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Effect of blending levels, fiber concentration and storage period on sensory quality of carambola-guava blended pre-biotic nectar

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Abstract
The present investigation was carried out to prepare pre-biotic carambola-guava blended nectar with objective to optimize suitable blend proportion and fibre concentration using twenty treatment combinations comprised of five levels of carambola and guava blend [20% Carambola (B_1), 15% Carambola + 05% Guava (B_2), 10% Carambola + 10% Guava (B_3), 05% Carambola + 15% Guava (B_4) and 20% Guava (B_5)] and four levels of fibre concentrations [0.0% (F_1), 0.2% (F_2), 0.4% (F_3) and 0.6% (F_4)]. The results of present investigation indicated that pre-biotic carambola-guava nectar prepared by using 15 per cent guava pulp with 5 per cent carambola and 0.20 per cent fibre (B_4F_2) remained shelf stable on the basis sensory quality up to three months storage in glass bottle.

Keywords: Blending levels of carambola and guava pulp, fibre concentrations, sensory quality, storage period, glass bottles

Introduction
The carambola fruit beverages are not preferred by the consumer due to their inherent acidic and astringent taste. The acceptance of carambola beverages can be increased by blending with guava fruits having acceptable taste and flavour. Guava is one of the best alternative having both acceptable taste and flavour besides high nutritional value. Although fruits are rich in fibre but the juice extraction through the juice extractor generally reduces the fibre content of fruits. These fibres are known to cure several degenerative diseases. Therefore, there is need to optimize suitable blend proportion and fibre concentration for preparation of pre-biotic blended nectar from carambola and guava.

The fruit nectar is one of the most delicious products being prepared from fruit pulp. The word nectar arrived from the Greek word "*nektar*", which means "drink of the god" and is a refreshing drink free of carbonation. Fruit nectars contain all the important components of the original fruit and to a large extent maintain their taste and flavour (Raj, 2016) [9]. Such health oriented drinks can be one of the refreshing drinks having zero carbonation, relatively low or zero preservative and excellent sources of several important vitamins, minerals, fibre *etc*., often prepared in the form of nectar. As per FPO, nectar is a fruit beverage that contains at least 20 per cent of fruit juice or pulp, 15 per cent of soluble solids and 0.3 per cent of acid. It is not diluted before serving. According to the traditional system of Indian Medicine, combinations of different foods are used to enhance the desired activity and to eliminate unwanted side effects. Food commodities like guava and underutilized medicinal fruit like carambola are used for the beneficial effects and are being used to cure different degenerative diseases.

Material and Methods
Guava and carambola fruits were purchased from farmers of Bharuch district and brought to Department of Post Harvest Technology, ASPEE College of Horticulture and Forestry, NAU, Navsari. Ripe and healthy guava and carambola fruits were selected, sorted, graded and washed. Then guava fruits were cut into pieces before passing through pulper for extraction of pulp. Pre-biotic nectar is a fruit beverage in which fibre is added to give health benefits. In the present experiment, fruit fibre was added to prepared nectar. Fibre was extracted from pomace of pineapple by washing (five times) with RO water by maintaining ratio of 1:10 (peel powder:

water) on weight basis. The extracted fibre was dried in cabinet drier at 60°C, milled to fine powder and utilized for preparation of pre-biotic carambola-guava nectar.

Pre-biotic carambola-guava nectar was prepared with the addition of pineapple fibre in nectar. Total 20 treatments with 3 repetitions were fixed for preparation of pre-biotic carambola-guava nectar using different concentration of fibre and carambola-guava blend as detail in Table 1. Nectar was prepared as per FPO specification containing 20% pulp, 15°Brix (TSS) and 0.30% acidity.

Sugar syrup was prepared by adding table sugar to boiling water. The strength of sugar syrup was measured using hand refractometer. Pre-biotic carambola-guava nectar was prepared by mixing of blended carambola-guava pulp (20%) (as per treatment), pineapple fibre (as per treatment) and sugar syrup to maintain desired TSS. Then the mixture was boiled upto 95±1 °C and required quantity of citric acid was added to the nectar to maintain 0.30% acidity. The prepared nectar was filled into pre-sterilized glass bottles (200ml) and sealed air tight with crown caps. The product was then pasteurized at 95±1 °C in boiling water for 30 minutes followed by cooling and storage at room temperature for three months.

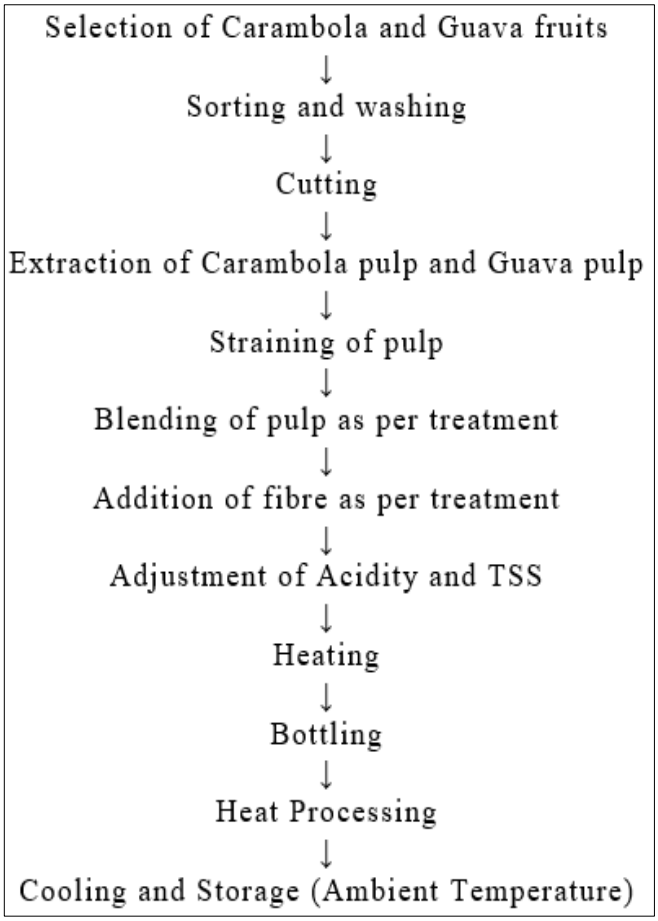

Fig 1: Principal steps for preparation of fiber enriched pre-biotic nectar

Factor 1: Blending levels

Blending level (B)	Carambola (%)	Guava (%)
B_1	20	0
B_2	15	5
B_3	10	10
B_4	5	15
B_5	0	20

Factor 2: Fibre levels

Fibre level (F)	Concentrations (%)
F_1	0.0
F_2	0.2
F_3	0.4
F_4	0.6

Table 1: Detail of treatments used to preparation of blended nectar

Treatment Combinations	Blends (B), %		Fibre level (F), %
	Carambola	Guava	
T_1- B_1F_1	20	0	0.0
T_2-B_1F_2	20	0	0.2
T_3-B_1F_3	20	0	0.4
T_4-B_1F_4	20	0	0.6
T_5-B_2F_1	15	5	0.0
T_6-B_2F_2	15	5	0.2
T_7-B_2F_3	15	5	0.4
T_8-B_2F_4	15	5	0.6
T_9-B_3F_1	10	10	0.0
T_{10}-B_3F_2	10	10	0.2
T_{11}-B_3F_3	10	10	0.4
T_{12}-B_3F_4	10	10	0.6
T_{13}-B_4F_1	5	15	0.0
T_{14}-B_4F_2	5	15	0.2
T_{15}-B_4F_3	5	15	0.4
T_{16}-B_4F_4	5	15	0.6
T_{17}-B_5F_1	0	20	0.0
T_{18}-B_5F_2	0	20	0.2
T_{19}-B_5F_3	0	20	0.4
T_{20}-B_5F_4	0	20	0.6

Methodology for sensory evaluation of the blended nectar during storage

Sensory evaluation of blended nectar was conducted during storage to assess the consumer's acceptance for the products. The prepared samples of blended nectar were evaluated for sensory qualities on the basis of colour, taste, flavor and overall acceptability on a 9 point Hedonic scale according to the method of Amerine *et al*. (1965) [2]. Sensory panelists (7-9 members) comprised of faculty members and PG students of Department of Post-Harvest Technology, NAU, Navsari (Gujarat) were used for sensory analysis throughout the entire period of storage. Coded samples of products were served. Plain tap water was provided to the panelists for mouth rinsing in between the sensory evaluation.

Result and Discussion

Colour

The perusal of data pertaining to effect of blending levels and fibre concentrations on colour of carambola-guava blended pre-biotic nectar during three months storage period has been presented in Table 2 The storage of carambola-guava nectar resulted decrease in mean colour from initial value of 8.05 to 7.17 during three month storage. The decrease in colours core during storage might be due to breakdown of free amino acids and their utilization in NEB caused by Maillard's reactions (Raj, 2004) [8]. The interaction of blending levels, fibre concentrations and storage depicted variation in colour from 6.71 to 8.29 during three month storage period, with maximum decrease in colour from 7.71 to 6.71 in nectar prepared using 20 per cent carambola juice with 0.60 per cent fibre ($B_1F_4M_1$ to $B_1F_4M_4$) and minimum from 8.30 to 7.50 in nectar prepared by 5 per cent carambola juice and 15 per cent guava pulp without added fibre ($B_4F_1M_1$ to $B_4F_1M_4$). The decline in colour score during storage could also be associated

with an increase of protolytic enzyme activity (Raj, 2004) [8]. The decrease in score during storage might be attributed due to changes in chemical constituents and non-enzymatic reactions. The decrease in sensory colour score during storage in the present investigation are in line with the observation reported by Mandal *et al.* (2013) [7] for *aonla* nectar. Ahmad (2017) [1] in fibre enriched mango nectar

Table 2: Effect of blending levels and fibre concentrations on colour score (9 point Hedonic scale) of carambola-guava blended pre-biotic nectar during storage period

Treatments	Colour score (9 point Hedonic scale)				
	Initial (M_1)	One month (M_2)	Two months (M_3)	Three months (M_4)	Mean
T_1- B_1F_1	7.98	7.67	7.13	6.92	7.43
T_2-B_1F_2	7.92	7.64	7.04	6.88	7.37
T_3-B_1F_3	7.81	7.52	6.92	6.75	7.25
T_4-B_1F_4	7.71	7.46	6.84	6.71	7.18
T_5-B_2F_1	8.09	7.75	7.50	7.09	7.61
T_6-B_2F_2	8.00	7.71	7.46	7.04	7.55
T_7-B_2F_3	7.92	7.67	7.38	7.00	7.49
T_8-B_2F_4	7.88	7.63	7.33	6.96	7.45
T_9-B_3F_1	8.21	7.92	7.67	7.38	7.80
T_{10}-B_3F_2	8.17	7.84	7.67	7.30	7.75
T_{11}-B_3F_3	8.00	7.75	7.58	7.25	7.65
T_{12}-B_3F_4	7.92	7.67	7.50	7.21	7.58
T_{13}-B_4F_1	8.30	8.05	7.88	7.50	7.93
T_{14}-B_4F_2	8.25	8.00	7.79	7.42	7.87
T_{15}-B_4F_3	8.13	7.80	7.75	7.38	7.77
T_{16}-B_4F_4	8.00	7.71	7.67	7.29	7.67
T_{17}-B_5F_1	8.29	7.96	7.79	7.46	7.88
T_{18}-B_5F_2	8.21	7.88	7.71	7.38	7.80
T_{19}-B_5F_3	8.13	7.84	7.63	7.25	7.71
T_{20}-B_5F_4	8.05	7.79	7.58	7.21	7.66
Mean	8.05	7.76	7.49	7.17	7.62

Flavour

Data obtained during flavour of carambola-guava nectar have been presented in table 3. The decrease in mean flavor score from initial value of 8.01 to 7.11 during three month storage. Variation in flavour among different treatments might be due to variation in proximate chemical composition of fresh pulp of guava and carambola. Similar variations in flavour were also reported earlier for different blends of kinnow, aonla and ginger juice prepared using different proportions (Bhardwaj and Mukherjee, 2012) [5]. Similar results have also been reported earlier for mixed fruit juice of ber, pomegranate and guava (Vaidya *et al.*, 1998) [13]. Vaghasiya (2016) [12] for *Aloe vera* based health drink. The interaction of blending levels, fibre concentrations and storage depicted variation in flavour from 6.59 to 8.38 during three month storage period, with maximum decrease in flavour from 7.50 to 6.59 in nectar prepared using 20 per cent carambola juice with 0.60 per cent fibre ($B_1F_4M_1$ to $B_1F_4M_4$) and minimum from 8.38 to 7.67 in nectar prepared by 20 per cent guava pulp with 0.20 per cent fibre ($B_5F_2M_1$ to $B_5F_2M_4$). The decrease in flavour score during storage might be attributed to loss of volatile aromatic compounds (Baramanray *et al*., 1995 and Choudhary *et al.*, 2008) [4, 6].

Table 3: Effect of blending levels and fibre concentrations on flavour score (9 point Hedonic scale) of carambola-guava blended pre-biotic nectar during storage period

Treatments	Flavour score (9 point Hedonic scale)				
	Initial (M_1)	One month (M_2)	Two months (M_3)	Three months (M_4)	Mean
T_1- B_1F_1	7.79	7.21	6.92	6.71	7.16
T_2-B_1F_2	7.67	7.29	7.05	6.67	7.17
T_3-B_1F_3	7.59	7.17	6.79	6.63	7.05
T_4-B_1F_4	7.5	7.13	6.71	6.59	6.98
T_5-B_2F_1	7.88	7.21	7.21	6.75	7.26
T_6-B_2F_2	7.92	7.29	7.34	7.04	7.40
T_7-B_2F_3	7.84	7.17	7.17	6.84	7.26
T_8-B_2F_4	7.79	7.13	7.04	6.75	7.18
T_9-B_3F_1	8.09	7.84	7.29	7.04	7.57
T_{10}-B_3F_2	8.09	7.88	7.42	7.13	7.63
T_{11}-B_3F_3	8.00	7.79	7.25	6.96	7.50
T_{12}-B_3F_4	7.96	7.71	7.13	6.88	7.42
T_{13}-B_4F_1	8.21	7.96	7.75	7.5	7.86
T_{14}-B_4F_2	8.29	8.04	7.83	7.63	7.95
T_{15}-B_4F_3	8.21	7.84	7.71	7.42	7.80
T_{16}-B_4F_4	8.13	7.79	7.63	7.34	7.72
T_{17}-B_5F_1	8.34	8	7.84	7.58	7.94
T_{18}-B_5F_2	8.38	8.04	7.88	7.67	7.99
T_{19}-B_5F_3	8.29	7.92	7.79	7.55	7.89
T_{20}-B_5F_4	8.29	7.88	7.64	7.46	7.82
Mean	8.01	7.61	7.37	7.11	7.53

Body

Data pertaining body score of fibre enriched prebiotic carambola-guava nectar presented in Table 4. The storage of carambola-guava nectar resulted decrease in mean body from initial value of 7.78 to 7.25 during three months storage. The interaction of blending levels, fibre concentrations and storage depicted variation in body from 6.84 to 7.96 during three month storage period, with maximum decrease in body from 7.63 to 6.84 in nectar prepared using 20 per cent carambola juice with 0.60 per cent fibre ($B_1F_4M_1$ to $B_1F_4M_4$) and minimum from 7.92 to 7.50 in nectar prepared by 15 per cent carambola juice and 5 per cent guava pulp added with 0.20 per cent fibre ($B_4F_2M_1$ to $B_4F_2M_4$). Decrease in body score may be due to separation and sedimentation of nectar due to fibre addition in nectar. Similar results were also reported by (Anon 2016) [2] in mango-noni blended nectar and Ahmad (2017) [1] in fibre enriched mango nectar.

Table 4: Effect of blending levels and fibre concentrations on body score (9 point Hedonic scale) of carambola-guava blended pre-biotic nectar during storage period

Treatments	Body score (9 point Hedonic scale)				
	Initial (M_1)	One month (M_2)	Two months (M_3)	Three months (M_4)	Mean
T_1- B_1F_1	7.71	7.50	7.42	7.09	7.43
T_2-B_1F_2	7.71	7.50	7.34	6.96	7.38
T_3-B_1F_3	7.63	7.46	7.29	6.92	7.33
T_4-B_1F_4	7.63	7.42	7.25	6.84	7.29
T_5-B_2F_1	7.83	7.59	7.50	7.29	7.55
T_6-B_2F_2	7.79	7.59	7.46	7.21	7.51
T_7-B_2F_3	7.75	7.54	7.42	7.13	7.46
T_8-B_2F_4	7.71	7.46	7.34	7.04	7.39
T_9-B_3F_1	7.75	7.67	7.59	7.38	7.60
T_{10}-B_3F_2	7.71	7.63	7.50	7.34	7.55
T_{11}-B_3F_3	7.71	7.54	7.46	7.29	7.50
T_{12}-B_3F_4	7.63	7.50	7.38	7.21	7.43
T_{13}-B_4F_1	7.96	7.75	7.63	7.54	7.72
T_{14}-B_4F_2	7.92	7.71	7.59	7.50	7.68
T_{15}-B_4F_3	7.88	7.63	7.50	7.42	7.61
T_{16}-B_4F_4	7.79	7.59	7.46	7.38	7.56
T_{17}-B_5F_1	7.96	7.79	7.59	7.46	7.70
T_{18}-B_5F_2	7.88	7.71	7.54	7.42	7.64
T_{19}-B_5F_3	7.84	7.58	7.42	7.34	7.55
T_{20}-B_5F_4	7.75	7.46	7.29	7.30	7.45
Mean	7.78	7.58	7.45	7.25	7.51

Taste

The data regarding taste score of pre-biotic carambola-guava nectar presented in table 5. Taste value of pre-biotic carambola-guava nectar decrease in mean taste from initial value of 8.18 to 7.34 during three months storage. The decrease in tase during storage is due to different blend having different taste. The blending levels, fibre concentrations and storage depicted variation in taste from 6.96 to 8.33 during three month storage period with maximum decrease in taste from 8.04 to 6.96 in nectar prepared using 20 per cent carambola juice with 0.60 per cent fibre ($B_1F_4M_1$ to $B_1F_4M_4$) and minimum from 8.33 to 7.67 in nectar prepared by 15 per cent guava pulp and 5 per cent carambola juice with 0.20 per cent fibre ($B_4F_2M_1$ to $B_4F_2M_4$). Similar result were also reported Tahsildar (2016) [10] in *Aloe vera*, guava and jamun blended nectar and Vaghasiya (2015) [11] for *Aloe vera* based health drink.

Table 5: Effect of blending levels and fibre concentrations on taste score (9 point Hedonic scale) of carambola-guava blended pre-biotic nectar during storage period

Treatments	Taste score (9 point Hedonic scale)				
	Initial (M_1)	One month (M_2)	Two months (M_3)	Three months (M_4)	Mean
T_1- B_1F_1	8.09	7.75	7.46	7.13	7.61
T_2-B_1F_2	8.13	7.79	7.50	7.17	7.65
T_3-B_1F_3	8.09	7.67	7.42	7.04	7.56
T_4-B_1F_4	8.04	7.63	7.34	6.96	7.49
T_5-B_2F_1	8.17	7.88	7.50	7.25	7.70
T_6-B_2F_2	8.17	7.92	7.59	7.34	7.76
T_7-B_2F_3	8.13	7.79	7.46	7.17	7.64
T_8-B_2F_4	8.09	7.75	7.29	7.08	7.55
T_9-B_3F_1	8.17	8.00	7.71	7.38	7.82
T_{10}-B_3F_2	8.25	8.04	7.75	7.42	7.87
T_{11}-B_3F_3	8.13	7.88	7.59	7.29	7.72
T_{12}-B_3F_4	8.09	7.83	7.55	7.25	7.68
T_{13}-B_4F_1	8.25	8.05	7.88	7.58	7.94
T_{14}-B_4F_2	8.33	8.13	7.96	7.67	8.02
T_{15}-B_4F_3	8.21	8.00	7.88	7.55	7.91
T_{16}-B_4F_4	8.17	7.92	7.80	7.46	7.84
T_{17}-B_5F_1	8.29	8.09	7.84	7.55	7.94
T_{18}-B_5F_2	8.29	8.17	7.92	7.63	8.00
T_{19}-B_5F_3	8.25	8.05	7.83	7.50	7.91
T_{20}-B_5F_4	8.21	8.00	7.71	7.42	7.84
Mean	8.18	7.92	7.65	7.34	7.77

Overall acceptability

The perusal of data pertaining to effect of blending levels and fibre concentrations during three months storage period on over all acceptability of carambola-guava blended pre-biotic nectar has been presented in Table 6. The storage of carambola-guava nectar resulted decrease in mean overall acceptability score from initial value of 8.00 to 7.22 during three month storage. Interaction of blending levels, fibre concentrations and storage depicted variation in overall acceptability from 6.77 to 8.22 during three month storage period with maximum decrease in overall acceptability from 7.72 to 6.77 innectar prepared using 20 per cent carambola juice with 0.60 per cent fibre ($B_1F_4M_1$ to $B_1F_4M_4$), and minimum from 8.20 to 7.56 in nectar prepared by 15 per cent guava pulp with 5 per cent carambola and 0.20 per cent fibre ($B_4F_2M_1$ to $B_4F_2M_4$). The decrease in overall sensory score of pre-biotic blended nectar during storage could be correlated to changes in colour, flavour and body of pre-biotic blended nectar. The values of present investigation are almost in conformed to that reported by Vaghasiya (2016) [12] for *Aloe vera* based health drink and Ahmad (2017) [1] in fibre enriched mango nectar.

Table 6: Effect of blending levels and fibre concentrations on overall acceptability (9 point Headonic scale) of carambola-guava blended pre-biotic nectar during storage period

Treatments	Overall acceptability score (9 point Hedonic scale)				
	Initial (M_1)	One month (M_2)	Two months (M_3)	Three months (M_4)	Mean
T_1- B_1F_1	7.89	7.53	7.24	6.96	7.41
T_2-B_1F_2	7.86	7.56	7.23	6.92	7.39
T_3-B_1F_3	7.78	7.45	7.11	6.83	7.29
T_4-B_1F_4	7.72	7.41	7.03	6.77	7.23
T_5-B_2F_1	7.99	7.66	7.43	7.1	7.55
T_6-B_2F_2	7.97	7.68	7.46	7.16	7.57
T_7-B_2F_3	7.91	7.6	7.36	7.03	7.48
T_8-B_2F_4	7.87	7.54	7.25	6.96	7.41
T_9-B_3F_1	8.06	7.86	7.57	7.29	7.70
T_{10}-B_3F_2	8.05	7.84	7.59	7.3	7.70
T_{11}-B_3F_3	7.96	7.74	7.47	7.2	7.59
T_{12}-B_3F_4	7.9	7.68	7.39	7.14	7.53
T_{13}-B_4F_1	8.18	7.95	7.78	7.53	7.86
T_{14}-B_4F_2	8.2	7.97	7.8	7.56	7.88
T_{15}-B_4F_3	8.11	7.82	7.71	7.44	7.77
T_{16}-B_4F_4	8.02	7.76	7.64	7.37	7.70
T_{17}-B_5F_1	8.22	7.96	7.77	7.51	7.87
T_{18}-B_5F_2	8.19	7.95	7.76	7.52	7.86
T_{19}-B_5F_3	8.13	7.85	7.67	7.41	7.77
T_{20}-B_5F_4	8.07	7.79	7.56	7.35	7.69
Mean	8.00	7.73	7.49	7.22	7.61

Conclusion

The findings summarized above indicate that fiber enriched pre-biotic carambola-guava blended nectar with considerable higher sensory quality can be prepared by using 15 per cent guava pulp with 5 per cent carambola, 0.20 per cent fiber, remain shelf stable on the basis of sensory quality up to three months in glass bottles in ambient temperature.

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