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Standardization of Recipe and Storage Behaviour of Papaya Based Fortified Toffee

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Abstract

An experiment was carried out at the Horticultural Processing Laboratory, Department of Fruit Science, College of Agriculture, IGKV, Raipur (C.G.) during years 2023–24 to make papaya-based fortified toffee. The experiment consisted of 7 treatments and 3 replications for making papaya-based fortified toffee. From the storage studies, it was revealed that T₄ (50% papaya pulp + 50% plum pulp + 300 g sugar) is most suitable in terms of their physicochemical properties and organoleptic evaluation of papaya-based fortified toffee. On the basis of the result, it is concluded that the treatment T₄ can be used in terms of commercialization of papaya-based fortified toffee. The results indicated that the quality observation and sensory evaluation were affected by various treatments.

Keywords: Papaya, fortified toffee, organoleptic evaluation, commercialization

Introduction

Papaya (*Carica papaya* L.) is considered one of the most nutritious and medicinally important fruit of tropical and subtropical regions of the world. Fruit having commercial importance because of its high nutritive value. Papaya is an important tropical fruit because of its nutritive contribution rich in vitamin A content (2020 IU/100 g) and proteolytic enzyme papain, which helps in digestion of protein rich food. Mango (*Mangifera indica* L.) belongs to the family Anacardiaceae originated from Indo burma region. It contains antioxidants like vitamin C and beta- carotene, which help protect cell from damage caused by free radicals and may reduce the risk of chronic diseases. Plum (*Prunus domestica*) is one of the important fruits crop cultivated in temperate regions of the world. The fibre content of plum promotes digestive health, aids in weight management and help regulate blood sugar levels the highly nutritious plum fruits can be utilised for the preparation of several value-added products and dried fruit leather. Fruit based toffee is a confectionary treat that incorporates fruit flavours into the traditional toffee recipe. Combining mango, plum and papaya toffee would result in a confectionary with unique flavour profile. Fortification in blended toffee made from papaya, mango and plum offers a unique opportunity to enhance nutrition, address micronutrients deficiencies, promote sustainable agriculture and create flavourful and appealing snacks that contribute to overall health and well being. Fortifying fruit based toffee with vitamin C can help boost immune function and enhance iron absorption, while fortifying with Calcium support bone health.

Materials and Methods

The present investigation will be carried out during year 2023-24 at horticultural processing Laboratory, Department of Fruit Science, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.).

Experimental materials used

Raw materials

The fruit papaya, plum, mango and ingredients i.e. milkmaid, sugar and ghee were used as experimental material. Healthy, fresh and ripened fruits and good quality ingredients were procured from the local market of Raipur and were stored in fruit Horticulture Processing Laboratory at the temp. of 25 + 2 °C.

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Selected fruits were properly matured, uniform in size, shape and free from insect, pests and disease. All fruits were washed thoroughly before preparation of papaya based fortified toffee.

Preparation of papaya based fortified toffee

Materials and Method

Fruits that were mature, ripe, and uniformly sized were procured from the market and brought to the laboratory for further experimentation. The fruits were thoroughly rinsed with pure tap water in order to eliminate any trace and dirt that may have been adhered to the upper layer. The fruits were cut into small pieces and the seeds were removed. After cutting, boil all the fruits pieces separately for about 10 minutes by adding water. After boiling, allow them to

cool down for some time and then pass the fruit into the pulper for grinding to make a fine paste. Extract pulp free of stones (in the case of mango, papaya and plum). Mix papaya, plum, and mango in a ratio of (50:50) and then heat the mixture by adding sucrose and glucose (when it reaches about half of its volume) and concentrate it to one third of its volume. Finally, add ghee and milk powdered paste for a better texture and taste.

Heating the mass of toffee to a thick consistency up to 80-82 °Brix, then check its Total Soluble Solids level in a refractometer, spreading the toffee in a sheet of 1 cm thickness (in a stainless-steel tray), and drying for 2 hrs (in a cool place). Cut the toffee into uniform sizes, wrap it in butter paper, and stored it in pouches (100 g).

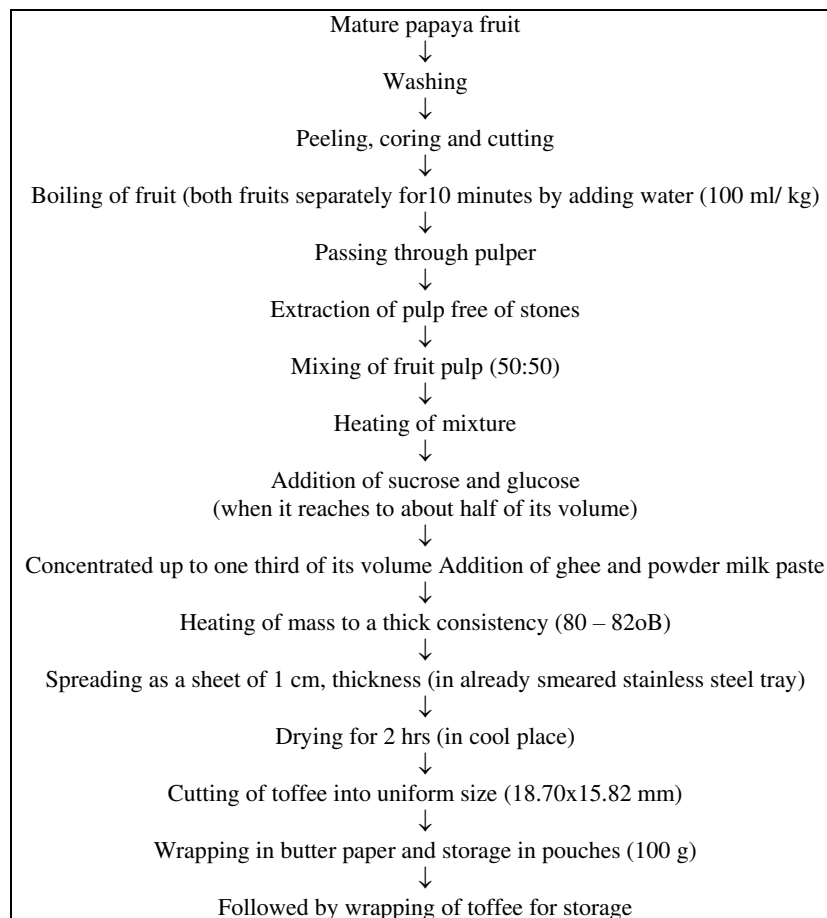


Fig 1: Flow chart for preparation of papaya based fortified toffee

Treatment details

The experiment was conducted in complete randomized

design with three replications. The details of treatments taken under present experiment are as under:

S. No	Treatment combinations	Notations used
1.	Control (100% Papaya Pulp)	T ₀
2.	50% Papaya Pulp + 50% Mango Pulp + 200 g Sugar	T ₁
3.	60% Papaya Pulp + 40% Mango Pulp + 200 g Sugar	T ₂
4.	40% Papaya Pulp + 60% Mango Pulp + 200 g Sugar	T ₃
5.	50% Papaya Pulp + 50% Plum Pulp + 300 g Sugar	T ₄
6.	40% Papaya Pulp + 60% Plum Pulp + 300 g Sugar	T ₅
7.	60% Papaya Pulp + 40% Plum Pulp + 300 g Sugar	T ₆

Results

After standardizing the recipe of papaya based fortified toffee, it has been concluded that the treatment T₄ (50% Papaya pulp + 50% Plum pulp + 300 g Sugar) was found best through chemical evaluation. During storage of T₄

papaya based fortified toffee chemical evaluation was recorded at every 15 days interval starting from the date of preparation and the observation were taken till the acceptability of the product.

Table 1: Effect of storage duration on total soluble solids (°Brix), titrable acidity (%), ascorbic acid (mg/100 g), TSS: Acid ratio, total sugar (%), reducing sugar (%) and non- reducing sugar (%) of Papaya based fortified toffee under ambient storage condition.

Notations	Days of storage	TSS (°Brix)	Titrable acidity (%)	Ascorbic acid (mg/100 g)	TSS: Acid ratio	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)
D1	0 Days	88.71a	0.18a	156.36g	492.83g	63.05a	12.19a	50.86a
D2	15 Days	a	ab	152.05f	269.00f	b	13.04b	51.50b
D3	30 Days	88.82a	0.36bc	149.06e	246.72e	65.16c	13.74c	51.52b
D4	45 Days	88.86a	0.39bc	145.11d	227.84d	66.70d	13.97cd	52.73c
D5	60 Days	88.91a	0.44bc	141.03c	202.06c	67.21d	14.28d	52.93c
D6	75 Days	88.96a	0.47bc	137.15b	189.27b	67.97e	14.32d	53.65d
D7	90 Days	89.01a	0.51c	132.08a	174.52a	68.19e	14.81e	53.68d
	SE (m)±	0.13	0.15	0.12	0.07	0.18	0.12	0.09
	C.D. at 5%	0.38	0.44	0.33	0.19	0.52	0.35	0.25

Total Soluble Solids (°Brix)

The maximum total soluble solids of Papaya based fortified toffee (89.01 Brix) was registered under the treatment D7 (90 days of Storage), which was found statistically at par with the treatments D1, D2, D3, D4, D5 and D6 having the respective total soluble solids of 88.71, 88.77, 88.22, 88.86, 88.91 and 88.96 °Brix at 5% level of significance under the present study. However, the minimum total soluble solids (88.71 Brix) were noticed under the treatment D1 (0 days of storage), which was also found statistically non significant with D2, D3, D4, D5, D6 and D7 under the present experiment.

Titrable acidity (%)

The minimum titrable acidity of Papaya based fortified toffee (0.05%) was observed under the treatment D7 (90 days of Storage), which was found statistically equivalent with the treatments D1, D2, D3, D4, D5, and D6 having the respective titrable acidity percentage of 0.18, 0.15, 0.13, 0.11, 0.09 and 0.05 at 5% level of significance under the present trial. However, the maximum titrable acidity (0.18%) were noticed under the treatment D1 (0 days of Storage) which was also found at par with D1, D2, D3, D4, D5, D6 and D7 under the present study.

Ascorbic acid (mg/100 g)

The maximum ascorbic acid content of Papaya based fortified toffee (156.36 mg/100 g) was registered under the treatment D1 (0 day of storage), which was significantly differs with the treatments D2, D3, D4, D5, D6 and D7 having the respective ascorbic acid content of 152.05, 149.06, 145.11, 141.03, 137.15 and 132.08 mg/100 g at 5% level of significance under the present study. However, the minimum ascorbic acid content (132.08) was noticed under the treatment D7 (90 days of storage), which was also found statistically dissimilar with D1, D2, D3, D4, D5 and D6 under the present experiment.

TSS: Acid ratio

The maximum TSS: Acid ratio of Papaya based fortified toffee (1780.20) was registered under the treatment D7 (90 days of storage), which was found significant differences with the treatments D1, D2, D3, D4, D5 and D6 having the respective TSS: Acid ratio of 492.83, 591.80, 683.23, 807.81, 987.88 and 1270.85 at 5% level of significance under the present investigation. However, the minimum TSS: Acid ratio (492.83) was observed under the treatment D1 (0 day of storage), which was also found significantly dissimilar with D2, D3, D4, D5, D6 and D7 under the present study.

Total sugar (%)

The maximum total sugar of Papaya based fortified toffee (68.19%) was noted under the treatment D7 (90 days of storage), which was found statistically at par with the treatments D6 having the respective total sugar percentage of 67.97 at 5% level of significance under the present study. Moreover, the treatments D4 and D5 with total sugar of Papaya based fortified toffee of 66.70 and 67.21% were also shown statistically equivalent with each other under the present investigation. However, the minimum total sugar (63.05%) was perceived under the treatment D1 (0 day of storage), which was found significant differences with D2, D3, D4, D5, D6 and D7 having the respective total sugar percentage of 64.54, 65.16, 66.70, 67.21, 67.97 and 68.19 at 5% level of significance under the present research

Reducing sugar (%)

The maximum reducing sugar of Papaya based fortified toffee (14.81%) was recorded under the treatment D7 (90 days of storage), which was found significant differences with the treatments D1, D2, D3, D4, D5 and D6 having the respective reducing sugar percentage of 12.19, 13.04, 13.74, 13.97, 14.28 and 14.32 at 5% level of significance under the present trial. Moreover, the treatments D2 & D3 and D3, D4 & D5 with reducing sugar of Papaya based fortified toffee of 13.74 & 13.97 and 13.97, 14.28 & 14.32% were shown statistically at par with each other under the present research. However, the minimum reducing sugar (12.19%) was registered under the treatment D1 (0 day of storage), which was also found significant differences with D7, D6, D5, D4, D3 and D2 under the present experiment.

Non-reducing sugar (%)

The maximum non-reducing sugar of Papaya based fortified toffee (53.68%) was noted under the treatment D7 (90 days of storage), which was found statistically at par with the treatments D6 having the respective non-reducing sugar percentage of 53.65 at 5% level of significance under the present experiment. Moreover, the treatments D2 & D3 and D4 and D5 with non-reducing sugar of Papaya based fortified toffee of 51.50 & 51.52 and 52.73 & 52.93% were also shown statistically equivalent with each other under the present study. However, the minimum non- reducing sugar (50.86%) was recorded under the treatment D1 (0 day of storage), which was found significant differences with D2, D3, D4, D5, D6 and D7 under the present investigation.

Sensory evaluation of papaya based fortified toffee

After standardization of the recipe of papaya based fortified toffee, organoleptic evaluation revealed that the treatment T₄ (50% papaya pulp + 50% plum pulp + 300 g sugar) performed best.

Table 2: Effect of storage duration on colour and appearance, texture, taste, flavour and overall acceptability of Papaya based fortified toffee under ambient storage condition

Notations	Days of storage	Colour and appearance	Texture	Taste	Flavour	Overall acceptability
D1	0 Days	9.05d	9.30c	9.04e	9.03f	9.06f
D2	15 Days	8.97d	9.25c	8.97de	8.96ef	8.93ef
D3	30 Days	8.92d	9.13bc	8.91de	8.83de	8.87e
D4	45 Days	8.82cd	9.03bc	8.79cd	8.69d	8.71d
D5	60 Days	8.38b	8.85b	8.69bc	8.49c	8.51c
D6	75 Days	8.07ab	8.33a	8.08a	8.25b	8.29b
D7	90 Days	7.99a	8.16a	7.98a	8.07a	8.09a
	SE (m) $\pm$	0.11	0.14	0.08	0.06	0.05
	C.D. at 5%	0.31	0.39	0.21	0.16	0.14

Evaluation of microbial loads in papaya based fortified toffee. Bacterial Colony Count (cfu/ml)

It was observed that there is gradual increase in bacterial colony count. Maximum Bacterial Colony Count (2.0×10^4) D7 (90 days of Storage) and the minimum bacterial colony count (Below detectable level)

was found under D1 (0 days of Storage).

Fungal Colony Count (cfu/ml)

Maximum fungal colony count (18.33×10^4) D7 (90 days of Storage) and the minimum fungal colony count storage (Below detectable level) was enrolled under treatment.

Table 3: Effect of storage duration on microbial loads in Papaya based fortified toffee under ambient storage condition

Notations	Days of storage	Bacterial colony count (104) cfu/ml	Fungal colony count (104) cfu/ml
D1	0 Days	0.00	0.00
D2	15 Days	1.00a	3.67a
D3	30 Days	3.67b	6.67b
D4	45 Days	4.67b	9.33bc
D5	60 Days	12.00c	11.67c
D6	75 Days	15.67d	16.00de
D7	90 Days	20.00e	18.33e
	SE (m) $\pm$	0.54	0.69
	C.D. at 1%	2.17	2.78

Conclusion

From the above result, Standardization of recipe and storage behaviour of papaya based fortified toffee with treatment T₄ (50% papaya pulp + 50% plum pulp + 300 g Sugar) shows best result from the other treatments.

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