

A Study on Nutritional Composition and Value Addition of Crab Apple (*Malus baccata*)

Anita Kumari^{1,*}, Y. S Dhaliwal²

¹Department of Nutrition Biology, School of Interdisciplinary and Life Sciences, Central University of Haryana, Mahendergarh, Haryana -123039, India

²Department of Food Science, Nutrition and Technology, College of Home Science, CSKHPKV, Palampur- 176 062, India

*Corresponding author: e-anikum_fsn@yahoo.com

Abstract Apple cultivation is main occupation of farmers in dry and high hills of Himachal Pradesh but this species of crab apple (*Malus baccata*) is grown wildly in the state but due to their smaller size, improper shape, poor colour, the fruit could not fetch good market value and gone as waste. By considering these parameters of the fruit, the study was conducted to evaluate nutritive composition and to develop food products i.e. fruit bar/ gelatinized layers and apple jam from highly nutritious underutilized fruit. The fruit contain high amounts of vitamin C content (17.13 mg/100g) and pectin content (5.57 % as calcium pectate). The nutritive composition in crab apple based fruit bar/ gelatinized layers and jam were studied during storage interval of 9 months. The results for fruit bar/ gelatinized layers shows that the TSS (⁰B), pH, ascorbic acid(mg/100g), total and non-reducing sugars (%) decreased from 75⁰B – 74.37⁰B, 3.06-2.96, 5.27-5.05, 64.67-62.49 and 8.26 – 5.32, respectively while acidity and reducing sugars(%) increased from 1.20 -1.37 and 55.98 -58.60 with the increase of storage intervals. Similar trend was observed for crab apple jam during storage interval. The prepared products viz., fruit bar/gelatinized layers and apple jam was subjected for sensory evaluation to a panel of members at different storage intervals i.e. (fresh, 3, 6 and 9 months of storage period) and the products were found as acceptable in terms of colour, taste, consistency/texture even up to storage interval of 9 months at ambient conditions.

Keywords: crab apple, leather, jam, nutritional parameters, storage stability, organoleptic evaluation

Cite This Article: Anita Kumari, and Y. S Dhaliwal, “A Study on Nutritional Composition and Value Addition of Crab Apple (*Malus baccata*).” *American Journal of Food Science and Technology*, vol. 5, no. 1 (2017): 19-22. doi: 10.12691/ajfst-5-1-4.

1. Introduction

Himachal Pradesh is a Horticulture state of India and apple cultivation is more common in dry and temperate regions of Himachal Pradesh. *Malus* is a genus of family *Rosaceae* which contains about 30-35 species (Phipps, 1990). In this study, *Malus baccata* specie is used because this fruit could not fetch good market price due to its smaller size, inappropriate shape, unattractive fruit colour. The main purpose of the study is to analyze the nutritional composition of the fruit and to develop food products so that the farmers can utilize this fruit in the forms of products and prepared products can be commercialized. Fruits have immense significance in human life as they provide vitamins and minerals. Different fruits are consumed by humans and every cultivar has different nutritive value. Micronutrient deficiencies are of great public health and socio-economic importance worldwide. In Himachal Pradesh no work has been carried out on this species.

The *Malus baccata* commonly known as crab apple mostly found in Kinnaur, Kullu and Lahaul & Spiti districts of Himachal Pradesh (India). The fruit is known by the name of sheed palek, palanu and palek locally. The

fruit is yellowish green when mature and belongs to family *Rosaceae*. The fruit ripens in the month of September. Fruits are usually of small size, sub-acidic to sweet in taste with some astringent taste. It is commonly used as a rootstock for apple. It is cheaper and highly nutritious underutilized fruit of temperate region and possesses great therapeutic and medicinal value. The fruit is eaten to obviate constipation, diarrhea and dysentery in infants [6] the consumption of apples also reduces risk of some cancers, cardiovascular diseases, asthma and diabetes [4]. Nutritional and physical properties of crab apple (*Malus silvestris*) were studied by Gezer et al., 2012. The biochemical studies revealed that fruit contain significant amount of organic and amino acids, fatty acids, phenolic compounds, sugars and soluble solids [20]. Shrestha and Bhatia [18] and Sahni et al. (1994) determined pH values and TSS for American, Maharaji, Ambri and Golden delicious varieties of apple fruit. Singh et al. [17] also studied nutritional composition of wild apple (*Malus baccata*). Asghar et al [3] determine the chemical composition of apple trees in Balochistan. Mukhtar [12] study the nutritional aspects of three varieties of apple. By keeping in view the significance of this underutilized fruit attempts have been made to evaluate the nutritive composition and to develop food products for the benefit of the society.

2. Materials and Methods

The crab apple was procured from Kinnaur district of Himachal Pradesh. The fruits were sorted, graded and washed under running tap water to remove adhering dirt etc. The fruits were analyzed for their physico-chemical analysis. The specific parameters viz fruit colour, flesh colour and shape were assessed by visual appearance. Physical methods viz., length and breadth of the fruit were assessed by using vernier caliper. The TSS and pH content was measured by hand refractometer and pH meter, respectively. The acidity, sugars, ascorbic acid and pectin were assessed by the method of Srivastava and Kumar [19]. The moisture, protein, fat, ash and fibre and sugars were estimated as per AOAC [1]. The carbohydrates were determined as

$$\text{Total carbohydrates (\%)} = 100 - \left(\begin{array}{l} \text{moisture \% + protein \%} \\ \text{+fat \% + fibre \% + ash \%} \end{array} \right)$$

2.1. Fruit Bar/Gelatinized Layers Formulation

The procured fruits were washed, peeled and seeds removed manually. The fruits were cut into small pieces and steamed for 4 minutes. The boiled material was cooled to room temperature and grounded into a domestic grinder to obtain homogeneous pulp. The pulp was sieved with the help of muslin cloth. 1.0g potassium bisulphate was added to 1 litre of pulp and stored in pre-sterilized glass bottles for further use. The pulp (1000 ml) and sugar (1 Kg) were mixed together and the contents were cooked to 75°Brix. The cooked material was poured in to previous greased tray and dried. Spread second layer and dried again. Repeat the process to a thickness of 1.0- 1.25 cm. Dry at 40°C for 4-5 hours. The prepared fruit bar/gelatinized layers was stored for 3, 6 and 9 months of storage interval and assessed for their nutritional analysis as per the approved methods of Ranganna [14] and also analyzed for sensory parameters viz., colour, taste, flensory parameters viz., colour, flavour, texture/consistency and overall acceptability to a panel of 10 judges by using 9 point Hedonic scale at different storage intervals.

2.2. Crab Apple Jam

The jam was prepared as per FPO specifications and sealed in air tight containers. The prepared jam was stored for 3, 6 and 9 months of storage interval and assessed for their nutritional analysis as per the approved methods of Ranganna [14] and also analyzed for sensory analysis for colour, taste, flavour, texture/consistency and overall acceptability to a panel of 10 judges by using 9 point Hedonic scale at different storage intervals.

3. Results and Discussion

Table 1 exhibits specific parameters of crab apple fruit. The fruit and flesh colour was observed as yellowish green and pale yellow with round shape and culled in

appearance. The mean values for length, breadth and weight were recorded as 4.75 (cm), 5.66 (cm) and 85.20 (g), respectively. The mean values for TSS (°B), pH, acidity, reducing, total and non reducing sugars were reported as 11.10, 2.64, 4.38, 3.12, 7.50 and 4.16 respectively. The vitamin C and pectin contents were noted as 17.13 mg/100g and 5.57 per cent, respectively. The data on proximate composition reveal that moisture, fat, fibre, ash, protein and total carbohydrate contents were reported as 78.53, 0.36, 1.26, 0.41, 0.43 and 19.01 per cent, respectively. The results of the present investigation are in aggrement with Gopalan *et al* [8].

Table 1. Specific parameters of crab apple

Parameters	Observations/ Mean values
Specific parameters	
Fruit colour	Yellowish green
Flesh colour	Pale yellow
Shape	Round
Physical parameters	
Length (cm)	4.75
Breadth (cm)	5.66
Weight (g)	85.20
Nutritional parameters	
TSS (° B)	11.10
pH	2.64
Acidity (% Malic acid)	4.38
Ascorbic acid (mg/100g)	17.13
Reducing sugars (%)	3.12
Total sugars (%)	7.50
Non- reducing sugars (%)	4.16
Pectin (% as calcium pectate)	5.57
Proximate composition	
Moisture (%)	78.53
Fat (%)	0.36
Fibre (%)	1.26
Ash (%)	0.41
Protein (%)	0.43
Total carbohydrates (%)	19.01

4. Quality Evaluation of Products

4.1. Fruit Bar/Gelatinized Layers

Fruit bar/ gelatinized layers were prepared by taking consideration of high amount of pectin content present in the fruit. The recipe was standardized in the laboratory and prepared product was evaluated for its nutritional profile at fresh, 3, 6 and 9 months of storage intervals. Table 2 shows a decreased trend in TSS during storage and it may be attributed due to conversion of sugars into acid. Similar findings have been reported by Aruna *et al.* [2] who observed a decrease in TSS values from 82.93 to 81.50°B in papaya bar during storage of 9 months. So, the finding gives credence to the present results. The pH values during storage decreased from 3.06 to 2.96 and acidity increased from 1.20 to 1.37 per cent. Organic acid formed by ascorbic acid degradation might have increased the acidity on storage [2,5]. Ascorbic acid content decreased with the enhancement of storage period. Further scrutiny of the data revealed that the reducing sugar content increased with the increase of storage interval.

The increase in reducing sugar content during storage might be due to inversion of non-reducing sugars into reducing sugars. Contrary to the total sugars, a decreased trend was observed from the beginning of storage interval to 9 months of storage. Results are in agreement with Aruna *et al.* [2]. A significant decrease in non-reducing sugars was observed from the initial day of analysis to 9 months of storage period. The decrease in non-reducing sugars in fruit bar/gelatinized layers may be due to higher rate of conversion of non-reducing sugars into reducing sugars. The results are in agreement with those reported by Aruna *et al.* [2]. The sensory scores for fruit bar/gelatinized layers are presented in Table 2 which exhibits that with storage, the colour scores decreased during 9 months of storage. The reduction of colour scores during storage might be due to effect of storage on colour pigments. Similar findings have been reported by Sharma [15] in *dheu* and karonda based bar. The taste, flavour and texture scores were also decreased with the enhancement of storage interval. On a whole, the overall acceptability of the product decreased after storage period of 9 months. But the scores ranged within the acceptable limits even up to storage interval of 9 months. Similar findings have been coded by Sharma [15] for *dheu* and karonda bar.

4.2. Jam

Table 3 show that the initial TSS for crab apple jam was noted as 68.03°B which increased with the increase of storage period. The increase in TSS during storage might be due to solubilization of solids present in the juice. Same trend was noted by Das [7] and Katoch [10] in

seabuckthorn jam during storage. The mean pH value for jam was 3.06 which decreased to 3.00 during 9 months of storage. The decrease in pH is due to chemical reaction taking place during storage. The results of the present investigation are in confirmation with the findings of Roy *et al.* [16] and Krishnaveni *et al.* [11] who observed a decrease in pH for jack fruit and mango RTS beverage during 180 and 30 days of storage, respectively. An increase in acidity was observed during storage and it might be due to formation of organic acid by degradation of ascorbic acid. The decrease of ascorbic acid is due to the degradation of ascorbic acid to carboic acid. Similar findings have been reported by Roy *et al.* [16], Krishnaveni *et al.* [11] and Das [7]. The data on reducing sugar content reveal an increase in trend was observed in jam during storage and it might be due to the conversion of sucrose into glucose and fructose with the increase in storage period. Storage had significant effect on total sugar and non-reducing sugar content. The values decreased as the storage period increased. Similar observations have been reported by Krishnaveni *et al.* [11] and Sharma [15]. The sensory scores for jam show that the colour scores decreased during 9 months of storage. The reduction of colour scores during storage might be due to effect of storage on colour pigments. Similar findings have been reported by Shivani (2011) in nectarine jam. The taste, flavour and texture scores were also decreased with the enhancement of storage interval. On a whole, the overall acceptability of the product decreased after storage period of 9 months. But the scores ranged within the acceptable limits even up to storage interval of 9 months.

Table 2. Effect of storage on nutritional and sensory parameters of crab apple leather

Parameters	Storage (months)					Mean	CD (P≤0.05)
	Fresh	3	6	9			
TSS (°B)	75.00	75.00	74.67	74.37	74.77	0.07	
pH	3.06	3.04	3.00	2.96	3.02	0.02	
Acidity (% citric acid)	1.20	1.25	1.34	1.37	1.29	0.01	
Ascorbic acid (mg/100g)	5.27	5.13	4.99	4.80	5.05	0.09	
Reducing sugars (%)	55.98	58.56	57.71	58.60	57.72	1.77	
Total sugars (%)	64.67	63.59	59.17	62.50	62.49	3.46	
Non- Reducing sugars (%)	8.26	4.61	4.74	3.67	5.32	2.03	
Sensory Parameters (9 point Hedonic Scale)							
Colour	8.70	8.60	8.30	8.50	8.52	0.31	
Taste	8.70	8.50	8.50	7.80	8.37	0.38	
Flavour	8.60	8.20	8.20	7.80	8.20	0.42	
Texture	8.70	8.60	8.40	7.80	8.37	0.33	
Overall acceptability	8.67	8.47	8.35	7.97	8.37	0.20	

Table 3. Effect of storage on nutritional and sensory parameters of crab apple jam

Parameters	Storage (months)					Mean	CD (P≤0.05)
	Fresh	3	6	9			
TSS (°B)	68.03	68.03	68.17	68.37	68.15	0.12	
pH	3.06	3.02	3.00	2.94	3.00	0.09	
Acidity (% citric acid)	1.20	1.25	1.36	1.47	1.32	0.02	
Ascorbic acid (mg/100g)	5.41	5.08	4.86	4.30	4.91	0.25	
Reducing sugars (%)	15.95	16.08	16.23	16.51	16.19	0.34	
Total sugars (%)	60.34	58.61	58.61	57.71	58.81	4.58	
Non- Reducing sugars (%)	42.32	41.35	40.26	39.14	40.77	3.80	
Sensory Parameters (9 point Hedonic Scale)							
Colour	8.30	8.10	7.90	7.70	8.00	0.62	
Taste	8.50	8.30	8.10	7.60	8.12	0.70	
Flavour	8.20	8.20	8.10	7.20	7.92	0.72	
Texture	8.50	8.50	8.10	7.60	8.17	0.38	
Overall acceptability	8.37	8.27	8.05	7.52	8.05	0.82	

References

- [1] AOAC. (1990). Approved methods of association of official analytical chemists, Washington, D.C, U.S.A, 11th Edition.
- [2] Aruna A, Vimla V, Dhanalakshmi K and Reddy V. (1999). Physico- chemical changes during storage of papaya fruit (*Carica papaya* L.) bar (Thandra), *Journal of Food Science and Technology*, 36 (5), 428-433.
- [3] Asghar, R., N. Mohd. and K. Siraj. (2004). Structural and biochemical study of apple bark spitting disorder in Balochistan pak, *J Bio Science*, 7(6), 916-920.
- [4] Boyer, J. and R.H. Liu. (2004). Apple photochemical and their health benefits, *Nutrition Journal*, 3(5), 1-15.
- [5] Chauhan S. K, Lal B.B and Joshi V.K. (1997). Preparation and evaluation of protein enriched mango fruit bar. *Indian Food Packer*, 24 (5), 5-9.
- [6] Considine, M. (1982). Food and food production encyclopedia, Van-Nostrand, 24(3).
- [7] Das, J.N. (2009). Studies on storage stability of jamun beverages, *Indian Journal of Horticulture*, 66 (4), 508-510.
- [8] Gopalan, C., Rama Sastri, B.V. and Balasubramanian. (2004). Nutritive value of Indian food, National Institute of Nutrition, Indian Council of Medical Research.
- [9] İbrahim, Gezeri., Mehmet, Musa Ozcan., Haydar, Haciseferogullari. and Sedat, Calisir. (2012). Some nutritional and physical properties of crab apple (*Malus silvestris* Mill.) fruit, *International Journal of Farming and Allied Sciences*, (1- 4), 101-107.
- [10] Katoch, S., Kalia, M and Singh, V. (2006). Product development of seabuckthorn in supplementation with guava and apple fruits vis- a- vis their feasibility, *Journal of Food Science and Technology*, 43 (5), 532-534.
- [11] Krishnaveni, A., Manimegalai, G. and Saravana, Kumar R. (2001). Storage stability of jackfruit (*Artocarpus heterophyllus*) RTS beverage, *Journal of Food Science and Technology*, 38 (6), 601-602.
- [12] Mukhtar, A.e.a. (2010). Some nutritional and microbiological aspects of apples of common varieties available for household consumption, *The Journal of Animal & Plant Sciences*, 253-257.
- [13] Phipps, J.B.e.a. (1990). A checklist of the subfamily maloideae (rosaceae), *Can. J. Bot.*, 68(10), 2209.
- [14] Ranganna, S. (2005). Handbook of analysis and quality control for fruits and vegetables products, 3rd edition, Tata Mcgraw – Hills.
- [15] Sharma R. (2011). Nutritional quality evaluation and value addition of *Dheu* (*Artocarpus lakoocha*) and *Karonda* (*Carissa carandas*) fruits, M.Sc. Thesis, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur.
- [16] Roy, A.K., Joshi, S and Nath, N. (1997). Effect of homogenization on sensory quality and rheological characteristics of pulp and beverages from ripe ‘Dushehari’ mangoes, *Journal of Food Science and Technology*, 34 (3), 212-217.
- [17] Singh, S.P., Yadav, D.S., Jasumali, Devi R.K. and Raman, S.K. (1996). Nutritious pickle and preserve from wild aonla and heitup (Wild apple), *Indian Horticulture*, 22 (3), 28-30.
- [18] Srestha, M. K. and Bhatia, B. S. (1982). Apple juice- Physico-chemical characteristics and storage study, *Indian Food Packer*, 13 (3), 53-60.
- [19] Srivastava, R.P. and Kumar, S. (2003). Fruit and vegetable preservation Principles and practices, International book distributing company, Lucknow. , U.P. (India).
- [20] Wu J, Gao H., Zhao L., Liao X., Chen F., Wang Z., Hu X. (2007). Chemical compositional characterization of some apple cultivars, *Food Chemistry*, 103, 88-93.