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Carambola value-added products and there sensory evaluation

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Abstract

Averrhoa carambola commonly known as Star Fruit and “Chmarakh” in local language of Himachal Pradesh. It has a lot of medicinal properties but the fruit remains neglected and hence there is a need to concentrate on diversification and popularization of such an un-exploited fruit. Carambola Fruit used as pulp and further formulated into different forms like Carambola RTS, carambola butter, carambola squash, carambola toffee, carambola chutney and carambola bar. Sensory evaluation was conducted on all the products and the results indicate that, carambola toffee were highly acceptable (7.74) among all other carambola products followed by carambola bar then carambola chutney, carambola squash and carambola RTS with good acceptability scores. Value addition of carambola fruits will improve the consumption by different communities, which will increase the demand of unexploited fruit and also reduce the postharvest losses.

Keywords: *Averrhoa carambola*, carambola pulp, value added products, sensory evaluation

Introduction

Underutilized fruit crops can be defined as fruit crops which have value but are not widely grown, rarely found in the market and not cultivated commercially (Agent, 1994) [1]. The underutilized foods can also be defined as —the foods which are less available, less utilized or rarely used or region specific (William and Haq, 2002) [2]. According to Dansi *et al.*, (2012) [3]. Many neglected and underutilized species are nutritionally rich and adapted to low input agriculture. The erosion of these species can have immediate consequences on the nutritional status and food security of the poor. Himachal Pradesh is one of the beautiful states located in Northern India. Fruit grow in Himachal Pradesh covers an area of 2.07 lac hectares. The kinds of fruits, which are popular and grown in the state of Himachal Pradesh, include pear, almond, citrus, raisins, peach plum, walnut, grapes, and mango. Other less known fruits include carambola (*Averrhoa carambola*) which is among such unattended fruits of Himachal Pradesh which are nutritionally and medicinally rich. Carambola also known as Star Fruit is also an un-exploited fruit in Himachal Pradesh. It is rich in antioxidants, potassium, and vitamin C; and low in sugar and sodium. Food preservation has an important role in the conservation and better utilization of fruits and vegetables in order to avoid the glut and utilize the surplus during the off season. It is necessary to employ modern methods to extend storage life for better distribution and also processing techniques to preserve them for utilization in the off-season in both large scale and small scale. Bhattacharyya *et al.*, (2007) [4]. The unique star shape and rich golden color, in addition to its use as a fresh fruit and in jelly making, provide a considerable market potential as a garnish for salads and drinks. In western countries, the fruit is generally eaten at a ripe stage when it is yellow. However, in some Asian countries, the green mature fruit is relished and consumed as fresh and in pickle preparations. Narain *et al.*, (2001) [5]. Value addition of Carambola fruits will improve the consumption by different communities and also reduce the postharvest losses of the unexploited fruit, apart from promoting several health benefits.

Material and methods**Procurement of raw material**

The un-exploited fruit carambola was procured from different agro- climatic zones of Himachal Pradesh as illustrated in Table 1. The fruit carambola preparation/formulation of value-added products was purchased from the local vendors and local people of Himachal Pradesh. The other ingredients namely; sugar, spices etc for the preparation/ formulation of value added products were also purchased from the local market.

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Table 1: Distribution of Carambola procured from different agro-climatic zones of Himachal Pradesh

Fruit	Botanical name	Availability areas	Procurement area
Carambola	<i>Averrhoa carambola</i>	Kangra, Shahpur, Chintpurni	Kangra, Shahpur

The Carambola fruits were procured and washed thoroughly in fresh tap water, drained completely. Carambola fruit is grounded after carefully removing seeds. The carambola pulp was sieved, pasteurized and stored in sterilized bottles at room temperature for further product development such as RTS, squash, toffee, bar, chutney and butter.

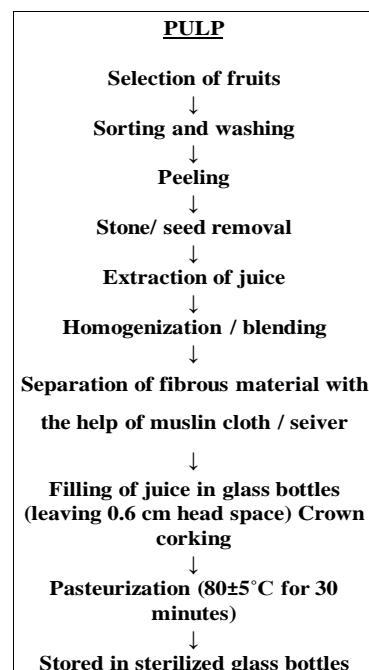
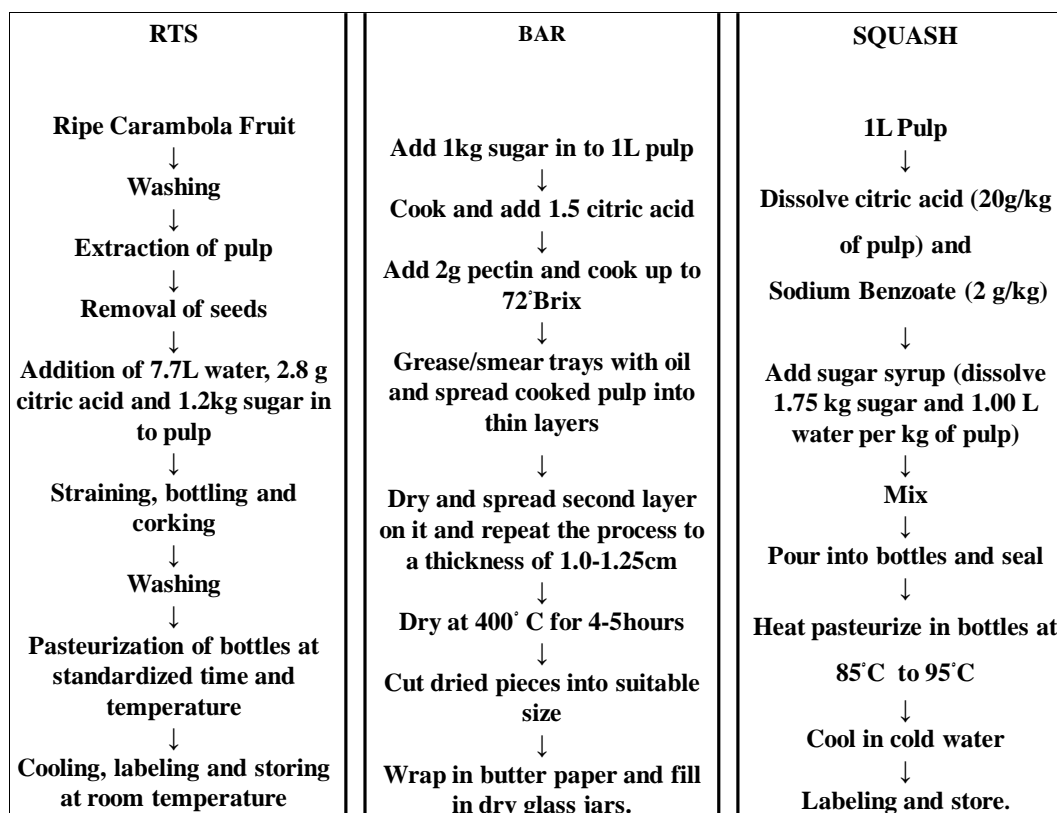
Development of value-added Carambola products

The Carambola pulp was used for formulating and standardizing 6 value added products like Carambola RTS (CR), Carambola Squash (CS), Carambola Toffee (CT), Carambola Bar (CB), Carambola Chutney (CC) and Carambola Butter (CB).

The sensory assessments were conducted in which the panel of 5 members consisted of random people. All the products prepared were coded and served in transparent bowls. Panelists were provided with a glass of water and instructed to sip in between samples. They were given written instructions and asked to evaluate the products for acceptability based on its colour, flavor, texture, taste and overall acceptability using nine-point hedonic scale (0=Dislike extremely to 9=Like extremely) (Ramya and Anitha., 2020) [6]. The data obtained

from sensory evaluation was subjected to analysis of variance (ANOVA).

Results and discussion

**Fig 1:** Flow chart of Pulp from *Averrhoa carambola***Fig 2A:** Flow chart of six different value added products from *Averrhoa carambola*.

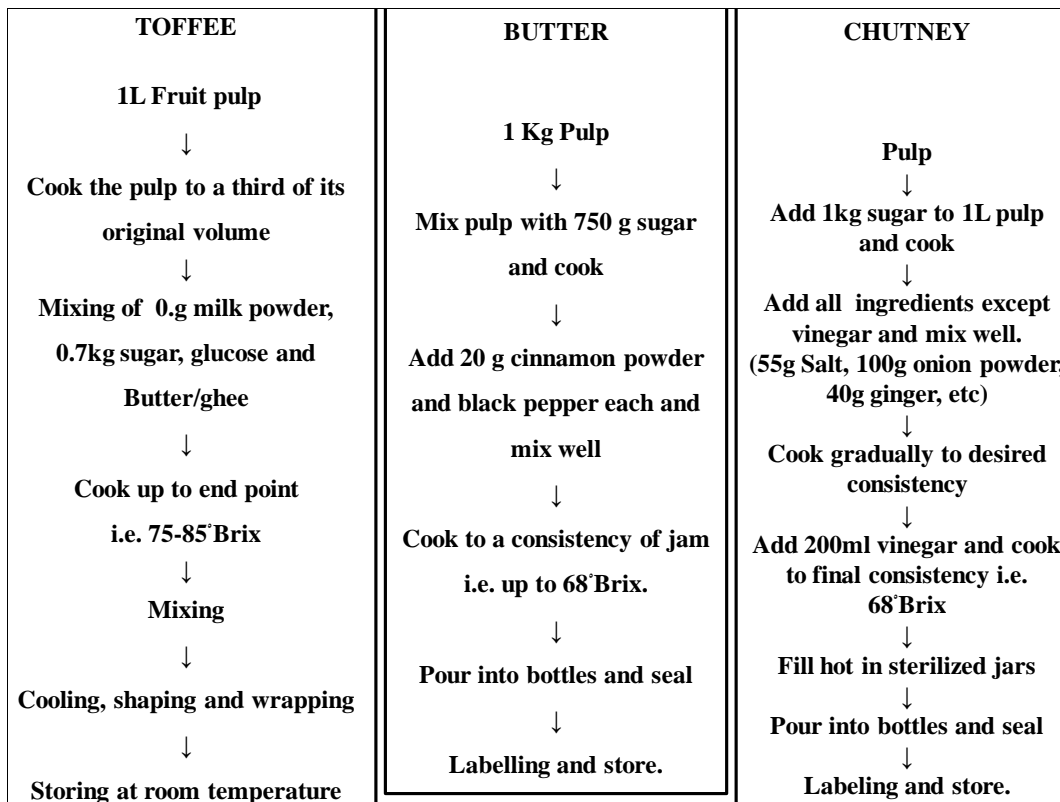
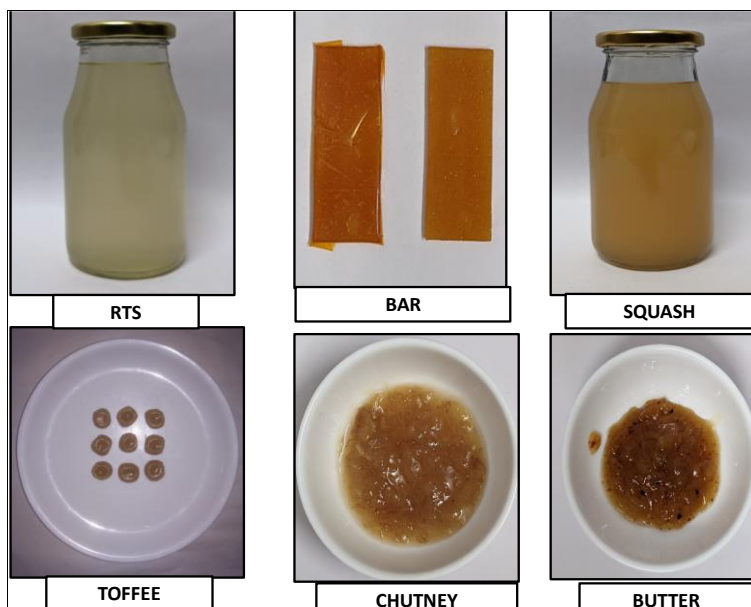
Fig 2B: Flow chart of six different value added products from *Averrhoa carambola*Fig 4: Value added products from *Averrhoa carambola*

Table 2: Sensory evaluation of products developed with Carambola Fruit.

S. No.	Carambola Products	Sensory Parameters	0 months	2 Months	4 months	6 Months	Mean
1.	RTS	Colour	7.81	7.54	7.35	7.31	7.50
		Taste	7.71	6.14	7.18	7.44	7.12
		Flavour	7.46	7.36	7.22	7.37	7.35
		Consistency	7.33	7.34	7.21	7.07	7.24
		Overall Acceptability	7.58	7.10	7.24	7.30	7.30
2.	Butter	Colour	7.71	7.80	7.57	7.37	7.69
		Taste	7.70	7.42	7.41	7.39	7.48
		Flavour	7.74	7.50	7.41	7.41	7.52
		Consistency	7.75	7.59	7.64	7.67	7.66
		Overall Acceptability	7.73	7.58	7.51	7.50	7.59
3.	Squash	Colour	7.46	7.42	7.29	7.01	7.30
		Taste	7.44	7.39	7.17	6.96	7.24
		Flavour	7.43	7.59	7.17	6.95	7.29

		Consistency	7.80	7.76	7.72	7.60	7.72
		Overall Acceptability	7.53	7.54	7.34	7.13	7.39
4.	Toffee	Colour	8.27	7.96	7.73	7.62	7.90
		Taste	7.60	7.44	7.38	7.38	7.45
		Flavour	8.07	7.96	7.67	7.60	7.83
		Consistency	8.15	7.79	7.67	7.49	7.78
		Overall Acceptability	8.02	7.79	7.61	7.52	7.74
5.	Chutney	Colour	8.07	7.96	7.67	7.60	7.83
		Taste	8.00	7.61	7.64	7.57	7.71
		Flavour	7.38	7.42	7.66	8.07	7.63
		Consistency	7.35	7.15	7.58	6.53	7.15
		Overall Acceptability	7.70	7.54	7.64	7.44	7.58
6.	Bar	Colour	7.74	7.46	7.57	7.26	7.51
		Taste	7.77	7.62	7.59	7.34	7.58
		Flavour	7.72	7.69	7.55	7.51	7.61
		Consistency	8.27	7.96	7.73	7.62	7.90
		Overall Acceptability	7.88	7.63	7.60	7.43	7.63

Table 2 describes organoleptic scores for the colour, taste, flavor, consistency and over all acceptability of all six value added products developed from carambola fruit.

The scores for color of carambola RTS at fresh was reported as decreased non-significantly from (7.81 to 7.31). However, the scores for taste, flavor and consistency were decreased significantly with the increase of storage period. The mean values for color, taste, flavor and consistency were reported as (7.50, 7.12, 7.35 and 7.24), respectively. The decrease in flavor may be due to degradation of volatile flavoring substances. The overall acceptability of the product decreased from (7.58 to 7.10) from the initial day of storage. Decrease in scores for color might be due to certain chemical reaction which might have taken place during storage. Similar findings were reported by Sarvana and Manimegalai (2005) [7] for all the parameters in whey based papaya RTS beverage during storage of 90days.

Further scrutiny of data reveals effect of storage on sensory scores for carambola fruit butter. The scores for colour varied non-significantly. The scores for colour at fresh was 7.71 which increased to 7.80 in 2 month of storage but thereafter a decrease in scores were observed for 4 and 6 month as 7.57 and 7.37, respectively. As far as taste and flavor are concerned, the scores for taste and flavor varied from 7.70 to 7.39 and 7.74 to 7.41 from the initial day of storage to 6 month of storage. The consistency of a product decreased non-significantly from 7.75 to 7.67. The score for overall acceptability at fresh was 7.73, which decreased significantly to 7.58, 7.51 and 7.50 for 2, 4 and 6 months of storage interval. Rao *et al.* (2009) [8] found that sensory scores decreased from 8.50 + 0.04 to 7.54 + 0.32 during storage of 6 months in grape spread. The product had a good acceptability during storage.

The data on effect of storage on organoleptic scores of carambola squash are presented in Table 2. Organoleptic scores for color decreased significantly with the increase in the storage period. The scores for colour decreased from 7.46 to 7.01. The scores for color was rated between liked very much to like extremely when squash was served to the panel of judges. Decrease in colour scores might be due to sulphur dioxide and increase in tannin content which may lead to darkening of products, also due to certain chemicals reaction which might have taken place during storage. The organoleptic scores for taste and flavor of carambola squash at fresh reported as 7.44 and 7.43. The decrease in scores for taste and flavor might be due to degradation of volatile substances. However, a significant reduction in scores for taste and flavor was observed during 6 month of storage (7.44

to 6.95) with the mean values was observed as 7.24 and 7.29, respectively. The organoleptic scores for consistency varied non-significantly when the scores were compared with each other during storage intervals. On a whole, the overall acceptability of a product decreased from 7.53 to 7.34. Certain chemical changes and discoloration (browning) are responsible for the masking of original sensory quality of the food products. Shivani (2011) [9] observed a gradual decrease in organoleptic scores for nectarine squash whereas Sethi (1993) [10] reported that litchi squash was found to be organoleptically acceptability up to 4 months of storage at room temperature and 6 months of storage at low temperature. The values for sensory score of toffee decrease with the increase of storage period. The values for colour decreased non-significantly. The sensory score for colour ranged from 8.27 to 7.62 from the initial day of storage. The scores for taste, flavor, consistency and overall acceptability decreased significantly when the values for fresh toffee were compared with the values of 2, 4 and 6 months of storage. The mean values of color, taste, flavour, texture and overall acceptability were 7.90, 7.45, 7.83, 7.78 and 7.74, respectively. Decrease in colour scores might be due to certain chemical reaction which might have taken place during storage while decrease in taste and flavor scores due to degradation of volatile flavorings compounds during storage. Shivani (2011) [9] also reported similar observations for nectarine toffee. Sharma (2000) [11] prepared toffee from fresh apple pomace and also evaluated organoleptically and were rated as "liked very much".

Further scrutiny of data reveals effect of storage on sensory scores for carambola chutney. The scores for colour varied non-significantly. The scores for colour at fresh was 8.07 which decreased to 7.96 in 2 month of storage but thereafter a decrease in scores were observed for 4 and 6 month as 7.67 and 7.60, respectively. As far as taste and flavor are concerned, the scores for taste and flavour varied from 8.00 to 7.57 and 7.38 to 8.07 from the initial day of storage to 6 month of storage. The consistency of a product decreased non-significantly from 7.35 to 6.53. The score for overall acceptability at fresh was 7.70, which decreased non-significantly to 7.54, 7.64 and 7.44 for 2, 4 and 6 months of storage interval. Rao *et al.* (2009) [8] found that sensory scores decreased from 8.50 + 0.04 to 7.54 + 0.32 during storage of 6 months in grape spread. The product had a good acceptability during storage.

A glance at Table 2 shows sensory scores for carambola bar. The scores for color varied non-significantly ranging from 7.74 to 7.21 when compared initial value with 6 months of

storage. The decrease in colour might be due to increase in tannins which lead to browning. The scores for taste and flavor were rated as liked moderately when carambola bar was served to panel of judges at fresh. But the scores of taste and flavor were decreased during 6 month of storage from (7.77 to 7.34 and 7.72 to 7.51) and rated as, liked slightly. The decrease in taste and flavor scores might be due to degradation of volatile flavoring substances data pertaining to consistency and overall acceptability shows that the scores for consistency and overall acceptability decreased with the increase of storage interval with range reported as (8.27 to 7.62) and (7.88 to 7.63), respectively. Similar observations were recorded by Sharma (2011) ^[11] in dheu papaya based leather.

Conclusion

Carambola also known as Star Fruit, Carambola is believed that it may have originated from Sri Lanka or Moluccas, Indonesia, but has been cultivated in the Indian Subcontinent and Southeast Asia for hundreds of years. The fruit is about 5 to 15 centimeters (which means 2 to 6 inches) in length and is in shape of oval. They are rich in antioxidants, potassium, and vitamin C; and low in sugar and sodium. Value addition of Carambola fruit into processed products will enhance the health benefits of consumers due to many bioactive components present. Also the product formulations and process optimization of Carambola value added products can help find the unexplored qualities of unexploited carambola fruit of Himachal Pradesh. Color, taste, flavor, consistency and overall acceptability of all the six products were evaluated by sensory evaluation. The overall acceptability result indicates that carambola toffee (7.74) was very much liked by the panelists, followed by carambola bar (7.63), thereafter butter (7.59) then chutney (7.58) and squash (7.39) and RTS at last with the reading of (7.30). Rigorous efforts as well as awareness about benefits of carambola fruits are needed to be advertised for the commercial plantations. *Averrhoa carambola* should be extensively promoted for development of various value added products etc for economic growth as well as to reduce post-harvest losses.

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