Original Research Article

Development of Nutritious Fruit Leather by Blending Guava and Papaya

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A B S T R A C T

Blended guava 'Allahabad Safeda' and papaya 'Taiwan Red Lady' fruit leathers were prepared by blending their pulp at different ratio of 100:0, 80:20, 60:40, 50:50, 40:60, 20:80 and 0:100 respectively. Acidity at 0.3 % using citric acid and KMS (potassium metabisulphite) at 600 ppm was added to blended pulp and TSS adjusted to 20°B then dried in a cabinet drier at 55 ± 5°C till the desired moisture content (15 % approx.) is achieved. Blended guava-papaya (40:60) leather was found best among other treatments in terms of quality and acceptability. It had a good yield of 26.78 % with 15.75 % moisture content and 0.59 water acidity which promises a good storability and safety. It was highly acceptable with maximum sensory acceptability in terms of colour, flavor and texture (total 80.78 out of 100) with acidity 1.22 %, reducing sugar 39.44 %, non-reducing sugar 29.41 % and total sugar 68.85 %. It improved the nutritional value with 137.3 mg per 100g ascorbic acid and 1367.3 µg carotenoids per 100 g of prepared leather. Non enzymatic browning (NEB) measured at optical density at 420 nm had 0.124 reading which was far below unacceptable level.

Introduction

Fruit leather or bar or slab is a self-stable confectionary, dehydrated product with soft gel like texture. It has a long shelf life and does not require refrigeration. It can be prepared from fresh pulp, frozen pulp or canned fruit. It is made by drying a very thin layer of fruit puree and other ingredients in cabinet drier in the form of leathery sheets (Andress and Harrison, 1999). Natural fruit pulp based fruit bars are more tasty and nutritious since substantial quantity of dietary fibers, mineral, vitamins and other phytochemicals are present. Fruit leathers add value to fruit which may otherwise not acceptable for the fresh produce market.

Guava (*Psidium guajava* L.) and papaya (*Carica papaya* L.) are two commercially

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important fruit with unique flavor which are tasty, digestive and nutritious. Guava is a rich source of vitamin C content next to *aonla* while papaya is a rich source of beta-carotene (precursor of vitamin A) next to mango. Beside these both fruits contain other various health promoting phytochemicals like vitamins, minerals, antioxidant, dietary fibre, etc. However, both fruit have very short postharvest life leading to huge postharvest loss in addition to problems of seasonal glut. These problems can be curbed up to certain extent by various methods of processing.

Blending of different fruits by processing into nutritious fruit leather can be explored to obtain phyto-nutritional benefits from both fruits (Sreemathi *et al.,* 2008; Dwivedi *et al.,* 2015; Uttarwar *et al.,* 2018). Guava fruit have white pulp with pleasant flavour and slight acidic taste, can be mixed with papaya having blood red pulp with good taste to give a quality product. Blending guava and papaya into a product will improve nutritional qualities, sensory qualities (colour, texture and flavor) and storage stability. Further, the good availability of both fruit almost throughout the year is another factor. Hence, an experiment to standardise nutritionally rich and tasty blended fruit leather from both fruits were carried out.

Materials and Methods

The present investigation was carried out at Division of Post-Harvest Technology, ICAR-IIHR, Bangalore. Guava var. 'Allahabad Safeda' and papaya var. 'Taiwan Red Lady' was procured from the farm of IIHR, Bangalore. Fully ripe fresh fruits uniform in size and shape, free from transportation injuries, bruises, insect damage and diseases which are uniformly ripened were selected. Both fruits were washed properly with running tap water to remove any adhering foreign matter. Guava fruits were peeled by lye peeling technique (using 0.5% NaOH boiling

solution for 2min.) then repeatedly washed using tap water while papaya fruits were hand peeled. To prevent browning, ascorbic acid (100 mg/ 100 g) was added to guava pulp. Both peeled fruits were cut into small pieces and pulped using a mixer. Pulp was then passed through a fine sieve to obtain a fine pulp separately.

The pulp from both guava and papaya fruits were mixed at seven different ratio of T_1 - 100:0, T_2 - 80:20, T_3 -60:40, T_4 -50:50, T_5 - 40:60, T_6 - 20:80 and T_7 - 0:100 respectively. The total soluble solids and acidity were adjusted to 20 ^{o}B and 0.3% acidity. Preservative as KMS (potassium metabisulphite) at 600 ppm was added in all the samples. Different treatment of mixed pulp of 1kg was spread on stainless steel drier trays in the form of a sheet at the rate of 250g/sq. ft. The trays were then kept for drying in a cabinet drier at 55 $\pm$ 5°C till a moisture content of 15 % (approx.). The dried sheets of fruit leather were weighted and cut into rectangular slabs of dimension 3.5x7.5 cm and kept for equalization in air-tight plastic boxes overnight. Data regarding the yield of fruit bars were recorded.

Fresh pulp and blended dehydrated leathers were analyzed for various physical and biochemical constituents as per methods described by A.O.A.C. (1995). Total soluble solids were recorded using hand refractrometer (Erma, Japan), non-enzymatic browning (OD at 440 nm) by UV visible spectrophotometer (Model T70, PG Instrument) and water activity by water activity meter (Rotronic, Hygro Lab). Organoleptic quality evaluation of blended guava and papaya fruit leather was done by a panel of semi-skilled judges (6) by adopting a hedonic rating system having 100 points with various sub-scores as colour (30), texture (30) and flavor (40). The experiment was laid out in completely randomized design comprising

of 3 replications. The mean values were evaluated by critical difference (CD) test at 5 % level of significance by using ANOVA.

Results and Discussion

The physico-chemical composition of fresh guava pulp var. 'Allahabad Safeda' and papaya pulp var. 'Taiwan Red Lady' in terms of various parameters like moisture content, total solids, ascorbic acid, carotenoids, titratable acidity, reducing sugars, non-reducing sugars total sugars and recovery percentage are presented in Table 1.

Effect of different treatments on the yield of prepared samples are shown in Figure 1 and maximum yield was obtained in fruit leather made from guava pulp only (29.18 %) while lowest yield was obtained for product made from 100 % papaya pulp (24.07 %). It was observed that higher blending ratio of guava resulted in significantly higher yield of finished product.

Higher total solids content of guava in the fresh produce is attributed to this result. This may be due to more total solids content of guava pulp than papaya pulp. Similar findings were reported by Basha *et al.,* (2018) in the development of guava leather and Yilmaz *et al.,* (2017) in pomegranate fruit leather.

Effects of blending on various physico-chemical characteristic of prepared leathers are presented in Table 2. Initial moisture content among various treatments was non-significant and ranged from 13.89 to 15.75 %. This may be due to equal initial TSS content of pulp and uniform method of drying (Fulchand *et al.,* 2015). Similarly water activity was also non-significant and ranged from 0.56 to 0.59 a_w. As the pulp was concentrated due to removal of moisture during drying, other constituents were found enhanced in comparison to fresh sample

(Shende and Datta, 2019). Acidity content was significantly highest in plain guava leather (1.46 %) and lowest in plain papaya leather (1.11 %) and there was increase in acidity with percentage increase in guava pulp blended in various treatments (Ahmad *et al.,* 2018). Plain guava leather had highest ascorbic acid content (226.6 mg/100g) with no carotenoids content. While plain papaya leather had highest carotenoids content (1600.2 µg/100g) and lowest ascorbic acid content (43.8 mg/100g). Due to more content of ascorbic acid in guava, those treatments with more blending ratio of guava have higher ascorbic acid content (Vasanthakaalam *et al.,* 2018). Blended guava and papaya fruit leather had improved ascorbic acid and carotenoids content due to contribution from both fruits. These results are in accordance with finding of Tiwari (2000) in blended guava-papaya RTS beverage. Maximum reducing sugar (46.10 %) and minimum non-reducing sugar (21.89 %) was observed in plain guava leather. While maximum non-reducing sugar (32.83 %) and minimum reducing sugar (35.74 %) in plain papaya leather.

Considerable increase in reducing sugar content with higher ratio of guava pulp was observed while reverse trends on non-reducing sugar. However, total sugar content was non-significant and it ranged from 65.67 to 73.57 %. These results are in conformity with the observations made in papaya leather by Kumar *et al.,* (2010) and Singh *et al.,* (2016). Lowest non-enzymatic browning (0.121) was observed in plain guava leather while highest (0.187) in guava-papaya blend at 50:50. However, the extent of non-enzymatic browning in all treatments was far below the unacceptable level. The addition of potassium metabisulphite and additional ascorbic acid helped to achieved lower non-enzymatic browning (Chen and Martynenko, 2018; Tontul and Topuz, 2017).

Plate.1 Blended guava-papaya leather (T_1- 100:0, T_2- 80:20, T_3- 60:40, T_4-50:50, T_5- 40:60, T_6- 20:80 and T_7- 0:100 guava and papaya respectively)

Table.1 Physico-chemical composition of the fresh guava var. 'Allahabad Safeda' and papaya var. 'Taiwan Red Lady's pulp used for the experiment

| S.No.	Chemical Parameters	Guava	Papaya
1.	Pulp Recovery (%)	48.71	35.46
2.	Moisture (%)	89.35	88.97
3.	Total Solids (TS) (%)	10.65	11.03
4.	Acidity (% citric acid)	0.44	0.25
5.	Total Soluble Solids (^{0}Brix)	8.73	12.20
6.	Ascorbic acid (mg/100g)	225.2	51.41
7.	Carotenoids (mg/100g)	Nil	13.18
8.	Reducing Sugars (%)	4.20	6.10
9.	Non-reducing Sugars (%)	1.79	1.21
10.	Total Sugars (%)	5.99	7.31

*Means of three observations

Table.2 Physico-chemical properties of blended guava and papaya fruit leather

Treatment	Moisture (%)	Water Activity	Acidity (%)	Ascorbic acid (mg/100g)	Carotenoids (µg/100g)	Reducing Sugar (%)	Non-reducing Sugar (%)	Total Sugar (%)	NEB (OD at 420 nm)
T_1	14.16	0.59	1.46	226.6	0.0	46.10	21.89	67.99	0.121
T_2	14.39	0.58	1.43	206.3	880.3	44.42	22.01	66.43	0.148
T_3	14.26	0.58	1.29	180.6	998.3	41.40	26.73	68.13	0.156
T_4	13.92	0.58	1.25	158.4	1224.5	44.50	27.48	73.07	0.187
T_5	15.75	0.59	1.22	132.6	1380.2	39.44	29.41	68.85	0.124
T_6	13.89	0.56	1.14	116.3	1529.1	37.99	32.69	69.97	0.158
T_7	13.99	0.57	1.11	43.8	1600.2	36.49	32.83	69.32	0.173
SEm±	0.64	0.03	0.08	4.7	38.0	0.90	0.81	1.24	0.016
CD at 5%	NS	NS	0.23	14.3	115.5	2.75	2.44	NS	NS

Table.3 Sensory score of blended guava and papaya fruit leather

Treatment		Colour (30)	Texture(30)	Flavour(40)	Overall acceptability(100)
T_1	Guava pulp 100 %	22.15	23.46	31.14	79.46
T_2	Guava pulp 80 % and papaya pulp 20 %	22.43	24.36	28.71	73.50
T_3	Guava pulp 60 % and papaya pulp 40 %	22.71	22.57	26.14	71.43
T_4	Guava pulp 50 % and papaya pulp 50 %	23.43	24.36	29.33	77.12
T_5	Guava pulp 40 % and papaya pulp 60 %	25.00	25.57	30.21	80.78
T_6	Guava pulp 20 % and papaya pulp 80 %	24.86	24.58	27.33	76.76
T_7	Papaya pulp 100 %	25.57	24.14	26.14	78.86
SEm±		0.67	0.78	0.84	1.89
CD at 5%		2.03	NS	2.53	5.73

Fig.1 Effect of different blending ratio on the yield of blended guava and papaya fruit leather
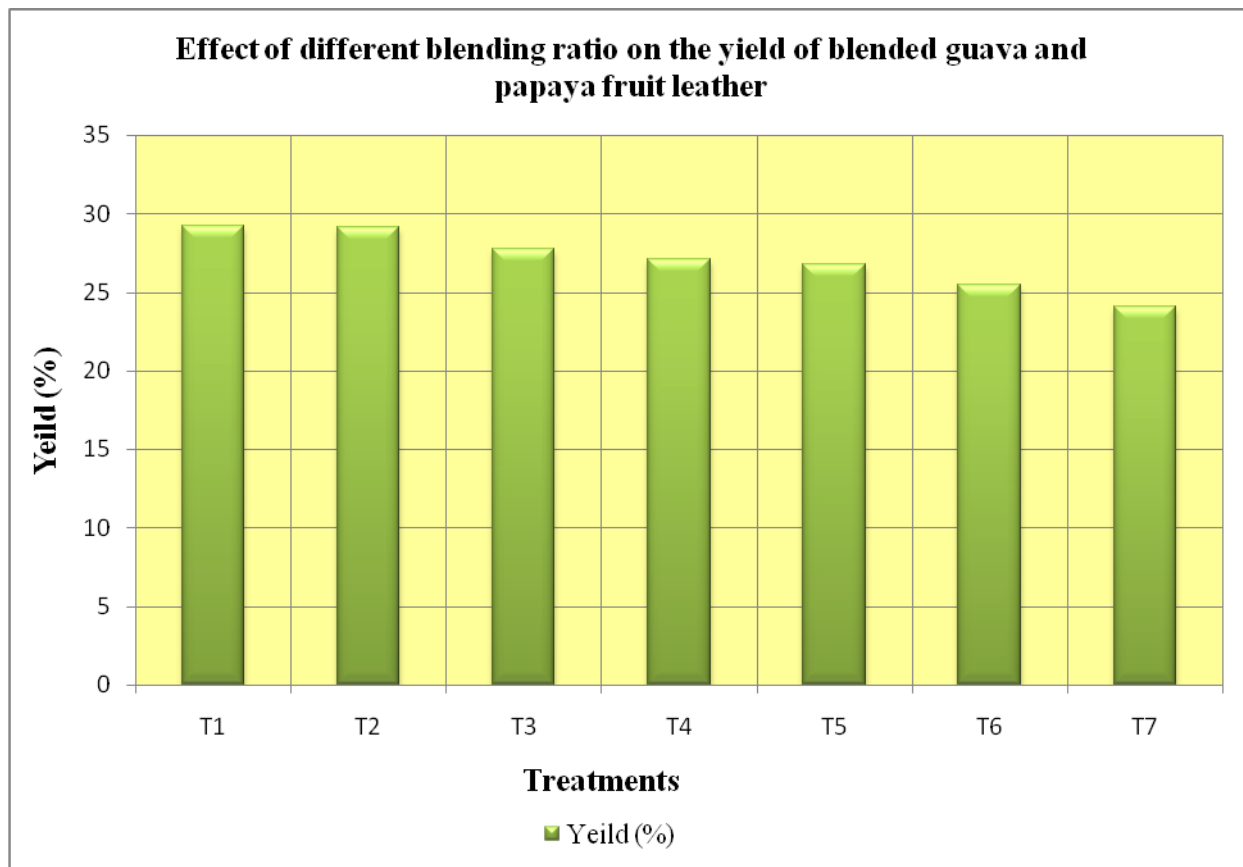
Sensory evaluation shows that all combination was highly acceptable as shown in Table 3. The colour score indicated plain papaya leather was superior to other with a maximum colour score of 25.57 which was at par with T_5 and T_6. The bright red colour due to papaya pulp was very attractive to the judges while plain guava leather was least preferred. The texture score by judges were non-significant (22.57 to 25.57) which might be due to non-significant moisture content (Dhake *et al.,* 2018). Sensory score for flavour was maximum in plain guava leather (31.14) which was also at par with T_4 and T_5 while least in plain papaya (26.14). This indicated that least favoured papaya pulp can be economically blended with guava without affecting the acceptability. Overall acceptability score indicated that fruit leather made by blending guava and papaya at 40:60

(80.78 out of 100) ranked best in terms of colour, texture and flavour. It was also at par with plain guava (79.46 out of 100) and plain papaya (78.86 out of 100). These results are in conformity with the findings on organoleptic properties of wild apricot bar by Raju *et al.,* (2012) and in mixed fruit leather from apple, banana and pineapple (Offia-Olua and Ekwunife, 2015).

In blended guava and papaya fruit leather, physico-chemical and sensory evaluation showed significant differences with respect to yield, acidity, ascorbic acid, carotenoids, reducing sugar and non-reducing sugar content, non-enzymatic browning, as well as sensory attributes such as colour and texture. Blended fruit leather made using guava pulp and papaya pulp in the ratio of 40:60 (T_5) was found superior to other treatments with good

nutritional content (137.3 mg/100g ascorbic acid and 1367.3 µg/100g carotenoids) and maximum sensory qualities (80.78 out of 100). Therefore, blending of guava and papaya pulp for preparation of leather has great potential and it can be successfully explored for sustainable use of these highly perishable commodities.

Acknowledgement

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