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STUDIES ON OPTIMIZATION OF KOKUM-BASED ANTHOCYANIN INFUSED WHITE FLESH GUAVA READY TO SERVE BEVERAGE

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ABSTRACT

A postharvest study was conducted at College of Horticulture Bagalkot, in order to find out best proportion of guava kokum blends in the form of RTS beverages. The blended ready to serve (RTS) beverages of guava kokum were analysed for physico-chemical composition and sensory quality at monthly interval for four months of storage. The highest scores for all the sensory parameters and chemical characters were obtained by formulation (T_8) from 80 per cent guava pulp + 20 per cent kokum extract. In physico-chemical analysis, it was found that variances in the scores of pH, acidity, ascorbic acid content, anthocyanin and the organoleptic scores for taste and overall acceptability were significant ($p < 0.05$). RTS formulations showed an increasing trend in total soluble solids (TSS: 13.00-13.39 °Brix), acidity (0.30-0.38 %) and a decreasing trend in pH (4.28-3.86), ascorbic acid content (18.80-17.53 mg/100ml), antioxidant (57.78-55.06 %) and anthocyanin (6.80-5.92 mg/100 ml), viscosity (0.60-0.42 PI) and the organoleptic scores for taste and overall acceptability as a function of storage time. The various physico-chemical and sensory parameters obtained during the course of investigation and the data obtained along with relevant discussion are presented in the full text of this paper.

Keywords : Guava, Kokum, Ready to serve beverage, Days after storage

Introduction

Guava (*Psidium guajava* L.) belongs to Myrtaceae family, native to Tropical America (Singh, 2016). It is utilized as fresh fruit consumption in India along with other Asian sub-continental countries. Guava is well known as "Apple of tropics" and its easy cultivation, high nutritional value and popularity of processed products makes it an important produce in international trade (Raj Kumar *et al*., 2016). Guava is widely grown across tropical and subtropical regions of India. The fruit consists of 20 per cent peel, 50 per cent pulp and the rest is the seed core. It is typically eaten fresh or as a dessert due to its excellent flavour, high digestibility, nutritional value, and wide availability. Often called a "superfruit," guava is nutritionally significant, particularly for its high vitamin A and C content. The abundance of vitamin C (ascorbic acid) makes guava highly effective in fighting free radicals and oxidative damage, which are linked to degenerative diseases. However, ripe guava has a short shelf life of 3-5 days, leading to post-harvest losses of 20-25 per cent. This presents an opportunity to process guava into various commercial products like pulp, paste, canned slices, ready-to-serve drinks (RTS), nectar and juice. Guava juice, in particular, has gained significant market importance, with consumption of 10-15 per cent annually. This is largely due to its natural, nutrient-rich composition, making it a popular alternative to other antioxidant-rich beverages like soft drinks, tea, and coffee (Singh, 2023).

Kokum (*Garcinia indica* Choisy) belongs to the family Guttiferae is one of the important indigenous tree spice crops originated and grown in Western Ghats of India, known by various names across India including Bindin, Bhirand, Bhinda, Biran, Punarpuli, Katambi, Ratamba or Amsol. Kokum contains three

major bioactive compounds namely anthocyanin, hydroxycitric acid and garcinol and all of these possesses nutraceutical properties. These are present in rind of kokum. They have beneficial role in human health since they have anti-cancer and anti-obesity properties. Kokum fruit contains acids like citric acid, acetic acid, malic acid, ascorbic acid, hydroxyl citric acid and garcinol. The kokum juice and squash made out of the rind is used to cure various diseases such as piles, haemorrhoids, colic problems, ulcers, inflammations, treat sores, dermatitis, diarrhoea, dysentery, ear infection etc (Ranveer and Sahoo, 2017).

The aim of the present work is to studies on optimization of kokum-based anthocyanin infused white flesh guava ready to serve beverage. Nutritionally, the white fleshed guava and kokum are two important fruit crops. White fleshed guava doesn't give acceptable colour during beverage production. Hence, there is a need to enrich fruit juice by blending with other fruit juices like kokum, which is rich in anthocyanins. With this we are not only increasing the consumer acceptability but also the nutritional quality.

Nutritional value of fruit crop based drinks

Fruit beverages are increasingly gaining popularity throughout the world due to nutritive and therapeutic values over synthetic beverages. Synthetic beverages typically consist of approximately 88 per cent water and 12 per cent carbohydrates, providing only around 48 Kcal. Thus, fruit-based beverages are far more superior to many synthetic drinks. Replacing synthetic drinks with fruit beverages would greatly benefit both consumers and fruit growers. Additionally, fruit pulps and beverages hold substantial potential for export markets.

Material and Methods

The experiment was carried out at the Department of Postharvest Management, University of Horticultural Sciences, Bagalkot, during the year 2023-24. The ripe fruits of the Sardar (L-49) cultivar of guava, characterized by firm texture and uniform size, were procured from the College of Horticulture, Bagalkot, Karnataka. The kokum rind used in the research was procured from M/s. Kadamba Organic Society, Sirsi, Uttara Kannada.

Methodology for preparation

Dried kokum rind was soaked in water (Kokum : Water, 1:3 w/v) for overnight, light heat process (50 – 55 °C), it was grinded and then filtered using muslin cloth to get a clear extract. The clear juice obtained after filtration used in the present study. Guava fruits were washed thoroughly with clean water and fruits were cut into small pieces and crushed in mixer grinder to have uniform consistency. Thus, obtained pulp was strained using stainless steel and this pulp is used in the present study. Treatment Details: Set 1: 12.5 % GP + KE - T_1: 100 % Guava pulp, T_2: 90 % Guava pulp + 10 % Kokum extract , T_3: 80 % Guava pulp + 20 % Kokum extract, T_4: 70 Guava pulp + 30 % Kokum extract and T_5: 60 % Guava pulp + 40 % Kokum extract, Set 2: 15 % GP + KE -T_6: 100 % Guava pulp, T_7: 90 % Guava pulp + 10 % Kokum extract and T_8: 80 % GP + 20 % KE, T_9: 70 % GP + 30 % KE, T_{10}: 60 % GP + 40 % KE and T_{11}: Commercial Guava RTS. Procedure- RTS was prepared by taking 10 per cent fruit juice and adjusting TSS to 13 °Brix and acidity to about 0.3 per cent. A 100ppm concentration of sodium benzoate was used as preservative. The mixture was pasteurized at 80º C for 30 minutes and filled in pre-sterilized glass bottles of 200 ml capacity. The bottles were sealed, pasteurized in boiling water for 30 minutes, cooled and stored at ambient temperature.

Analysis of physical and chemical parameters

The proximate analyses of guava kokum blended beverages were done for different parameter. The total soluble solids were determined by using hand refractometer and expressed in °Brix as followed by (Byanna and Gowda, 2013). The titrable acidity was analysed by the procedure followed by (Ranganna, 1986). The pH of the RTS was recorded with the help of pH meter as followed by Jackson, (1973). Ascorbic acid content was estimated by using 2, 6-dichloro phenol indophenol dye (Ranganna, 1997). The total anthocyanins were determined by adopting the pH differential method given by Fuleki and Francis (1968). Sensory score for taste and flavour were given by using nine points hedonic scale (Gupta, 1976). Antioxident activity was estimated by using 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity in the blended juice was assessed using a method described by Kathiravan *et al*. (2015). Viscosity of the pulp was determined using a digital viscometer (Brookfield model LVTD) with spindle number 4,1 and 31 at 60 rpm for coarse pulp (Manjunath, 2001). All the data were statistical analyzed in according to the Completely Randomized Design with one-way analysis of variance (ANOVA) using Web Agri Stat Package (WASP) version 2 (Jangam and Thali, 2010).

Result and Discussion

TSS

The data exhibited in table 1 depicted that there was no significant difference among the treatments. This is because, initially 13 °Brix TSS was maintained

uniformly for all the treatments by adding sugar at the time of preparation to meet the FSSAI standards. The mean TSS content of the beverage irrespective of the treatment showed increasing trend from initial (13 °Brix) to final (13.36 °Brix) at the end of storage period (120 DAS).

This increase in TSS is likely due to the concentration effect as the products lose moisture over time. According to Masoodi *et al.* (1991), the increase in TSS may also be attributed to the conversion of polysaccharides into sugars. Similar results were found by Tiwari (2000) in guava and papaya RTS blends, Ilamaran and Amutha (2007) in sapota beverages and Pandey and Singh (1999) in guava RTS beverages.

pH

There were significant differences with regard to pH among the treatments, storage intervals (table 1). The average pH over all treatments was found to show significant decrease from 4.30 (initial day) to 3.89 (120 days of storage). The maximum pH value was recorded in treatment T_1 **(**100 % GP**)** during initial and 120 days after storage (4.66 and 4.26) The minimum pH was recorded by T_{10} **(**60 % GP + 40 % KE) during initial and 120 days after storage (3.81 and 3.38). This might be because of addition of kokum, which reduces pH and increases the acidity and sourness in the drink. Siddharth and Sharma (2013) in blended kokum extract-Concord grape juice and Wasker (2011) in pomegranate and kokum blended juice found similar results.

It obvious from the data presented in Table 1, there was gradual reduction in pH value of guava kokum blended RTS. The main reason for decrease in pH is enzymatic and chemical changes in RTS during storage (Heamalatha *et al*., 2018) and also due to increase in acidity (Karpagavalli and Amutha, 2015). The present findings are in agreement with Sasikumar (2015), who noted a significant decrease in pH during the storage of functional beverages made from aloe vera juice blended with bael fruit juice and litchi-pomegranate RTS.

Titratable acidity

There were significant differences with regard to titrable acidity among the treatments, storage intervals (Table 2). The average titrable acidity over all treatments was found to show significant decrease from 0.30 (initial day) to 0.37 (120 days of storage). The maximum titratable acidity was recorded in treatment T_{10} (60 % GP+ 40 % KE) during initial and 120 days after storage (0.32, and 0.40 %). However, the minimum titratable acidity was recorded in the treatment T_1 **(**100 % GP**)** during initial and 120 days after storage (0.30 and 0.35 %). This might be because of increases in the acidity observed as kokum extract concentration increases in the treatments. Similar result was found by Waskar (2011) in pomegranate juice blended with kokum juice.

It obvious from the data presented in Table 2, there was gradual increase in titratable acidity percentage of guava kokum blended RTS during a four-month storage period. This rise in acidity may be due to the formation of organic acids from the breakdown of ascorbic acid. Additionally, the increased acidity could be related to the accelerated breakdown of pectin in the pulp, which converts into soluble solids in the beverage (Patel and Naik, 2014). The results are consistent with the findings of Pathak *et al*. (2012) in litchi-pomegranate RTS, Sasikumar (2015) in aloe vera and aonla blended therapeutic RTS beverages.

Ascorbic acid (mg/100 ml)

There were significant differences in ascorbic acid content among the juice blending treatments, storage intervals and interactions between them (Table 2). It was observed that the ascorbic acid content of RTS decreased significantly from 17.64 mg/100 ml at initial day to 16.37 mg/100 ml at 120 days of storage period. The treatment T_6 **(**100 % GP**)** recorded significantly maximal ascorbic acid in guava kokum blended RTS during initial and 120 days after storage (20.40 and 19.21 mg/100 ml). However, the minimal ascorbic acid was observed in treatment T_5 (60 % GP + 40 % KE) during initial and 120 days after storage (14.24 and 12.97 mg/100 ml). This is because more ascorbic acid content in guava fruits. Guava fruit contains 249.27 mg/100 gm of fruit (Tiwari *et al*., 2016).

It obvious from the data presented in Table 2, there was gradual reduction in ascorbic acid content of guava kokum blended RTS. This reduction in ascorbic acid content likely due to the oxidation of vitamin C by trapped oxygen in glass bottles, leading to the formation of dehydroascorbic acid. Additionally, the decrease may be influenced by factors such as processing, storage duration, and exposure to light. Similar reduction in ascorbic acid content was also recorded by Pandey (2004) in guava RTS and Kumar *et al*. (2010) in aonla-guava blended RTS beverages.

Antioxidant activity (%)

The data (Table 3) revealed that there were significant differences among the treatments, storage intervals and their interactions. The percentage of antioxidant activity increased from the day of preparation (53.68 %) to 120 days after storage (52.30 %). The maximum antioxidant activity was noticed in

treatment T_{10} (60 % GP+ 40 % KE) during initial and 120 days after storage (59.27 and 56.88 % respectively). However, the minimum antioxidant was observed in the treatment T_{11} **(**Commercial guava RTS**)** during initial and 120 days after storage (42.00 and 40.61 % respectively). This is due to more antioxidant activity i.e 2436.35 mg/100 ml in kokum extract (Hegde *et al*., 2018) as compared to guava. So as kokum concentration increases antioxidant activity also increases in the beverage.

It obvious from the data presented in Table 3, there was gradual reduction in antioxidant activity of guava kokum blended RTS. This significant reduction may be due to the degradation of ascorbic acid and phenols over time, as noted by Mgaya-Kilima *et al*. (2015). Similar decreases in antioxidant activity have been observed by Sridhar *et al*. (2017) in jamun and guava blended juice, Kumar (2016) in aonla-ginger blended RTS, Tripoli *et al*. (2007) in orange juice, and Navyarani (2019) in West Indian cherry juice.

Anthocyanin content (mg/100 ml)

The data regarding the anthocyanin content (Table 3) were found to have significant differences due to juice blends and storage. During the storage period, the anthocyanin content was found to decrease significantly from the day of preparation (6.00 mg/100 ml) to 120 days of storage (5.29 mg/100 ml). The maximum anthocyanin content was noticed in treatment T_{10} (60 % GP + 40 % KE) during initial and 120 days after storage (13.00 and 12.06 mg/100ml). However, the minimum anthocyanin content was observed in the treatment T_1 (100 % GP) during initial and 120 days after storage (0.25 and 0.04 mg/100 ml, respectively). This is due to more anthocyanin i.e 27.38 mg/100 ml in kokum extract (Hegde *et al*., 2018) as compared to guava. As the proportion of kokum extract was increasing in the juice blends, a corresponding increase in anthocyanin content was observed.

It obvious from the data presented in table 3, there was gradual reduction in anthocyanin content of guava kokum blended RTS. Decrease in anthocyanin content of RTS might be due to processing of guava kokum blended beverages and also anthocyanin is sensitive to heat and oxidized quickly in the presence of oxygen, hence, it might have been destroyed during processing and subsequently during storage (Sharma *et al*., 2009). Similar trend of decline of anthocyanin content was noticed in opuntia blended beverage (Pratap., *et al*., 2005), jamun nectar (Sonia *et al*., 2010) and jamun blended squash (Priyanka *et al.*, 2015).

Viscosity (PI)

There were significant differences in viscosity among the juice blending treatments, storage intervals and interactions between them (Table 4). It was observed that the viscosity of RTS decreased significantly from 0.61 PI at initial day to 0.41 PI at 120 days of storage period. The highest viscosity was observed in treatment T_6 **(**100 % GP**)** during initial and 120 days after storage (0.98 and 0.81). Whereas, the lowest was recorded in treatment T_5 (60 % GP + 40 % KE) during initial and 120 DAS (0.87 and 0.65 respectively). This might be due to pectin content in guava, which slightly thickens the mixture by reacting with sugar, as pectin is known for it,s gelling properties.

It obvious from the data presented in Table 4, there was gradual reduction viscosity in of guava kokum blended RTS. Decrease in viscosity of RTS might be due to the degradation of pectin, which is sensitive to enzymatic activity and pH changes. Oxidation also contributes to the breakdown of thickening agents. Microbial activity, even if minimal, further reduces the consistency. The acidity of kokum can accelerate these degradation processes over time.

Taste

The organoleptic evaluation revealed that there were significant differences among the treatments, storage intervals and their interactions (Table 5). Significant decrease was recorded in organoleptic score with respect to the taste of different RTS. It was found to decrease from 7.87 (initial day) to 7.03 (120 days). In fresh RTS, maximal score for mouth feel was observed in treatment T_8 (80 % GP + 20 % KE) during initial and 120 days after storage (8.27 and 7.40). The minimum scores being associated with treatment T_1 (100 % GP) during initial and 120 days after storage (7.71 and 6.79). This might be due by addition of kokum a good sugar acid blend attained enhance the taste of the beverage. Similar findings were observed by Siddharth and Sharma (2013) in kokum grape blended juice.

From the data it was obvious that sensory score of taste was showed significant difference during storage spell of 4 months under ambient condition which was depicted in Table 5. It was clear from the data sensory score for taste decreasing with increasing storage period. This might be because of reduction in flavour components in the course of storage period (Bafna, 2014).

Overall acceptability

The average organoleptic score for flavour decreased significantly (table 5) from a maximum score of 7.89 (initial day) to a minimum score of 7.03 (120 days). Maximum score in terms of overall acceptability was noted in the treatment T_8 (80 % GP + 20 % KE) during initial and 120 days after storage

(8.30 and 7.39). The lowest overall acceptability score was obtained by the treatment T_1 (100 % GP) during initial and 120 days after storage (7.70 and 6.88). This is mainly because of highest score for colour, taste, consistency, flavour recorded in treatment T_8.

It was observable from data overall acceptability of the RTS shows decreasing trend throughout the storage period and which was depicted in Table 5. The main reason was reduction in flavour, taste, colour, consistency which leads to decrease in score of overall acceptability. This is in conformity with the studies of Rani *et al*. (2018) in mandarin and strawberry mixed fruit juices and Balaswamy *et al*. (2011) in sour grape beverages.

Table 1: Effect of storage period on total soluble solids and pH of guava kokum blended ready to serve beverage

Treatment	Total soluble solids (°Brix)					pH				
	Initial	30 DAS	60 DAS	90 DAS	120 DAS	Initial	30 DAS	60 DAS	90 DAS	120 DAS
Set 1: 12.5 % GP + KE										
T_1: 100 % GP	13.00	13.03	13.15	13.22	13.30	4.66 ^{a}	4.60 ^{a}	4.53 ^{a}	4.43 ^{a}	4.26 ^{a}
T_2: 90 % GP+ 10 % KE	13.00	13.05	13.18	13.24	13.33	4.40 ^{b}	4.33 ^{b}	4.25 ^{b}	4.14 ^{bc}	3.97 ^{b}
T_3: 80 % GP+ 20 % KE	13.00	13.08	13.19	13.26	13.35	4.30 ^{b}	4.23 ^{b}	4.16 ^{b}	4.05 ^{c}	3.90 ^{b}
T_4: 70 % GP + 30 % KE	13.00	13.11	13.21	13.28	13.37	4.16 ^{c}	4.10 ^{bc}	4.02 ^{c}	3.92 ^{c}	3.76 ^{b}
T_5: 60 % GP + 40 % KE	13.00	13.13	13.24	13.30	13.40	3.90 ^{d}	3.84 ^{d}	3.77 ^{d}	3.66 ^{d}	3.49 ^{c}
Set 2: 15 % GP + KE										
T_6: 100 % GP	13.00	13.05	13.17	13.24	13.33	4.65 ^{a}	4.59 ^{a}	4.52 ^{a}	4.41 ^{a}	4.25 ^{a}
T_7: 90 % GP + 10 % KE	13.00	13.08	13.19	13.26	13.36	4.39 ^{b}	4.32 ^{b}	4.25 ^{b}	4.14 ^{bc}	3.95 ^{b}
T_8: 80 % GP + 20 % KE	13.00	13.11	13.21	13.27	13.39	4.28 ^{bc}	4.21 ^{b}	4.13 ^{bc}	4.03 ^{c}	3.86 ^{b}
T_9: 70 % GP + 30 % KE	13.00	13.13	13.23	13.29	13.40	4.14 ^{c}	4.08 ^{c}	4.01 ^{c}	3.90 ^{c}	3.75 ^{b}
T_{10}: 60 % GP+ 40 % KE	13.00	13.15	13.25	13.32	13.43	3.81 ^{d}	3.74 ^{d}	3.65 ^{d}	3.56 ^{d}	3.38 ^{c}
T_{11}: Commercial guava RTS	13.00	13.05	13.17	13.23	13.00	4.65 ^{a}	4.59 ^{a}	4.51 ^{a}	4.42 ^{a}	4.24 ^{a}
Mean	**13.00**	**13.09**	**13.20**	**13.27**	**13.36**	**4.30**	**4.24**	**4.16**	**4.06**	**3.89**
S.Em±	0.11	0.14	0.14	0.09	0.13	0.04	0.04	0.04	0.05	0.04
C.D. at 1%	NS	NS	NS	NS	NS	0.15	0.15	0.15	0.18	0.16

GP-Guava pulp **KE**-Kokum extract **DAS**- Days after storage **NS**- Non significant

Table 2: Effect of storage period on titratable acidity and ascorbic acid of guava kokum blended ready to serve beverage

Treatment	Titratable acidity (%)					Ascorbic acid (mg/100 ml)				
	Initial	30 DAS	60 DAS	90 DAS	120 DAS	Initial	30 DAS	60 DAS	90 DAS	120 DAS
Set 1: 12.5 % GP + KE										
T_1: 100 % GP	0.30 ^{b}	0.31 ^{b}	0.32 ^{b}	0.34 ^{bc}	0.35 ^{c}	19.62 ^{b}	19.25 ^{b}	19.19 ^{ab}	18.61 ^{b}	18.26 ^{b}
T_2: 90 % GP+ 10 % KE	0.30 ^{b}	0.31 ^{b}	0.33 ^{b}	0.34 ^{bc}	0.36 ^{bc}	17.63 ^{d}	17.32 ^{e}	17.18 ^{ef}	16.62 ^{de}	16.36 ^{d}
T_3: 80 % GP+ 20 % KE	0.30 ^{b}	0.32 ^{ab}	0.33 ^{b}	0.35 ^{b}	0.36 ^{bc}	16.38 ^{e}	16.21 ^{f}	15.80 ^{g}	15.48 ^{f}	15.19 ^{e}
T_4: 70 % GP + 30 % KE	0.30 ^{b}	0.32 ^{ab}	0.34 ^{ab}	0.36 ^{ab}	0.37 ^{b}	15.30 ^{f}	14.92 ^{g}	14.87 ^{h}	14.29 ^{g}	13.94 ^{g}
T_5: 60 % GP + 40 % KE	0.31 ^{ab}	0.32 ^{ab}	0.35 ^{a}	0.37 ^{a}	0.38 ^{ab}	14.24	13.93 ^{h}	13.79 ^{i}	13.22 ^{h}	12.97 ^{h}
Set 2: 15 % GP + KE										
T_6: 100 % GP	0.30 ^{b}	0.31 ^{b}	0.33 ^{b}	0.34 ^{bc}	0.36 ^{bc}	20.40 ^{a}	20.25 ^{a}	19.82 ^{a}	19.50 ^{a}	19.21 ^{a}
T_7: 90 % GP + 10 % KE	0.30 ^{b}	0.32 ^{ab}	0.34 ^{ab}	0.35 ^{b}	0.37 ^{b}	19.35 ^{bc}	18.98 ^{bc}	18.92 ^{bc}	18.34 ^{bc}	17.99 ^{bc}
T_8: 80 % GP + 20 % KE	0.30 ^{b}	0.33 ^{a}	0.34 ^{ab}	0.36 ^{ab}	0.38 ^{ab}	18.80 ^{c}	18.49 ^{c}	18.35 ^{cd}	17.78 ^{c}	17.53 ^{c}
T_9: 70 % GP + 30 % KE	0.31 ^{ab}	0.34 ^{a}	0.35 ^{a}	0.37 ^{a}	0.39 ^{a}	17.32 ^{d}	17.57 ^{de}	16.74 ^{f}	16.42 ^{e}	16.13 ^{d}
T_{10}: 60 % GP+ 40 % KE	0.32 ^{a}	0.34 ^{a}	0.36 ^{a}	0.38 ^{a}	0.40 ^{a}	16.21 ^{e}	15.90 ^{f}	15.76 ^{g}	15.20 ^{f}	14.94 ^{f}
T_{11}: Commercial guava RTS	0.30 ^{b}	0.31 ^{b}	0.32 ^{b}	0.33 ^{c}	0.34 ^{c}	18.80 ^{c}	18.19 ^{cd}	18.00 ^{d}	17.03 ^{d}	17.60 ^{c}
Mean	**0.30**	**0.32**	**0.34**	**0.35**	**0.37**	**17.64**	**17.37**	**17.13**	**16.59**	**16.37**
S.Em±	0.00	0.01	0.01	0.01	0.01	0.16	0.20	0.18	0.17	0.13
C.D. at 1%	0.01	0.02	0.02	0.02	0.02	0.63	0.76	0.68	0.66	0.52

GP-Guava pulp **KE**-Kokum extract **DAS**- Days after storage

Table 3: Effect of storage period on antioxidant activity and anthocyanin content (mg/100 ml) of guava kokum blended ready to serve beverage

Treatment	Antioxidant activity (%)					Anthocyanin content (mg/100 ml)				
	Initial	30 DAS	60 DAS	90 DAS	120 DAS	Initial	30 DAS	60 DAS	90 DAS	120 DAS
Set 1: 12.5 % GP + KE										
T_1: 100 % GP	44.00 ^{d}	44.60 ^{c}	44.52 ^{d}	43.94 ^{c}	43.63 ^{e}	0.25 ^{j}	0.19 ^{j}	0.11 ^{j}	0.06 ^{j}	0.04 ^{j}
T_2: 90 % GP+ 10 % KE	55.45 ^{c}	55.07 ^{b}	54.98 ^{c}	54.41 ^{b}	54.13 ^{c}	3.15 ^{h}	2.97 ^{h}	2.68 ^{h}	2.54 ^{h}	2.31 ^{h}
T_3: 80 % GP+ 20 % KE	56.79 ^{b}	56.00 ^{b}	55.52 ^{c}	55.36 ^{b}	54.01 ^{c}	6.10 ^{f}	5.84 ^{f}	5.70 ^{f}	5.39 ^{f}	5.21 ^{f}
T_4: 70 % GP + 30 % KE	57.18 ^{ab}	56.78 ^{ab}	56.71 ^{b}	56.12 ^{ab}	55.81 ^{ab}	9.13 ^{d}	8.89 ^{d}	8.62 ^{d}	8.38 ^{d}	8.23 ^{d}
T_5: 60 % GP + 40 % KE	58.21 ^{a}	57.83 ^{a}	57.73 ^{ab}	57.17 ^{a}	56.89 ^{a}	12.09 ^{b}	11.90 ^{b}	11.59 ^{b}	11.47 ^{b}	11.22 ^{b}

Set 2: 15 % GP + KE										
T_6: 100 % GP	45.20 ^{d}	44.94 ^{c}	44.46 ^{d}	44.31 ^{c}	43.97 ^{e}	0.27 ^{j}	0.21 ^{j}	0.13 ^{j}	0.09 ^{j}	0.06 ^{j}
T_7: 90 % GP + 10 % KE	56.43 ^{bc}	56.03 ^{b}	55.95 ^{bc}	55.37 ^{b}	45.97 ^{d}	4.00 ^{g}	3.82 ^{g}	3.50 ^{g}	3.26 ^{g}	3.13 ^{g}
T_8: 80 % GP + 20 % KE	57.78 ^{a}	57.40 ^{a}	57.29 ^{a}	56.74 ^{a}	55.06 ^{bc}	6.80 ^{e}	6.48 ^{e}	6.24 ^{e}	6.11 ^{e}	5.92 ^{e}
T_9: 70 % GP + 30 % KE	58.15 ^{a}	57.87 ^{a}	57.39 ^{a}	57.23 ^{a}	56.46 ^{a}	9.92 ^{c}	9.69 ^{c}	9.41 ^{c}	9.20 ^{c}	9.05 ^{c}
T_{10}: 60 % GP+ 40 % KE	59.27 ^{a}	58.89 ^{a}	58.80 ^{a}	58.23 ^{a}	56.88 ^{a}	13.00 ^{a}	12.75 ^{a}	12.49 ^{a}	12.33 ^{a}	12.06 ^{a}
T_{11}: Commercial guava RTS	42.00 ^{e}	41.58 ^{d}	41.46 ^{e}	40.87 ^{d}	40.61 ^{f}	1.25 ^{i}	1.13 ^{i}	1.08 ^{i}	1.00 ^{i}	0.94 ^{i}
Mean	**53.68**	**53.36**	**53.17**	**52.71**	**52.30**	**6.00**	**5.81**	**5.60**	**5.44**	**5.29**
S.Em±	0.42	0.55	0.47	0.58	0.42	0.08	0.07	0.04	0.05	0.06
C.D. at 1%	1.61	2.13	1.83	2.23	1.61	0.32	0.27	0.16	0.21	0.25

GP-Guava pulp **KE**-Kokum extract **DAS**- Days after storage

Table 4: Effect of storage period on viscosity of guava kokum blended ready to serve beverage

Treatment	Viscosity (PI)				
	Initial	**30 DAS**	**60 DAS**	**90 DAS**	**120 DAS**
Set 1: 12.5 % GP + KE					
T_1: 100 % GP	0.91 ^{b}	0.87 ^{b}	0.85 ^{a}	0.80 ^{b}	0.74 ^{b}
T_2: 90 % GP+ 10 % KE	0.71 ^{e}	0.66 ^{d}	0.63 ^{d}	0.57 ^{e}	0.53 ^{e}
T_3: 80 % GP+ 20 % KE	0.55 ^{g}	0.48 ^{f}	0.39 ^{f}	0.31 ^{g}	0.25 ^{h}
T_4: 70 % GP + 30 % KE	0.38 ^{i}	0.29 ^{h}	0.22 ^{h}	0.12 ^{h}	0.09 ^{i}
T_5: 60 % GP + 40 % KE	0.18 ^{k}	0.12 ^{i}	0.08 ^{j}	0.07 ^{i}	0.05 ^{j}
Set 2: 15 % GP + KE					
T_6: 100 % GP	0.98 ^{a}	0.93 ^{a}	0.87 ^{a}	0.83 ^{a}	0.81 ^{a}
T_7: 90 % GP + 10 % KE	0.80 ^{d}	0.73 ^{c}	0.70 ^{c}	0.65 ^{d}	0.59 ^{d}
T_8: 80 % GP + 20 % KE	0.60 ^{f}	0.54 ^{e}	0.50 ^{e}	0.47 ^{f}	0.42 ^{f}
T_9: 70 % GP + 30 % KE	0.44 ^{h}	0.40 ^{g}	0.34 ^{g}	0.31 ^{g}	0.29 ^{g}
T_{10}: 60 % GP+ 40 % KE	0.29 ^{j}	0.14 ^{i}	0.11 ^{i}	0.09 ^{i}	0.07 ^{ij}
T_{11}: Commercial guava RTS	0.87 ^{c}	0.84 ^{b}	0.77 ^{b}	0.73 ^{c}	0.65 ^{c}
Mean	**0.61**	**0.55**	**0.50**	**0.45**	**0.41**
S.Em±	0.01	0.01	0.01	0.01	0.01
CD at 1%	0.03	0.03	0.02	0.02	0.02

GP-Guava pulp **KE**-Kokum extract **DAS**- Days after storage

Table 5: Effect of storage period on organoleptic evaluation for taste and overall acceptability of ready to serve beverage (based on 9 point hedonic scale)

Treatment	Taste					Overall acceptability				
	Initial	**30 DAS**	**60 DAS**	**90 DAS**	**120 DAS**	**Initial**	**30 DAS**	**60 DAS**	**90 DAS**	**120 DAS**
Set 1: 12.5 % GP + KE										
T_1: 100 % GP	7.71 ^{b}	7.44 ^{b}	7.20 ^{b}	6.94 ^{d}	6.79 ^{d}	7.70 ^{c}	7.41 ^{c}	7.29 ^{c}	7.05 ^{c}	6.88 ^{c}
T_2: 90 % GP+ 10 % KE	7.73 ^{b}	7.50 ^{b}	7.21 ^{b}	7.01 ^{d}	6.85 ^{d}	7.74 ^{c}	7.47 ^{c}	7.31 ^{c}	7.18 ^{c}	6.89 ^{c}
T_3: 80 % GP+ 20 % KE	7.75 ^{b}	7.44 ^{b}	7.19 ^{b}	7.07 ^{c}	6.89 ^{d}	7.78 ^{c}	7.57 ^{c}	7.42 ^{c}	7.14 ^{c}	6.91 ^{c}
T_4: 70 % GP + 30 % KE	8.25 ^{a}	8.02 ^{a}	7.70 ^{a}	7.50 ^{ab}	7.38 ^{a}	8.27 ^{a}	8.06 ^{a}	7.91 ^{a}	7.71 ^{a}	7.35 ^{a}
T_5: 60 % GP + 40 % KE	7.92 ^{b}	7.67 ^{b}	7.42 ^{b}	7.25 ^{c}	7.01 ^{cd}	7.94 ^{b}	7.70 ^{b}	7.57 ^{bc}	7.25 ^{c}	7.07 ^{bc}
Set 2: 15 % GP + KE										
T_6: 100 % GP	7.72 ^{b}	7.46 ^{b}	7.23 ^{b}	6.97 ^{d}	6.86 ^{d}	7.73 ^{c}	7.45 ^{c}	7.30 ^{c}	7.12 ^{c}	6.93 ^{c}
T_7: 90 % GP + 10 % KE	7.74 ^{b}	7.55 ^{b}	7.25 ^{b}	7.05 ^{cd}	6.87 ^{d}	7.76 ^{c}	7.51 ^{c}	7.39 ^{c}	7.20 ^{c}	6.89 ^{c}
T_8: 80 % GP + 20 % KE	8.27 ^{a}	8.06 ^{a}	7.75 ^{a}	7.57 ^{a}	7.40 ^{a}	8.30 ^{a}	8.14 ^{a}	7.93 ^{a}	7.66 ^{a}	7.39 ^{a}
T_9: 70 % GP + 30 % KE	7.99 ^{ab}	7.73 ^{ab}	7.48 ^{ab}	7.28 ^{bc}	7.13 ^{bc}	7.94 ^{bc}	7.63 ^{c}	7.45 ^{c}	7.31 ^{bc}	7.05 ^{c}
T_{10}: 60 % GP+ 40 % KE	7.79 ^{b}	7.61 ^{b}	7.31 ^{b}	7.18 ^{c}	7.01 ^{c}	7.83 ^{c}	7.70 ^{bc}	7.40 ^{c}	7.16 ^{c}	6.97 ^{c}
T_{11}: Commercial guava RTS	7.74 ^{b}	7.57 ^{b}	7.36 ^{b}	7.23 ^{c}	7.10 ^{c}	7.75 ^{c}	7.56 ^{c}	7.37 ^{c}	7.13 ^{c}	6.95 ^{c}
Mean	**7.87**	**7.64**	**7.37**	**7.19**	**7.03**	**7.89**	**7.65**	**7.48**	**7.26**	**7.03**
S.Em±	0.07	0.09	0.08	0.07	0.06	0.08	0.07	0.07	0.08	0.07
C.D. at 1%	0.29	0.34	0.30	0.26	0.23	0.32	0.26	0.28	0.31	0.27

GP-Guava pulp **KE**-Kokum extract **DAS**- Days after storage

Conclusion

The guava kokum blended RTS was prepared with 80 per cent guava pulp + 20 per cent kokum extract and adjusted to 13 °Brix TSS were readily acceptable. The guava kokum blended RTS was acceptable for up to 4 months of storage under ambient condition. The kokum extract imparts colour to guava juice so that its acceptability can be enhanced and its medicinal properties can be retained and utilised.

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