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RESEARCH PAPER

Development of Appetizer from Box Myrtle (*Myrica nagi*) and its Quality Evaluation during Storage

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Abstract

Box myrtle (*Myrica nagi*), a wild fruit is a rich source of antioxidants like phenols and anthocyanins, and has commercial importance because of higher sugar content. Investigations were conducted to develop a commercial appetizer (spiced squash) and evaluate its quality during storage. Different combinations of juice and sugar syrup were tried to standardize a proper combination for appetizer. The appetizer prepared by the optimize recipe was packed in glass and PET bottles and stored for six months under ambient and refrigerated temperature conditions. Appetizer could be safely stored for a period of six months under both the ambient and refrigerated conditions without much change in various quality characteristics. However, the changes in the quality characteristics of the appetizer were slower in refrigerated storage conditions as compared to ambient conditions. Both the packaging materials viz., PET and glass bottles were found suitable, with comparatively lesser changes occurring in glass bottle under refrigerated conditions than others.

Keywords: Box myrtle, *Myrica nagi*, appetizer, spiced squash

Box myrtle (*Myrica nagi*) is an important wild fruit which is known as *kaafal* in Himachal Pradesh. It belongs to genera *Myrica* in family myricaceae. *Myrica* genus has about 35-50 species of trees and shrubs. This genus is widely distributed in Africa, Asia, Europe, North America and South America. Apparent centre of distribution of this genus is in Africa (Gibson and Jordan, 1983). The various *Myrica* species have been cultivated in China for centuries for their edible sub-sweetish fruits and kernels (Arora 1985). Among the various species *Myrica nagi* is a sub-temperate, evergreen wild tree found throughout the mid-Himalayas between 1300 meters to 2000 meters above the mean sea level. It is found in Khasia, Sylhet and southwards up to Singapore, Malaya Islands, China and Japan. In India, it is widely distributed between 900 to 2100 meters above mean sea level in Indian Himalaya from Ravi Eastward to Assam, Khasi, Jhantia, Naga and Lushi hills (Parmar and Kaushal, 1982).

Trees of this species are evergreen in nature and the fruiting season starts from the first week of May and continues till the last week of this month. Its fruit is globose, succulent drupe which is pinkish red in colour (Parmar and Kaushal, 1982). The fruit yield increases with tree size and potential yield at different sites has been recorded as 2.0-4.2 tonnes/ha (Bhat *et al.*, 2000).

The fruits of *Myrica nagi* are rich source of anti-oxidants along with other class of chemicals (Jeeva *et al.* 2011). Its fruits are known for their ravishing taste because of higher sugars, tannins and vitamin C (Jain and Jain, 2010; Patel *et al.*, 2011). The small seeded fruits of this species are consumed fresh because of their taste and juiciness in HP (Parmar and Kaushal, 1982). The juice of this fruit is very attractive, sparkling red in colour and ripe fruits are consumed as a potential source of formulations for nutraceuticals or natural food (Saklani *et al.* 2012). No work on processing of this fruit has been documented so far. So, being a rich source of antioxidants specially colour pigments like anthocyanins as well as sugars, this fruit can be exploited for the development of some beverages specially appetizer. Thus, the present studies were under taken to develop appetizer from this fruit and study its storage life.

Materials and methods

The mature fruits of *Myrica nagi* were procured from Mandi district of Himachal Pradesh and used for various physico-chemical analysis and juice extraction.

Juice extraction: The juice from the fruits was extracted by following four different methods *viz.* manual, power driven food processor, power driven screw type juice extractor and power driven commercial pulper having brushes.

Spiced squash (appetizer): Box myrtle appetizer was prepared by mixing its juice with sugar syrup in different concentrations as given in Table 1. A constant amount of spice extract was also added to all the combinations. Spice extract was prepared by boiling a ground mixture of pre-determined quantities of spices like cardamom (1 g), cumin (2.5 g), black pepper (2.5 g), common salt (5 g) in 200 ml of water, then straining and mixing the extract with mint extract (10 ml) and ginger juice (15 ml). To get the desirable concentration of acid (1.20%) in appetizer, citric acid was added in different combinations. Sodium benzoate (600 ppm) was added at the end of product preparation of appetizer in all the combinations.

Packaging and storage: The appetizer prepared by following the best selected recipe was packed in pre-sterilised glass and PET bottles (700 ml capacity). All the packed products were properly labelled and stored in ambient (20-25° C) and low temperature (4-7° C) conditions for six months. The physico-chemical and sensory characteristics of all the products were estimated at zero, three and six months of storage.

Table 1: Treatment detail of appetizer

Treatment	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}
Juice (%)	20	25	30	35	40	20	25	30	35	40
TSS (°B)	40	40	40	40	40	45	45	45	45	45

Physico-chemical analysis: The colour of randomly selected fruits was observed visually by comparing with the colour cards of Royal Horticulture Society, London and the card numbers were mentioned along with the colour. The colour of appetizer in terms of different units (Red & Yellow) was observed with Tintometer (Lovibond Tintometer Model-E). Average fruit size, weight, volume, specific gravity, juice pulp and seed percentage were estimated according to methods of Ranganna (1997). Moisture, total solids, TSS, reducing sugars, total sugars, titratable acidity and anthocyanins of juice and prepared products were determined according to Ranganna (1997) and AOAC (1984,1990). The pH of the samples was determined by using a digital pH meter (CRISON Instrument, Ltd, Spain). Total phenols content was determined by Folin-Ciocalteu procedure given by Singleton and Rossi (1965).

Sensory evaluation: Nine point hedonic rating test (Amerine *et al*. 1965) was followed for conducting the sensory evaluation of box myrtle appetizer. The panel of ten judges were selected to evaluate the product for sensory parameters such as colour, body, taste, aroma and overall acceptability. Efforts were made to keep the same panel for sensory evaluation throughout the entire period of study.

Statistical analysis: Data on physico-chemical characteristics of appetizer were analysed by Completely Randomized Design (CRD) before and during storage, whereas, data pertaining to the sensory evaluation were analyzed by using Randomized

Block Design (RBD) as described by Mahony (1985). The experiments on recipe standardization and for storage studies were replicated three times.

Results and Discussion

Physico-chemical characteristics of box myrtle fruit: Data of physical characteristics of box myrtle fruit presented in Table 2 indicate that the mean length and diameter of fruit found to be 12.77 ± 1.52 and 9.86 ± 1.41 mm, respectively. Further, mean weight and volume of fruit were recorded as 0.89 ±0.26 g and 678.40 ± 40.97 µl, respectively.

Table 2: Physical characteristics of box myrtle fruit

Characteristics	Mean Values
Length (cm)	12.77 ± 1.52
Diameter (cm)	9.86 ± 1.41
Weight (g)	0.89 ±0.26
Volume (µl)	678.40 ± 40.97
Specific gravity	1.07 ± 0.01
Visual Colour	Red purple (59 A)*
Juice (%)	39.82 ± 0.84
Pulp (%)	65.01 ± 1.61
Seed (%)	34.98 ± 1.61

* Colour Card Royal Horticulture Society, London
± = Standard quotation

The mean specific gravity of fruit was found to be 1.07 ± 0.01 while the visual color of fruit was recorded as Red purple (59 A). The mean pulp and juice contents were found to be 65.01 ± 1.61 per cent and 39.82 ± 0.84 per cent, respectively. The seed percentage was recorded as 34.98 ± 1.61 per cent in box myrtle fruit.

The data mentioned in Table 3 show that the average moisture and total solids content of fruit was found to be 73.16 ± 1.70 and 26.83 ± 1.70 per cent, respectively. The mean TSS content of box myrtle fruit was found as 20.6 ± 2.48 °B and titratable acidity and pH of the same were recorded as 2.87 ± 0.10 per cent (as % citric acid) and 3.79 ± 0.01, respectively. The ascorbic acid content was found to be 7.6 ± 0.48 mg/100 g of fruit. The total sugars content of fruit was observed as 17.17 ± 0.49 per cent out of which the reducing sugars content was found to be 15.16 ± 0.30 per cent. Crude fibre content of the box myrtle fruit was found to be 1.05 ± 0.16 per cent. Whereas, the higher amounts of anthocyanins and total phenolic contents in the fruit were observed as 42.30 ± 1.24 mg/ 100 g and 176.94 ± 1.83 mg/ 100 g, respectively. This fruit was found to be low in pectin content (0.22 ± 0.01 %) and higher in ash content (1.23 ± 0.06 %).

Table 3: Chemical characteristics of box myrtle fruit

Characteristics	Mean Values
Moisture (%)	73.16 ± 1.70
Total solids (%)	26.83 ± 1.70
TSS (°B)	20.6 ± 2.48
Titratable acidity (% Citric acid)	2.87 ± 0.10
Ph	3.79 ± 0.01
Ascorbic acid (mg/100 g)	7.6 ± 0.48
Reducing sugars (%)	15.16 ± 0.30
Total sugars (%)	17.17 ± 0.49
Crude fibre (%)	1.05 ± 0.16
Anthocyanins (mg/100 g)	42.30 ± 1.24
Total phenols (mg/100 g)	176.94 ± 1.83
Pectin (%)	0.22 ± 0.01
Ash (%)	1.23 ± 0.06

± = Standard quotation

Screening of juice extraction method: The data pertaining to physical, chemical and sensory characteristics of box myrtle fruit juice extracted by four different methods/modes viz., manual, food processor, screw type juice extractor and pulper (brush type) are given in the Table 4.

The yield of fruit juice extracted by using different methods/modes ranged between 25.45 to 43.58 per cent (w/w). The maximum (43.58 %) yield was observed in pulper (brush type) while the lowest juice yield (25.45%) was recorded in food processor. Corresponding to the juice yield the pomace left after extraction of juice by different methods ranged

Table 4: Physico-chemical and sensory characteristics of box myrtle juice extracted by different methods

		Manual	Food Processor	Juice Extractor (Screw type)	Pulper (Brush Type)	CD 0.05
			Physical			
Juice yield (%)		40.29	25.45	30.90	*43.58	1.91
Pomace		59.71	74.55	69.10	56.43	1.91
Tintometer Colour Units	Red (TCU)	26.28	25.14	22.51	28.85	0.86
	Yellow (TCU)	2.44	2.36	2.93	2.06	0.03
Apparent viscosity (Flow rate in seconds)		70.12	70.00	71.45	71.85	NS
			Chemical			
TSS		20.53	20.48	20.18	20.50	NS
Titratable acidity (%)		2.88	2.89	2.90	2.89	NS
pH		3.85	3.83	3.81	3.88	NS
Ascorbic acid (mg/100 g)		7.55	7.55	7.58	7.50	NS
Reducing sugars (%)		15.15	15.13	15.03	15.08	NS
Total sugars (%)		17.13	17.15	17.05	17.15	NS
Anthocyanins (mg/100 g)		42.35	40.55	39.43	42.08	0.73
Total phenols (mg/100 g)		178.13	179.15	177.53	177.48	NS
			#Sensory scores			
Colour		7.08	6.05	4.95	8.50	0.26
Body		7.18	7.33	5.20	7.98	0.48
Taste		6.83	6.96	3.68	8.30	0.66
Aroma		7.40	7.15	6.20	8.10	0.48
Overall acceptability		7.12	6.82	5.24	8.13	0.26

TCU: Tintometer colour units
* Af er pulp extraction juice was filtered through muslin cloth.
#: Based on 9 point Hedonic scale; CD = Critical difference

between 56.43 to 74.55 per cent. The visual red and yellow TCU of extracted juice from different methods/modes ranged between 22.51 to 28.85 and 2.06 to 2.93, respectively.

The data on chemical characteristics of juice presented in the Table 4 show that, there was no significant difference among the various methods (except anthocyanins) of juice extraction with respect to all chemical characteristics of extracted juice. The anthocyanins content of fruit juice extracted by using different methods/modes ranged between 39.43 to 42.35 mg/100 ml. The maximum anthocyanins content was found to be in manually extracted juice (42.35 mg/100 ml) which was statistically at par with juice extracted with pulper (42.08 mg/100 ml).

The data on sensory characteristics (Table 4) show that maximum colour (8.50), body (7.98), taste (8.30), aroma (8.10) and overall acceptability (8.13) scores

Table 5: Physico-chemical characteristics of different recipes of box myrtle appetizer

Treatments	Physico-chemical characteristics					
	Color (TCU)		TSS (oB)	Ascorbic acid (mg/100 ml)	Total phenols (mg/100 ml)	Anthocyanins (mg/100 ml)
	R	Y				
A1	15.41	2.97	40.00	1.19	72.62	14.80
A2	16.80	2.55	40.00	1.60	74.42	15.02
A3	17.55	2.17	40.00	2.13	74.95	15.18
A4	18.00	2.05	40.00	2.47	75.49	15.42
A5	19.12	1.92	40.00	2.99	77.03	15.67
A6	15.72	2.71	45.00	1.24	72.57	14.81
A7	16.91	2.46	45.00	1.62	74.46	15.05
A8	17.64	2.05	45.00	2.23	74.95	15.20
A9	18.31	1.92	45.00	2.57	76.49	15.41
A10	19.74	1.77	45.00	3.02	78.06	15.65
CD 0.05	0.10	0.03	—	0.09	0.06	0.03

of juice extracted by different methods/modes were obtained in juice extracted with the help of pulper (brush type).

It was observed that pulper (brush type) was the best method/mode for extraction of juice from box myrtle fruit on the basis of sensory attributes and some physical characteristics of juice.

Standardization of recipe for the preparation of box myrtle appetizer: Data in Table 5 reveal that visual red and yellow TCU of different recipes ranged between 15.41 to 19.74 and 1.77 to 2.97, respectively. The maximum value (19.74) red TCU was recorded in A_{10} which was highest among all the remaining recipes. The lowest value (15.41) red TCU was recorded in A_1. The highest value (2.97) yellow TCU was recorded in A_1 and lowest value (1.77) in recipe A_{10}. The ascorbic acid content of this beverage ranged between 1.19 to 3.02 mg/100 ml in the product. The highest value (3.02 mg/100 ml) was recorded in A_{10} which was statistically at par with A_5. The lowest value (1.19 mg/100 ml) was recorded in A_1 which was statistically at par with A_6. The total phenol content of different recipes of this beverage varied from 72.57 to 78.06 mg/100 ml. The highest (78.06 mg/100 ml) value was recorded in A_{10} and lowest (72.57 mg/100 ml) in A_6.The anthocyanins content of different recipes of this beverage ranged between 14.80 to 15.67 mg/100 ml. The highest (15.67 mg/100 ml) value was recorded in A_5 which was significantly superior among all the remaining treatments except, A_{10}. The lowest (14.80 mg/100 ml) was recorded in A_1.

Data on sensory characteristics of different recipes of box myrtle drink given in Table 6 indicate that the mean colour score was highest (8.43) in A_4 and lowest (6.27) in A_6 which was statistically at par with A_1, A_7, A_8, A_9 and A_{10}. The same recipe obtained maximum body score of 8.43 and minimum (7.10) in A_8 which was statistically at par with A_1, A_6 and A_7. The highest score (8.43) of taste was awarded to A_4 while A_7 got the lowest score of 6.50. The maximum (7.97) score for aroma was recorded in recipe A_4 and $A_5$and minimum score of 5.87 was recorded in A_6 closely followed by A_7. The highest score (8.31) of overall acceptability was recorded in A_5 followed by A_4.

It was observed that the recipe with 35 per cent juice and 40 °B TSS (A_4) was the best on the basis of sensory and some physico-chemical characteristics of appetizer.

Table 6: Sensory characteristics (score) of different recipes of box myrtle appetizer

Treatment	Colour	Body	Taste	Aroma	Overall acceptability
A_1	7.57	7.30	6.87	6.20	7.03
A_2	7.67	7.60	7.17	6.43	7.07
A_3	7.97	7.63	7.57	6.90	7.47
A_4	8.43	8.43	8.43	7.97	8.31
A_5	8.03	7.97	8.07	7.97	8.10
A_6	6.27	7.17	6.70	5.87	6.57
A_7	6.50	7.30	6.50	6.00	6.56
A_8	6.43	7.10	6.80	6.50	6.54
A_9	6.53	7.53	7.13	6.87	7.17
A_{10}	6.47	7.33	7.10	7.13	7.00
$CD_{0.05}$	0.32	0.22	0.28	0.22	0.27

Storage of box myrtle appetizer

Physico-chemical characteristics

Colour: There was a significant decrease in red and yellow TCU (Fig. 1a and 1b) during storage of box myrtle appetizer. More decrease in red and yellow colour units of appetizer was recorded under ambient storage conditions as compared to refrigerated conditions. Decrease in colour units during storage might be due to degradation of anthocyanins pigments, however, degradation of anthocyanins were stimulated by light and high temperature in ambient conditions as compared to refrigerated conditions. As far as the packaging material is concerned, more retention of red and yellow colour units in appetizer packed in glass bot le took place because of the slower reaction rate in it as a result of slower conduction of heat to the product compared to the PET bot le. Similar trend of decrease in red and yellow TCU has been reported by Suryawanshi *et al*. (2008) in pomegranate juice and Kaushal *et al*. (2008) in seabuckthorn appetizer.

Apparent viscosity: Apparent viscosity of box myrtle appetizer increased significantly (Fig. 1c) during the storage period. Increase in apparent viscosity may be due to increase in TSS and soluble sugar. As the flow index decreases it helps to develop pseudo plasticity and increased the apparent viscosity of the product (Bal *et al*. 2014). This increase in apparent viscosity was observed more in appetizer stored under ambient temperature conditions as compared to refrigerated storage conditions. However, with respect to packaging material a non-significant difference in apparent viscosity of the drink was observed. Similar results have been reported by Khurdiya and Lothra (1994) for kinnow mandarin juices and El-Mansy *et al*. (2005) in mango and papaya nectar.

TSS: The TSS content of appetizer increased only any slightly during storage (Fig. 1d) which might be due to hydrolysis of polysaccharides into monosaccharide and soluble disaccharides (Gould, 1983). More increase in TSS was found in appetizer stored under ambient conditions as compared to refrigerated storage conditions which could be due to the faster rate of reaction because of high temperature in ambient conditions. Selvamuthukumaran and Khanum (2013) in spiced seabuckthorn squash have also reported slight increase in TSS of the respective products during storage.

Reducing sugar: During storage of box myrtle appetizer there was a gradual increase in reducing sugars however, (Fig. 1e). More increase in sugars however was found in appetizer stored under ambient conditions as compared to refrigerated storage conditions. Increase in sugars during storage might be at ributed to the hydrolysis of starch into sugars (Heikal *et al*. 1964) and more increase might be due to the faster rate of reaction because of high temperature in ambient conditions. Similar trend of increase in sugars has been reported by Kaushal *et al*. (2008) in seabuckthorn appetizer. The more increase in sugars recorded in appetizer packed in PET bot le as compared to glass bot le might be due to faster rate of chemical reactions in the product packed in PET bot le as a result of difference in their thermal conductance properties. Similar results have been reported by Krishnaveni *et al.* (2009) in jackfruit drink.

Titratable acidity: The titratable acidity of appetizer showed slight decrease during storage (Fig. 2a) which

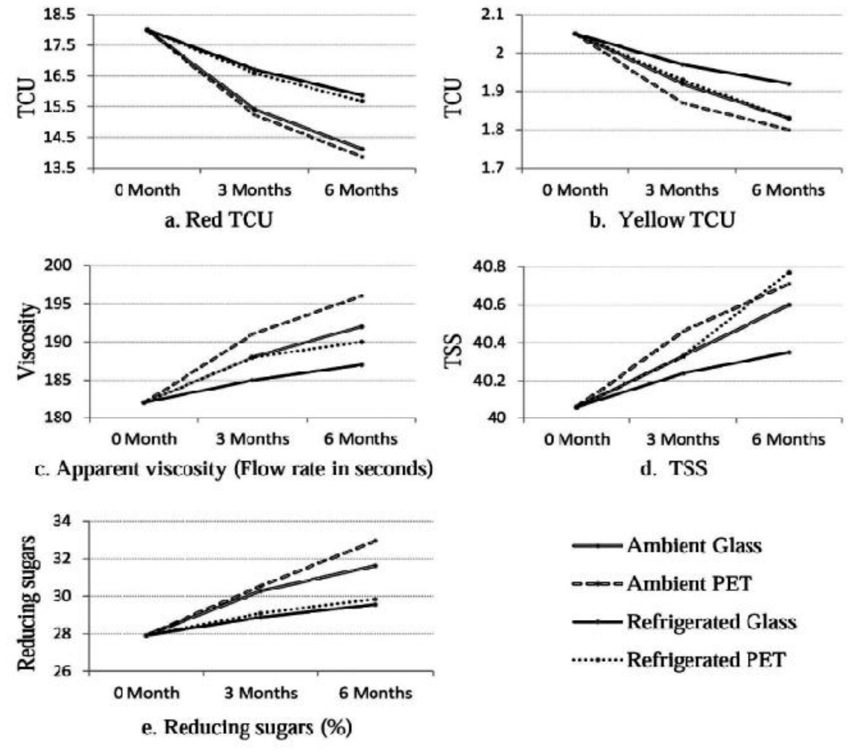

Figure 1: Effect of storage on physico-chemical characteristics of box myrtle appetizer

was higher under ambient storage conditions than refrigerated conditions. However, decrease was non-significant. Decrease in titratable acidity of appetizer could be attributed to the chemical interactions of organic acids of appetizer with sugars and amino acids. Slower rate of reactions of these constituents in refrigerated conditions might have contributed to the less loss of acid during storage as compared to ambient conditions. Our results are in conformity with the findings of Lal *et al*. (1999) in apple and ginger based squash and Deka *et al*. (2004) in lime-aonla appetizer.

Ascorbic acid: There was a continuous decrease in ascorbic acid content of appetizer with advancement of storage period (Fig. 2b), however, decrease was significantly lower under refrigerated conditions as compared to ambient conditions. Decrease in ascorbic acid content during storage might be due to its degradation into dehydro-ascorbic acid or furfural. Ascorbic acid is highly sensitive to heat; therefore its degradation was more in ambient conditions. Similar findings have been reported by Lal *et al.* (1999) in apple appetizer and Selvamuthukumaran and Khanum (2013) in seabuckthorn appetizer. Lower decrease in ascorbic acid of appetizer packed in glass bottle observed during storage might be due to the slower rate of reactions in it as glass materials absorb heat slower than PET material. Our results are in accordance with the findings of Suryawanshi *et al.* (2008) in pomegranate juice.

Anthocyanins: A significant decrease in anthocyanins content of appetizer was recorded during storage (Fig. 2c) which was more in ambient storage conditions than refrigerated conditions. Loss of anthocyanins in appetizer might be due to their high susceptibility to auto-oxidative degradation during storage. However, less loss of this attribute in the product might be due to slower rate of its auto-oxidation in refrigerated storage conditions as compared to ambient conditions. More retention of anthocyanins of appetizer packed in glass bottle during storage might be due to the slower rate of reactions in glass bot le than PET as a result of difference in their thermal conductance properties. Our results are in accordance with the findings of Suryawanshi *et al*. (2008) in pomegranate juice.

Total Phenols: A gradual decrease in total phenols content of appetizer was observed during storage (Fig. 2d) which was slower under refrigerated storage conditions than ambient conditions. Significant decrease in total phenols content during storage might be due to their involvement in the formation of polymeric compounds, complexing of phenols with protein and their subsequent precipitations as observed by Abers and Wrolstad (1979) in strawberry preserve. Slower rate of loss of total phenols might be due to slower reaction rate in refrigerated storage conditions as compared to the ambient. However, retention of more phenols of appetizer in glass bot le may also be due to the slower reaction rate in glass bot le, as glass material absorbs heat at slower rate as compared to PET. Similar observations have also been reported by Selvamuthukumaran and Khanum (2013) in seabuckthorn appetizer.

Sensory characteristics of box myrtle appetizer during storage

Colour: The colour scores of appetizer decreased significantly during storage. However, decrease in score was less in refrigerated storage conditions than ambient. Decrease in colour scores during storage might be the result of degradation of colour pigment (anthocyanins) and browning caused by copolymerization of organic acids of the product which might have led the judges to award lower scores during storage. The retention of higher colour scores of appetizer in refrigerated storage conditions might be due to lesser degradation of colour pigment which led the judges to award the higher scores as compared to ambient conditions. As far as packaging material is concerned, there was no significant effect of packaging materials on the colour scores of appetizer. However, decrease in colour scores have also been reported by Kaushal *et al*. (2008) and Selvamuthukumaran and Khanum (2013) in seabuckthorn appetizer during storage.

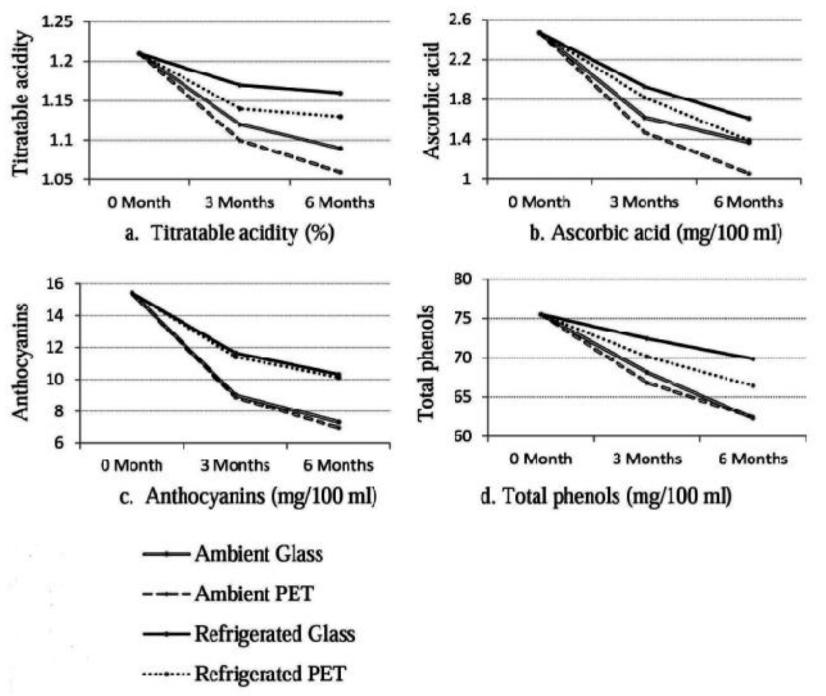

Figure 2: Effect of storage on physico-chemical characteristics of box myrtle appetizer

Body: Body scores of appetizer decreased with advancement of storage period and the decrease was less in refrigerated storage conditions than ambient. As far as the packaging material is concerned, there was non-significant difference in body score of appetizer stored in glass and PET bot le during storage. The possible reason for decrease in body scores might be due to the formation of precipitates in the product as a result of interactions between phenols and protein as well as the formation of cation complexes with pectin and phenols which led the judges to award lower scores to the product during storage. Retention of higher body scores in refrigerated conditions might be the result of bet er condition of the appetizer during storage as a result of slower rate of above mentioned reactions. Our results of body scores are in conformity with the findings of Selvamuthukumaran and Khanum (2013) in seabuckthorn appetizer.

Taste: There was a decrease in taste scores of appetizer with advancement of storage period. However, this decrease was significantly lower under refrigerated storage conditions than ambient conditions. As far as the packaging material is concerned there was non-significant difference in taste scores of appetizer packed in PET and glass bot le. The possible reason for decrease in taste scores might be due to the loss of sugar-acid-salt blend responsible for taste during storage. Similar observations of decrease in taste scores of the product during storage were noticed by Kaushal *et al*. (2008) in seabuckthorn appetizer. Retention of higher taste scores in refrigerated conditions might be due to the bet er retention of original sugar-acid-salt blend as a result of slow reaction rate contributing change in this blend.

Aroma: The aroma scores of appetizer decreased during storage. However, the appetizer stored in refrigerated storage conditions had significantly bet er aroma scores than ambient conditions. The aroma scores of appetizer packed in glass bot le were retained bet er than PET bot le during storage. The loss of aroma scores during storage might be due to the possible loss of volatile aromatic compounds which led the judges to award the lower scores. These results are in conformity with the findings of Kaushal *et al*. (2008) in seabuckthorn appetizer. Retention of higher scores of aroma in refrigerated conditions might be due to the lower losses of aromatic compounds at low temperature during storage as compared to ambient conditions. Bet er aroma scores retained in glass bot le as compared to PET which might be due to the slower rate of loss of aromatic compounds during storage.

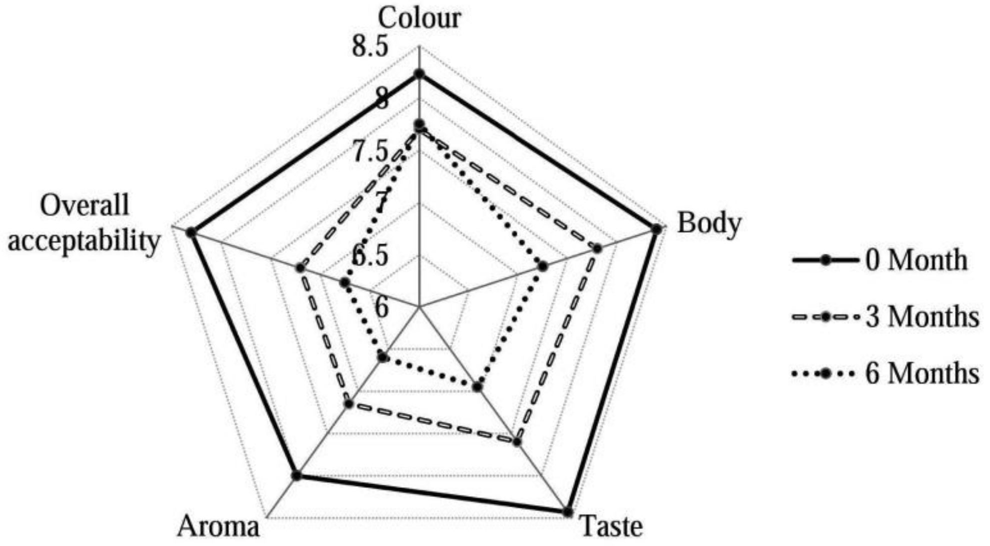

Figure 3: Effect of storage on sensory characteristics of box myrtle appetizer packed in PET bottles stored under ambient conditions

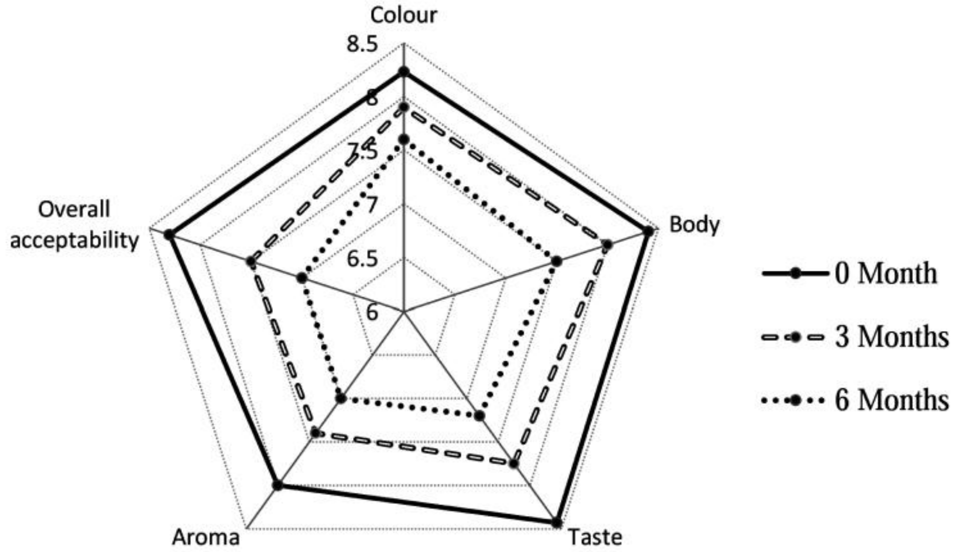

Figure 4: Effect of storage on sensory characteristics of box myrtle appetizer packed in glass bottles stored under ambient conditions

Overall acceptability: The overall acceptability scores of appetizer decreased significantly during storage. However, the appetizer stored at refrigerated storage conditions was significantly bet er in overall acceptability scores than in ambient conditions. Appetizer packed in glass bot le retained more overall acceptability scores than PET bot le. Decrease in overall acceptability scores might be due to the loss in appearance, flavour compounds and uniformity of the product during storage. Higher overall acceptability scores retained in refrigerated conditions might be due to the minute losses of colour, flavour compounds and uniformity of the product during storage. However, the retention of bet er overall acceptability scores of appetizer in glass bot le might be due to the bet er retention of above mentioned factors as a result of slower reaction rates in glass bot le as compared to PET. Selvamuthukumaran and Khanum (2013) and Kaushal *et al*. (2008) have also observed decrease in overall acceptability in spiced seabuckthorn squash scores during storage.

Conclusion

For the extraction of juice from this fruit brush type pulper was found to be the best on basis of juice yield, colour and its sensory at ributes. Box myrtle appetizer was developed by mixing 35 per cent juice, 40 ^{o}B TSS and with a spice extract of cardamom (1 g), cumin (2.5 g) black pepper (2.5 g), common salt (5 g), mint juice (10 ml) and ginger juice (15 ml) on the basis of some of its physico-chemical and sensory characteristics.

The appetizer could be stored safely for a period of six months under both storage conditions and also in both packaging materials like PET and glass bot les. However, best quality of this beverage could be maintained in glass bot le stored under refrigerated storage conditions as compared to PET bot le.

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