C.D. at 5%		3.27	1.67	0.21	0.32

Among the different fruit bars, the maximum percent of reducing sugars of 16.63Percent was recorded in guava-SMP fruit bar with 84 percent pulp + 6 percent SMP +10 percent carrot puree (T_4) fruit bar which was on par with guava- SMP fruit bar with 86 percent pulp + 4 percent DSF +10 percent carrot puree (T_3) (16.06 percent), guava- SMP fruit bar with 88 percent pulp + 2 percent DSF +10 percent carrot puree (T_2) (15.10 percent) while minimum percent of reducing sugars of 13.06percent was recorded in Guava –DSF fruit bar with 84 percent pulp + 6 percent DFS+10 percent carrot puree (T_7). It was observed that the increase in reducing sugars in T_4 (84 percent pulp + 6 percent SMP +10 percent carrot puree) fruit bar was mainly due to the acid hydrolysis of sugars. The results of present investigation in accordance with the findings of Karan Jalker *et al*. (2013) [10].

Significant differences were observed among the treatments regarding the total sugars. Among the treatments, guava-SMP fruit bar with 84 percent pulp + 6 percent SMP + 10 percent carrot puree (T_4) recorded highest total sugar content of 55.93percent which was on par with values of guava-SMP fruit bar 86 percent pulp + 4 percent SMP +10 percent carrot puree ($T_{3)}$ (55.93 percent) and lowest total sugar percent of 50.20 percent was observed in control (100percent pulp) fruit bar ($T_{1)}$.The shelf life of fruit leathers depends on the sugar content of leathers (Teshome, 2010) [21]. In this study, the highest total sugar content (55.93 percent) was recorded by guava-SMP fruit bar with 84 percent pulp + 6 percent SMP +10 percent carrot puree (T_4) which was mainly due to increased concentration of SMP and also due to conversion of insoluble polysaccharides and other carbohydrate polymers to soluble sugars. The results of present investigation are in conformity with the findings of Kuchi *et al.* (2014) [11] in standardization of recipe for preparation of guava jelly bar.

Table 3: Effect of blending with different concentrations of skim milk powder, defatted soy flour and carrot puree on reducing sugars (%),Total sugars (%), Browning index (A_{420}) of guava fruit bar.

Treatment		Reducing sugars (%)	Total sugars (%)	Browning index (A_{420})
T_1	Control (100% pulp)	14.33	0.08	50.20
T_2	88%pulp+2%SMP+10% CP	15.10	0.11	52.06
T_3	86%pulp+4%SMP+10% CP	16.06	0.13	54.33
T_4	84%pulp+6%SMP+10% CP	16.63	0.18	55.93
T_5	86%pulp+4%DSF+10% CP	14.66	0.18	50.73
T_6	85%pulp+5%DSF+10% CP	13.66	0.20	51.66
T_7	84%pulp+6%DSF+10% CP	13.06	0.20	52.50
S.Em±		0.65	0.78	0.00
C.D. at 5%		1.99	2.41	0.02

The highest browning index 0.20 was recorded in guava-DSF fruit bar with blend ratio of 84 percent pulp, 6 percent DFS and 10 percent carrot puree (T_7) and this was on par with guava-DSF with ratio of 85 percent pulp, 5 percent DSF and 10 percent carrot puree (T_6) (0.20) and lowest browning index of 0.08 was recorded in control (T_1). The increase in non-enzymatic browning might be due to higher temperature concomitant with heat, oxidation or due to volatilization (Bolin and Boyle, 1972 and Echkoff and Okos, 1986) [6]. In the present study, although non enzymatic browning was observed in all treatments, the highest browning in guava-DSF might be due to incorporation of DSF which imparted darker colour to the product.

Sensory evaluation of freshly prepared fruit bars

The results drawn from a sensory evaluation panel acceptance test indicated that the fruit bars were organoleptically acceptable in all the samples. Among all the treatments, fruit bar with 100 percent guava pulp (control) was more attractive and preferred by all the panelists because its taste, colour, texture, flavour and overall acceptability.

The maximum score for colour (8.33) was recorded in guava-SMP fruit bar with 84 percent pulp, 6 percent SMP and 10 percent carrot puree (T_4) followed by guava-SMP fruit bar with 86 percent pulp, 4 percent SMP and 10 percent carrot puree (T_3) (8.23) while least score for colour 4.99 was observed in guava-DSF fruit bar with 84 percent pulp, 6 percent DSF & 10 percent CP (T_7). The maximum score for colour in guava-SMP fruit bar with 84 percent pulp, 6 percent SMP and 10 percent carrot puree (T_4) is mainly due to low browning index.

Maximum score for texture 7.43 was recorded in guava-SMP fruit bar with 84 percent pulp, 6 percent SMP and 10 percent carrot puree (T_4) followed by guava-SMP fruit bar with 86 percent pulp, 4 percent SMP and 10 percent carrot puree (T_3) (7.32) and least score for colour 4.02 was observed in fruit bar with 84 percent pulp, 6 percent DSF, 10 percent carrot puree (T_7). The composition of fruit bar with skim milk powder upto 6 percent has improved the texture of the fruit bar. The addition of Defatted soy flour upto 6percent might have attributed to hard texture, hence fewer score for DSF fortified fruit bars. Similar results with regard to texture were reported by sujatha and sayantan (2014) [20] in fortified sapota-papaya fruit bar.

Maximum score for flavor 7.23 was recorded in guava-SMP fruit bar with 84 percent pulp, 6 percent SMP and 10 percent carrot puree (T_4) followed by guava-SMP fruit bar with 86 percent pulp, 4 percent SMP and 10 percent carrot puree (T_3) i.e. 7.13 and least score (5.93) for flavor was observed in fruit bar with 84percent pulp, 6percent DSF, 10percent carrot puree (T7).

The flavor of the fruit bars with defatted Soy flour decreased hence less score. Similar results with regard to flavor were reported by sujatha and sayantan (2014) [20] in fortified sapota-papaya fruit bar. Maximum score for taste 7.43 was recorded in guava-SMP fruit bar with composition of 84 percent pulp, 6 percent SMP and 10 percent carrot puree (T_4) followed by guava-SMP fruit bar with composition of 86 percent pulp, 4 percent SMP and 10 percent carrot puree (T_3) while least score for taste 4.23 was observed in guava –DSF fruit bar with 84 percent pulp, 6 percent DSF, 10 percent carrot puree (T_7). Similar results were reported by sujatha and sayantan (2014) [20] in fortified sapota-papaya fruit bar.

The overall acceptability of fortified fruit bars with Skimmed milk powder of 6 percent concentration was superior. Thus incorporation of skimmed milk powder @ 6 percent followed by 4Percent in fortified guava fruit bars were considered optimum with respect to sensory quality characteristics.

Similar results have been reported with regard to overall acceptability by Sujatha and Sayantan (2014) [20] in fortified sapota-papaya fruit bar.

Table 4: Effect of blending with different concentrations of skim milk powder, defatted soy flour and carrot puree on colour, texture, flavor, taste and overall acceptability of guava fruit bar

Treatment		colour	Texture	Flavor	Taste	overall acceptability
T_1	Control (100% pulp)	8.03	6.72	6.93	7.12	7.13
T_2	88%pulp+2%SMP+10% CP	7.63	6.33	7.03	6.53	6.88
T_3	86%pulp+4%SMP+10% CP	8.23	7.32	7.13	7.15	7.44
T_4	84%pulp+6%SMP+10% CP	8.33	7.43	7.23	7.43	7.53
T_5	86%pulp+4%DSF+10% CP	5.93	5.63	6.13	5.72	5.85
T_6	85%pulp+5%DSF+10% CP	5.13	5.23	6.16	5.43	5.47
T_7	84%pulp+6%DSF+10% CP	4.99	4.02	5.93	4.23	4.79
S.Em±		0.05	0.05	0.06	0.05	0.03
C.D. at 5%		0.17	0.15	0.20	0.15	0.11

Microbial count

Contamination of food by moulds and yeast is common. Hence their presence in the finished products is considered unfit for consumption. In order to find the presence of moulds and yeast, total plate count method in nutrient agar was carried out.

Fruit bar was free from microbial spoilage during initial stages (0 days) and no mould and yeast growth was detected in any of fruit bar samples. Microorganisms were inactivated in the fruit bars due to the heat processing of pulp, along with the addition of KMS a chemical preservative and also due to dehydration of product. In the present study there were no microbial count and all treatments were acceptable for consumption.

In the study, the unfortified guava fruit bar (control) recorded the highest acidity, ascorbic acid and low browning index as compared to fortified fruit bars whereas fortified guava –Skim milk protein (SMP) fruit bars were rich in protein,based on physico-chemical properties, organoleptic evaluation & microbial load of guava fruit bars of seven treatments two treatments viz., T_4 (84 percent pulp + 6 percent SMP + 10 percent carrot puree) and T_3 (86 percent pulp + 4 percent SMP +10 percent carrot puree) were selected as best treatments for storage studies.

References

1. Aleem Zaker MD, Genitha TR. Syed Imran Hashmi. Effects of defatted soy flour incorporation on physical, sensorial and nutritional properties of biscuits. Journal of Food Processing and Technology. 2012; 3(4):1-4.
2. Anju B, Kumari KR, Anand V, Anjum MA. Preparation, quality evaluation and storage stability of peach-soy fruit leather. SAARC Journal of Agriculture. 2014; 12(1):73-88.
3. Azeredo HMC, Brito ES. Moreira GEG, Farias VL, Bruno LM. Effect of drying and storage time on the physico-chemical properties of mango leathers. International Journal of Food Science and Technology. 2006; 41(6):635-638.
4. Babalola SO, Ashaye OA, Babalola AO, Aina JO. Effect of cold temperature storage on the quality attributes of pawpaw and guava leathers. African Journal of Biotechnology. 2002; 1(2):61-63.
5. Baramanray A, Gupta OP, Dhawan SS. Evaluation of guava (*Psidium guajava* L.) hybrid for making nectar. Haryana Journal of Horticultural Science. 1995; 24:102-109.
6. Bolin HR, Boyle FP. Effect of storage and processing on sulphur dioxide in preserved fruit. Food Product Development. 1972; 7:82-86.
7. Chauhan SK, Joshi VK, Lal BB. Apricot-soy fruit bar: a new protein enriched product. Journal of Food science and Technology. 1993; 30(6):457-458.
8. Jain PK, Asati VK. Evaluation of guava cultivars for pulp preparation. Journal of Food Science and Technology. 2004; 41(6):684-686.
9. Kadam DM, Prathibha K, Ramesh Kumar. Evaluation of guava products quality. International Journal of Food Science and Nutrition Engineering. 2012; 2(1):7-11.
10. Karanjalker GR, Singh DB, Rajwade VB. Development and evaluation of protein enriched guava nectar blended with soymilk an Inernational quarterly journal of life sciences. 2013; 8(2):631-634.
11. Kuchi VS, Gupta R, Tamang S. Standardization of recipe for preparation of guava jelly bar. Journal of Crop and Weed, 2014; 10(2):77-81.
12. Mahony MO. Sensory evaluation of food: statistical methods and procedures. Marcel Dekker. New York. 1985; 168-169.
13. Natalia AQ. Ruiz SM, Demarchi, Giner SA. Research on dehydrated fruit leathers: A Review. 2011.
14. Natalia AQ, Ruiz M, Silvana J, Demarchi F, Massolo M, Luis Rodoni A *et al.* Evaluation of quality during storage of apple leather. Food Science and Technology. 2012; 47:485-492.
15. National Horticulture Board DataBase. 2012-13. http://www.nhb.gov.in.
16. Negi SS, Rajan S. Improvement of guava through breeding Proc.1st International guava symposium Eds. G. Singh. Acta Horticulturae. 2007; 735:31-37.
17. Nidhi C, Matthew P. Development of guava candies. Journal of Food Science and Technology. 2006; 43(2):210-212.
18. Raab C, Oehler N. Making dried fruit leather. Fact Sheet 232, Oregon State University Service, Tillamook, Ore, USA, 1999.
19. Ranganna S. Handbook of Analysis and Quality Control for Fruits and vegetable Products. Tata McGraw Hill Publishing Company Limited, New Delhi, 1991.
20. Sujatha Y, Sayantan B. Optimization of ingredients in papaya fruit bar. International Quarterly Journal of Biology & Life sciences. 2014; 2(1):377-380.
21. Teshome B. Effect of Processing on some quality attributes of mango (*Mangifera indica*) fruit leather [Electronic]. 146. Retrieved, Master of Science, 2010.