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Development of Carambola (*Averrhoa carambola* L.)-pineapple (*Ananas comosus* L.) Blended jelly cubes

PP Ahirrao, PP Relekar and SK Kadam

Abstract
The objectives of this research work were to standardization of juice proportion of carambola and pineapple for development of blended cube jelly. Blended carambola and pineapple jelly cubes was prepared by using various proportions of carambola and pineapple fruit juices *viz*. 100:00, 90:10, 80:20, 70:30, 60:40 and 00:100. The jelly cube was evaluated for physical, chemical and sensory quality parameters up to 90 days of storage to standardize the proportion of fruit juices in the blended jelly. An increase in moisture, reducing sugars with decrease in TSS, titratable acidity, total sugars, ascorbic acid and β-carotene in the product was observed during 90 days of storage period at ambient condition. Sensory evaluation of the carambola-pineapple blended jelly cubes showed that the sensory score for colour, flavour and texture decreased during storage. Based on the organoleptic evaluation of the jelly cubes, the carambola-pineapple blended jelly cubes could be prepared by blending carambola-pineapple juice in the ratio of 60:40 with optimum consumer acceptability upto90 days of storage at ambient condition.

Keywords: Carambola, pineapple, juice, jelly cubes

Introduction
Carambola (*Averrhoa carambola* L.) is a nutritious fruit belonging to the oxalidaceae family. The chromosome number of carambola is 22 or 24. Averrhoa has now been set in another family Averrhoaceae by Hutchinson. The oxalidaceae family has seven genera, addressing in excess of 200 species, which are disseminated basically in the tropical and subtropical district of the world (Pawar, 2009) [16]. The family Averrhoaceae contains two species *viz*. Carambola (*Averrhoa carambola* L) and Bilimbi or cucumber tree (*Averrhoa bilimbi* L). The fruit is also known as golden star or starfruit. The word Carambola is derived from Sanskrit word karmaranga meaning "food appetizer" (Monalisa *et al*., 2014) [14]. Carambola is local of Indonesia and Malaysia yet conveyed all throughout the planet particularly in South East Asian nations including China, Malaysia, Thailand, Pakistan, Indonesia and India (Pawar, 2009) [16]. In India, it is dispersed in Uttar Pradesh, Assam, West Bengal, Madhya Pradesh, Bihar and foot slopes of Tamil Nadu and other tropical regions. It is likewise seen in the Konkan area of Maharashtra.
In tropical territories, carambola trees can possibly blossom all the year (Crane *et al*., 1998) [5], however, creates two primary flushes, one in October-November and another in April-May. The carambola fruit are oval to ellipsoid, 5-15 cm long and 3-10 cm in distance across, with 4-6 (normally 5) conspicuous longitudinal ribs, weighing around 70-130 g. The fruit cuts in cross segment are star-molded, subsequently the name starfruit (Shinde, 2013) [21]. The skin of fruit is thin, smooth, and waxy and turns gold green to dark yellow when it is ripe. The carambola flesh light yellow in colour with crispy texture, translucent, juicy and firm. The acidic nature of pulp is due to its oxalic acid content (Pawar, 2009) [16]. Starfruit seeds are small, 0.6 to 1.3 cm long, thin, brown, edible and there are usually 10-12 seeds per fruit. The fruit is extremely sour or mildly sweet depending upon the cultivar type and amount of oxalic acid concentration. The sour type is smaller in size, richly flavoured with more oxalic acid and sweet type is larger in size, mild flavoured, with less amount of oxalic acid (Pawar, 2009) [16].
According to Mia *et al*. (2007) [13], the carambola juice is used as antioxidant, astringent property to treat vomiting, diarrhea, dysentery, piles, etc. *Averrhoa carambola* possesses a medicinal property such as anti-inflammatory, hepato protective and anticancer activity, anti-ulcer activity, analgesic, hypoglycemic and therefore, the plant and fruit can be used as a perfect medicine (Dasgupta *et al*., 2013) [6]. The fruit is a rich source of vitamin C, also β-complex, antioxidants, Phyto-nutrients such as polyphenols and flavonoids, lower percentage

of sugar, high acid content with small amount of minerals and electrolytes like K, P, Zn and iron (Shui and Leong, 2004) [22]. Carambola fruits have enriched nutritive value as well as medicinal properties but due to sour taste it makes unpopular among all fruits with less market demands and consumer acceptability.

Products of carambola contain a delicious mash which might be acidic or sweet relying upon type. Hundred grams of carambola contains 35.70 calories, 89-91 g water, 0.38 g protein, 0.08 g fat, 9.38 g carbs, 0.8-0.9 f fiber, 4.4-6 mg calcium, 15.5-21 mg phosphorous, 0.32-1.65 mg iron, 26-53.1 mg ascorbic corrosive. Moreover, the fruit is a potential source of pectin (Naphade *et al*., 2010).

The ripe carambola fruit is processed into fermented or unfermented drinks, sweets, jam, jelly, etc. Besides other products like essence, juice, wine and blended cordial can be prepared from the carambola fruit (Nagy *et al*., 1990) [15].

Due to availability of fruits for a longer period, there is a huge scope to develop new product of carambola blended with pineapple juice so as to have an appealing taste and making its availability throughout the year.

Pineapple, botanically known as *Ananas comosus*, is one of the most important horticultural crops belonging to the order Farinosae and family bromeliaceae. The chromosome number of pineapple is 2n= 50. In terms of production, it is considered as the third most important tropical fruit in the world after banana and citrus. The name pineapple got from Spanish name 'Pina', given to the plant, in light of appearance of its organic products, which look like a pine cone. The name 'Ananas', which later turned into the conventional name is gotten from Tupi Indian name 'Nana'.

As far as nutritive value of pineapple is concerned per hundred grams of pineapple gives 52 calories of energy, 1.40 g dietary fiber, 13.7 g starch, 0.54 g protein, 0.28 mg iron, 12 mg calcium, 150 mg potassium, 11 mg phosphorous, 0.10 mg of zinc, 130 I.U. vitamin A, 0.079 mg vitamin B1, 0.031 mg vitamin B2, 0.489 mg vitamin B3, 0.110 mg vitamin B6 and 24 mg of vitamin C. It contains 81.2 to 86.2 per cent moisture and 13-19 per cent total solids (Hossain *et al*., 2015) [9].

Pineapple fruits have characteristics pleasant, flavour, distinct aroma, exquisite taste and absence of seeds which qualifies it together of choicest fruits throughout the world (Auti, 2012) [2]. Pineapple is additionally referred as queen of fruits due to its excellent flavour and taste. It is cultivated predominantly for its fruit that's consumed fresh or as canned fruit and juice. Pineapple is the only source of bromelain, a complex proteolytic enzyme used in the pharmaceutical market and as a meat-tenderizing agent. The leaves and stems of pineapple plant are also a source of fibre that is white, creamy and lustrous as silk. Pineapple fibre has been processed into paper with remarkable qualities of thinness, smoothness and liability. Plant parts are used for silage and hay for cattle feed. After the production of juice, processing wastes in the form of shell, core materials and centrifuged solids are also used as animal feed. The alcoholic beverages can also be prepared from juice (Anon., 2018).

According to Khan *et al*. (1988) [10], the technology of blending of different fruit juices could be utilized economically for the production of value-added products such as jam, jellies, etc. Some varieties of fruits used for processing do not have favourable characteristics such as colour, aroma and mouth feel. Moreover, a few fruits though rich in nutrients are not acceptable due to high acidity or poor taste and flavour. However, its juice can be successfully blended with the other fruits to improve their acceptability and thereby, making use of available nutrients.

The carambola has a poor flavour whereas pineapple has better flavour and attractive colour with good nutritional qualities. Hence, carambola juice blending with pineapple juice may improve the nutritional quality of the carambola: pineapple blended jelly cubes. The carambola fruit, therefore, could be utilized as a fruit base in the production of blended jelly wherein pineapple could be used as potential source for boosting the nutritive value and palatability of carambola-pineapple blended jelly.

Materials and Methods

The experiment was conducted at the Department of Post-Harvest Management of Fruit, Vegetable and Flower Crops, Post Graduate Institute of Post-Harvest Management, Killa-Roha, Dist. Raigad, (18°25'35.16312" N,73°10'45.77484" E) during the year 2020-2021.

The preparation of jelly by using mature fruit juice of carambola and pineapple as well as for making jelly, pectin, sugar and chemicals like citric acid and potassium metabisufite were added.

The experiment was layout under Factorial Completely Randomized Design (FCRD) with 24 treatment combination and 4 replications. The treatment details are as follows.

Main treatments		Sub treatments	
Treatments	**Proportion of carambola and pineapple juice**	**Treatments**	**Days**
T_1	100:00	S_1	0
T_2	90:10	S_2	30
T_3	80:20	S_3	60
T_4	70:30	S_4	90
T_5	60:40		
T_6	00:100		

The making jelly as per the treatments and examine upto 90 days during ambient temperature storage and record physical, chemical parameters and microbial activity at 30 days interval.

The colour of carambola and pineapple fruit juices was assessed using a colour reader (Konica Minolta CR-400, Japan) and expressed as L*, a*, and b* values. The chemical parameters like moisture, total soluble solids, titratable acidity were analysed as per the method of AOAC, 2000 and reducing, total sugars according to Rangana, (2003). In case of ascorbic acid, β carotene were analyzed with the methods described Roy (1973) [20]. The microbial examination of the blended carambola-pineapple jelly cubes was conducted at 0 day and 90 days after storage, according to Kiiyukia's method (2003).

Preparation of jelly cubes

The product was prepared as per the steps given below

Extraction of juice

Fresh carambola fruits were peeled and cut into small pieces by using knife and the peeled pieces were crushed with help of mixer grinder and then, the pulp was squeezed through muslin cloth for the juice extraction. Fresh pineapple fruits were peeled and cut into small pieces and crushed in a mixer. The pulp thus extracted was then squeezed through muslin cloth for the juice extraction.

Straining of juice
Carambola and pineapple juices were filtered four times through muslin cloth to eliminate all colloidal particles and scum.

Addition of water
After that, in a 1:1 proportion, potable water was added to both juices.

Blending of juices
Carambola and pineapple (Cv. Local) juices were blended in variable concentrations according to the treatments.

Addition of sugar
About 600 g of blended juice of carambola and pineapple was used in each replication for the preparation of jelly. The sugar was added in 1:1 proportion in the juice.

Boiling
After adding the sugar, the mixture was quickly boiled to avoid pectin degradation and preserve the jelly's colour and flavour. The scum was scraped off with a spoon as it appeared.

Addition of pectin
1/10th of the total sugar required was mixed with 2% pectin powder to make the pectin dissolve easily in the juice. To avoid the loss of pectin's jelly-forming strength, the pectin extract was sprinkled on the mixture with continuous stirring once it reached 600B TSS.

Addition of citric acid
When the TSS reached 65ºB, the citric acid was added at a rate of 0.5 percent to prevent sucrose crystallisation in the end product and to achieve the best gel formation. For proper sugar inversion, citric acid was added at the end of the cooking process.

Filling, packing and processing of jelly
When the TSS of the jelly reached 68ºB, the blended jelly was poured hot into the cube form moulds and left to set in the moulds for 15 minutes. The blended jelly cubes were placed in glass bottles after the jelly was set. The jelly cubes were stored in ambient conditions for future study after being treated in boiling water for 20 minutes.

Result and discussion

Physical parameter
Regarding the physical quality parameters of the blended jelly, it was observed that the L* value for colour varied from 33.40 to 29.31 among the treatments and it decreased continuously from 35.24 to 27.72 during storage. Thus, it was concluded that the lightness of colour decreased with increase in the storage period. Maximum a* value (12.21) for colour was recorded in the treatment T_6 [carambola (0%): pineapple (100%)] and minimum a* value (10.88) for the colour in the treatment T_1 [carambola (100%): pineapple (0%)]. During storage, a* value for colour was significantly increased from 10.85 to 13.34. It indicates that the redness of jelly was increased with corresponding increase in the storage period. The treatment T_6 [carambola (0%): pineapple (100%)] exhibited highest b* value (53.84) for colour whereas lowest b* value (39.50) for colour was noticed in the treatment T_1 [carambola (100%): pineapple (0%)]. A significant decrease in the b* value from 52.93 to 46.81 was observed during 90 days of storage period.
A significant decrease was recorded for mean L* values for colour of jelly cubes during the storage period of 90 days. It was decreased from 35.24 to 27.72up to 90 days of storage. Thus, it can be concluded that darkness of the colour in jelly cubes increased with the advancement of storage period. It might be due to change in colour of blended jelly due to phenolic and non-enzymatic browning during storage. The results in accordance with these findings were reported by Rout *et al.* (2015) in pomegranate and sapota juice blended jelly.
Interaction effect between different proportions of carambola and pineapple juices in blended jelly cubes and storage period was found to be statistically non-significant for mean L* value for colour of the jelly cubes at 5 per cent level of significance.
It was observed from the data that the redness of jelly cubes increased with the addition of pineapple juice in the blended jelly cubes. Similar result was recorded by Deokar (2018) [7] in sapota and tamarind blended jelly cubes for a* value of colour.
The redness of jelly cubes increased significantly throughout a 90-day storage period, according to data on the a* value for colour. The mean a* value for colour at the time of preparation was 10.85, but after 90 days of storage, it was increased significantly to 13.34. The redness of jelly increased due to some browning reactions during storage. Similar findings for a* value was recorded by Rout (2015) in pomegranate and sapota juice blended jelly.
The b* value for colour increased with corresponding increase in the proportion of pineapple juice in the blended jelly cubes. Similar result was observed by Gaikwad (2016) [8] in sapota and beetroot blended jelly.
A continuous decreasing trend with significant differences was observed in mean b* value for colour during storage. It was 52.93 at the time of preparation which decreased to 46.81 at 90 days of storage. It is clear from the data that the b* value for colour decreased with the advancement of the storage. The observation in accordance with this finding was recorded by Gaikwad (2016) [8] in sapota and beetroot blended jelly for b* value of colour.

Chemical parameters
Moisture content of the carambola-pineapple blended jelly cubes varied in the range of 23.17 to 24.95 per cent with significant differences among the treatments.. Moisture content of jelly cubes changed significantly during 90 days of storage period. Maximum mean value for moisture content was observed at 90 days of storage period which was 24.96 per cent. Minimum (23.63) mean value for the moisture content was recorded at the time of preparation. The significant increase in the moisture content of jelly cubes from 23.63 to 24.96 per cent was observed during 0 to 90 days of storage period. This effect was related with the increase in biochemical reactions during 90 days of storage period. Similar trends were reported by Raut (2015) in pomegranate and sapota juice blended jelly and Relekar *et al.* (2011) [19] in sapota jelly.
Total soluble solid content was found to be maximum (69.33ºB) in the treatment T_6 [carambola (0%): pineapple (100%)] and minimum (68.63ºB) in the treatment T_1

[carambola (100%): pineapple (0%)]. It was decreased from 69.68to 68.49ºB during 90 days of storage. The significant decrease was observed in the total soluble solid content of jelly cubes from 69.68 to 68.49ºBrix during 0 to 90 days of storage period. Rahman (2018) found similar results for total soluble solid content during preparation of strawberry jam.

The mean value for titratable acidity was lowest (0.62%) in the treatment the treatment T_2[carambola (90%): pineapple (10%)] and T_4 [carambola (70%): pineapple (30%)] and highest (0.63%) in the treatment T_1 [carambola (100%): pineapple (0%)] recorded numerically maximum (0.63%) mean value followed by the treatment T_3 [carambola (80%): pineapple (20%)], T_5 [carambola (60%): pineapple (40%)] and T_6 [carambola (0%): pineapple (100%)]. A linear decline in the mean values of titratable acidity of carambola-pineapple blended jelly cubes was noticed from 0.67 per cent initially to 0.59 per cent after 90 days of storage and results were statistically significant. This might be attributed to the chemical reactions between organic constituents of the product induced by temperature and action of enzyme during storage. During three months of storage, Deokar *et al*. (2018) [7] discovered a decreasing trend in titratable acidity in sapota and tamarind juice blended jelly.

Ascorbic acid content was found to be maximum (3.83 mg/100g) in the treatment T_1 [carambola (100%): pineapple (0%)] and minimum (3.00 mg/100 g) in the treatment T_6 [carambola (0%): pineapple (100%)]. It was decreased from 5.92 to 1.41 mg/100g during 90 days of storage. The significant decrease was observed in the ascorbic acid content of jelly cubes from 5.92 to 1.41mg/100g during 0 to 90 days of storage period. Kumar and Deen (2017) found similar results for ascorbic acid content during preparation of jelly from wood apple fruit extract.

The reducing sugar content increased from 20.08 to 22.36 per cent during 90 days of storage. Significantly increasing difference was observed in the mean values of reducing sugar content of carambola and pineapple blended jelly cubes during 90 days of storage period. Lowest (20.03%) mean value for reducing sugar content was observed at the time of preparation, while highest mean value for reducing sugars content (22.36%) was recorded at 90 days of storage. Thus, a significant increase in reducing sugar content of the blended jelly was found throughout the storage period of 90 days. This might be due to inversion of non-reducing sugars to reducing sugars after acid hydrolysis of polysaccharides. Tomar *et al*. (1988) [23] recorded an increase in reducing sugar content of diabetic jelly during three months of storage period. Similar trend of increase in reducing sugar content of sapota jelly was observed by Relekar *et al*. (2011) [19] and Gaikwad (2016) [8] in sapota and beetroot blended jelly.

The total sugars were decreased from 63.32 to 59.86 per cent during 90 days of storage. A significant difference was found in the total sugar content of carambola and pineapple blended jelly cubes in all treatments. The treatment T_6 [carambola (0%): pineapple (100%)] recorded the highest (63.51%) mean value for total sugar content and significantly superior to all other treatments, followed by treatments T_5 [carambola (60%): pineapple (40%)] and T_4[carambola (70%): pineapple (30%)]. The lowest (60.21%) mean value for total sugar content was observed in the treatment T_3[carambola (80%): pineapple (20%)], which was at par with treatment T_2[carambola (90%): pineapple (10%)], followed by the treatment T_1[carambola (100%): pineapple (0%)].The analogous results to the present findings were recorded by Hossen *et al*. (2009) in guava jelly and Relekar *et al*. (2011) [19] in sapota jelly.

It is clearly noticed from the data that the total sugar content of carambola and pineapple blended jelly significantly decreased with increase in the storage period.

The total sugar content of the blended jelly decreased significantly from 63.32 per cent initially to 59.86 per cent after a storage period of 90 days at ambient conditions. Gaikwad (2016) [8] reported similar results for total sugar content during storage of sapota and beetroot jelly. For total sugar content of carambola and pineapple blended jellycubes the interaction effect between treatments and storage period was found to be statistically non-significant at 5 per cent level of significance.

The mean value for β-carotene was lowest (0.25 µg/100g) in the treatment T_6 [carambola (0%): pineapple (100%)] and the treatment T_5 [carambola (60%): pineapple (40%)] However, highest mean value (0.28µg/100g) recorded in the treatment T_1[carambola (100%): pineapple (0%)]. β-carotene of the jelly was decreased from 0.32 to 0.22 µg/100 g during storage. The significant decrease was observed in the β-carotene content of jelly cubes from 0.32 to 0.22 mg/100g during 0 to 90 days of storage period. Thus, a decreasing trend was noticed in β-carotene content of the blended jelly with increase in storage period. A decline in the β-carotene content might be due to oxidative breakdown or enzymatic destruction of carotenoid pigment. Bhat and Bhat (2018) [3] found similar results for β-carotene content during preparation of pumpkin and guava blended jam.

Microbial analysis

In terms of microbial analysis of the product, it was discovered that there was no microbial growth in the carambola and pineapple blended jelly cubes at both the initial and 90-day storage periods at ambient temperatures. Similar result was recorded by Cravalho *et al.* (2012) for sapota pulp jelly.

Sensory quality parameters of the carambola-pineapple blended jelly cubes during storage

The sensory quality parameters of the carambola-pineapple blended jelly cubes *viz*. colour, flavour and texture were evaluated by nine points hedonic rating test method. The sensory score for colour of the jelly was highest (8.28) in the treatment T_5 [carambola (60%): pineapple (40%)] and lowest (6.70) in the treatment T_1 [carambola (100%): pineapple (0%)]. A decreasing trend was observed in sensory score for colour of the blended jelly from 7.63 to 7.18 during 90 days of storage at ambient conditions. The mean score for flavour of the jelly was highest (7.61) for the treatment T_5 [carambola (60%): pineapple (40%)] and lowest mean score (6.15) for flavour was observed in the treatment T_1 [carambola (100%): pineapple (0%)]. The mean score for flavour was decreased from 7.18 to 6.47 during 90 days of storage. The mean score (7.53) for texture (firmness) of the blended jelly obtained by the treatment T_5 [carambola (60%): pineapple (40%)] was the highest. Lowest (6.10) mean sensory score was observed in the treatment T_1 [carambola (100%): pineapple (0%)], and it was decreased from 7.11 to 6.40 during 90 days of storage.

The mean sensory score for colour varied significantly during storage period of 90 days. It was highest (7.63) at the time of preparation and lowest (7.18) at 90 days of storage. It was

revealed from the data that the lightness for colour of jelly decreased during storage period of 90 days. It might be due to the darkening of the jelly due to browning reactions during storage. Similar trend of decrease in sensory score for colour was observed by Raut (2015) in pomegranate and sapota juice blended jelly. and Deokar (2017) [7] in sapota and tamarind blended jelly cubes.

Based on mean score for colour, flavour, texture and overall acceptability, the treatment T_5 [carambola (60%): pineapple (40%)] was rated as the best treatment with maximum mean sensory score (7.81) for overall acceptability due to its attractive colour with optimum carambola and pineapple flavour and firm texture.

The interaction effect between treatments and storage period was found to be statistically non-significant for sensory score for colour of carambola and pineapple blended jelly cubes at 5 per cent level of significance.

Table 1: Changes in the physical quality parameters of the carambola-pineapple blended jelly cubes during storage.

Treatments	L* value for colour					a* value for colour					b* value for colour				
Storage period (Days)	**0**	**30**	**60**	**90**	**Mean**	**0**	**30**	**60**	**90**	**Mean**	**0**	**30**	**60**	**90**	**Mean**
T_1	36.62	33.47	32.43	31.08	33.40	10.18	10.61	10.91	11.83	10.88	43.30	40.40	37.53	36.78	39.50
T_2	36.56	32.28	30.67	29.83	32.34	10.44	10.81	11.68	14.06	11.75	52.47	50.33	48.26	45.98	49.26
T_3	36.35	31.83	31.08	25.33	31.15	10.72	11.49	12.13	12.71	11.76	54.41	53.36	50.64	49.58	52.00
T_4	36.01	31.50	30.76	25.30	30.89	11.30	11.56	11.93	13.33	12.03	54.28	52.90	51.70	49.63	52.13
T_5	33.08	30.21	29.09	28.63	30.25	10.74	11.36	12.34	14.06	12.13	56.55	54.64	54.36	49.44	53.75
T_6	32.83	29.52	28.71	26.17	29.31	11.75	11.36	11.68	14.06	12.21	56.55	54.65	54.72	49.44	53.84
Mean	35.24	31.47	30.46	27.72		10.85	11.20	11.78	13.34		52.93	51.05	49.53	46.81	
S.Em ±	Treatments (T)		0.46			0.25					0.46				
	Storage (S)		0.37			0.21					0.38				
	Interaction (T×S)		0.92			0.50					0.93				
CD at 5%	Treatments (T)		1.31			0.72					1.33				
	Storage (S)		1.07			0.59					1.08				
	Interaction (T×S)		N. S			N. S					N. S				

Table 2a: Changes in the chemical parameters of the carambola-pineapple blended jelly cubes during storage

Treatments	Moisture (%)					TSS (ºB)				Titratable acidity (%)					
Storage period (Days)	**0**	**30**	**60**	**90**	**Mean**	**0**	**30**	**60**	**90**	**Mean**	**0**	**30**	**60**	**90**	**Mean**
T_1	22.56	22.66	23.36	24.11	23.17	68.97	68.67	68.53	68.37	68.63	0.65	0.63	0.63	0.61	0.63
T_2	23.13	23.20	23.84	24.61	23.70	69.47	68.93	68.73	68.33	68.87	0.67	0.64	0.60	0.58	0.62
T_3	23.71	23.83	24.62	25.11	24.32	69.67	69.30	68.97	68.60	69.13	0.69	0.63	0.61	0.59	0.63
T_4	23.96	24.50	25.00	25.16	24.65	69.80	69.37	68.90	68.50	69.14	0.67	0.63	0.61	0.58	0.62
T_5	24.36	24.89	25.22	25.32	24.95	70.00	69.57	68.87	68.63	69.27	0.68	0.64	0.62	0.60	0.63
T_6	24.06	24.83	25.26	25.48	24.91	70.17	69.70	68.93	68.50	69.33	0.67	0.64	0.63	0.58	0.63
Mean	23.63	23.99	24.55	24.96		69.68	69.26	68.82	68.49		0.67	0.64	0.62	0.59	
S.Em ±	Treatments (T)		0.08			0.10				0.01					
	Storage (S)		0.07			0.08				0.00					
	Interaction (T×S)		0.17			0.20				0.01					
CD at 5%	Treatments (T)		0.24			0.29				N. S					
	Storage (S)		0.19			0.23				0.01					
	Interaction (T×S)		N. S			N.S				N. S					

Table 2b: Changes in the chemical parameters of the carambola-pineapple blended jelly cubes during storage

Treatments	Ascorbic acid (mg/100g)					Reducing sugars (%)					Total sugars (%)				
Storage period (Days)	**0**	**30**	**60**	**90**	**Mean**	**0**	**30**	**60**	**90**	**Mean**	**0**	**30**	**60**	**90**	**Mean**
T_1	6.00	4.59	2.84	1.91	3.83	21.39	21.74	22.45	23.39	22.24	63.29	61.56	60.42	59.37	61.16
T_2	6.05	4.80	2.43	1.72	3.75	21.29	21.41	22.21	22.91	21.95	62.65	59.96	59.82	59.42	60.46
T_3	6.20	4.64	2.43	1.51	3.70	20.21	20.65	21.29	22.15	21.07	62.70	60.61	59.48	58.06	60.21
T_4	6.11	4.62	2.54	1.05	3.58	19.01	19.74	20.51	21.80	20.27	62.91	61.71	60.71	59.78	61.28
T_5	5.42	3.75	3.06	1.23	3.37	18.22	19.37	20.35	21.10	19.76	63.55	62.84	61.50	60.19	62.02
T_6	5.72	3.58	1.68	1.03	3.00	20.08	20.49	21.38	22.81	21.19	64.80	64.17	62.75	62.32	63.51
Mean	5.92	4.33	2.50	1.41		20.03	20.57	21.37	22.36		63.32	61.81	60.78	59.86	
S.Em ±	Treatments (T)		0.15			0.15					0.19				
	Storage (S)		0.12			0.12					0.15				
	Interaction (T×S)		0.30			0.31					0.38				
CD at 5%	Treatments (T)		0.42			0.44					0.54				
	Storage (S)		0.35			0.36					0.44				
	Interaction (T×S)		N. S			N. S					N.S				

Table 3: Changes in the β-carotene (µg/100g) and Microbial count (cfu/g) of the carambola-pineapple blended jelly cubes during storage

Treatments	β-carotene (µg/100g)					Microbial count (cfu/g)	
Storage period (Days)	0	30	60	90	Mean	0	90
T_1	0.32	0.30	0.26	0.21	0.28	ND	ND
T_2	0.33	0.26	0.24	0.22	0.27	ND	ND
T_3	0.31	0.26	0.23	0.21	0.26	ND	ND
T_4	0.33	0.26	0.24	0.22	0.26	ND	ND
T_5	0.31	0.25	0.23	0.21	0.25	ND	ND
T_6	0.31	0.25	0.23	0.21	0.25	ND	ND
Mean	0.32	0.26	0.24	0.22		-	-
S.Em ±	Treatments (T)		0.00			-	
	Storage (S)		0.00			-	
	Interaction (T×S)		0.01			-	
CD at 5%	Treatments (T)		0.01			-	
	Storage (S)		0.01			-	
	Interaction (T×S)		N. S			-	

Conclusion

It was observed from the data that the carambola-pineapple blended jelly cubes irrespective of ratios were acceptable during three months of storage at ambient conditions. Blending of carambola and pineapple improved physical, chemical and sensory quality characteristics of the jelly.

The sensory evaluation of jelly revealed that the colour, flavour and texture of the jelly retained upto 90 days of storage period at ambient conditions. Blending of carambola and pineapple improved colour and flavour of the blended jelly. Based on the organoleptic evaluation of the jelly, it is concluded that the carambola-pineapple blended jelly cubes could be prepared successfully by blending carambola and pineapple juice in the ratio of T_5 [carambola (60%): pineapple (40%)].

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