



Studies on Physio-Chemical Properties of Value Added Herbal Papaya (*Carica papaya* L.) Candy

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Authors' contributions

This work was carried out in collaboration between both authors. Author KJ designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author SM managed the analyses of the study and the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

A field experiment was conducted during year 2019-2020 at the Post Harvest Laboratory of Horticulture Department, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj to study "Studies on physio-chemical properties of value added herbal papaya (*Carica papaya* L.) candy". The experiment was conducted in Randomized Block Design with ten treatments, replicated thrice. Total number of treatments were ten viz. (T₀ (Control)-70% sugar), (T₁-Raw papaya + 70% sugar + 0.5% tulsi), (T₂ -Raw papaya + 70% sugar + 1.0% tulsi), (T₃ -Raw papaya + 70% sugar + 1.5% tulsi), (T₄ -Raw papaya + 70% sugar + 0.5% cardamom), (T₅ -Raw papaya + 70 % sugar + 1.0% cardamom), (T₆ -Raw papaya + 70 % sugar + 1.5% cardamom), (T₇ -Raw papaya + 70% sugar + 0.5% lemon grass), (T₈ -Raw papaya + 70% sugar + 1.0% lemon grass) and (T₉ -Raw papaya +70% sugar + 1.5% lemon grass). The treatment T₆ (Raw papaya + 70 % sugar + 1.5% cardamom) was found superior in respect of parameters like total soluble solids (85.78 °Brix), Titrable acidity (1.29), PH (5.05), flavour score (9.00), taste score (9.00) and overall acceptability score (8.50). Benefit-cost Ratio was found highest (1.64) in the

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treatments (T₁ - Raw papaya + 70% sugar + 0.5% tulsi), (T₂ - Raw papaya + 70% sugar + 1.0% tulsi), (T₃ - Raw papaya + 70% sugar +1.5% tulsi) and (T₇ -Raw papaya + 70% sugar + 0.5% lemon grass).

Keywords: Herbal Papaya candy; sugar; tulsi; cardamom and lemon grass.

1. INTRODUCTION

Carica papaya Linn (Papaya) is a tropical fruit belonging to the family Caricaceae. It is also referred as common man's fruit. The papaya plant is a semi-woody, usually single-stemmed, short lived and perennial. It is a round to oval shaped fruit with orange-red pulp inside it. The fruit is green when raw, gradually turning to yellow or orange when matures.

It is rich in various nutrients, low in calories (32 kcal/100g ripe fruit) and good source of vitamins and minerals especially Vitamin A, C and carotenoid content. However, it has very low concentration of Vitamin E (0.3 mg/100 g fresh weight). The seeds are black and are often used as an adulterant in black pepper because of their spicy taste. Additionally, papaya is rich in certain enzymes like papain which is present in more quantity in raw fruit and helps in improving digestion. It is also rich in benzyl isothiocyanate (BITC) which is believed to be used in chemoprevention against cancer [1].

Papaya, also known as Pawpaw in certain countries, has various medicinal properties. The properties are due to various chemical constituents present in different parts of the plant. More than 300 volatile compounds have been identified among which Linalool and benzyl isothiocyanate, methyl butanoate or ethyl butanoate are the most abundant [2].

It has additional benefit of preserving the colour, flavour, nutritional content of the fruit and preventing enzymatic and oxidative browning. Moreover, as it partially removes water it also reduces water removal load at the dryer and makes drying quick comparatively [3].

The loss of water and amount of solid gain depends on the type of fruit or vegetable, the pre-treatment given and temperature. The ripeness level of fruit, gelification level of pectin, enzymatic activity is some of the variables that affect the process. Moreover, the increase in temperature is also found to increase the water loss activity. Pre-treatments like blanching or freezing leads to increased permeability than selectivity thus promoting more water loss.

Osmotic dehydration is considered to be effective when the water removal is maximum and solute uptake is minimum.

As papaya has a rich nutritional content and high moisture content, it serves as a good media for microbes and hence more prone to spoilage. Spoilage even accelerates because of softness occurring during ripening [4]. Development of papaya candy by osmotic dehydration followed by tray drying seems a good approach to preserve the nutrients, making them easily available and acceptable to all along with more storage life than the fruit itself.

A good tutti fruity Pieces having sharp edges and retaining its shape will be crisp and will not leave any fibrous residue in mouth. It will be bright in colour and not dull in appearance. There will be minimum free syrup on surface and pieces will not be sticky.

2. MATERIALS AND METHODS

The present investigation entitled "Studies on physio-chemical properties of value added herbal papaya (*Carica papaya* L.) candy" was laid out in the Post Harvest Laboratory of Horticulture Department, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during the year 2019-2020. The present Experiment was conducted in Randomized Block Design (RBD), with ten treatments, replicated thrice [5]. Total number of treatments were ten viz. (T₀ (Control)- 70% sugar), (T₁-Raw papaya + 70% sugar + 0.5% tulsi), (T₂ -Raw papaya + 70% sugar + 1.0% tulsi), (T₃ -Raw papaya + 70% sugar +1.5% tulsi), (T₄ -Raw papaya + 70% sugar + 0.5% cardamom), (T₅ -Raw papaya + 70 % sugar + 1.0% cardamom), (T₆ -Raw papaya + 70% sugar + 1.5% cardamom), (T₇ -Raw papaya + 70% sugar + 0.5% lemon grass), (T₈ -Raw papaya + 70% sugar + 1.0% lemon grass) and (T₉ -Raw papaya +70% sugar + 1.5% lemon grass).

2.1 Climatic Condition in the Experimental Site

The area of Prayagraj district comes under subtropical belt in the south east of Uttar

Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46°C-48°C and seldom falls as low as 4°C- 5°C. The relative humidity ranges between 20 to 94 %. The average rainfall in this area is around 1013.4 mm annually. However, occasional precipitation is also not uncommon during winter months.

2.2 Material Used for Candy Preparation

Peeled Papaya : 300 g
Sugar : 220 g
Water : 200 ml.
Flavours : cardamom powder, tulsi powder, lemon grass powder citric acid

2.3 Method of Preparation

Select right quality of raw papaya and wash them properly. Make few streaks on papaya with a knife. Allow latex to flow out and peel the papaya. Cleanse them without latex. Allow them to dry. Cut the papaya and remove the seeds and chop them into small cubes (preferably 2-3 cm in dimension). Soak the cubes in common salt for one hour.

Later, cubes of papaya are blanched in water for 10-15 minutes until they become soft and transparent. Remove the water and drain it properly before transferring cubes into a container. Take another container with 220 ml of water adding 220 grams of sugar to it. Boil the solution until the sugar is completely dissolved. Add 300 grams of papaya cubes to the sugar syrup. Boil them for 20-25 minutes and steep the pieces in the Sugar syrup for 6-8 hours. Add 1.5 grams of Citric Acid as a preservative.

Add the chosen herbal flavours Tulsi, Cardamom and Lemon grass in preferable proportion. Add organic food colour, if required. Drain the papaya cubes from sugar syrup and allow them to dry in shade until they become crisp. Pack them in Bio-degradable polythene pouches or right quality plastic containers.

3. RESULTS AND DISCUSSION

3.1 Effect of Different Treatments on Total Soluble Solids (°Brix) of Value Added Herbal Papaya Candy

An increasing trend in the total soluble solids (°Brix) (85.78) of value added herbal papaya

candy was recorded in T₆ Raw papaya + 70% sugar + 1.5% cardamom followed by T₅ Raw papaya + 70% sugar + 1.0% cardamom, T₄Raw papaya + 70% sugar + 0.5% cardamom, T₁Raw papaya + 70% sugar + 0.5% tulsi, T₃Raw papaya + 70% sugar +1.5% tulsi and T₉Raw papaya + 70% sugar + 1.5% lemon grass and the minimum total soluble solids (°Brix) (80.65) was recorded in T₀ (control) Raw papaya + 70% sugar. This findings correlates the findings of Ahmad and Tariq [6], Manivasagan et al. [7] and Mall and Tandon [8].

3.2 Effect of Different Treatments on Acidity (%) of Value Added Herbal Papaya Candy

An increasing trend in the acidity (1.29) of value added herbal papaya candy was recorded in treatments T₆ Raw papaya + 70% sugar + 1.5% cardamom followed by T₇Raw papaya + 70% sugar + 0.5% lemon grass, T₅Raw papaya + 70% sugar + 1.0% cardamom , T₄Raw papaya + 70% sugar + 0.5% cardamom and T₁Raw papaya + 70% sugar + 0.5% tulsi and the minimum acidity (1.23) was recorded in T₀ (control) Raw papaya + 70% sugar. This findings correlates the findings of Rathore et al. [9] and Khushbu et al.[10].

3.3 Effect of Different Treatments on pH of Value Added Herbal Papaya Candy

An decreasing trend in the pH (5.05) of value added herbal papaya candy was recorded in T₆ Raw papaya + 70% sugar + 1.5% cardamom followed by T₅Raw papaya + 70% sugar + 1.0% cardamom, T₁Raw papaya + 70% sugar + 0.5% tulsi, T₂ Raw papaya + 70% sugar + 1.0% tulsi, T₇Raw papaya + 70% sugar + 0.5% lemon grass and T₉ Raw papaya +70% sugar + 1.5% lemon grass and the maximum pH (6.06) was recorded in T₀ (control) Raw papaya + 70% sugar. This findings correlates the findings of Braimwell and Badrie[11], Siddiqui[12] and Khushbu et al. [10].

3.4 Influence of Different Treatments on Scores for Flavour of Value Added Herbal Papaya Candy

The maximum flavour score (9.00) was recorded in T₆ Raw papaya + 70 % sugar + 1.5%

cardamom followed by T₅ Raw papaya + 70 % sugar + 1.0% cardamom , T₄ Raw papaya + 70% sugar + 0.5% cardamom , T₁ Raw papaya + 70% sugar + 0.5% tulsi , T₉ Raw papaya +70% sugar + 1.5% lemon grass and T₇ Raw papaya + 70% sugar + 0.5% lemon grass and the minimum flavour score (3.33) was found in T₀ (control) Raw papaya + 70% sugar. This findings correlates the findings of Rathore et al. [9], Shakti et al. [13] and Khushbu et al. [10].

3.5 Influence of Different Treatments on Scores for Taste of Value Added Herbal Papaya Candy

The maximum taste score (9.00) was recorded in T₆ Raw papaya + 70 % sugar + 1.5% cardamom followed by T₅ Raw papaya + 70 % sugar + 1.0% cardamom , T₄ Raw papaya + 70% sugar + 0.5% cardamom , T₁ Raw papaya + 70% sugar + 0.5% tulsi , T₉ Raw papaya +70% sugar + 1.5% lemon grass and T₇ Raw papaya + 70% sugar + 0.5% lemon grass and the minimum taste score (3.67) was found in T₀ (control) Raw papaya + 70% sugar. This findings correlates the findings of Rathore et al. [9], Shakti et al. [13] and Khushbu et al. [10].

3.6 Influence of Different Treatments on Scores for Overall Acceptability of Value Added Herbal Papaya Candy

The maximum overall acceptability score (8.50) was recorded in T₆ Raw papaya + 70 % sugar + 1.5% cardamom followed by T₅ Raw papaya + 70 % sugar + 1.0% cardamom , T₄ Raw papaya + 70% sugar + 0.5% cardamom , T₁ Raw papaya + 70% sugar + 0.5% tulsi , T₉ Raw papaya +70% sugar + 1.5% lemon grass and T₇ Raw papaya + 70% sugar + 0.5% lemon grass and the minimum overall acceptability score (4.58) was found in T₀ (control) Raw papaya + 70% sugar. This findings correlates the findings of Vikram and Singh [14] and Rekha et al. [15].

3.7 Effect of Benefit Cost Ratio of Value Added Herbal Papaya Candy

Benefit-cost Ratio was found highest (1.64) in the treatments (T₁ - Raw papaya + 70% sugar + 0.5% tulsi), (T₂ - Raw papaya + 70% sugar + 1.0% tulsi), (T₃ - Raw papaya + 70% sugar +1.5% tulsi) and (T₇ -Raw papaya + 70% sugar + 0.5% lemon grass).

4. TABLES & FIGURES

This tables and figures are indicating the results of the research.

Table 1. Effect of different treatments on total soluble solids (°Brix), Acidity (%) and pH of value added herbal papaya candy.

Treatments	Treatment details	Total soluble solids (°Brix)	Acidity (%)	pH
T ₀ (control)	Raw papaya + 70% sugar	80.65	1.23	6.06
T ₁	Raw papaya + 70% sugar + 0.5% tulsi	84.54	1.28	5.36
T ₂	Raw papaya + 70% sugar + 1.0% tulsi	82.16	1.24	5.42
T ₃	Raw papaya + 70% sugar +1.5% tulsi	83.39	1.24	5.84
T ₄	Raw papaya + 70% sugar + 0.5% cardamom	85.34	1.27	5.93
T ₅	Raw papaya + 70 % sugar + 1.0% cardamom	85.85	1.27	5.22
T ₆	Raw papaya + 70 % sugar + 1.5% cardamom	85.78	1.29	5.05
T ₇	Raw papaya + 70% sugar + 0.5% lemon grass	81.58	1.27	5.33
T ₈	Raw papaya + 70% sugar + 1.0% lemon grass	82.66	1.22	5.47
T ₉	Raw papaya +70% sugar + 1.5% lemon grass	83.17	1.26	5.60
	F-Test	S	S	S
	C. D. at 0.5%	0.323	0.035	0.083
	S.Ed. (+)	0.154	0.017	0.039

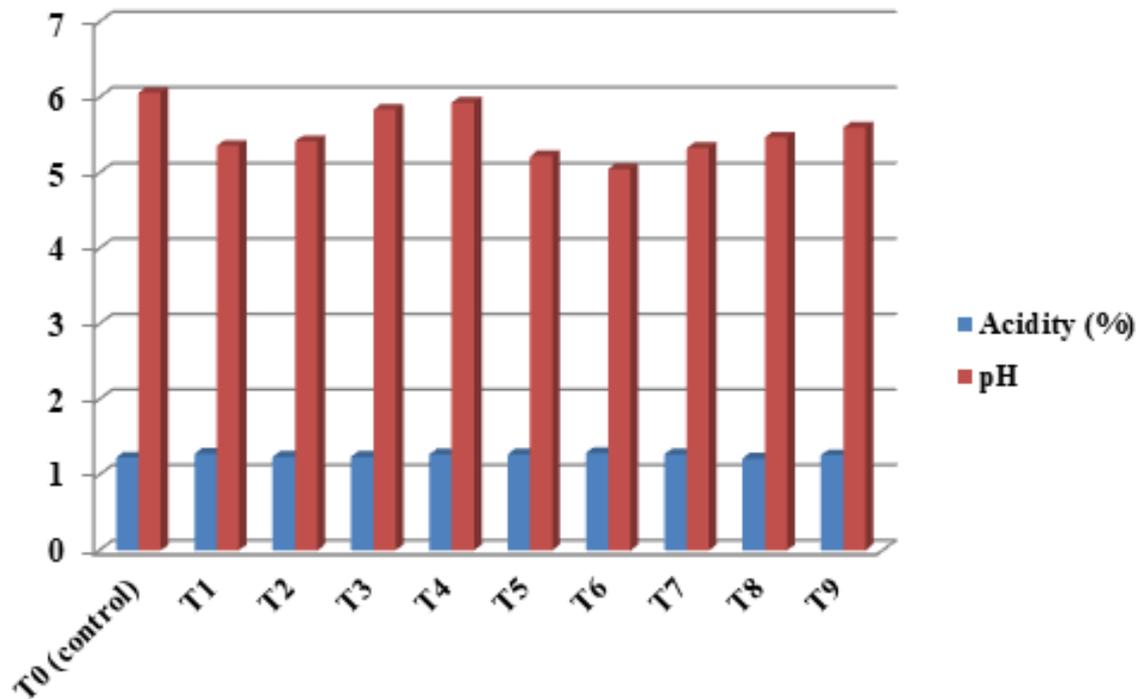


Fig. 1. Effect of different treatments on Acidity (%) and pH of value added herbal papaya candy

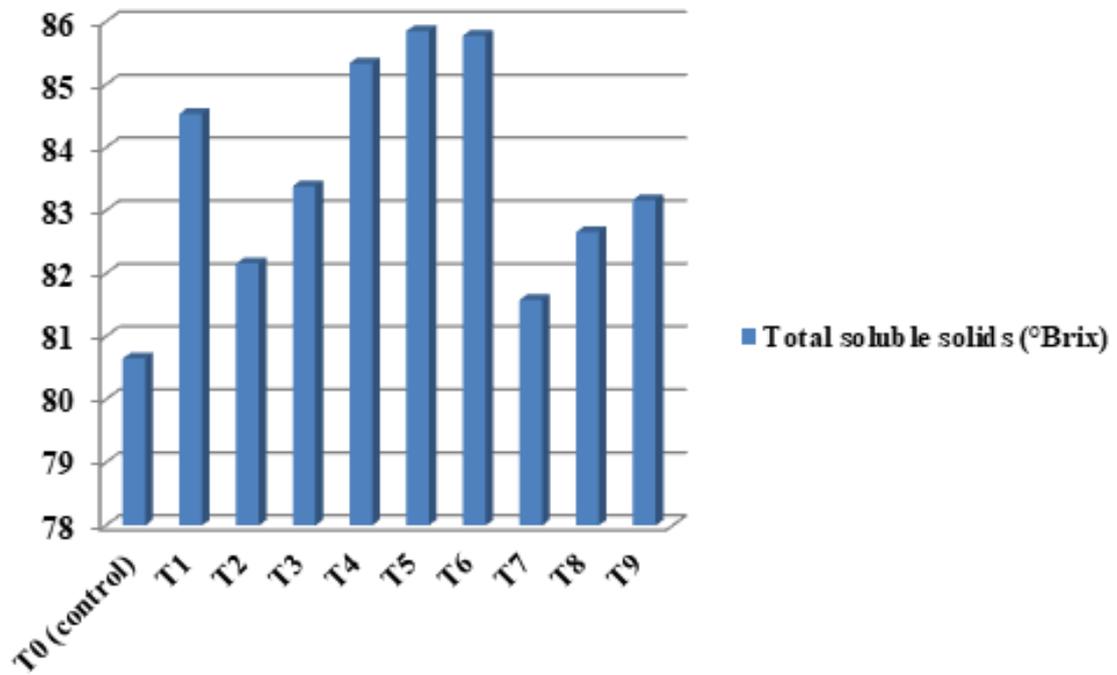


Fig. 2. Effect of different treatments on total soluble solids (°Brix) of value added herbal papaya candy

Table 2. Effect of different treatments on flavour, taste, and overall acceptability and benefit cost ratio of value added herbal papaya candy

Treatments	Treatment details	Flavour	Taste	Overall acceptability	Benefit cost ratio
T ₀ (control)	Raw papaya + 70% sugar	3.33	3.67	4.58	1.28
T ₁	Raw papaya + 70% sugar + 0.5% tulsi	4.67	4.67	4.92	1.64
T ₂	Raw papaya + 70% sugar + 1.0% tulsi	5.67	5.33	5.58	1.64
T ₃	Raw papaya + 70% sugar +1.5% tulsi	6.67	6.00	6.00	1.64
T ₄	Raw papaya + 70% sugar + 0.5% cardamom	8.00	8.67	8.33	1.63
T ₅	Raw papaya + 70 % sugar + 1.0% cardamom	8.00	8.00	7.92	1.61
T ₆	Raw papaya + 70 % sugar + 1.5% cardamom	9.00	9.00	8.50	1.59
T ₇	Raw papaya + 70% sugar + 0.5% lemon grass	6.67	5.33	6.00	1.64
T ₈	Raw papaya + 70% sugar + 1.0% lemon grass	6.67	6.00	6.17	1.63
T ₉	Raw papaya +70% sugar + 1.5% lemon grass	6.00	6.00	6.17	1.62
	F-Test	S	S	S	-
	C. D. at 0.5%	1.750	1.847	0.859	-
	S.Ed. (+)	0.833	0.879	0.409	-

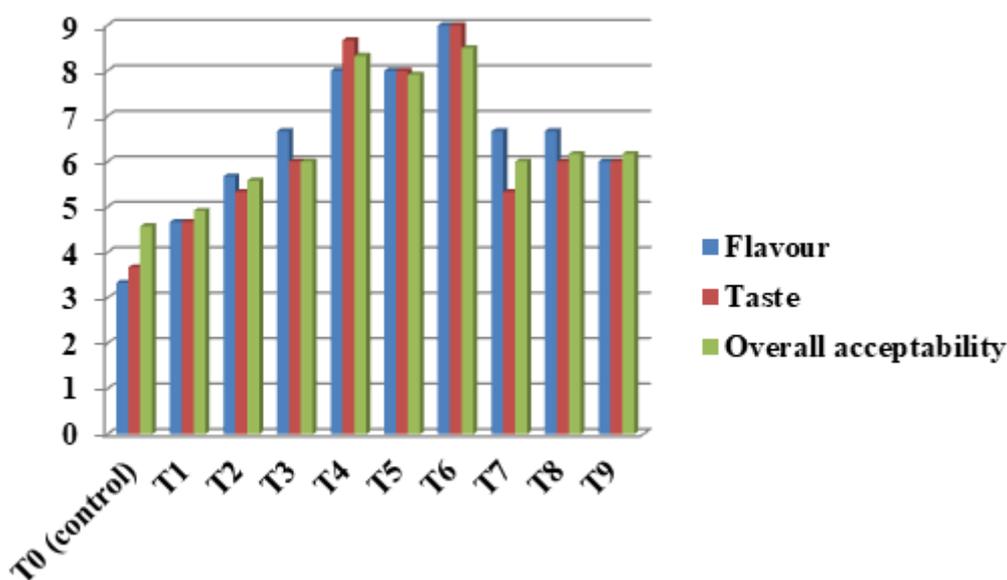


Fig. 3. Effect of different treatments on flavour, taste and overall acceptability of value added herbal papaya candy

4. CONCLUSION

Based on the present experiment it is concluded that treatment T₆ (Raw papaya + 70 % sugar + 1.5% cardamom) was found superior in respect of parameters like total soluble solids, Titrable acidity, PH. with respectively colour and appearance ,Flavour and Taste, Texture and

overall acceptability also T₆ was found best. Benefit-cost Ratio was found highest in the treatments (T₁Raw papaya + 70% sugar + 0.5% tulsi),(T₂ Raw papaya + 70% sugar + 1.0% tulsi), (T₃Raw papaya + 70% sugar +1.5% tulsi), (T₇ Raw papaya + 70% sugar + 0.5% lemon grass).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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