

Standardization of protocol for best blending ratio of papaya cv. Red Lady and guava cv. Allahabad Safeda fruit pulp for preparation of fruit bar

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ABSTRACT

The papaya and guava pulps were blended in the ratios of 100:0, 80:20, 60:40, 50:50 and 40: 60 in preparation of fruit bar and physicochemical analysis and sensory attributes were evaluated at zero (initial), 30 and 60 days of storage. Among the different blending ratios, fruit bar prepared with 60% papaya pulp + 40% guava pulp (T₃) was selected as best ratio (combination) as the treatment had maximum score for sensory attributes i.e., overall acceptability (8.75). The microbial load recorded in the same treatment was also minimum (yeast and mould) and within safe levels for consumption even after 60 days of storage. In general there was an increase in total soluble solids, reducing sugars and pH, whereas moisture content, titrable acidity, total sugars, ascorbic acid, total carotenoids, protein content and all sensory attributes were decreased with the advancement of storage period.

Key Words *Blending Ratio, Guava, Microbial load, Overall acceptability, Papaya*

INTRODUCTION

Papaya (*Carica papaya* L.) and Guava (*Psidium guajava* L.) are important tropical fruits and claim superiority over other fruits by virtue of their commercial and nutritional values. Papaya is regarded as the wonder fruit of the tropics and subtropics. Owing to the increased demand for fruits and papain, the area and production of papaya has increased

35 quickly during the last few decades. It comes early in bearing than any other fruit crop,
36 produces fruits in less than a year. It is the fifth most important crop in India after mango,
37 banana, citrus and guava. The fruit is an excellent source of vitamin A (2020 IU/100g) and
38 also rich source of other vitamins like thiamine, riboflavin, nicotinic acid [7]. India is the
39 largest producer of papaya in the world with an annual production of about 5508 lakh tonnes
40 from an area of about 126 lakh hectares [17]. In Andhra Pradesh papaya was cultivated in an
41 area of 18.40 lakh hectares with annual production of about 1471.68 tonnes [17].

42 Guava, the poor man's apple, is one of the most common fruits grown widely in
43 tropical and subtropical regions of the world. It was originated in tropical America, stretching
44 from Mexico to Peru, and gradually became a crop of commercial significance in several
45 countries because of its hardy nature, prolific bearing, high vitamin C content, minerals and
46 high remuneration with less maintenance. The high vitamin C content of guava makes it a
47 power house in combating free radicals and oxidation which are key enemies that cause many
48 degenerative diseases [8]. In recent years, guava cultivation has become popular due to
49 increasing international trade, nutritional value and value added products. Guava has well-
50 established markets in more than 60 countries. The largest producers are India, Mexico,
51 Brazil, Cuba, Venezuela, USA, Australia, New Zealand, China, Thailand [16].

52 In India, Guava has become an important fruit crop contributing to 4 per cent of total
53 fruit production and ranks fourth in production after Mango, Banana, and Citrus with an
54 estimated production of 4083 lakh tonnes from 251 lakh hectares [17].

55 The destruction of original fruit structure by pureeing and restructuring it into
56 dehydrated sugar-acid-pectin gels called "fruit leathers" provide attractive, coloured products.
57 Fruit leathers also allow left over ripe fruits to be preserved [15]. Dehydrated fruit processing
58 is gaining importance nowadays due to long shelf life, light weight, better handling during
59 export and providing variety to the consumers. Fruit leathers are dried sheets of fruit pulp that
60 have a soft, rubbery texture and sweet taste.

61 The fresh papaya and guava fruits have limited shelf life. Therefore, it is necessary to
62 utilize this fruit for making different products to increase its availability over an extended
63 period and to stabilize the price during glut season. Unfortunately papaya fruit has not caught
64 the fancy of the consumers as much as it deserves, mainly because of its odour which is not
65 appealing and thus limits its commercial exploitation at processing levels. However, papaya
66 fruit has blood red pulp, good taste and low acid content hence; it can be used for blending
67 with other fruits and also for preparation of nutritional enriched food products [2] Whereas
68 guava emits a sweet aroma which is pleasant, refreshing and acidic in flavour and besides

being rich source of pectin, its pulp shows compatibility and suitability for blending and making mixed fruit products viz., jam, jelly, candy, leather etc. However, blending of these two fruits could be an economic proposition to utilize them profitably [7]. The present study aimed to standardize the protocol for best blending ratio of papaya cv. Red Lady and guava cv. Allahabad Safeda fruit pulp for the preparation of fruit bar, with view to determine the physicochemical potentials and microbial loads of the fruit blends.

MATERIALS AND METHODS

The present study was carried out at College of Horticulture, Anantharajupeta, during the year 2015-16. The details of the materials used and methods adopted during the investigation were elucidated in this chapter under following headings.

Procurement of raw materials

Red Lady variety is a early, vigorous and high-yielding papaya variety with excellent fruit quality. Fruits are short, oblong shaped with red flesh, aromatic and very sweet. The Fruits of Allahabad safeda are medium, round, smooth with skin colour yellow on ripening, white pulped, with few medium soft seeds and have good keeping quality. Fully matured ripened guava and papaya fruits were obtained from farmer field in and around Anantharajupeta.

Preparation of papaya and guava pulp

The method for preparation of fruit bar based on the procedure described by [2]. Red Lady and Allahabad Safeda were used for extraction of pulp for fruit bar preparation of papaya and guava. These fruits were washed in clean tap water. Then they were cut into pieces. By using pulp extractor papaya and guava pulp was extracted. Guava seeds were separated from pulp by sieve installed in the pulp extractor. The pulp recovery is more in papaya fruit (78.0%) when compared to guava fruit (54.5%). The papaya guava fruit bar was prepared by mixing the pulp (1kg) in different proportions as per the treatment with 250g sugar. The mixture was heated with continuous stirring till it reached to 50⁰ Brix. The boiled mass was slightly cooled and 500 ppm of KMS (Potassium metabisulphate) was added.

Drying

The concentrated pulp mixture was spread on trays (smeared with ghee) up to 0.5 cm thickness and dried in cabinet drier at 60⁰ C. After five hours of drying, second layer of 0.5 cm thickness was spread over the first layer and continued for eight hours. The product was dried before packing.

Cutting, filling and packing

Dried sheets of each blend were cooled and cut into rectangular pieces of 3 x 0.5 cm size. The cut pieces were packed individually in butter paper and labelled with details of treatments and replications and stored at temperature 25.35° C. The fruit pulp from these varieties was blended at different proportions as per the treatments. Papaya guava fruit bar was prepared according to the methodology given by [2] with slight modification. Then processed pulp mixture was loaded in aluminium trays and kept in cabinet dryer for drying. The treatment combinations are given in Table 1.

Table 1 Treatment Details:

Treatments	Pulp (%)	
	Papaya cv. Red Lady	Guava cv. Allahabad Safeda
T ₁ (control)	100	-
T ₂	80	20
T ₃	60	40
T ₄	50	50
T ₅	40	60

AS- Allahabad Safeda

Physicochemical analysis

Biochemical quality and organoleptic evaluation of papaya guava fruit bar was carried out at zero, 30 and 60 days after storage. Two samples per treatment were subjected to physico-chemical analysis. The parameters such as total soluble solids, pH, total sugars, reducing sugars, titrable acidity, ascorbic acid and overall acceptability were analyzed by the methods suggested by [20]. Moisture content was determined on fresh weight basis [23]. Protein content and total carotenoids in papaya guava bar sample was estimated by using [13] method and procedure suggested by [28] respectively. Microbial count in the fruit bar was measured based on the procedure described by [5].

Statistical analysis

The data for various physicochemical attributes and sensory evaluation were analyzed by using Completely Randomized Design (CRD). The data was statistically analyzed according to [18].

RESULTS AND DISCUSSION

Data pertaining to moisture content of different recipes used in the preparation of papaya-guava fruit bar at various stages of storage were presented in Table 2. The moisture content in papaya guava fruit bar ranged from 14.95 (T₅) to 15.04 % (T₁). The maximum value of moisture content of 15.04 per cent was recorded in fruit bar with 100 per cent papaya pulp (T₁) followed by T₂ (80 per cent papaya pulp + 20 per cent guava pulp (Allahabad Safeda) at zero days of storage. The minimum value of moisture per cent 14.98 was recorded in fruit bar with 40 per cent papaya + 60 per cent guava pulp (T₅) at zero days of storage. However, there were no significant differences among treatments. At 30 days of storage, highest moisture content (15.03 %) was recorded in fruit bar with 100 per cent papaya pulp (T₁) followed by treatment (T₂) with 80 per cent papaya pulp + 20 per cent guava pulp (Allahabad Safeda) (15.01). Whereas, lowest moisture content (14.97%) was recorded in fruit bar with 40 per cent papaya + 60 per cent guava pulp (Allahabad Safeda) (T₅) at 30 days of storage. At 60 days of storage, the moisture content (15.01%) recorded in fruit bar with 100 per cent papaya pulp (T₁) was maximum. The minimum moisture per cent of 14.95 was recorded at 60 days of storage in fruit bar with 40 per cent papaya + 60 per cent guava pulp (T₅).

Among different treatments, fruit bar prepared using 100% papaya pulp *i.e.*, T₁ recorded maximum value (15.04%) at zero stage, (15.03%) at 30 days and (15.01%) at 60 days due to high moisture content in the fruit pulp [2]. The papaya guava fruit bar registered slight decrease in moisture per cent with the advancement of storage period irrespective of the blending ratios. The slight decrease in moisture content might be due to evaporation from sample surface [10]. These findings are also in conformity with observations made by other workers in case of guava leather by [22].

Total soluble solids (°Brix)

Among different blending ratios T₅ (40 % papaya pulp + 60 % guava pulp (Allahabad Safeda) recorded maximum value (79.15°Brix). While the lowest total soluble solids of 76.21°Brix was recorded in 100 per cent papaya pulp at zero day of storage (Table 2). There were no significant differences among treatments for the total soluble solids in papaya guava fruit bar at zero, 30 and 60 days of storage. However, the total soluble solids ranged from 76.21° Brix (T₁) to 80.05 ° Brix (T₅). At zero day of storage, the highest total soluble solids of 79.15° Brix was recorded in fruit bar with 40 per cent papaya pulp + 60 per cent guava

pulp (Allahabad Safeda) (T₅). While the lowest total soluble solids of 76.21 °Brix was recorded in 100 per cent papaya pulp (T₁) at zero days of storage. Total soluble solids recorded maximum (79.94°Brix) in fruit bar prepared with 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T₅) and the minimum (77.34 °Brix) was recorded in 100 per cent papaya pulp (T₁) at 30 days of storage. The highest total soluble solids of 80.05° Brix was recorded in fruit bar with 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T₅) and the lowest total soluble solids of 78.15°Brix was recorded in 80% papaya pulp and 20% guava pulp (Allahabad Safeda) (T₂) at 60 days of storage.

In all the treatments there was an increase in total soluble solids content with the progress of storage period. The slight increase in total soluble solids during storage might be due to conversion of left over polysaccharides into soluble sugars by acid hydrolysis [3] Similar results were obtained on guava leather by [22], peach-soy fruit leather by [1].

Titration Acidity (%)

Data with respect to titration acidity at zero, 30 and 60 days of storage clearly indicates that there were significant differences among treatments. The titration acidity ranged from 0.88% (T₅) to 1.02% (T₁) among the treatments at different days of storage. The papaya guava fruit bar prepared with 100 per cent papaya pulp (T₁) recorded highest titration acidity (1.02%) which was on par with treatment (T₂) of 80 per cent papaya pulp + 20 per cent guava pulp (Allahabad Safeda) (1.00%) and with 60 per cent papaya pulp + 40 per cent guava pulp (AS) (T₃) (0.98%) at zero days of storage. In contrast, fruit bar prepared from 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T₅) showed lowest titration acidity of 0.91% at zero days of storage (Table2).

At 30 days of storage the fruit bar prepared with 100 per cent papaya pulp (T₁) recorded highest titration acidity (1.01%) which was on par with treatment (T₂) with 80 per cent papaya pulp + 20 per cent guava pulp (Allahabad Safeda) (0.99%) and (T₃) 60 per cent papaya pulp + 40 per cent guava pulp (Allahabad Safeda) (0.97%). Whereas, titration acidity recorded in fruit bar prepared from 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T₅) was lowest (0.89%) at 30 days of storage. The titration acidity recorded was maximum (1.00%) in T₁ (fruit bar prepared with 100 per cent papaya pulp) which was on par with T₂ (80 per cent papaya pulp + 20 per cent guava pulp (Allahabad Safeda)) (0.98%) and T₃ (60 per cent papaya pulp + 40 per cent guava pulp (Allahabad Safeda) at 60 days of storage. Whereas, lowest titration acidity (0.88%) was recorded in T₅ (fruit bar prepared from 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda)).

There was slight decrease in acidity per cent continuously in papaya guava fruit bar with progress in storage from zero days of storage to 60 days of storage in all the treatments. The decline in acidity during storage might be due to formation of salts [11]. The result of decrease in acidity during storage was also in conformity with report on apricot fruit bar by [25] and wood apple bar by [31].

pH

There were significant differences among treatments for pH in papaya guava fruit bar at zero, 30 and 60 days of storage (Table 3). The pH values in fruit bar ranged from 3.25 (T₅) to 3.53 (T₁). The highest pH value of 3.52 was recorded in fruit bar with 100 per cent papaya pulp (T₁), followed by 3.45 in 80 per cent papaya pulp + 20 per cent guava pulp (Allahabad Safeda) (T₂) and 3.38 in 60 per cent papaya pulp + 40 per cent guava pulp (Allahaba Safeda) (T₃) at zero day of storage, however the treatments T₁, T₂ and T₃ are on par with each other. While the lowest pH, 3.25 was recorded in fruit bar with 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T₅) at zero days of storage. At 30 days of storage the pH recorded in fruit bar prepared with 100 per cent papaya pulp (T₁) was maximum (3.52) which was on par with treatment (T₂) containing 80 per cent papaya + 20 per cent guava pulp (Allahabad Safeda) (3.46) and 60 per cent papaya pulp + 40 per cent guava pulp (Allahabad Safeda) (T₃) (3.38). The pH value recorded was minimum (3.26) in fruit bar with 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T₅) after 30 days of storage.

The fruit bar with 100 per cent papaya pulp (T₁) recorded highest pH of 3.53 which was on par with treatment (T₂) with 80 per cent papaya + 20 per cent guava pulp (Allahabad Safeda) (3.46) and with 60 per cent papaya pulp + 40 per cent guava pulp (Allahabad Safeda) (T₃) (3.39) at 60 days of storage. The lowest pH of 3.26 was observed in fruit bar with 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T₅) at 60 days of storage. There was a negligible increase in pH of papaya guava fruit bar with the advancement of storage period. This may be due to formation of free acids and hydrolysis of pectin [6] similar results was obtained on apple pulp by [4].

Reducing sugars (%)

Data pertaining to reducing sugars (%) of papaya guava fruit bar at different stages of storage are presented in Table 3. There was significant difference among the treatments in reducing sugar content of papaya guava fruit bar at zero, 30 and 60 days of storage. In papaya guava fruit bar, reducing sugars per cent ranged from 36.49 % (T₁) to 47.56% (T₅). Among the treatments, the highest reducing sugars of 44.50 per cent was recorded in fruit bar made

by 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T₅) followed by 41.40 per cent with 50 per cent papaya pulp + 50 per cent guava pulp (Allahabad Safeda) (T₄) at zero day of storage. In contrast, the lowest reducing sugar per cent of 36.49 was recorded in fruit bar made by 100 per cent papaya pulp (T₁) at zero days of storage.

The reducing sugars at 30 days of storage of fruit bar of different treatments indicated that, significantly maximum reducing sugars (45.20%) was recorded in fruit bar made by 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T₅) followed by 42.22 % with 50 per cent papaya pulp + 50 per cent guava pulp (Allahabad Safeda) (T₄). Whereas, in fruit bar made by 100 per cent papaya pulp (T₁) recorded minimum reducing sugars (36.92%) at 30 days of storage. The fruit bar prepared with 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T₅) recorded highest reducing sugars per cent of 47.56 followed by 43.27 % with 50 per cent papaya pulp + 50 per cent guava pulp (Allahabad Safeda) (T₄) at 60 days of storage. The fruit bar prepared from 100 per cent papaya pulp recorded lowest reducing sugars (38.16 %) at 60 days of storage. There was increase in reducing sugars content in fruit bar prepared with all the blending ratios of papaya and guava pulp with the progress of storage period. The increase in reducing sugars during storage might be due to inversion of non reducing sugars to reducing sugars and conversion of polysaccharides to monosaccharide [25]. These findings are also in conformity with observations made by other workers in case of mango leather by [21] and sapota-papaya bar by [27].

Total sugars (%)

Data pertaining to total sugars in papaya guava fruit bar at different stages of storage are presented in Table 3. There was no significant difference among treatments for the total sugars percentage in papaya guava fruit bar at zero, 30 and 60 days of storage. Total sugars in fruit bar made with different blending ratios of papaya and guava pulp at zero, 30 and 60 days of storage ranged from 67.05% (T₁) to 73.07 % (T₅). The highest per cent of total sugars (73.07%) in fruit bar was recorded in T₅ (with 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda)) followed by T₄ (with 50 per cent papaya pulp + 50 per cent guava pulp (Allahabad Safeda)) (71.45%) at zero days of storage. The lowest per cent of total sugars (69.32%) was recorded in T₁ (with 100 per cent papaya pulp) at zero days of storage.

The total sugars recorded were maximum (72.15%) at 30 days of storage in fruit bar with 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T₅), whereas minimum (68.15%) in fruit bar with 100 per cent papaya pulp (T₁). At 60 days of storage,

highest per cent of total sugars (70.54%) recorded in fruit bar made with 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T₅) and lowest (67.05%) was recorded with 100 per cent papaya pulp (T₁). With increase in storage period of papaya guava fruit bar there was a slight decrease in total sugar per cent. The slight decrease in total sugars per cent during storage might be due to of inversion of sugars to monosaccharide by acid hydrolysis [14]. These results are in conformity with the findings of on papaya toffee and papaya leather by [2] and apricot fruit bar by [25].

Ascorbic acid (mg/100g)

The data presented in Table 4 and it indicates different blending ratios of papaya and guava pulp in preparation of fruit bar had significant effect on ascorbic acid content (mg/100g) at zero, 30 and 60 days of storage. The ascorbic acid content of papaya guava fruit bar was in the range of 45.34 (T₁) to 145.4 (T₅) mg/100g among the treatments at different days of storage. Among the treatments significantly highest ascorbic acid content of 145.4 mg/100g was recorded in fruit bar with 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T₅) followed by 125.6 mg/100g with 50 per cent papaya pulp + 50 per cent guava pulp (Allahabad Safeda) (T₄) and lowest in fruit bar with 100 per cent papaya pulp (T₁) at zero days of storage. Fruit bar prepared with 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T₅) have shown significantly highest ascorbic acid content (137.6 mg/100g) followed by fruit bar with 50 per cent papaya pulp + 50 per cent guava pulp (AS) (T₄) (110.4 mg/100g) at 30 days of storage. Lowest ascorbic acid content 51.52 mg/100g was recorded in fruit bar with 100 per cent papaya pulp (T₁) at 30 days of storage.

The ascorbic acid content at 60 days of storage was significantly higher (124.5mg/100g) in fruit bar with 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T₅) followed by treatment (T₄) with 50 per cent papaya pulp + 50 per cent guava pulp (Allahabad Safeda) (105.6 mg/100g). Whereas it was observed to be lowest (45.34mg/100g) in fruit bar with 100 per cent papaya pulp (T₁). The ascorbic acid content significantly increased with increase in blending ratio of guava pulp in preparation of fruit bar compared to 100% papaya pulp as guava served as source of Vitamin C [12].

There was a gradual decrease in the ascorbic acid content of papaya guava blended fruit bar with the advancement of storage period. The gradual decrease in ascorbic acid content might be due to oxidation of ascorbic acid to dehydroascorbic acid followed by further degradation to 2, 3-diketogluconic acid and finally to furfural compounds which enter

the browning reaction [25]. The result of decrease in ascorbic acid during storage was also in conformity with report on guava nectar by [9].

Total carotenoids ($\mu\text{g}/100\text{g}$)

Data related to total carotenoids ($\mu\text{g}/100\text{g}$) in fruit bar with different papaya and guava pulp ratios at different stages of storage are presented in Table 4. There were highly significant differences among treatments for the total carotenoids content in papaya guava fruit bar was observed at zero, 30 and 60 days of storage. Total carotenoids ranged from of 635 (T_5) to 1593 (T_1) $\mu\text{g}/100\text{g}$.

Among treatments, highest carotenoids 1593 $\mu\text{g}/100\text{g}$ was observed in fruit bar with 100 per cent papaya pulp (T_1), followed by treatment (T_2) with 80 per cent papaya pulp + 20 per cent guava pulp (Allahabad Safeda) (1510 $\mu\text{g}/100\text{g}$) at zero day of storage. In contrast, the lowest carotenoids 968 $\mu\text{g}/100\text{g}$ was observed in fruit bar with 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T_5) at zero day of storage. Maximum total carotenoids content (1534 $\mu\text{g}/100\text{g}$) was observed in fruit bar made with 100 per cent papaya pulp (T_1), followed by treatment (T_2) with 80 per cent papaya pulp + 20 per cent guava pulp (AS) (1424 $\mu\text{g}/100\text{g}$), T_3 with 60 per cent papaya pulp + 40 per cent guava pulp (AS) (1195 $\mu\text{g}/100\text{g}$), T_4 with 50 per cent papaya pulp + 50 per cent guava pulp (Allahabad Safeda) (994 $\mu\text{g}/100\text{g}$) at zero days of storage. Fruit bar prepared with higher per cent of guava pulp viz., T_5 (with 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) recorded lowest total carotenoids content (787 $\mu\text{g}/100\text{g}$) at 30 days of storage. At 60 days of storage, highest carotenoids 1385 $\mu\text{g}/100\text{g}$ was observed in fruit bar with 100 per cent papaya pulp (T_1) followed by treatment (T_2) with 80 per cent papaya pulp + 20 per cent guava pulp (Allahabad Safeda) (1271 $\mu\text{g}/100\text{g}$) and treatment (T_3) 60 per cent guava pulp + 40 per cent papaya pulp (Allahabad Safeda) (1030 $\mu\text{g}/100$). In contrast, the lowest carotenoids 635 $\mu\text{g}/100\text{g}$ was observed in fruit bar with 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T_5).

There was an increase in carotenoids content as papaya pulp increased in blending ratio of fruit bar because papaya is a rich source of carotenoids [29]. The loss of carotenoids content in the processed samples was mainly due to non-oxidative changes (cis-trans isomerisation, epoxide formation of thermal degradation) or oxidative changes. A close

perusal of data indicates that there was a gradual decline in total carotenoids with the advancement of storage period. The result of loss in carotenoids during storage was also in conformity with report on papaya toffee and papaya leather by [2]

Protein (%)

Protein content (%) of fruit bar was significantly influenced by different treatments with blending ratio of papaya and guava pulp at zero, 30 and 60 days of storage (Table 4). In papaya guava fruit bar protein per cent was in the range of 0.62 per cent (T₁) to 1.04 (T₅).

The maximum protein content (1.04%) was observed in fruit bar with 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad SafedaS) (T₅), which was on par with treatment (T₄) with 50 per cent papaya pulp + 50 per cent guava pulp (Allahabad Safeda) (1.00 %) followed by T₃ with 60 per cent papaya pulp + 40 per cent guava pulp (Allahabad Safeda) (0.96%) at zero days of storage. Significantly minimum protein content (0.85%) was observed in fruit bar with 100 per cent papaya pulp (T₁). In the treatment with 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T₅) recorded significantly maximum protein content (0.86%) in fruit bar which was on par with T₄ (50 per cent papaya pulp + 50 per cent guava pulp (Allahabad Safeda)) (0.85%) and T₃ (60 per cent papaya pulp + 40 per cent guava pulp (Allahabad Safeda)) (0.84%) at 30 days of storage. In fruit bar made with 100 per cent papaya pulp (T₁) (0.75%) and with 80 per cent papaya pulp + 20 per cent guava pulp (Allahabad Safeda) (T₂) (0.79%) registered lower protein content and both the treatments are on par with each other at 30 days of storage.

The data related to protein content at 60 days of storage revealed that there was decrease in protein content in all the treatments as the storage period is progressed. Significantly maximum content of protein (0.75%) was observed in fruit bar made with 40 per cent papaya pulp + 60 per cent guava pulp (Allahabad Safeda) (T₅) which was on par with T₄ (with 50 per cent papaya pulp + 50 per cent guava pulp (Allahabad Safeda)) (0.72). Whereas, minimum protein content (0.62%) was observed in fruit bar with 100 per cent papaya pulp (T₁) at 60 days of storage.

There was increase in protein content of fruit bar when blending ratio of guava pulp was increased with papaya pulp while preparation of fruit bar. This might be due to higher content of proteins present in guava fruit compared to papaya. During the storage of papaya guava fruit bar there was a gradual decrease in protein content with the advancement of storage period. The decrease in protein content might be due to participation of protein in

Millard reaction [1]. The decrease in protein per cent during storage of fruit bar made with papaya and guava was also in conformity with report on plum-soy products by [24] and apricot-soya products by Thakur and Neena [30].

Overall acceptability

The sensory score for overall acceptability of papaya guava fruit bar as influenced by treatments is presented in Table 5. There was no significant difference among treatments for overall acceptability of fruit bar at zero and 30 days of storage except at 60 days of storage. The overall acceptability score ranged from 7.78 (T₁) to 8.75 (T₃) in papaya guava blended fruit bar. The highest overall acceptability rating value 8.75 and 8.60 were recorded in fruit bar blended with 60 per cent papaya pulp + 40 per cent guava pulp (Allahabad Safeda) (T₃) at zero and 30 days of storage respectively. The least score for overall acceptability 8.30 and 8.17 were recorded in fruit bar blended with 40 per cent papaya pulp + 60 per cent guava pulp (AS) (T₅) at zero and 30 days of storage respectively. At 60 days of storage, significantly highest overall acceptability score 8.48 was recorded in fruit bar blended with 60 per cent papaya pulp + 40 per cent guava pulp (Allahabad Safeda) (T₃) followed by T₂ (80 per cent papaya pulp + 20 per cent guava pulp (Allahabad Safeda)) (7.99). The least score for overall acceptability 7.78 was recorded in fruit bar with 100 per cent papaya pulp (T₁).

There was a gradual decrease in overall acceptability score with the advancement of storage period. Among all the treatments overall acceptability score of papaya guava fruit bar with 60 per cent papaya pulp + 40 per cent guava pulp (Allahabad Safeda) (T₃) was found superior. The gradual decrease in overall acceptability score during storage might be due to change in composition of the product and loss of colour and flavour [19]. The result of decline in overall acceptability score during storage was also in conformity with report by [24] on aonla dehydrated product.

Microbial count (cfu/g)

Data related to microbial analysis of fruit bar blended with different ratios of papaya and guava pulp at different stages of storage are presented in Table 5. Fruit bar was free from microbial spoilage during initial stage (zero days) in all the treatments. There is no growth of yeast and mould was detected at zero days of storage. At 30 days and 60 days of storage, yeast and mould growth recorded was maximum in 100 per cent papaya bar (T₁) (0.3×10^2 cfu/g), when compared to other treatments. However, the growth of yeast and mould was far below the danger count at 30 and 60 days of storage and within the acceptable limits of [32]. As per WHO (1994) guidelines, the total microbial count should be less than 1×10^4 cfu/g.

Therefore, the fruit bar prepared with different blended ratios of papaya and guava pulp was highly stable and safe from consumption point of view.

Conclusion

Treatment (T₃) with 60 per cent papaya pulp + 40 per cent guava pulp (Allahabad Safeda) was found to be the best on the basis of sensory evaluation and it also recorded 115.4 mg/100g ascorbic acid, 1340 µg/100g total carotenoids, 0.96% protein and retained sufficient amount of nutrients even after 60 days storage.

Table 2: Influence of different blending ratios of papaya guava fruit bar on moisture content (%), Total soluble solids (°Brix) and Titrable acidity (%) at different days of storage

Treatments	Moisture content (%)			Total soluble solids (°Brix)			Titrable acidity (%)		
	Days after storage			Days after storage			Days after storage		
	0	30	60	0	30	60	0	30	60
T1	15.04	15.03	15.01	76.21	77.34	78.56	1.02	1.01	1.00
T2	15.02	15.01	14.99	76.25	77.71	78.15	1.00	0.99	0.98
T3	15.01	15.00	14.98	77.58	78.56	78.69	0.98	0.97	0.96
T4	14.99	14.98	14.96	78.32	79.38	79.85	0.94	0.93	0.92
T5	14.98	14.97	14.95	79.15	79.94	80.05	0.91	0.89	0.88
SEM ±	0.22	0.22	0.22	1.12	1.14	1.14	0.01	0.01	0.01
CD @ 5 %	NS	NS	NS	NS	NS	NS	0.04	0.04	0.04

CD : Critical Difference, NS: Non-significant; T1: (100 % Papaya pulp), T2: (80 % Papaya pulp + 20 % Guava pulp), T3: (60 % Papaya pulp + 40 % Guava pulp), T4: (50 % Papaya pulp + 50 % Guava pulp), T5: (40 % Papaya pulp + 60 % Guava pulp)

Table 3 Influence of different blending ratios of papaya guava fruit bar on pH at different days of storage

Treatments	pH			Reducing sugars (%)			Total sugars (%)		
	Days after storage			Days after storage			Days after storage		
	0	30	60	0	30	60	0	30	60
T1	3.52	3.52	3.53	36.49	36.92	38.16	69.32	68.15	67.05

T2	3.45	3.46	3.46	37.99	38.52	39.99	69.97	68.55	67.45
T3	3.38	3.38	3.39	39.44	39.49	41.65	70.05	69.25	68.30
T4	3.31	3.31	3.32	41.40	42.22	43.27	71.45	70.05	69.54
T5	3.25	3.26	3.26	44.50	45.20	47.56	73.07	72.15	70.54
SEM ±	0.04	0.05	0.05	0.62	0.59	0.61	1.02	1.00	0.99
CD @ 5 %	0.14	0.14	0.14	1.82	1.75	1.80	NS	NS	NS

410 CD : Critical Difference , NS: Non-significant; T1: (100 % Papaya pulp), T2: (80 % Papaya
411 pulp + 20 % Guava pulp), T3: (60 % Papaya pulp + 40 % Guava pulp), T4: (50 % Papaya
412 pulp + 50 % Guava pulp), T5: (40 % Papaya pulp + 60 % Guava pulp)

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414 **Table 4 Influence of different blending ratios of papaya guava fruit bar on ascorbic acid**
415 **(mg/100g) at different days of storage**

Treatments	Ascorbic acid (mg/100 g)			Total carotenoids (µg/100 g)			Protein (%)		
	Days after storage			Days after storage			Days after storage		
	0	30	60	0	30	60	0	30	60
T1	56.42	51.52	45.34	1593	1534	1385	0.85	0.75	0.62
T2	91.58	84.36	75.16	1510	1424	1271	0.90	0.79	0.65
T3	115.4	104.65	97.46	1340	1195	1030	0.96	0.84	0.69
T4	125.6	110.4	105.6	1214	994	834	1.00	0.85	0.72
T5	145.4	137.6	124.5	968	787	635	1.04	0.86	0.75
SEM ±	1.70	1.51	1.43	18.44	15.84	13.59	0.01	0.01	0.01
CD @ 5 %	5.03	4.45	4.22	54.40	46.70	40.08	0.04	0.04	0.03

416 CD : Critical Difference ,NS: Non-significant; T1: (100 % Papaya pulp), T2: (80 % Papaya
417 pulp + 20 % Guava pulp), T3: (60 % Papaya pulp + 40 % Guava pulp), T4: (50 % Papaya
418 pulp + 50 % Guava pulp), T5: (40 % Papaya pulp + 60 % Guava pulp)

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420 **Table 5 Influence of different blending ratios of papaya guava fruit bar on overall**
421 **acceptability score at different days of storage**

Treatments	Overall acceptability score			Microbial count (yeast and mould) (cfu/g)		
	Days after storage			Days after storage		
	0	30	60	0	30	60

T1	8.42	8.30	7.78	0	0.3×10^2	0.5×10^2
T2	8.42	8.26	7.99	0	0.1×10^2	0.2×10^2
T3	8.75	8.60	8.48	0	0.01×10^1	0.1×10^1
T4	8.33	8.25	7.87	0	0.1×10^2	0.3×10^2
T5	8.30	8.17	7.93	0	0.2×10^1	0.4×10^1
SEM $\pm$	0.12	0.12	0.11	NA	NA	NA
CD @ 5 %	NS	NS	0.34	NA	NA	NA

CD : Critical Difference ,NS: Non-significant; NA: Not applicable, T1: (100 % Papaya pulp), T2: (80 % Papaya pulp + 20 % Guava pulp), T3: (60 % Papaya pulp + 40 % Guava pulp), T4: (50 % Papaya pulp + 50 % Guava pulp), T5: (40 % Papaya pulp + 60 % Guava pulp)

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