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Evaluation of chemical composition and changes occur under fridge storage of tendu nectar (*Diospyros melanoxylon Roxb.*)

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Abstract

Tendu (*Diospyros melanoxylon Roxb.*) is considered to be minor forest produce (MFP) in India. The Tendu plant is grown in abundant all over the eastern part of India for commercialization of its leaves for making Bidi, a traditional cigarette.) The Tendu Nectar recipe developed with 10 treatments of experiment conducted. Tendu fruits were harvested from selected CPT of Two districts. A variation was observed in chemical composition of Nectar prepared over a period of storage time 0-90 days of fruit juice among investigated genotypes. During the experimentation acidity, ascorbic acid, TSS, total sugar, reducing sugar, the non-reducing sugars in Tendu fruit were analyzed. The final product maintains quality and is accepted over a period of time (0 to 90 days) without any deterioration. Since Tendu fruits are perishable they can't be kept for a long time. The need of the hour is that wild and underutilized fruits of the forest must be utilized through processing, preservation, and value addition technology so that employment will be generate, and provide opportunities to the tribal communities to uplift their livelihood from these NTFPs. In Tendu fruit mineral such as potassium, calcium, and phosphorus present in high concentration. The storage behavior of Nectar up 90 days duration variation occurring in different combinations. Chemical composition of different treatments in Nectar have studied 15-day interval to 90-day storage the Acidity in Nectar 0.14 observed whereas, the ascorbic acid was recorded in mg/100 g unit in Nectar 9.93. The TSS acid ratio is 16.39% in the case of Nectar. The total sugar content observed in Nectar was 5.41 percent, whereas, reducing sugar in Nectar was 3.05 percent recorded. The Non-reducing sugar in Nectar was 2.34 percent recorded. The above combination of chemicals ensures the quality, storage behavior, and test of these beverages are safe to be consumed by a human being. The non-significant variation was observed the acidity of Nectar changed from 0.04 to 0.15%. The concentration of ascorbic acid; total sugar, reducing sugar, TSS, and non-reducing sugar were observed from the date of manufacture to reduce as increasing the age of the product.

Keywords: Tendu fruit nectar, chemical composition, tendu juice

Introduction

Tendu tree *Diospyros melanoxylon Roxb.* (Family: Ebenaceae) is called Tendu in Hindi, Malabar Ebony in English and Tinduka in Sanskrit. This fruit is also very popular in tribal communities in Orissa, Madhya Pradesh, Chhattisgarh, Andhra Pradesh, Telangana and other states in South-Central India. Tendu (*Diospyros melanoxylon Roxb.*) is an underdeveloped fruit found in the forests of West Bengal, Odisha, Madhya Pradesh, Bihar, Jharkhand, Chhattisgarh, and Andhra Pradesh and the marginal areas grow in a natural wild way. In Bankura, Purulia, and Paschim Midnapur plateau areas, as an economic species of local residents and tribes, it is naturally protected by them (Sailakshmi et.al 2018)^[16]. All plant parts such as bark, leaves, fruits, and seeds can be used for different commercial purposes. Fruits are a good source of carbohydrates, calcium, phosphorus, and carotene, which can prevent malnutrition in the tribe. Dried fruit powder is used as an aroma agent, and dried flowers are reported to be used for urinary, skin, and blood diseases. The seeds are prescribed to treat mental disorders, heart pain, and neurasthenia. The leaves are used as a raw material for the "Bidi" industry. Due to its importance, the West Bengal Tribal Development Cooperative Co., Ltd. (WBTDCC) has the highest priority in this regard. Therefore, priority should be given to this crop in order to provide nutritional security and promote poverty. The socio-economic conditions of the tribal people also can be improved if the fruit is also processed and value-added products are made available in the market. Therefore, the nutrition, medicine, and other aspects of the crop have been reviewed to maximize the use of this underutilized fruit tree.

The fruit is very soft and generally dark yellow and light orange color. Tendu grows naturally and the fruit's maturing time is between March and April, the fruit size is round in shape and the fruit length and breadth are 25-30 mm/ fruit and maximum weight 13-15 gm/fruit.

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Fruit weight maximum 15-18 g per fruit. The fruit is processed into nectar and RTS (Ready to serve) The most important thing about this fruit is that it is easily available in local market and tribal areas and have a very low price in the market around 10-15 Rs/Kg and this fruit is a rich source of carbohydrate, vitamin A and C fruit is found in forest areas, therefore, It is 100% organic fruit and processed preserved juice. Tendu fruit ripen during the month of March-June. Fruit is ovoid or globose. It turns yellow to light orange when ripe. The pulp is yellow, glutinous, soft mildly sweet and slightly astringent. These fruit are rich in sugar, proteins, fiber and vitamin C. Tendu fruit Nectar is popular among the tribal community. An analysis of Nectar prepared from Tendu fruit reveals that it contains acidity, ascorbic acid, Total sugar, reducing sugar, non-reducing sugar, TSS(Total salable soled).

2. Material and Method

The present investigation entitles "Evaluation of Chemical Composition and Changes Occur under Fridge Storage of Tendu Nectar (*Diospyros melanoxylon Roxb.*)" Conducted in the Horticultural Processing and chemical Laboratory and Forestry Department of Indira Gandhi Agricultural University, Raipur (CG). The Tendu fruit Juice/beverages prepared with fruit pulp products Nectar are prepared in 10 treatments each product respectively. The storage of Juice is 90 days under refrigeration and chemical properties were analyzed in 15 days intervals of the product.

3. Chemical composition of Tendu fruit pulp, product Nectar 0-90 day's storage period

Acidity (%), Total soluble solids (%), Total sugars (%), Reducing sugar (%), Non-reducing sugar (%), Ascorbic acid (mg/100 g)

4. Method used in Chemical composition of fruits, Nectar

The chemical analysis of Tendu nectar was initially carried out immediately after preparation, and the analysis carried out 0 day and up to 3 months every 15 days interval from the date of its preparation during storage under refrigerated conditions.

1) Acidity (%)

The acidity of pulp, Nectar was determined by the procedure given by Ranganna (1997). The total acid content is estimated by titrating 10 ml of Juice or 10 ml of Nectar using phenolphthalein as the N/10 NaOH standard solution and 2 drop Phenephthelin indicator the than titrate 0.1N NaOH end point is shown in light pink. The acidity is expressed as a percentage basis. The formula is given below.

2) Ascorbic acid (mg/100 g)

The ascorbic acid of juice, Nectar was determined by the procedure given by Ranganna (1997). The ascorbic acid of pulp was determined by the procedure given by Ranganna (1986) [14].

Estimation

Titrate 10 ml of L-ascorbic acid solution containing the same amount of HPO₃ with 2, 6-dichlorophenol-indoxyl. The end point is judged by light yellow colour. Dye coefficient is determined as follows:

The standard ascorbic acid solution containing the HPO₃ solution was titrated against the dye solution until a pink color appeared. Repeat this method for pulp Nectar and RTS beverage. Ascorbic acid is expressed as mg / 100 ml.

3) Total soluble solids (%)

Manual hand measuring instrument of ranges 0-28 was calculable to possess total soluble solids of fruit pulp. 1 to 2 drop of pulp with the help of fresh glass rods was placed on measuring instrument prism. The measuring instrument was gently closed over and looked through the elements with a light-facing projection recess the sample chamber was clean with swish cloth artifact once each use. The reading was taken at room temperature.

4) Sugar

Sugar was determined by the method of lane and Eynon as described by Ranganna (1997).

Lead acetate (45%) solution -To make lead acetate 225 g of lead acetate is dissolved in distilled water and then 500 ml of it is mixed.

Potassium oxalate (22%) solution- To make potassium oxalate, after 110g potassium oxalate is added to distilled water, its volume is reduced to 500 ml.

A. Reducing Sugar (%)

Estimation

A fixed amount of filtered Juice 25ml juice has been transferred in to 250 ml volumetric flask and neutralizing 100 ml amount of distilled water with this alkali solution. Than 2 drop phenolphthalein indicator than titrate 1 NaOH (Pink colour) after this 1-2 drops of HCL (Hydrochloric acid) are added to remove the pink colour. After this, add 2 ml potassium oxalate and keep it for 10 minutes. After than add 2 ml lead acetate than we will get milk colour solution and make up the volume 250 ml in conical flask. This procedure was followed to get clarified solution. Take 5 ml Fehling's solution A and Fehling's solution B and 10 ml distill water was taken in a conical flask. Burette was filled with sugar solution. Conical flask was heated in an open flame. Two or four ml sugar solution was poured and 2 drop of Methylene blue indicator was added. Now this solution was kept for heating and sugar solution was added to it. The end point appeared with brick-red colour. The reducing sugar was expressed in per cent.

Total Sugar (%)

A total 25 ml sample clarified sugar solution was added 100 ml distill water after than 2 drop phenolphthalein indicator than Titrate with 1 N NaOH (unit obtained pink colour solution) take adding 5ml HCL than add 5 g of citric acid with 250 ml distilled water. Store for 24 hours. Next day filter the solution & fill in the burette of 50 ml take 5 ml felling solution A &B and 10 ml distill water in 250 ml volumetric flask and neutralized with Phenolphthalein Indicator and made up the volume. Titration Titrate value was expressed as per cent total sugars. The total sugar was expressed in per cent basis.

B. Non-reducing Sugar (%)

The non-reducing sugar is determined by subtracting the value of reducing sugar from the total sugar of sample.

Result and Discussion

Acidity%

The chemical content of Tendu fruit juice in case of Nectar showed subsequent variables i.e. "acidity, ascorbic acid, TSS, Total sugar, Reducing sugar, Non-reducing sugar Nectar observation conferred in table 1 and diagrammatically

delineated from data pertaining to the effect of treatments on the acidity under the freezing condition of storage are and illustrated in Fig. 1 The data depicted that acidity of Tendu fruit Nectar in an increasing trend with increasing period of storage (from 0 days to 90 days) 2019-20 and 2021-22.it was observed “that at the end of 90 days the acidity value reached highest for (0.17) in treatment T₅(25% Juice + 20% TSS + 0.3%)” acidity followed by (0.17) treatment” T₉ (20% Juice + 16% TSS + 0.3% acidity)” and minimum value recorded for (0.09) T₀ (control) treatment”T₀ (20% Juice + 20%TSS + 0.3% acidity)“Similar observations also reported by Humar *et al.* (2017) in case of Physico-chemical, mechanical and antioxidant properties of Kendu (*Diospyros melanoxylon Roxb.*) and* also recorded that acidity value ranges from 0.16

± 0.02 acid level *expressed frequently in terms of pH and titratable acidity.

Choudhary *et al.* (2008)^[8] also reported a similar trend in*guava varieties and standardization of recipe for Nectar preparation. “The acidity in guava nectar increased in all the varieties during storage with the increasing age of storage guava Juice. At the end of five months, the nectar of Guava L-49 variety had an acidity of 0.49% followed by Allahabad Safeda, apple color and R-72 (0.90%)”. Looking to the processing and storage of Nectar and RTS by the above worker it can be concluded that the acidity increases with the increasing age of the juice in the present investigation also found a similar trend confirms the results obtained.

Table 1: Storage acidity analysis of Tendu Nectar from (0 to 90 day) duration indifferent Treatments (2019-20) and (2021-22)

Notation	Treatment	2019-20	2021-22	Overall mean
“T ₀ ”	“(20%juice+20%TSS+0.3% acidity)”	0.09	0.09	0.09
“T ₁ ”	“(21%juice+20%TSS+0.3% acidity)”	0.14	0.12	0.13
“T ₂ ”	“(22%juice+20%TSS+0.3% acidity)”	0.16	0.15	0.15
“T ₃ ”	“(23%juice+20%TSS+0.3% acidity)”	0.12	0.15	0.13
“T ₄ ”	“(24%juice+20%TSS+0.3% acidity)”	0.16	0.15	0.15
“T ₅ ”	“(25%juice+20%TSS+0.3% acidity)”	0.18	0.16	0.17
“T ₆ ”	“(20%juice+19%TSS+0.3% acidity)”	0.17	0.16	0.16
“T ₇ ”	“(20%juice+18%TSS+0.3% acidity)”	0.14	0.15	0.14
“T ₈ ”	“(20%juice+17%TSS+0.3% acidity)”	0.15	0.14	0.14
“T ₉ ”	“(20%juice+16%TSS+0.3% acidity)”	0.18	0.16	0.17

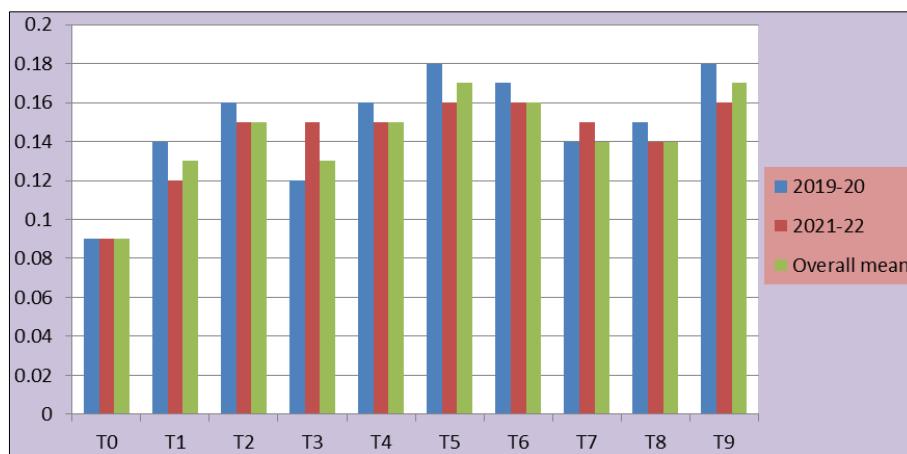


Fig 1: Storage acidity analysis of Tendu Nectar from (0 to 90 day) duration in different Treatments (2019-20) and (2021-22)

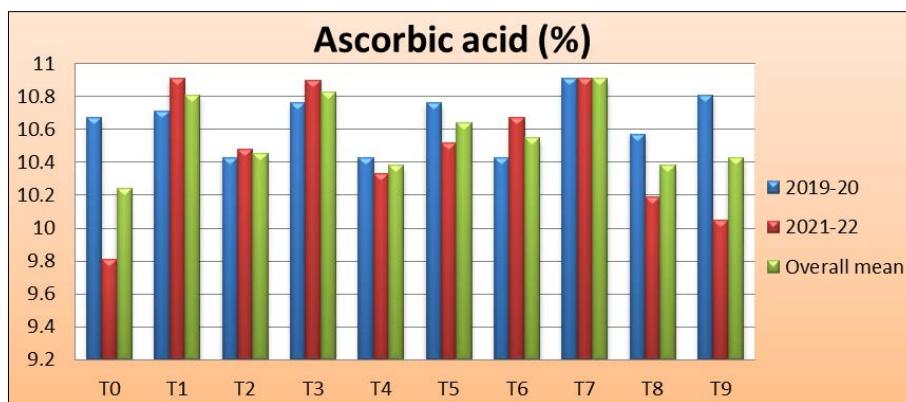
2. Ascorbic acid (mg/100g)

The chemical analysis of Ascorbic acid in Tendu fruit Juice of Nectar recorded computed and conferred and diagrammatically delineated from data pertaining *to effect of treatments on the acidity* under freezing condition of Nectar stored are presented in and Table.2 and illustrated, in Fig*2. The data reveled are depicted that acidity of Tendu fruit Nectar was in *decreasing trend with increasing storage period zero to ninety days 2019-20 and 2021-22 both the years. It was observed that at the end of 90 days*the ascorbic acid value recorded highest for (10.91mg) T7 (*20% Juice + 18% TSS + 0.3%*) and minimum value recorded for (10.24mg) T₀ (control) treatment it was found (20% Juice + 20% TSS + 0.3% acidity).

Similar observation also obtained by Bal *et al.* (2014)^[3] while evaluating quality attributes during storage of Guava Nectar. The minimum changes of ascorbic acid ware observed treatment P₁B₂ (14.7-13.82 mg/100g)”. Ahmad *et al.* (2016)^[2] also reported in his experiment in fruit Nectar of Guava fruit Juice as a refreshing beverage. He has standardize the recipe for Guava Nectar highest ascorbic acid value in fresh 53.65(mg/100g) and after six month 22.20 (mg/100g). In the present investigation the decreasing trend of ascorbic acid in increasing age of storage Tendu Nectar confirms the results of above worker due to the different chemical structure of Tendu as very less amount of ascorbic acid reduced form 0 day it was 14.33mg and after 90 days it was 8.67mg.

Table 2: Storage Ascorbic acid analysis of Tendu Nectar from (0 to 90 day) duration in different Treatments (2019-20) and (2021-22)

Notation	Treatment	2019-20	2021-22	Overall mean
(T ₀)	“(20% juice+20% TSS+0.3% acidity)”	10.67	9.81	10.24
(T ₁)	“(21% juice+20% TSS+0.3% acidity)”	10.71	10.91	10.81
(T ₂)	“(22% juice+20% TSS+0.3% acidity)”	10.43	10.48	10.45
(T ₃)	“(23% juice+20% TSS+0.3% acidity)”	10.76	10.90	10.83
“T ₄ ”	“(24% juice+20% TSS+0.3% acidity)”	10.43	10.33	10.38
“(T ₅)”	“(25% juice+20% TSS+0.3% acidity)”	10.76	10.52	10.64
“(T ₆)”	“(20% juice+19% TSS+0.3% acidity)”	10.43	10.67	10.55
“(T ₇)”	“(20% juice+18% TSS+0.3% acidity)”	10.91	10.91	10.91
“(T ₈)”	“(20% juice+17% TSS+0.3% acidity)”	10.57	10.19	10.38
“(T ₉)”	“(20% juice+16% TSS+0.3% acidity)”	10.81	10.05	10.43

**Fig 2:** Storage acidity analysis of Tendu Nectar from (0 to 90 day) duration in different Treatments (2019-20) and (2021-22)

3. Total Soluble Solids (TSS)

Data revealed on impact of various combinations of treatments on entire Total soluble solids of Tendu Juice Nectar beneath state change condition are depicted in Table 3. and illustrated in fig.3 It is clear from the information that total soluble solids content in Tendu fruit Nectar showed an decreasing trend with increasing age of storage in 2019-20 and 2021-22 two year chemical analysis (0 to 90 days). The total soluble solids content in fruit Juice of Tendu was found to be vital from 0 to 90 days of storage at the time of manufacture. When it was prepared there was a considerable variation in total soluble solids (0 days- to 90 days) of storage, the total soluble solids content of Tendu fruit Nectar was showed to be substantial it was observed that at the end of 90 days the total soluble solids value recorded highest (17.14%) in treatment T₄ (“24% Juice+20%TSS+0.3%”) and minimum value was recorded (14.36%) in treatment T₉ (“20% Juice+16%TSS+0.3% acidity”).

A similar results obtained by Nawal *et al.* (2018) that utilization of four Sudanese wild fruit to produce Nectars the highest TSS (10.50%), TS (10.61%) Doum wild fruits were

obtained when one unit of Doum fruit was soaked with four units of water for 2 or 3 hours in addition, there were significant differences and the highest levels of Kirkir extracts were 9.50% (TSS), 10.32% (TS) and 23.69% (TEM). Ahmad *et al.* (2016)^[2] similar trend in fruit nectar as a refreshing beverage in highest TSS fresh 16% and six months 16.50% TSS and “Choudhary *et al.* (2008)^[8] and Ahmad *et al.* (2009) conducted research on standardize the recipe for guava nectar and they reported that 20 per cent pulp. 0.3 per cent acidity and 17° Brix (TSS) recorded highest organoleptic score mark” unit five month of period. In present investigation of Tendu Nectar the TSS value was decreased as during manufacture it was 20% and after 90 days it was decreased 13% it is interesting to note that in some fruit TSS increases as per storage age but this may be due to the nutrient combination differ with fruit to fruit it may be because of acidity of ascorbic acid concentration may be the reason. As reported by Umesh *et.al* (2012) in his experiment the TSS content decreased with the increasing age of storage of Tendu wine it was decreased from 0.74 to 0.34 in 90 day time span confirms the finding of present study.

Table 3: Storage TSS analysis of Tendu Nectar from (0 to 90 day) duration in different Treatments (2019-20) and (2021-22)

Notation	Treatment	2019-20	2021-22	Overall mean
T ₀	(20% juice+ 20% TSS +0.3% acidity)	16.67	16.86	16.76
T ₁	(21% juice+ 20% TSS +0.3% acidity)	16.86	17.05	16.95
T ₂	(22% juice+ 20% TSS +0.3% acidity)	16.76	17.14	16.95
T ₃	(23% juice+ 20% TSS +0.3% acidity)	16.67	17.29	16.98
T ₄	(24% juice+ 20% TSS +0.3% acidity)	16.76	17.52	17.14
T ₅	(25% juice+ 20% TSS +0.3% acidity)	16.57	17.43	17.00
T ₆	(20% juice+ 19% TSS +0.3% acidity)	16.05	16.62	16.33
T ₇	(20% juice+ 18% TSS +0.3% acidity)	15.38	15.86	15.62
T ₈	(20% juice+ 17% TSS +0.3% acidity)	14.81	15.19	15.00
T ₉	(20% juice+ 16% TSS +0.3% acidity)	14.00	14.71	14.36

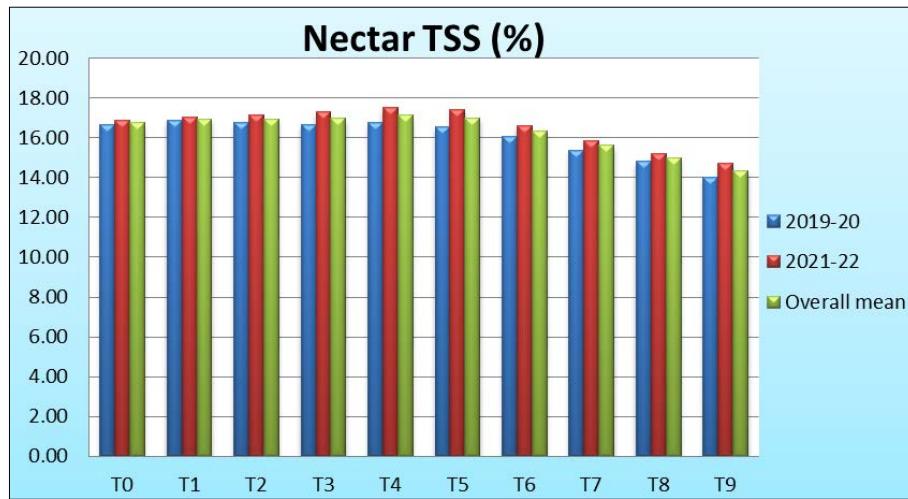


Fig 3: Storage TSS analysis of Tendu Nectar from (0 to 90 day) duration in different Treatments (2019-20) and (2021-22)

4. Total sugar (%)

Data pertaining to effect of different recipe treatments on the Total sugar value of Tendu fruit Nectar under freezing condition of storage are presented in Table 4 and illustrated in Fig 4."It is evident from the data that the total sugar value in Tendu fruit Nectar showed a Decreasing trend increasing with period of storage (0-90*days). However, a significant difference in the Total sugar value was observed up to 90 days of storage". Total sugar value recorded highest for (5.52%) in T₂ treatment (*22% Juice + 20% TSS + 0.3%*) and minimum value was recorded for (5.21%) in T₅ treatment (25% juice + 20% TSS + 0.3% acidity).

Choudhary *et al.* (2008)^[8] reported in Nectar of Guava (*Psidium guajava* L.) varieties and standardization of recipe

preparation." The total and reducing sugar content in Guava Nectar showed an increasing trend in all the varieties with increasing period of storage up to five months under ambient condition". "R-72 contained maximum total and reducing sugar following by apple colour, Allahabad Safeda and L-49 in fresh samples at the time of the preparation as well as at five months of storage". In present investigation of Tendu Nectar the total sugar % was found in decreasing trend in 0 Day it was 6.26% and in 90 days 4.72% the decreasing trend of total sugar in Nectar of Tendu with increasing storage period may be the phenolics available in fruit and chemical composition may be the reason for decreasing the total sugar confirms that this variation occurs with fruit to fruits composition.

Table 4: Storage Total sugar analysis of Tendu Nectar from (0 to 90 day) duration in different Treatments (2019-20) and (2021-22)

Notation	Treatment	2019-20	2021-22	Overall mean
T ₀	(20% juice+ 20% TSS +0.3% acidity)	5.39	5.60	5.49
T ₁	(21% juice+ 20% TSS +0.3% acidity)	5.34	5.21	5.27
T ₂	(22% juice+ 20% TSS +0.3% acidity)	5.42	5.62	5.52
T ₃	(23% juice+ 20% TSS +0.3% acidity)	5.27	5.51	5.39
T ₄	(24% juice+ 20% TSS +0.3% acidity)	5.30	5.15	5.23
T ₅	(25% juice+ 20% TSS +0.3% acidity)	5.32	5.09	5.21
T ₆	(20% juice+ 19% TSS +0.3% acidity)	5.56	5.25	5.41
T ₇	(20% juice+ 18% TSS +0.3% acidity)	5.50	5.48	5.49
T ₈	(20% juice+ 17% TSS +0.3% acidity)	5.48	5.42	5.45
T ₉	(20% juice+ 16% TSS +0.3% acidity)	5.68	5.06	5.37

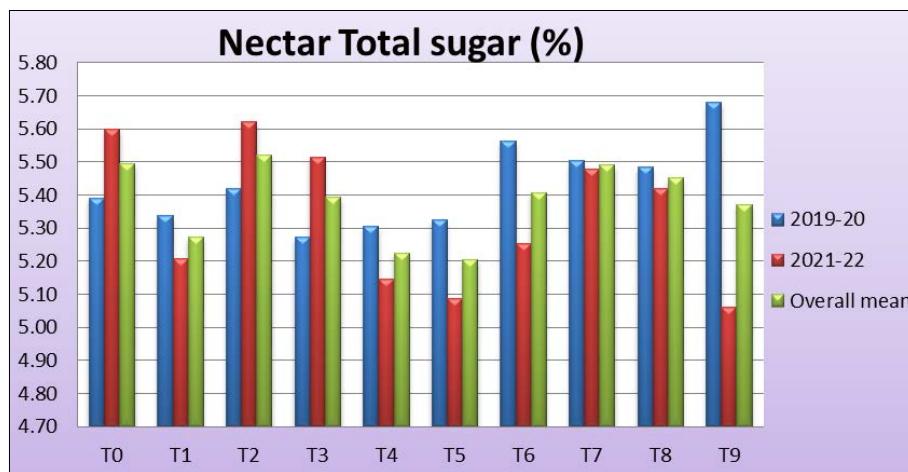


Fig 4: Storage Total sugar analysis of Tendu Nectar from (0 to 90 day) duration in different Treatments (2019-20) and (2021-22)

5 reducing sugar (%)”

Data pertaining to effect of different recipe treatments regarding reducing sugar of blended Tendu fruit Juice under freezing condition stored are depicted in “Table ‘5 and illustrated in Fig.”5. It is evident from the data that the different recipes influenced the reducing sugar” in Tendu fruit Nectar 2019-20 and 2021-22 the two year data compiled “showed a decreasing trend with increasing period of storage (0-90 days). The reducing sugar was” recorded “to be significant from (0 to 90 days) of storage. The value of Reducing sugar recorded” highest “with the treatment (3.10%) in T2 (22% Juice + 20% TSS + 0.3%) and minimum reducing sugar was recorded (2.93%) in T₆ treatment” (20% Juice+19%TSS+0.3%) acidity combination.

Choudhary *et al.* (2008)^[8] reported in case of Guava (*Psidium*

guajava L.) varieties evaluated and “standardization of recipe for Nectar preparation. The total and reducing sugar content in Guava nectar showed an increasing trend in all the varieties with increasing period of storage up to five months under ambient condition. “R-72 contained maximum total and reducing sugar following by apple colour, Allahabad Safeda” and L-49” in fresh samples at the time of the preparation as well as at five months of storage. In the “present investigation the Reducing sugar decreases with the increasing storage period” this may be the reason that the chemical composition of Tendu is differ with the Guava in Tendu fruit the phenolics are more in % and the effect showed the decreasing trend of Nectar as per storage period increased the reducing sugar decreases.

Table 5: Storage reducing sugar analysis of Tendu Nectar from (0 to 90 day) duration in different Treatments (2019-20) and (2021-22)

Notation	Treatment	2019-20	2021-22	Overall mean
“(T ₀)”	(20% juice+ 20%TSS +0.3% acidity)	2.76	3.42	3.09
“(T ₁)”	(21% juice+ 20%TSS +0.3% acidity)	2.75	3.33	3.04
“(T ₂)”	(22% juice+ 20%TSS+ 0.3% acidity)	2.76	3.43	3.10
“(T ₃)”	(23% juice+ 20%TSS+ 0.3% acidity)	2.90	3.28	3.09
“(T ₄)”	(24% juice+ 20%TSS+ 0.3% acidity)	2.79	3.31	3.05
“(T ₅)”	(25% juice+ 20%TSS+ 0.3% acidity)	2.73	3.27	3.00
“(T ₆)”	(20% juice+ 19%TSS+ 0.3% acidity)	2.74	3.12	2.93
“(T ₇)”	(20% juice+ 18%TSS+ 0.3% acidity)	2.76	3.30	3.03
“(T ₈)”	(20% juice+ 17%TSS+ 0.3% acidity)	2.76	3.32	3.04
“(T ₉)”	(20% juice+ 16%TSS+ 0.3% acidity)	2.83	3.30	3.06

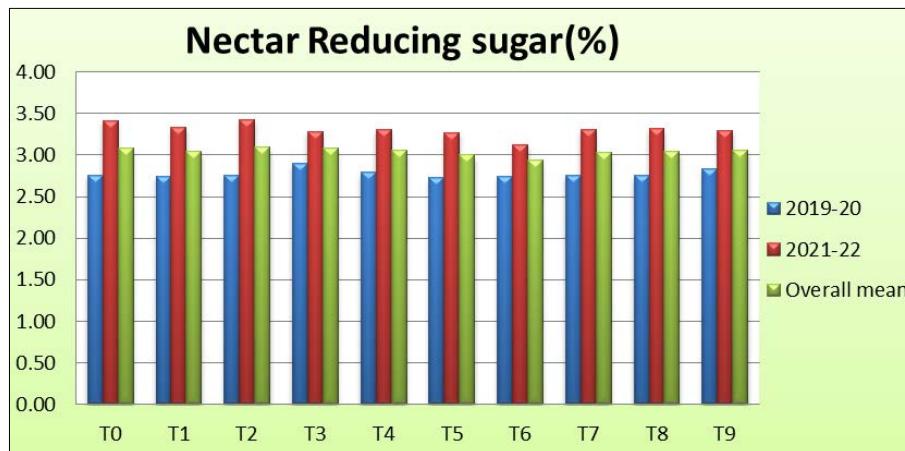


Fig 5: Storage reducing sugar analysis of Tendu Nectar from (0 to 90 day) duration in different Treatments (2019-20) and (2021-22)

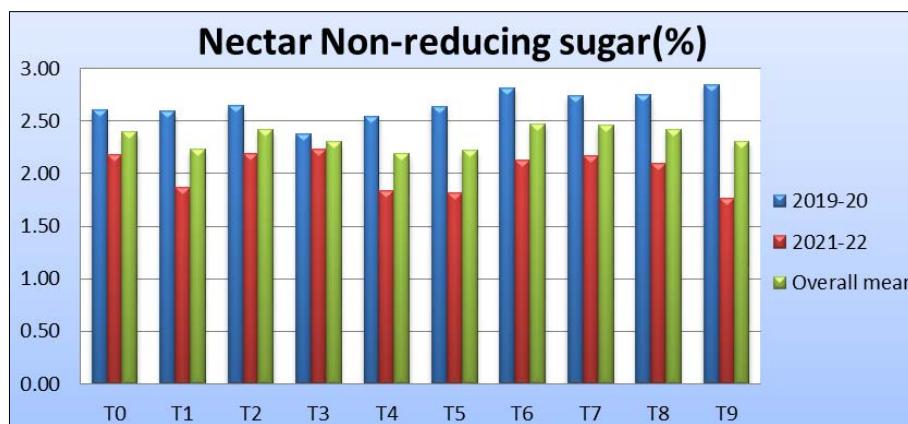
6. Non-Reducing Sugar (%)

“Data pertaining to effect of different treatments on Non-reducing sugar of blended Tendu fruit Nectar under freezing condition storage are presented in Table 6 and illustrated in Fig. 6 It is evident from the data that the non-reducing sugar in Tendu fruit Nectar showed a Decreasing trend with increasing period of storage (0-90 days). The non-reducing sugar was found to be significant from (0 to 90 days) of storage.” During 2019-20 and 2021-22 the Nectar prepared and observation recorded (0-90 days) the significant variation in non-reducing sugar was recorded Maximum (2.47%) with the treatment T₆ (20% Juice+19% TSS+*0.3% acidity). While,

minimum non*reducing sugar was observed (2.19%) with the treatment T₄ (24%juice+20%TSS+0.3%acidity). A similar reported by Bal *et al.* (2014)^[3] “evaluation of quality attributes during storage of guava nectar. Non reducing sugar in guava nectar showed the minimum changes in treatment P₄ B₂(6.07 to 4.77%) during storage. This gradually decreased during storage which might be due to significant increase in reducing sugar by acid hydrolysis” and thereby inversion of non-reducing sugar to reducing sugar. The similar results observed in the present investigation that it was recorded in decreasing trend due to acid hydrolysis it decreases with increasing storage period confirms the finding.

Table 6: Storage Period Non-reducing sugar analysis of Tendu Nectar from (0 to 90days) in Various Treatments (2019-20) and (2021-22)

Notation	Treatment	2019-20	2021-22	Overall mean
T ₀	(20% juice +20% TSS +0.3% acidity),*	2.61	2.18	2.39
T ₁	(21% juice +20% TSS +0.3% acidity)	2.59	1.87	2.23
T ₂	(22% juice +20% TSS +0.3% acidity)	2.64	2.19	2.42
T ₃	(23% juice +20% TSS +0.3% acidity)	2.38	2.23	2.30
T ₄	(24% juice +20% TSS +0.3% acidity)	2.55	1.83	2.19
T ₅	(25% juice +20% TSS +0.3% acidity)	2.64	1.81	2.23
T ₆	(20% juice +19% TSS +0.3% acidity)	2.82	2.13	2.47
T ₇	(20% juice +18% TSS +0.3% acidity)	2.74	2.17	2.46
T ₈	(20% juice +17% TSS +0.3% acidity)	2.75	2.10	2.42
T ₉	(20% juice +16% TSS +0.3% acidity)	2.85	1.76	2.31

**Fig 6:** Storage Non-reducing sugar analysis of Tendu Nectar from (0 to 90days) in various Treatments (2019-20) and (2021-22)

Conclusion

The Present study concluded that underutilized forest fruit like Tendu (*Diospyros melanoxylon*) which is not having commercial value because of there is no processed product is available so far in India and abroad. The Scientific collection post-harvest processing value addition and smart packaging of Tendu fruit product like organic juice will be manufactured and sold in the market as Tendu Juice will; uplift the livelihood of the rural poor and tribal community with the technology developed in this experiment. The recipe standardized for nectar can be exploited for commercial use after concrete recommendations of this experiment. The overall mature fruit juice contains to chemical analysis for Nectar in acidity, ascorbic acid," total sugar content, reducing sugar, non-reducing sugar and TSS were recorded" as 0.14%, 9.93 (mg/100g), 5.41%, 3.05%, 2.34%, 16.39% respectively. After brewing the beverage, the "ascorbic acid content in nectar decreases with the advancement of storage period up to acceptability (Ninety days). The maximum ascorbic acid was retained in the nectar at the zero day of preparation. The acidity in nectar increased at increasing period of storage up to 90 days under ambient condition. The TSS decreased in and nectar during period up to acceptability (90 days) and the reducing sugar content in the nectar and RTS also found was decreasing trend with the advancement of storage up to 90 days under ambient temperature. A progressive decrease in non-reducing sugar was noted throughout the storage period

up to acceptability and consumption of Juice (90 days). Overall chemical analysis and best Nectar recipe (20% Juice + 18% TSS + 0.3% acidity) combination is suitable for quality drink. Tendu fruit is found in abundance in the forest in Chhattisgarh, but the fruit cannot be stored for a long time because of its short life of storing the pulp, the farmer can immediately buy it at 10 rupees per kg sell it in the market. This processing technology can increase income, provide employment of poor small, marginal and tribal farmers and develop value added products to increase their income and create employment in rural areas.

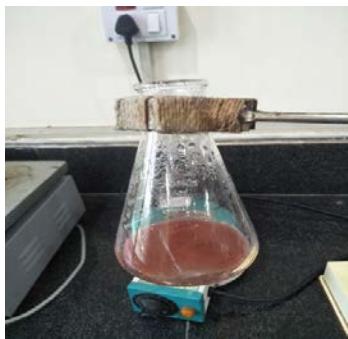
1. Chemical composition of fruits, Nectar (Acidity %)



2. Chemical composition of fruits, nectar and RTS (Ascorbic Acid mg/100 g)



3. Chemical composition of fruits, nectar and RTS (Total sugar %)



4. Chemical composition of fruits, nectar and RTS (Reducing sugar %)



5. Chemical composition of fruits, nectar and RTS (TSS %)



6. Chemical composition of fruits, nectar and RTS(Non reducing sugar %)



7. Preparation of Tendu fruit nectar and RTS beverages (Marking and Storage)



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