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STUDIES ON RECIPE STANDARDIZATION OF TENDER COCONUT WATER FOR NECTAR

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ABSTRACT
The experiment was conducted at Horticulture Processing Laboratory, Department of Fruit Science, College of Agriculture, IGKV, Raipur (C.G.) during the year 2017-18. The experiment consisted of eighteen treatments and three replications under completely randomized design. Among various recipe tried in this investigation, the nectar prepared from the treatment T_3 (20% juice + 18% TSS + 0.3% acidity) recorded highest ascorbic acid, non-reducing sugar and organoleptic score with respect to colour, appearance, aroma, taste and overall acceptability as compared to other recipes during storage. During storage of nectar the acidity, TSS, total and reducing sugar showed an increasing trend with increasing period of storage while there was a decreasing trend of ascorbic acid, pH, non-reducing sugar and organoleptic score during storage period upto 90 days under ambient condition.

KEY WORDS: Coconut water, nectar, physic-chemical changes, storage, organoleptic score.

INTRODUCTION
Tender coconut water is a very popular drink in the world market, especially for its healing qualities such as oral or intravenous rehydration. Coconut water and kernel are liquid and solid endosperm of a tender coconut (Raghavendra, 2001). The kernel of seven to eight month old coconut nut is consumed either as such or along with the sweet tender nut water. At this stage, the kernel will be very soft with the maximum content of protein and sugar. The tender coconut water or green coconut water is sterile and is used as an oral rehydration medium for children suffering from gastroenteritis (Saat *et al*., 2002). It acts as antiseptic to urinary track and increases blood circulation.

Fruit juice and beverages hold an important position due to their richness in essential minerals, vitamins and other nutritive constituents. Being delicious and appealing they have great demand and are appreciated by people of all age groups. Synthetic drinks which are more popular commercially are not so healthy or nutritive compared to natural once. Hence, if natural drinks could substitute synthetic drinks, it would provide numerous benefits to consumers as well as farmers. In view of the rising demands for natural and organic products, fruit juice and other fruit-based beverages have great scope.

Nectar is one of the refreshing beverages having zero carbonation, relatively few preservatives and an excellent source of several important vitamins and minerals and is used as a health drink. Therefore, the present study was undertaken to develop a tender coconut water beverage having good consumer acceptability. The total soluble solids and acidity of the beverage were also optimized as they play major role in the acceptability of the beverages.

MATERIALS AND METHODS
The experiment was conducted at Horticulture processing laboratory, Department of Fruit Science, IGKV, Raipur during 2017-2018. Uniform sized and good quality green coconut was collected from the local market for the preparation of nectar. Green coconut fruits were cut by hand with the help of coconut cutter for extraction of juice and passed through a fine muslin cloth. After extraction of juice the calculated amount of sugar and water was taken in a stainless steel *ganj*, then boiled. The citric acid was added at the boiling and mixture passed through a muslin cloth for filtration. The total soluble solids was maintained as 15, 16, 17, 18, 19 and 20 per cent in the recipe combination for nectar similarly the acidity was maintained to 0.1, 0.2 and 0.3 per cent by addition of a required amount of citric acid. The prepared nectar were again filtered by sieving through a muslin cloth to obtain a product of uniform consistency. The product was poured into hot, sterilized bottles of 200 ml capacity and corked air-tight with the help of a crown corking machine. The filled bottles were pasteurized in boiling water until the temperature of the product reaches 100ºC. The bottles of nectar beverages were kept at ambient condition for further studies up to 90 days.

The treatments were as follows:

T_1 = 20% juice + 20% TSS + 0.3% acidity
T_2 = 20% juice + 19% TSS + 0.3% acidity
T_3 = 20% juice + 18% TSS + 0.3% acidity
T_4 = 20% juice + 17 % TSS + 0.3% acidity
T_5 = 20% juice + 16% TSS + 0.3% acidity
T_6 = 20% juice + 15% TSS + 0.3% acidity
T_7 = 20% juice + 20% TSS + 0.2% acidity
T_8 = 20% juice + 19% TSS + 0.2% acidity
T_9 = 20% juice + 18% TSS + 0.2% acidity
T_{10} = 20% juice + 17% TSS + 0.2% acidity
T_{11} = 20% juice + 16% TSS + 0.2% acidity
T_{12} = 20% juice + 15% TSS + 0.2% acidity

T_{13} = 20% juice + 20% TSS + 0.1% acidity
T_{14} = 20% juice + 19% TSS + 0.1% acidity
T_{15} = 20% juice + 18% TSS + 0.1% acidity
T_{16} = 20% juice + 17% TSS + 0.1% acidity
T_{17} = 20% juice + 16% TSS + 0.1% acidity
T_{18} = 20% juice + 15% TSS + 0.1% acidity

The total soluble solids were determined by using hand refractometer and expressed in ^{o}Brix as followed by Ranganna (1986).The titrable acidity and ascorbic acid 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 Covenin (1984). Total sugars and reducing sugars were determined following the method described by Lane and Eyon (Ranganna, 1986). The data obtained was subjected to statistical analysis using Completely Randomized Design with 3 replications. The results were statistically evaluated by one-way analysis of variance (ANOVA).

RESULTS AND DISCUSSION

The products were analyzed for the changes in their chemical constituents like TSS, pH, titrable acidity, ascorbic acid, sugars and organoleptic score during 90 days of storage.

Total soluble solids (°Brix)

A continuous increasing trend was observed in TSS throughout the storage period (Table 1). At the time of preparation, TSS (20.16ºBrix) was found significantly higher with the treatment 20% juice + 20% TSS + 0.3% acidity (T_1) followed by 20% juice + 20% TSS + 0.2% acidity (T_7). While, minimum TSS content (14.94°Brix) was recorded with the treatment 20% juice + 15% TSS + 0.1% acidity (T_{18}). The treatments T_1, T_7 and T_{13} were statistically similar. At 30 days of storage, the total soluble solids content (20.17ºBrix) was found to be maximum under the treatment 20% juice + 20% TSS + 0.3% acidity (T_1) followed by 20% juice + 20% TSS + 0.2% acidity (T_7). Whereas, minimum TSS content (14.95°Brix) was observed with the treatment 20% juice + 15% TSS + 0.1% acidity (T_{18}). The treatments T_1, T_7 and T_{13} were statistically similar. At 60 days of storage, maximum TSS (20.27°Brix) was recorded with the treatment 20% juice + 20% TSS + 0.3% acidity (T_1) followed by 20% juice + 20% TSS + 0.2% acidity (T_7). While, minimum TSS content (15.06°Brix) was observed with the treatment 20% juice + 15% TSS + 0.1% acidity (T_{18}). The treatments T_1, T_7 and T_{13} were statistically similar. At 90 days of storage, a similar trend was observed in TSS.

The increased TSS in nectar during storage was probably due to the conversion of left over polysaccharides into soluble sugars. Pal *et al.* (2007) observed that TSS was increased slightly in nectar by blending watermelon juice and coconut water during the storage period. Gehlot *et al*. (2010) observed that the TSS increased slightly in Jamun RTS drink and nectar during three months of storage.

Acidity (%)

The acidity of coconut water nectar showed an increasing trend with increasing period of storage (Table 1). At the time of preparation, maximun acidity (0.36%) was found with the treatment 20% juice + 15% TSS +0.3% acidity (T_6) followed by 20% juice +20% TSS +0.3% acidity (T_1). While minimum acidity (0.10%) was observed with 20% juice + 20% TSS + 0.1% acidity (T_{13}). The treatments T_1, T_2, T_3, T_4 and T_5 were similar. At 30 days of storage, maximum acidity (0.38%) was found with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6) followed by 20% juice + 20% TSS + 0.3% acidity (T_1). While, minimum acidity (0.12%) was observed with 20% juice + 20% TSS + 0.1% acidity (T_{13}). At 60 days of storage, higher acidity (0.48%) was found with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6) followed by 20% juice + 16% TSS + 0.3% acidity (T_5). Whereas, minimum acidity (0.14%) was observed with 20% juice + 20% TSS + 0.1% acidity (T_{13}). The treatments T_{13}, T_{14}, T_{15}, T_{16} and T_{17} were statistically at par. After 90 days of storage, the titrable acidity (0.56%) was found to be higher under the treatment 20% juice +15% TSS + 0.3% acidity (T_6) followed by 20% juice +20% TSS + 0.3% acidity (T_1). While, minimum acidity (0.18%) was observed in the treatment 20% juice + 20% TSS + 0.1% acidity (T_{13}).

The increase in acidity of nectar during storage might be due to the formation of organic acids by ascorbic acid degradation as well as a progressive decrease in the pectin content. Similar findings were also reported by Khurdiya and Roy (1985), who reported a gradual increase in acidity of Jamun RTS (1.37% to1.42%) during the storage of 90 days. Mehmood *et al.* (2008) observed that the acidity increased from 0.32 to 0.52% in apple juice during 3 months of storage period.

Ascorbic acid (mg/100ml)

The ascorbic acid content in coconut water nectar of all the treatments showed a decreasing trend with increasing period of storage 0 to 90 days (Table1). At the time of preparation (0 day), maximum under the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) and it was minimum in treatment 20% juice + 15% TSS + 0.1% acidity (T_{18}). Similarly during 0 to 30 days of storage, maximum ascorbic acid was recorded with the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) and it was minimum in the treatment 20% juice + 15% TSS + 0.1% acidity (T_{18}). After 60 days of storage, significantly maximum ascorbic acid (0.47 mg/100ml) was observed with the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) followed by 20% juice + 19% TSS + 0.3% acidity (T_2). The minimum ascorbic acid (0.20 mg/100ml) was recorded with the treatment 20% juice + 15% TSS + 0.1% acidity (T_{18}). The treatments T_4 and T_6, T_{10} and T_7, was found statistically at par. After 90 days of storage, significantly maximum ascorbic acid (0.23 mg/100ml) was recorded with the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) followed by 20% juice + 19% TSS + 0.3% acidity (T_2). The minimum ascorbic acid (0.06 mg/100ml) was recorded with the treatment 20% juice + 15% TSS + 0.1% acidity (T_{18}). The treatments T_4 and T_8, T_{18} and T_{11} were at par.

The decrease in ascorbic acid in nectar during storage might be due to oxidation or irreversible conversion of L-ascorbic acid into de-hydro ascorbic acid in the presence of enzyme ascorbic acid oxidase (ascorbinase) caused by trapped or residual oxygen in the glass bottles. The present findings are in accordance with the view of Das (2009), who reported that ascorbic acid content in Jamun products (RTS, nectar, squash, syrup) decreased continuously during the entire period of storage. Chauhan *et al.* (2014) observed that ascorbic acid decreased in a beverage by blending coconut water and lemon juice during the storage period.

pH

The pH value in nectar of coconut water showed a decreasing trend with increasing period of storage (0-90) days (Table2). At the time of preparation, maximum pH value (5.52) was observed with the treatment 20% juice + 19% TSS + 0.1% acidity (T_{14}) followed by 20% juice + 20% TSS + 0.1% acidity (T_{13}). While, minimum pH (3.72) was observed with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6). The treatments T_{17} and T_{18}, T_2 and T_1 were statistically at par. At 30 days of storage, the pH of nectar (5.49) was maximum under the treatment 20% juice + 19% TSS + 0.1% acidity (T_{14}) followed by 20% juice + 20% TSS + 0.1% acidity (T_{13}). The minimum pH value (3.69) was recorded with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6). At 60 days of storage, maximum pH value (5.24) was recorded with the treatment 20% juice + 19% TSS + 0.1% acidity (T_{14}) followed by 20% juice + 18% TSS + 0.1% acidity (T_{15}). The minimum pH value (3.30) was recorded with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6). The treatments T_{17}, T_{16} and T_{18} were showed statistically at par differences. After 90 days of storage, maximum pH value (4.78) was observed with the treatment 20% juice + 16% TSS + 0.1% acidity (T_{17}) followed by 20% juice + 17% TSS + 0.1% acidity (T_{16}). The minimum pH value (2.93) was recorded with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6). The treatments T_{11} and T_{10} were statistically similar.

The increased acidity and TSS under all the recipe treatments during storage had a corresponding decrease in pH. Hence, the reduction in pH could be attributed to a simultaneous increase in acidity and TSS of nectar irrespective of their storage temperature. The present findings are in agreement with Krishnaveni *et al.* (2001), who observed that there was a considerable reduction in pH of jackfruit RTS beverage during the storage period of 6 months. Byanna and Gowda (2012) also observed that the pH of sweet orange RTS beverages was decreased during the six months of storage period.

Total sugar (%)

The total sugar content in nectar of coconut water showed an increasing trend with increasing period of storage (Table2). At the time of preparation, the maximum total sugar content (16.93%) was observed with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6) followed by 20% juice + 20% TSS + 0.3% acidity (T_1). The minimum total sugar content (10.70%) was recorded with the treatment 20% juice + 19% TSS + 0.1% acidity (T_{14}). The treatment T_2 and T_3 was statistically at par. After 30 days of storage, the maximum total sugar content (17.04%) was observed with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6) followed by 20% juice + 20% TSS + 0.3% acidity (T_1). The minimum total sugar content (10.75%) was recorded with the treatment 20% juice + 19% TSS + 0.1% acidity (T_{14}). The treatments T_7 and T_{12}, T_{13} and T_{18} were found statistically similar. After 60 days of storage, the maximum total sugar content (17.18%) was observed with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6) followed by 20% juice + 20% TSS + 0.3% acidity (T_1). The minimum total sugar content (10.84%) was recorded with the treatment 20% juice + 19% TSS + 0.1% acidity (T_{14}). The treatments T_{12} and T_{18} were found statistically at par. At the end (90 days) of storage, the maximum total sugar content (17.30%) was observed with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6) followed by 20% juice + 20% TSS + 0.3% acidity (T_1). The minimum total sugar content (10.88%) was recorded with the treatment 20% juice + 19% TSS + 0.1% acidity (T_{14}).

The present findings are in close conformity with the findings of Verma and Gehlot (2006), reported that there was a continuous increase in the level of total sugar in bael beverages viz., RTS drink and nectar during storage. Similar findings were observed by Sharma *et al.* (2009) in guava-jamun RTS drink and Gehlot *et al.* (2010) in jamun nectar and RTS drink and by Lather *et al.* (2015) in aonla juice.

Reducing sugar (%)

The reducing sugar content in nectar of coconut water showed an increasing trend with increasing period of storage (Table2). At the time of preparation, the maximum reducing sugar (5.45%) was observed with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6) followed by 20% juice + 20% TSS + 0.3% acidity (T_1). The minimum reducing sugar (3.54%) was recorded with the treatment 20% juice + 19% TSS + 0.1% acidity (T_{14}). At the time of 30 days storage, maximum reducing sugar (5.66%) was observed with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6) followed by 20% juice + 20% TSS + 0.3% acidity (T_1). The minimum reducing sugar (3.64%) was recorded with the treatment 20% juice + 19% TSS + 0.1% acidity (T_{14}). The treatment T_3 and T_{12} were found statistically at par. After 60 days of storage, maximum reducing sugar (6.12%) was recorded with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6) followed by 20% juice + 20% TSS + 0.3% acidity (T_1). The minimum reducing sugar (3.88%) was recorded with the treatment 20% juice + 19% TSS + 0.1% acidity (T_{14}). After 90 days of storage, maximum reducing sugar (6.71%) was recorded with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6) followed by 20% juice + 20% TSS + 0.3% acidity (T_1). The minimum reducing sugar (4.24%) was recorded with the treatment 20% juice + 19% TSS + 0.1% acidity (T_{14}).

Pal *et al.* (2007) reported that the reducing sugar was increased during the storage period in nectar by blending watermelon juice and coconut water. Mehmood *et al.* (2008) reported that reducing sugar increased significantly from 7.12 to 7.65% in apple juice during the storage period.

Non-reducing sugar (%)

The non-reducing sugar in nectar of coconut water showed decreasing trend with increasing period of storage (Table 2). At the time of preparation, maximum non-reducing sugar (11.73%) was recorded with the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) followed by 20% juice + 19% TSS + 0.3% acidity (T_2). Whereas, the minimum (6.95%) non-reducing sugar was observed with the treatment 20% juice + 15% TSS + 0.1% acidity (T_{18}). The treatments T_7 and T_{12} were statistically at par. After 30 days of storage, maximum non-reducing sugar (11.64%)

was observed with the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) followed by 20% juice + 19% TSS + 0.3% acidity (T_2). While, the minimum content (6.89%) was observed with the treatment 20% juice + 15% TSS + 0.1% acidity (T_{18}). After 60 days of storage, maximum non-reducing sugar (11.43%) was recorded with the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) followed by 20% juice + 19% TSS + 0.3% acidity (T_2). Whereas, the minimum content (6.73%) was observed with the treatment 20% juice + 15% TSS + 0.1% acidity (T_{18}). After 90 days of storage, maximum non-reducing sugar (10.93%) was recorded with the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) followed by 20% juice +19% TSS + 0.3% acidity (T_2). Whereas, the minimum content (6.33%) was observed with the treatment 20% juice + 15% TSS + 0.1% acidity (T_{18}).

The increase in reducing sugar as well as total sugar corresponded to the increase in total soluble solids (TSS) and the ultimate decrease in non-reducing sugar in both the beverages during the storage period. The variation in different fractions of sugar might be due to hydrolysis of polysaccharides like starch, pectin and inversion of non-reducing sugar into reducing sugar, as increase in reducing sugar was correlated with the decrease in non-reducing sugar. The increased level of total sugar was probably due to the conversion of starch and pectin into simple sugars. Similar findings were reported by Saravanan *et al.* (2004) in papaya RTS beverage and by Mehmood *et al.* (2008) in apple juice.

Organoleptic score

The organoleptic score for colour and appearance, aroma, taste and overall acceptability continuously decreased with all the treatments upto 90 days of storage (Table3). At the time of preparation, significantally maximum mean score for colour and appearance (8.28) was recorded with the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) followed by 20% juice + 19% TSS + 0.3% acidity (T_2). The minimum mean score (6.14) was recorded with the treatment 20% juice + 15% TSS + 0.1% acidity (T_{18}). In the same way, the maximum mean score for aroma (8.20) was recorded with the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) followed by 20% juice + 19% TSS + 0.3% acidity (T_2). The minimum mean score (5.66) was recorded with the treatment 20% juice + 20% TSS + 0.3% acidity (T_1). Maximum mean score for taste (8.50) was recorded with the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) followed by 20% juice + 19% TSS + 0.3% acidity (T_2). The minimum mean score (5.16) was observed with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6). The treatments T_8 and T_9, T_{12} and T_{17} were statistically at par. Similar to above characters, the maximum mean score for overall acceptability (8.33) was recorded with the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) followed by 20% juice + 19% TSS + 0.3% acidity (T_2). The minimum mean score (5.70) was recorded with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6).

After 30 days of storage, significantly maximum mean score for colour and appearance (7.76) was recorded with the treatment 20% juice +18% TSS + 0.3% acidity (T_3) followed by 20% juice + 19% TSS + 0.3% acidity (T_2). The minimum mean score (5.66) was recorded with the treatment 20% juice +15% TSS +0.1% acidity (T_{18}). Similarly, the maximum mean score for aroma (7.79) was recorded with the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) followed by 20% juice + 19% TSS + 0.3% acidity (T_2). The minimum mean score (5.19) was recorded with the treatment 20% juice + 20% TSS + 0.3% acidity (T_1). The maximum mean score for taste (8.10) was recorded with the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) followed by 20% juice + 19% TSS + 0.3% acidity (T_2). The significantly minimum mean score (4.61) was recorded with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6). In the same way, maximum mean score for overall acceptability (7.88) was recorded with the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) followed by 20% juice + 19% TSS + 0.3% acidity (T_2). The significantly minimum mean score (5.20) was recorded with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6).

After 60 days of storage, maximum mean score for colour and appearance (7.19) was recorded with the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) followed by 20% juice + 19% TSS + 0.3% acidity (T_2). The significantly minimum mean score (5.06) was recorded with the treatment 20% juice + 15% TSS + 0.1% acidity (T_{18}). The maximum mean score for aroma (7.12) was recorded with the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) followed by 20% juice + 19% TSS + 0.3% acidity (T_2). The minimum mean score (4.42) was recorded with the treatment 20% juice + 20% TSS + 0.3% acidity (T_1). Similarly, maximum mean score for taste (7.46) was recorded with the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) followed by 20% juice + 19% TSS + 0.3% acidity (T_2). Minimum mean score (4.06) was recorded with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6). The maximum mean score for overall acceptability (7.26) was recorded with the treatment 20% juice + 18% TSS + 0.3% acidity (T_3) followed by 20% juice + 19% TSS + 0.3% acidity (T_2). The significantly minimum mean score (4.58) was recorded with the treatment 20% juice + 15% TSS + 0.3% acidity (T_6).

After 90 days of storage, a similar trend was observed. There are many extrinsic factors which determine the storage stability of products and temperature plays an important role among them. There are certain biochemical changes which occurs under low pH and high temperature that leads to the formation of brown pigments and produces off flavour in the beverages. The other possible reasons could be the loss of volatile aromatic substances responsible for flavour and taste which decreased acceptability in storage at ambient condition. The present findings are in accordance with the view of Gehlot *et al.* (2008), who reported that the colour and appearance, flavour, taste and overall acceptability of jamun beverages decreased significantly with the advancement in storage period.

CONCLUSION

The nectar prepared from the recipe T_3 (20 per cent juice, 18 per cent TSS and 0.3 per cent acidity) contained highest ascorbic acid, non-reducing sugar and organoleptic score as compared to other recipes during storage. Therefore, it was found to be superior for nectar preparation with respect to commercial scale.

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TABLE 1: Changes in TSS (°Brix), acidity (%) and ascorbic acid (mg/100ml) in nectar of coconut water during storage

Treatment	TSS (ºBrix)				Acidity (%)				Ascorbic acid (mg/100ml)			
	0 day	30 days	60 days	90 days	0 days	30 days	60 days	90 days	0 days	30 days	60 days	90 days
T_1	20.16	20.17	20.27	20.32	0.33	0.36	0.46	0.54	0.84	0.73	0.62	0.50
T_2	19.09	19.10	19.12	19.14	0.31	0.32	0.38	0.44	0.86	0.75	0.64	0.53
T_3	18.00	18.02	18.03	18.05	0.30	0.30	0.34	0.39	0.89	0.77	0.67	0.58
T_4	17.02	17.02	17.04	17.06	0.32	0.33	0.42	0.47	0.83	0.70	0.59	0.45
T_5	16.12	16.15	16.25	16.31	0.33	0.36	0.46	0.54	0.80	0.65	0.56	0.41
T_6	15.01	15.02	15.13	15.17	0.36	0.38	0.48	0.56	0.81	0.68	0.58	0.43
T_7	20.14	20.16	20.26	20.30	0.20	0.22	0.24	0.28	0.74	0.62	0.52	0.43
T_8	19.06	19.06	19.10	19.12	0.21	0.23	0.25	0.29	0.76	0.64	0.54	0.45
T_9	18.10	18.10	18.16	18.20	0.21	0.23	0.25	0.29	0.78	0.66	0.57	0.48
T_{10}	17.08	17.08	17.09	17.12	0.23	0.26	0.25	0.32	0.74	0.62	0.52	0.43
T_{11}	16.09	16.10	16.13	16.15	0.23	0.26	0.25	0.32	0.71	0.59	0.48	0.30
T_{12}	15.00	15.01	15.06	15.10	0.24	0.28	0.32	0.37	0.72	0.60	0.49	0.31
T_{13}	20.10	20.12	20.22	20.28	0.10	0.12	0.14	0.18	0.64	0.51	0.45	0.33
T_{14}	19.03	19.06	19.08	19.12	0.11	0.13	0.15	0.19	0.67	0.54	0.48	0.35
T_{15}	18.12	18.13	18.15	18.18	0.11	0.13	0.15	0.19	0.69	0.56	0.49	0.38
T_{16}	17.10	17.11	17.13	17.22	0.13	0.16	0.15	0.22	0.64	0.51	0.45	0.32
T_{17}	16.00	16.02	16.08	16.11	0.13	0.16	0.15	0.22	0.62	0.49	0.43	0.31
T_{18}	14.94	14.95	15.06	15.12	0.14	0.18	0.22	0.27	0.60	0.47	0.40	0.30
SEm±	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.01
CDat 5%	0.05	0.04	0.05	0.05	0.01	0.01	0.01	0.02	NS	NS	0.01	0.01

TABLE 2: Changes in pH, Total sugar (%), Reducing sugar (%) and Non-reducing sugar (%) in nectar of coconut water during storage

Treatment	pH				Total sugar (%)				Reducing sugar(%)				Non-reducing sugar(%)			
	0 Days	30 days	60 days	90 days	0 Days	30 days	60 days	90 days	0 days	30 days	60 days	90 days	0 days	30 days	60 days	90 days
T_1	4.00	3.97	3.63	3.26	16.90	17.00	17.14	17.26	5.39	5.59	6.05	6.63	11.51	11.41	11.09	10.63
T_2	4.04	4.01	3.66	3.30	16.69	16.77	16.88	16.93	4.99	5.16	5.49	6.03	11.70	11.61	11.39	10.90
T_3	4.05	4.03	3.70	3.33	16.68	16.74	16.85	16.89	4.95	5.10	5.42	5.96	11.73	11.64	11.43	10.93
T_4	3.91	3.87	3.52	3.13	16.79	16.87	17.01	17.12	5.18	5.35	5.77	6.36	11.61	11.52	11.24	10.76
T_5	3.83	3.78	3.40	3.02	16.87	16.69	17.11	17.23	5.33	5.52	5.98	6.57	11.54	11.44	11.13	10.66
T_6	3.72	3.69	3.30	2.93	16.93	17.04	17.18	17.30	5.45	5.66	6.12	6.71	11.48	11.38	11.06	10.59
T_7	4.38	4.36	4.10	3.74	13.90	14.00	14.14	14.26	4.91	5.06	5.36	5.87	8.96	8.90	8.74	8.34
T_8	4.42	4.39	4.14	3.78	13.70	13.75	13.84	13.88	4.54	4.64	4.88	5.24	9.16	9.11	8.96	8.64
T_9	4.33	4.30	4.07	3.71	13.73	13.80	13.91	13.96	4.63	4.73	5.01	5.40	9.10	9.07	8.91	8.56
T_{10}	4.21	4.19	3.84	3.49	13.81	13.91	14.04	14.15	4.80	4.93	5.25	5.69	9.01	8.98	8.79	8.46
T_{11}	4.13	4.11	3.76	3.42	13.87	13.95	14.08	14.22	4.89	5.03	5.32	5.84	8.98	8.92	8.76	8.38
T_{12}	4.10	4.07	3.73	3.37	13.93	13.98	14.12	14.26	4.95	5.09	5.39	5.93	8.95	8.89	8.73	8.33
T_{13}	5.48	5.46	5.07	4.74	10.90	11.00	11.14	11.26	3.91	4.06	4.36	4.87	6.96	6.90	6.74	6.34
T_{14}	5.52	5.49	5.24	4.78	10.70	10.75	10.84	10.88	3.54	3.64	3.88	4.24	7.16	7.11	6.96	6.64
T_{15}	5.44	5.40	5.10	4.71	10.73	10.80	10.91	10.96	3.63	3.73	4.01	4.40	7.10	7.07	6.91	6.56
T_{16}	5.31	5.29	4.84	4.49	10.81	10.91	11.04	11.15	3.80	3.93	4.25	4.69	7.01	6.98	6.79	6.46
T_{17}	5.23	5.21	4.86	4.52	10.87	10.95	11.08	11.22	3.89	4.03	4.32	4.84	6.98	6.92	6.76	6.38
T_{18}	5.20	5.17	4.83	4.47	10.93	10.98	11.12	11.26	3.95	4.09	4.39	4.93	6.95	6.89	6.73	6.33
SEm±	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02	0.02	0.02	0.01
CD5%	0.05	0.04	0.04	0.04	0.01	0.02	0.01	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01

TABLE 3: Changes in organoleptic score viz. colour and appearance, aroma, taste and overall acceptability in nectar of coconut water during storage

Treatment	Colour and appearance				Aroma				Taste				Overall acceptability			
	0 Days	30 days	60 days	90 days	0 Days	30 days	60 days	90 days	0 days	30 days	60 days	90 days	0 days	30 days	60 days	90 days
T_1	6.55	6.17	5.52	4.68	5.66	5.19	4.42	3.72	5.23	4.70	4.11	3.31	5.81	5.35	4.68	3.90
T_2	8.24	7.72	7.15	6.32	8.14	7.72	7.08	6.25	8.45	8.04	7.40	6.58	8.28	7.82	7.21	6.38
T_3	8.28	7.76	7.19	6.39	8.20	7.79	7.12	6.32	8.50	8.10	7.46	6.64	8.33	7.88	7.26	6.45
T_4	8.19	7.67	7.09	6.29	7.75	7.31	6.70	5.69	8.12	7.66	7.06	6.20	8.02	7.54	6.95	6.06
T_5	8.03	7.57	6.91	6.15	7.73	7.28	6.66	5.61	7.73	7.34	6.78	5.74	7.83	7.39	6.78	5.83
T_6	6.26	5.78	5.18	4.40	5.69	5.23	4.51	3.78	5.16	4.61	4.06	3.20	5.70	5.20	4.58	3.79
T_7	6.50	6.12	5.47	5.85	5.68	5.21	4.44	5.57	5.35	4.82	4.23	5.68	5.84	5.38	4.71	5.70
T_8	7.64	7.28	6.64	4.63	7.70	7.24	6.60	3.74	7.62	7.23	6.69	3.43	7.65	7.25	6.64	3.93
T_9	7.54	7.14	6.52	5.71	7.60	7.10	6.50	5.43	7.61	7.22	6.65	5.65	7.58	7.15	6.56	5.60
T_{10}	7.48	7.06	6.40	5.60	7.43	6.95	6.33	5.30	7.00	6.54	5.98	5.10	7.30	6.85	6.23	5.35
T_{11}	7.40	7.01	6.33	5.54	7.38	6.88	6.27	5.24	6.50	6.05	5.48	4.60	7.09	6.64	6.02	5.12
T_{12}	6.20	5.72	5.11	4.34	5.72	5.28	4.58	3.84	5.28	4.78	4.18	3.34	5.73	5.26	4.62	3.84
T_{13}	6.45	6.07	5.42	4.58	5.70	5.23	4.46	3.76	5.47	4.92	4.35	3.55	5.87	5.41	4.74	3.96
T_{14}	7.04	6.68	6.13	5.38	7.26	6.80	6.12	4.89	6.79	6.40	5.98	4.78	7.02	6.62	6.07	5.02
T_{15}	6.80	6.40	5.85	5.03	7.00	6.50	5.88	4.54	6.72	6.33	5.84	4.66	6.83	6.40	5.86	4.75
T_{16}	6.77	6.35	5.71	4.91	7.11	6.63	5.96	4.91	5.88	5.42	4.90	4.00	6.76	6.31	5.51	4.64
T_{17}	6.70	6.31	5.75	4.93	7.03	6.53	5.88	4.87	5.27	4.82	4.90	3.46	6.35	5.90	5.26	4.41
T_{18}	6.14	5.66	5.06	4.28	5.75	5.31	4.65	3.91	5.40	4.90	4.30	3.46	5.76	5.29	4.66	3.89
SEm±	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.01
CD5%	0.02	0.04	0.01	0.02	0.02	0.02	0.03	0.01	0.02	0.03	0.02	0.03	0.03	0.01	0.01	0.01