Himachal Journal of Agricultural Research 47(2): 228-234 (2021)

Standardization, preparation and evaluation of dheu (*Artocarpus lakoocha*) based Toffee

Ranjana Verma, Rajni Sharma and Satya Bhama*

Department of Foods Science Nutrition and Technology
College of Community Science
CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur-176 062, India.

*Corresponding author: sbhama74@yahoo.co.in
Manuscript received: 16.02.2021; Accepted:28.06.2021

Abstract

Many of the underexploited fruits have nutritional, therapeutic and medicinal values and holds lots of potential to become as new fruit crops. *Dheu* is among such potential fruits which is neglected from post harvest technological view point. It contains some valuable nutrients such as ascorbic acid and fibre and minerals. In *dheu* based toffee the acceptability scores was increased with blending with papaya. The product was found to be acceptable during storage upto 90 days. The results revealed that with the addition of papaya the ascorbic acid content of toffee decreased significantly from 31.20 mg/100g to 24.0 mg/100g. With increase in proportion of papaya pulp in *dheu* pulp, scores for texture of toffee decreased from 8.05 to 7.90. Similarly, the mean scores for overall acceptability for fresh toffee were 8.15 which decreased to 7.89 in toffee prepared with 50:50, *dheu* and papaya pulp. Although, the overall acceptability scores decreased with storage but the values ranged between liked moderately to liked very much. In the present scenario, where lot of emphasis is being laid on the consumption of health foods, development of such products may help the consumers to harness the nutritional and medicinal properties of such fruits.

Key words : *Dheu*, pulp, toffee, sensory evaluation, ascorbic acid .

Dehu (*Artocarpus lakoocha*), commonly known as the jackfruit and belonging to the family Moraceae and is endemic to Western Ghats and Kerala in India (Nayak *et al*. 2017). It is considered to be "poor man's food", as it is widely available in summer at an economical price when there is a shortage of agricultural produce in India. (Zhang *et al*. 2017, Jagtap *et al*. 2010). In India, the trees are found distributed continuously in places where rainfall is high and, sporadically in areas where it is low. The fruits are of dietary use and are an important source of carbohydrate, protein, fat, minerals and vitamins. Historical reports suggest that jackfruit tree is supposed to have originated in the rain forests of the Western Ghats in the Southwestern part of India. However with time, the trees have been introduced to other parts of India and tropical regions of the world (Baliga *et al*. 2011). Jack fruit is a highly nutritive seasonal food, which is considered as poor man's food in south East Asia. Edible portion of jack fruit is rich in carbohydrate, protein, fat, fiber, calcium, phosphorous, iron, vitamin A and thiamine. Fructose, glucose and sucrose are the major sugars present in jack fruit (Hari *et al*. 2014).

It substitutes the diet of people both as vegetable and as a nutritious food during the season (Singh *et al*. 1963, Bose 1985). The flesh of the jackfruit is starchy and fibrous and is a source of dietary fiber. The flavor is comparable to a combination of apple, pineapple, mango, and banana. Jackfruit is one of the least known super foods. Most people from the South love it as a fruit and its seed as a protein rich nut. In the North, tender jackfruit or *kathal* is a gourmet vegetable and in Bengal, it's *gacch-patha* (tree mutton). Besides this jack fruit has various health benefits like it helps to reduce weight, cholesterol, prevent colon cancer, increases your longevity and beat diabetes. So keeping in mind the above facts an attempt has been made to standardization, preparation and evaluation of *dheu* and papaya based toffee.

Material and Methods

Procurement of raw material

The fruit sample of *dheu* was procured from various villages of District Kangra and adjoining areas. The fruits were sorted, washed and cleaned for further use. The chemicals and other ingredients used for the research study and preparation of value added food products were procured from local market.

Extraction of pulp

The texture of ripe fruits of *dheu* was soft and juicy and easily convertible into pulp manually. The seeds of fruit are edible can be crushed while making pulp. The extracted pulp was homogenized properly in a blender and sieved through net to get a smooth pulp.

Preparation toffee

The *dheu* based toffee was prepared by standardized method and kept for the storage studies under ambient storage conditions for a period of 90 days. The product was analyzed fresh for their nutritional parameters and organoleptic scores at 30, 60 and 90 days of storage interval. The product was evaluated for various nutritional parameters viz. TSS, acidity, brix acid ratio, ascorbic acid, reducing sugars, total sugars and non-reducing sugars and also moisture as per standardized methods described.

Organoleptic quality determines the storage stability of the toffee. The 9 point hedonic scale (Larmond, 1977) was employed for the sensory evaluation of prepared toffee. A panel of 10 judges were selected at random. Each panel member was asked to evaluate the toffee with respect to colour, flavor, taste and consistency.

Preparation of toffee

Dheu based toffees was prepared by blending *dheu* pulp with papaya pulp in equal proportions (50:50). For every proportion of 100 g pulp, 70 g sugar was added. To this 10 g each glucose powder and hydrogenated fat was mixed. Skimmed milk powder (15 g) was also added. The operations involved in preparation of fruit toffee are illustrated in Figure 1. The prepared toffees after wrapping in butter paper were stored in polythene bags under ambient storage conditions.

Nutritional characteristics of *Dheu*

Various nutritional characteristics like Brix acid ratio, pH, Total soluble solids and Titrable acidity was estimated by Ranganna (2007), while ascorbic acid was estimated by AOAC (1990) method.

Statistical Analysis

The data obtained from various parameters were subjected to statistical analysis with the help of computer using CRD design. Data were compared at 5 per cent level of significance.

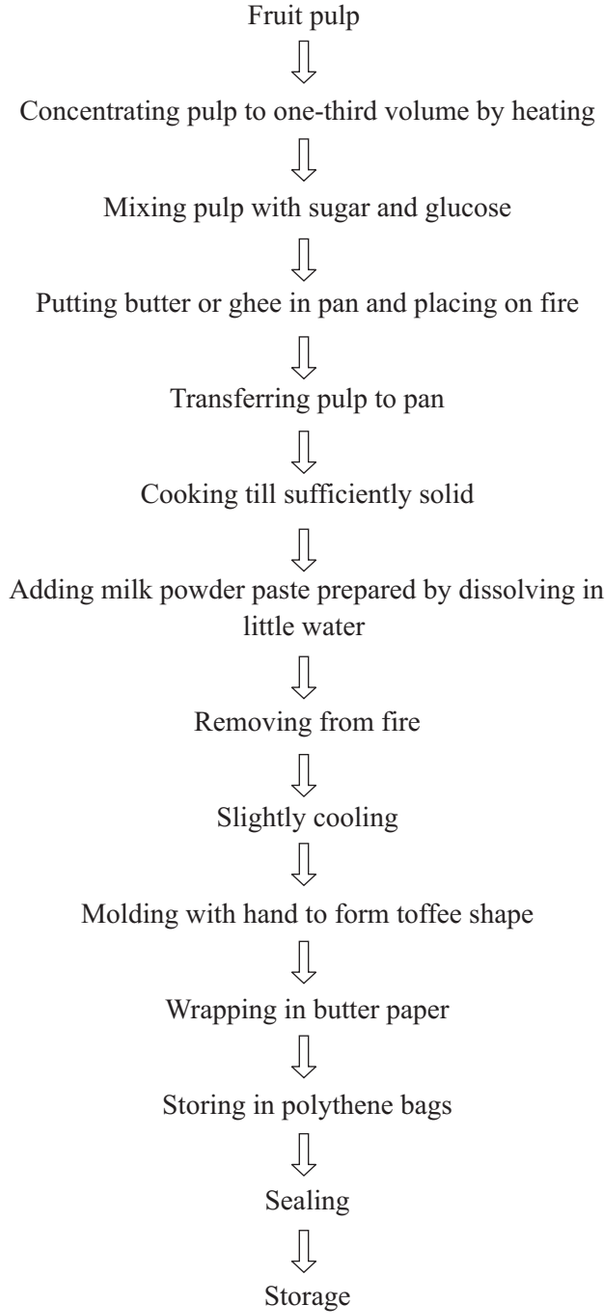

Fig. 1 Steps involved in the preparation of toffee

Results and Discussion

Table 1 represents the effect of blending and storage on the moisture, acidity, ascorbic acid and sugar content on *dheu* based toffee blended with papaya pulp. The moisture content of pure *dheu* and papaya blended toffee (50:50) was nearly same i.e. 1.75 and 1.76 per cent, respectively. Irrespective of the treatments, the mean moisture content of toffee was 1.76 per cent which increased to 6.31 per cent after 90 days of storage. During storage the toffee became soggy and this may be due to the presence of humidity in the environment or some internal reactions with contents of toffee. The results are in conformation to those reported by Garg (2004).

The acidity content of pure *dheu* toffee was 0.81 whereas, the corresponding value for toffee prepared with equal proportions of *dheu* and papaya was 0.60 per cent. With storage, the mean acidity content for both blends was 0.70 per cent which increased to 0.81, 1.02 and 1.15 per cent after 30, 60 and 90 days of storage. Kumar (2015) reported that the per cent acidity of mixed fruit toffee was increased continuously and significant difference was recorded in all the treatment with the progress in storage period up to 120 days.

The results are in agreement to those reported by Manimegalai *et al*. (2001) and Sheoran *et al*. (2007). A perusal of data revealed that as the proportion of papaya pulp increased in toffee the ascorbic acid content of toffee decreased significantly from 31.20 mg/100g to 24.00 mg/100g. Whereas, with storage, the mean ascorbic acid content in both the blends decreased significantly (P≤0.05) from 27.60 mg/100g to 11.60 mg/100g after 90 days of storage. Similar results were reported by Chavan *et al*. (2016). Degradation of ascorbic acid to carbolic acid due to increased acidity of the stored product could be

Table 1. Effect of blending and storage on the acidity, ascorbic acid, moisture, reducing sugars and non reducing sugars on *dheu* based toffee blended with papaya pulp

Proportion	**Storage Interval (days)**				
***Dheu*: Papaya**	**Fresh**	**30**	**60**	**90**	**Mean**
Moisture (%)					
100:00	1.75	2.30	3.94	6.10	3.52
50:50	1.76	2.26	4.25	6.52	3.70
Mean	1.76	2.28	4.09	6.31	3.61
Acidity (%) as citric acid					
100:00	0.81	0.94	1.11	1.24	1.02
50:50	0.60	0.68	0.94	1.06	0.82
Mean	0.70	0.81	1.02	1.15	0.92
Ascorbic acid (mg/100g)					
100:00	31.20	27.67	17.07	12.80	22.18
50:50	24.00	23.79	11.73	10.40	17.48
Mean	27.60	25.73	14.40	11.60	19.82
CD(P≤ 0.05)	Moisture	Acidity	Ascorbic acid		
Blends (A)	0.17	0.06	1.70		
Storage	0.24	0.09	2.41		
Interval (B)			3.40		
A×B	0.34	1.28			

attributed as a reason for decrease in ascorbic acid (Sharma, 2010). Sarker *et al*. (2016) reported that the vitamin C content of *Artocarpus lakoocha* germplasm varied from 27.34 to 57.88 mg/100g .

Table 2 represents the effect of storage and blending on total sugars content of *dheu* based toffee blended with papaya. It was observed that with addition of papaya pulp in the *dheu* toffee the total sugar content decreased from 68.28 to 66.20 per cent. The decrease in total sugar may be due to Maillard reaction and other chemical reactions of sugars with acids during storage (Barwal *et al*. 2005, Kumar and Manimagalai 2005). The reducing sugar content in pure *dheu* based toffee was 56.68 per cent which decreased to 53.46 per cent in toffee prepared 50:50 *dheu* : papaya pulp. Irrespective of the blends, the mean reducing sugar content was 55.07 per cent which increased to 57.83, 59.60 and 59.63 per cent after 30, 60 and 90 days of storage respectively. It might be due to the inversion of non reducing sugars (Sharma, 2010). The non reducing sugar for pure *dheu* toffee was 13.99 per cent which decreased to 12.04 per cent in toffee prepared by using equal parts *dheu* and papaya pulp 50 parts of papaya was added to it. Whereas, with storage the mean non-reducing sugar content of 13.01 per cent decreased significantly ($P \leq 0.05$) to 4.96 per cent. Kumari *et al*. (2020) reported a significant effect of storage on the nutritional parameters of the pomegranate tablet. The wild pomegranate beverage blended with cultivated pomegranate in different ratios (0:100, 25:75, 50:50,75:25 and 100:00) showed that the TSS, acidity, ascorbic acid, total and non-reducing sugars decreased significantly while reducing sugars increased significantly with the increase of storage interval.

Table 2. Effect of storage and blending on total sugars content of dheu based toffee blended with papaya

Proportion	**Storage Interval (days)**				
(*Dheu*:papaya)	**Fresh**	**30**	**60**	**90**	**Mean**
Total sugars					
100:00	68.28	67.08	67.74	66.20	67.33
50:50	66.22	64.17	65.78	63.51	64.92
Mean	67.25	65.63	66.78	64.86	66.12
Reducing sugar (% as glucose)					
100:00	56.68	58.97	60.00	60.17	58.95
50:50	53.46	56.68	59.03	59.27	57.11
Mean	55.07	57.83	59.60	59.63	58.03
Non reducing sugar (% as sucrose)					
100:00	13.99	7.53	7.20	5.89	8.65
50:50	12.04	6.71	6.41	4.03	7.30
Mean	13.01	7.12	6.81	4.96	7.98
CD($P \leq 0.05$)	Total sugar	Reducing sugar	Non reducing sugar		2.95
		2.95			
Blends (A)	2.01	4.18	1.29		
Storage	2.84		1.83		
Interval (B)		5.91	2.59		
A×B	4.01				

Table 3 depicts the effect of blending and storage on the colour, taste, consistency and overall acceptability of *dheu* toffee with and without blending with papaya pulp. The colour scores for pure *dheu* toffee were 8.30 which decreased to 7.50 after addition of 50 parts of papaya. Whereas, irrespective of the blend the mean colour scores declined from 7.90 to 6.80 after 90 days of storage. Similarly, the scores for taste decreased from 8.10 to 7.90 with increase in proportion of papaya pulp in toffee. While with storage, the mean score for taste decreased significantly (P≤0.05) from 8.00 to 7.05 after 90 days of storage. In general, fresh *dheu* based toffee was more acceptable in terms of colour and taste.

Table 3. Effect of blending and storage on the colour, taste and texture of dheu based toffee blended with papaya

Parameter/ Proportion Dheu : Papaya	Storage Interval (days)				
	Fresh	30	60	90	Mean
Colour					
100:00	8.30	7.45	7.10	6.80	7.41
50:50	7.50	7.15	6.78	6.80	7.06
Mean	7.90	7.30	6.94	6.80	7.23
Taste					
100:00	8.10	7.60	7.00	7.10	7.45
50:50	7.90	7.45	7.40	7.00	7.44
Mean	8.00	7.53	7.20	7.05	7.44
Texture					
100:00	8.05	7.15	6.50	5.90	6.90
50:50	7.90	7.40	7.00	5.90	7.05
Mean	7.98	7.28	6.75	5.90	6.98
Overall acceptability					
100 : 00	8.15	7.39	7.11	6.59	7.31
50 : 50	7.89	7.33	7.15	6.57	7.24
Mean	8.02	7.36	7.13	6.58	7.28
CD (P≤0.05)	Colour	Taste	Texture	Overall acceptability	
Blends (A)	0.33	0.32	0.36	0.27	
Storage Interval (B)	0.47	0.45	0.51	0.38	
A×B	0.61	0.64	0.72	0.54	

The data revealed that with increase in proportion of papaya pulp in *dheu* pulp, scores for texture of toffee decreased from 8.05 to 7.90. Irrespective of blending, the mean texture scores of toffee decreased from 7.98 to 5.90 after 90 days of storage. Similar results were obtained by Ani *et al*. (2019) in candy (toffee) made from Tiger nut. The mean scores for overall acceptability for pure toffee were 8.15 which decreased to 7.89 in toffee prepared with 50:50, *dheu* and papaya pulp. The initial mean overall acceptability scores for toffee in both the blends was 8.02 which decreased significantly (P≤ 0.05) to 7.36, 7.13 and 6.58 after 30, 60 and 90 days of storage respectively. Kumari *et al*. (2020) reported that the mean taste and flavor scores for all the blends of RTS prepared from pure cultivated pomegranate fruit juice varied from 6.82 to 8.02 and 7.12 to 7.97, respectively.

Conclusion

Many of the underexploited fruits have nutritional, therapeutic and medicinal values and holds lots of potential to become as new fruit crops. Utilization of such fruits will not only enlarge the components of our food basket but also help to harness the beneficial effects of such fruits. *Dheu* is a potential fruit and contains valuable nutrients such as ascorbic acid, fiber and minerals. This fruit is neglected from post harvest technological view point. In the present scenario, where lot of emphasis is being laid on the consumption of health foods, development of various value added products may help the consumers to harness the nutritional and medicinal properties of such fruits.

Conflicts of interest: The authors declare that there is no conflict of interest in this research paper.

References

Ani IF, Adeoye BK, Ngozi EO and Kehinde ZA. 2019. Nutritional Composition and Quality Acceptability of Soft Candy (Toffee) Made from Tiger nut. International Journal of Research and Innovation in Applied Science **4** (7): 2454-6194.

AOAC. 1990. Approved Methods of Association of Official Analytical Chemist Washington, DC, USA.

Baliga MS, Shivashankara AR, Haniadka R, Dsouza J and Bhat HP. 2011. Phytochemistry, nutritional and pharmacological properties of *Artocarpus heterophyllus Lam* (jackfruit): A review. Food Research International **44:** 1800-1811.

Barwal VS, Singh TK and Alkesh 2005. Studies on processing and development of ready- to- serve drink from bitter gourd fruit. Journal of Food Science and Technology **42** (3): 217-220.

Bose TK. 1985. Jackfruit. In: Mitra, B.K. (Ed.), Fruits of India: Tropical and Subtropical. Naya Prokas, Calcutta. pp. 488-497.

Chavan UD, Shegade SL, Karma BR and Dalvi US. 2016. Studies on Preparation of Toffee from Guava. International Journal of Advanced Research in Biological Sciences **3** (1): 99-111.

Garg V. 2004. Development and evaluation of aonla based fruit drink and mouth fresher. M Sc Thesis. Dr. Y.S. Pramar University of Horticulture and Forestry, Solan.

Jagtap UB and Bapat VA. 2010. *Artocarpus:* A review of its traditional uses, photochemistry and pharmacology. Journal of Ethnopharmacology **129** (2010): 142-166.

Hari A, Revikumar KG and Divya D. 2014. Artocarpus: A review of its phytochemistry and pharmacology. Journal of Pharma Search **9** (1):7.

Jagtap UB, Panaskar SN, Bapat, VA 2010. Evaluation of antioxidant capacity and phenol content in jackfruit (*Artocarpus heterophyllus* Lam.) fruit pulp. Plant Foods Human Nutrition **65**: 99–104.

Kumar B. 2015. Standardization of the Recipe for Preparation of Mixed Fruit Toffee (Mango and Papaya). M Sc Thesis. Department of Horticulture College of Agriculture, Jabalpur Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh. India.

Kumar S and Manimegalai G. 2005. Studies on storage stability of whey based papaya juice blended RTS beverage. Journal of Food Science and Technology **42** (3):185-188.

Kumari A, Dhaliwal YS and Sandal A. 2020. Development and quality evaluation of Ready-to-serve (RTS) beverage and tablet prepared from wild pomegranate (*Punica granatum*) . GAU Research Journal **45** (4): 214-222.

Larmond E. 1977. Laboratory methods for sensory evaluation of foods. Canada Department of Agriculture Publications 1637. Food Research Institute, Ottawa: Ontario p: 73.

Manimegalai G, Krishnaveni A and Kumar RS. 2001. Processing and preservation of jackfruit (*Artocarpus heterophyllus*) bar (*Thandra*). Journal of Food Science and Technology **38** (5): 529-531.

Nayak M, Nagarajan A, Majeed M and Mundkur LA. 2017. Evaluation of in vitro antioxidant potential, antiinflammatory activity and melanogenesis inhibition of *Artocarpus hirsutus Lam*. Extracts. International Journal of Scientific & Technology Research **6** (1): 196-203.

Ranganna S. 2007. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 3rd Edition: Tata Mc. Graw. Hill Publishing Company, New Delhi.

Sarker CR, Robbani M, Hasan MF, Rahim MA and Iqbal

TMT. 2016. Physico- chemical characteristics of monkey jack (*Artocarpus lakoocha Roxb*.) germplasm. Bangladesh Horticulture **1** (2): 73-84.

Sheoran M, Gehlot R, Singh R and Rana MK. 2007. Studies on development and evaluation of bael (*Aegle marmelos*) Correa slab and toffee. Haryana Journal of Horticulture Sciences **36** (1&2): 27-28.

Singh S, Krishnamurthy S and Katyal S. 1963. Fruit Culture in India. ACAR, New Delhi.

Sharma S. 2010. Development and quality evaluation of sand pear (Pyrus pyrifolia) based value added products using hurdle technology. M Sc Thesis. Department of Food Science and Nutrition, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur, India.

Zhang L, Tu ZC, Xie X, Wang H, Wang H, Wang ZX, Sha XM and Lu Y. 2017. Jackfruit (*Artocarpus heterophyllus Lam*.) peel: A better source of antioxidants and a-glucosidase inhibitors than pulp, flake and seed, and phytochemical profile by HPLC-QTOF-MS/MS. Food Chemistry **234**: 303-313.