

## Original Research Article

### **Value addition and standardization of recipe on dragon fruit jelly (*Hylocerousundatus L.*)**

#### **Abstract**

The present investigation entitled “Value addition and standardization of recipe on dragon fruit jelly (*HylocerousundatusL.*)” was conducted at Post-Harvest Laboratory of Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during the year 2022. The experiment was laid down in Complete randomized design ( RBD) with 3 replications and 10 treatments viz. T<sub>0</sub>= (Control ) Dragon fruit extract 1000ml+sugar 550g, T<sub>1</sub>=Dragon fruit extract 1000ml + Mint 2.5g + sugar 550g T<sub>2</sub> =Dragon fruit extract 1000ml + Mint 5g + sugar 550g , T<sub>3</sub> =Dragon fruit extract 1000ml + Mint 7.5g + sugar 550g, T<sub>4</sub> =Dragon fruit extract 1000ml + Cardamom 2g + Sugar 550g, T<sub>5</sub>= Dragon fruit extract 1000ml + Cardamom 3g + Sugar 550g, T<sub>6</sub> = Dragon fruit extract 1000ml + Cardamom 4g + Sugar 550g, T<sub>7</sub> = Dragon fruit extract 1000ml + Ginger 2.5g + Sugar 550g, T<sub>8</sub> =Dragon fruit extract 1000ml + Ginger 5g + Sugar 550g and T<sub>9</sub> =Dragon fruit extract 1000ml + Ginger 7.5 g + Sugar 550g. Study results revealed that, there was significant statistical variation TSS( °Brix) , Reducing Sugar( %), Non Reducing Sugar( %), total Sugar( %), titrable acidity (%), pH, ascorbic acid( mg/100gm), and Benefit cost Ratio. Maximum TSS ( 67.01°Brix), pH ( 4.41), Reducing Sugar(36.16 %), Non reducing Sugar( 53.92%), Total sugar ( 72.08%) , Titratable acidity (0.62%), Ascorbic acid ( 2.44mg/100gm), Colour appearance ( 8.45) , Consistency ( 8.26), flavour and Taste ( 8.67) , Aroma ( 6.07) , overall acceptability ( 8.58) , transpiracy ( 8.34), self-life 89.65) and benefit cost ratio 2.33 was recorded in T<sub>6</sub> = Dragon fruit extract 1000ml + Cardamom 4g + Sugar 550g. Basis on this study Treatment T<sub>7</sub> can be suggested to farmers to obtain better quality and higher benefit in jelly production.

**Comment [JCFDR1]:** It is the T<sub>6</sub> treatment that should be suggested.

**Keywords:** *Ascorbic Acid, Dragon fruit extract, Jelly and Shelf life*

## Introduction

Pitayas or pitahayas belong to the genus *Hylocereus* (sweet pitaya). In Latin America, Pitaya (*Hylocereus* spp.) is primarily found in tropical and subtropical forest regions, particularly in North, Central, and South America (Crane and Balerdi 2005; Luders and McMahon, 2006). The fruit is known as dragon fruit in Asia due to its bracts (scales) that resemble dragons. Its large, fragrant, night-blooming flowers have prompted worldwide recognition of dragon fruit (*Hylocereus* spp.) as an ornamental plant. There are three different types of dragon fruit: *Selenicereus megalanthus*, which has white flesh and a yellow peel, *Hylocereus undatus*, which has white flesh and a red peel, and *Hylocereus polyrhizus*, which has red flesh and a red peel. The most widely farmed and consumed species of dragon fruit is *Hylocereus undatus*. Due to their highly appealing sensory qualities, this species' fruits are in high demand on the market. In its native country, it has been extensively consumed by the general population since the pre-Columbian era (Crane and Balerdi, 2005). Le-Belle et al. (2006) describe this fruit as a non-climacteric fruit with rosy-red skin studded with green scales and white flesh containing many small black seeds. A century ago, the French imported the tree from its original area to Vietnam, which was grown exclusively for the king as an ornamental crop. Dragon fruit is also known as a strawberry pear, a night-blooming cereus, a conderella plant, or the queen of the night. In the late 1990s, the dragon fruit was introduced in India. However, the area under dragon fruit is still quite tiny. It has been grown on a very minor scale in India. Particularly a small number of farmers in the states of Karnataka, Kerala, Tamil Nadu, Maharashtra, Gujarat, and Andhra Pradesh have started growing dragon fruit. Less than 100 acres are used for dragon fruit production overall (Tripathi et al., 2014).

Due to its low water and tillage requirements, farmers in Karnataka and Maharashtra are currently becoming much more knowledgeable about the cultivation of dragon fruit. As a result, the area under cultivation of dragon fruit will also rise in the next years. The major benefit of this crop is that, once planted, it will keep growing successfully for approximately 20 years and can sustain between 1000 and 2000 dragon fruit plants per hectare. It begins to produce fruit in the second year after planting and reaches its maximum yield in five year. Each plant yields 40 to 100 fruits annually, weighing between 300 and 800 g. According to Tripathi et al. (2014), one plant typically produces 15 to 25 kilogrammes of fruits. According to Tripathi et al. (2014), the edible portion of dragon fruit, which accounts for 64.5% of the fruit's weight, comprises moisture 82.5-83%, protein 0.16-0.23%, fat 0.21-0.61%, calcium

Comment [JCFDR2]: It does not exist in the references. Big mistake.

Comment [JCFDR3]: It does not exist in the references. Big mistake.

6.3-8.8 mg, phosphorus 30.2-36.1 mg, iron 0.5-0.61 mg, and vitamin C 8-9 mg. [36]. Additionally, it contains nutrients including glucose, polyphenol, thiamine, flavonoids, niacin, and pyridoxine (Vaillant and Imbert, 2006). According to Charoensiri et al. (2009), the dragon fruit has average amounts of beta-carotene, lycopene, and vitamin E of 1.4 mg/100 g, 3.4 mg/100 g, and 0.26 mg/100 g, respectively. According to Ariffin et al. (2009), Rui H et al. (2009), and Azis et al. (2009), 50% of the important fatty acids in dragon fruit seed are linoleic acid, which makes up 48%, and linolenic acid, which makes up 1.5%.

**Comment [JCFDR4]:** It does not exist in the references. Big mistake.

**Comment [JCFDR5]:** It does not exist in the references. Big mistake.

In India, native fruits are processed into a variety of products with added value, including jam, juice, jelly, cheese, and preserves. The jelly is a semi-solid product composed of a clear, strained solution of pectin with fruit extract, free of pulp, cooked with sugar and acid to produce a semi-solid product. Ideally, jelly should be transparent, well-set, but not stiff, and have the original flavor of the fruit. If it is removed from the mold, it should keep its shape and have an attractive color. Despite being firm enough to maintain a sharp edge, it should also be soft enough to quiver when squeezed. Crystallized sugar, gummy or sticky texture, or a syrupy consistency are not good. No dullness, little or no syneresis (weeping) and no rubbery or tough texture are desirable.

According to Kanjana et al. (2006), dragon fruit has 0.20-1.04% pectin, hence its jam and jelly typically calls for additional pectin (Islam et al., 2012 and Sharma et al., 2017). Jelly's organoleptic and physico-chemical qualities might vary depending on the amount of added pectin. The growth of the nation's burgeoning food businesses depends heavily on the creation of different products like jam, jelly, and squash using local ingredients. For this fruit, however, there is not a lot of product diversification or preservation practised in India. Due to the therapeutic and nutritional potential of dragon fruit, this study was designed with that in mind. By processing the fruit into jelly and other value-added products, dragon fruit might be used commercially.

**Comment [JCFDR6]:** It does not exist in the references. Big mistake.

**Comment [JCFDR7]:** It does not exist in the references. Big mistake.

## Materials and methods

The Experimental work of "Value addition and standardization of recipe on dragon fruit jelly (*Hylocereus undatus*)" was conducted in the Post-Harvest Laboratory of Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during the year 2022.

### Formulation of dragon fruit jelly

**Comment [JCFDR8]:** Other treatments are shown in table 1

The jelly prepared from dragon fruit with different treatments was coded as: Jelly T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub>, and T<sub>6</sub>. The formulation of different dragon fruit jelly was shown in Table 1.

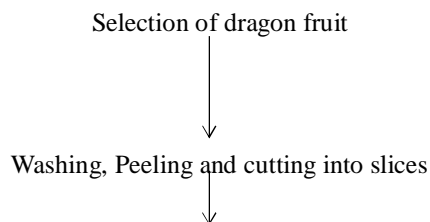
**Table 1 Treatments Details**

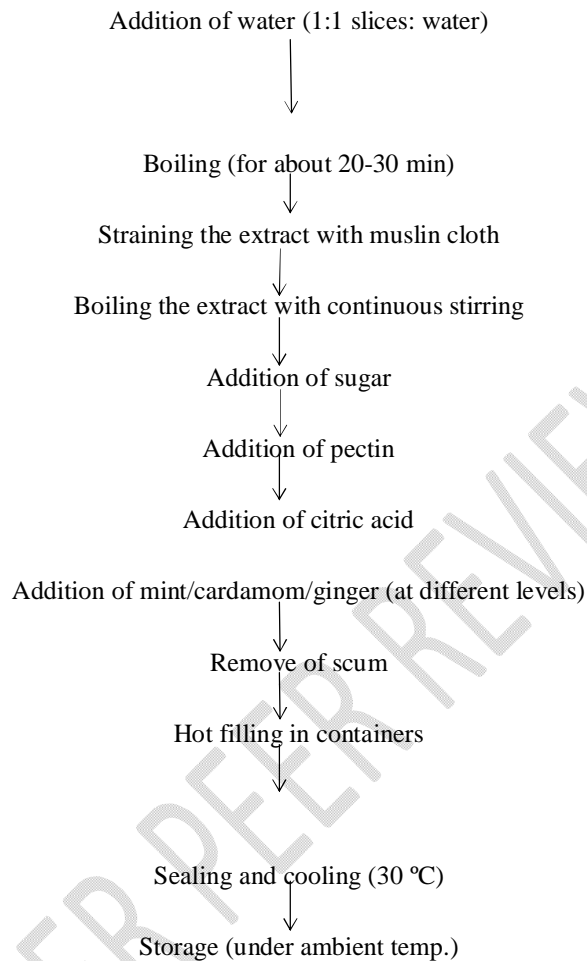
NOTATIONS	TREATMENT COMBINATION
T <sub>0</sub>	(Control) Dragon fruit extract 1000ml+sugar 550g
T <sub>1</sub>	Dragon fruit extract 1000ml + Mint 2.5g + sugar 550g
T <sub>2</sub>	Dragon fruit extract 1000ml + Mint 5g + sugar 550g
T <sub>3</sub>	Dragon fruit extract 1000ml + Mint 7.5g + sugar 550g
T <sub>4</sub>	Dragon fruit extract 1000ml + Cardamom 2g + Sugar 550g
T <sub>5</sub>	Dragon fruit extract 1000ml + Cardamom 3g + Sugar 550g
T <sub>6</sub>	Dragon fruit extract 1000ml + Cardamom 4g + Sugar 550g
T <sub>7</sub>	Dragon fruit extract 1000ml + Ginger 2.5g + Sugar 550g
T <sub>8</sub>	Dragon fruit extract 1000ml + Ginger 5g + Sugar 550g
T <sub>9</sub>	Dragon fruit extract 1000ml + Ginger 7.5g + Sugar 550g

**Fruit Selection:**

Matured and quality dragon fruits were purchased from fruit market mundera mandi of Prayagraj during the course of experiment 2022 and stored in the Post Harvest Laboratory of Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj at room temperature.

Chart 1 : The preparation of value-added dragon fruit jelly





#### **Methods used for the preparation of dragon fruit jelly**

The clear fruit extract was poured in a stainless steel pan and boiled, then required amount of pectin (High Methoxy pectin: DE > 50) was mixed with small amount sugar in a stainless steel pot. The remaining sugar was mixed with fruit extract and mixture was boiled until the TSS become nearer to 55 °Brix. Then sugar mixed pectin was added and continued the boiling until TSS becomes nearer to 58 °Brix. The citric acid was added and continued the boiling till the desired consistency and TSS reaches to 67° Brix. Then the KMS was added the scum raised on the top of the boiling mass was removed occasionally with the help of laddle during preparation of jelly.

## Determination of end point of jelly

When the mass become sufficiently thick in consistency, the end point was judged by sheet test. Sheet test: A small portion of jelly was taken out during boiling, in a spoon. It was then allowed to drop. If the product falls off in the form of a sheet or flakes instead of flowing in a continuous stream, was considered as the end-point of jelly.

## Storage

The jelly was poured and sealed into tight glass containers (250ml) and stored at ambient temperature for a period of 90days. The bottles were opened only at an interval of 30 days for the sensory as well as chemical analysis. At intervals of 0, 30, 60, and 90 days of storage, preserved dragon fruit jelly underwent chemical and organoleptic evaluation.

**Comment [JCFDR9]:** I did not visualize in Table 2 results that prove analyzes in the mentioned storage periods. This needs to be reviewed.

## Sensory evaluation of jelly

The Sensory evaluation of dragon fruit jelly samples were carried out according to the standard method of Amerine et al. (1965) on 9-point Hedonic scale, The mean score minimum 10 semi-trained judges for each quality parameter viz., colour and appearance, taste, flavour, consistency, transparency and overall acceptability was recorded.

## Chemical analysis of jelly

Total soluble solids of each fruit was determined with the help of hand refractometer of 0-32 scale while that of jelly was determined by hand refractometer of 32-80 scale(AOAC, 1990). The titratable acidity was determined by the procedure as reported by Ranganna (2001) The ascorbic acid content in the products was estimated by titrimetic method as summarized by Ranganna (2009)using 2,6-dichlorophenol indophenol dye and sugars by Lane and Eynon (1923) as reported by Ranganna (1986) method.

**Comment [JCFDR10]:** It does not exist in the references. Big mistake.

**Comment [JCFDR11]:** It does not exist in the references. Big mistake..

## STATISTICAL ANALYSIS

The data recorded during the course of investigation were subjected to statistical analysis using CRD (Complete Randomized Design) as per the method of "Analysis of variance" technique (Panse and Sukhatme, 1967). The significant Difference between the treatments means were tested at 5% level of significance.

**Comment [JCFDR12]:** What is the average test used? Where is the presentation of differences between treatments for the various analyses? By the table of results can only discuss using absolute values.

TREATMENTS	TSS (OBrix)	pH	Reducing sugars (%)	Nonreducing sugar (%)	Total sugars (%)	Titration acidity (%)	Ascorbic acid (mg/100g)	Colour and Appearance	Consistency	Flavour and taste	Aroma	Overall acceptability	transparency	Self life	Benefit cost ratio
T0 (Control)	64.62	4.03	31.75	34.12	65.64	0.45	2.3	5.50	6.08	6.05	3.95	6.45	6.24	76.56	2.01
T1 (mint 2.5g)	64.73	4.11	31.88	33.89	66.5	0.49	2.33	6.53	7.57	6.33	4.90	7.4	7.06	78.62	2.19
T2 (mint 5g)	64.79	4.18	32.79	34.62	66.91	0.47	2.07	6.32	7.43	6.53	5.20	7.7	7.36	79.26	2.18
T3 (mint 7.5g)	65.89	4.03	33.23	33.76	66.99	0.49	2.22	6.91	6.60	7.02	5.55	8.05	7.31	80.35	2.18
T4 (cardamom 2g)	66.83	4.32	34.11	35.67	69.78	0.59	2.36	6.71	7.91	8.46	5.84	8.34	7.92	85.16	2.17
T5 (cardamom 3g)	66.59	4.26	32.51	34.72	67.23	0.50	2.27	7.35	7.43	8.02	4.78	7.28	6.58	83.69	2.16
T6 (cardamom 4g)	67.01	4.41	36.16	35.92	72.08	0.62	2.44	8.45	8.26	8.67	6.08	8.58	8.34	89.65	2.33
T7 (ginger 2.5g)	65.91	4.13	32.57	35.53	68.1	0.56	2.34	7.14	6.97	6.77	5.49	7.99	7.72	87.46	2.19
T8 (ginger 5g)	66.21	4.36	32.77	35.67	68.44	0.59	1.79	7.07	7.20	7.03	4.80	7.3	7.51	86.59	2.18
T9 (ginger 7.5g)	66.23	4.41	33.02	35.37	68.39	0.57	1.71	7.36	6.45	7.56	4.05	6.55	7.07	88.91	2.17
F Test	S	S	S	S	S	S	S	S	S	S	S	S	S	S	
Sed.	0.291	0.228	0.382	1.415	0.952	0.028	0.401	0.829	0.076	0.012	0.410	0.489	0.118	2.753	
C.D.@5%	0.738	0.442	0.78	2.891	1.95	0.057	0.792	1.754	0.165	0.025	0.820	0.965	0.256	5.621	

Table2.Relation between various parameters and various treatments.

**Comment [JCFDR13]:** This table must be included after the item 'Results and Discussion', and mainly, it is necessary to include more details in the description of the table. Which parameters? You need to mention that they are physical-chemical and organoleptic parameters. It is also mandatory to state that the analyzes were carried out after 3 months of storage and under what conditions.

## Results and Discussion

### Physico-chemical parameters

The data showed maximum TSS content in dragon fruit jelly was recorded in T<sub>6</sub> with 67.01 °B followed by with 66.83 °B and the minimum was recorded in T<sub>0</sub> with 64.62 °B. A slight increase in total soluble solids during storage might be due to conversion of polysaccharides into sugars during hydrolysis process. This finding agreed with the finding of **Vikram and Prasad (2014)** compositional changes in value-added Kinnow Aonla RTS revealed that there was increase in the level of TSS during the storage period (six months) and (**Jain et al., 2007**) in aonla RTS beverage.

The maximum pH value in dragon fruit jelly was recorded in T<sub>6</sub> with 4.41 followed by T<sub>4</sub> with 4.32 and the minimum was recorded in T<sub>0</sub> (Control) with 4.03 pH value. Variations in pH during storage may be due to change in chemical properties which are affected by storage conditions. This finding agreed with the finding of **Rayguru et al., (2008)** & **Vikram and Prasad (2014)**, also reported similar trend in apple jam.

The maximum acidity % content in dragon fruit jelly was recorded in with 0.62 % followed by T<sub>4</sub> with 0.59 % and the minimum was recorded in T<sub>0</sub> with 0.45%. **Jaiswal et al., (2008)** reported that degradation of pectic substances into soluble solids might have contributed towards increase the level of acidity in the during storage period of aonla jam.

The maximum ascorbic acid (mg/100g) content in dragon fruit jelly was recorded in T<sub>6</sub> (Dragon fruit extract 1000ml + Cardamom 4g + Sugar 550g) with 2.44 mg/100g followed by T<sub>4</sub> (Dragon fruit extract 1000ml + Cardamom 2g + Sugar 550g) with 2.36 mg/100g and the minimum was recorded in T<sub>9</sub> with 1.71mg/100g.

The maximum reducing content in dragon fruit jelly was recorded in T<sub>6</sub> at 36.16 % followed by T<sub>4</sub> with 34.11 % and the minimum was recorded in T<sub>0</sub> (Control) with 31.75 %. The increase in reducing sugar was slightly higher in storage condition that could be attributed to more rapid hydrolysis of polysaccharides and their subsequent conversion into sugars. and **Deka et al., (2004)** reported similar finding with lime- aonla blended RTS.

The maximum non reducing sugar content in dragon fruit jelly was recorded in T<sub>6</sub> with 35.92 % followed by T<sub>4</sub> with 35.67 % and the minimum was recorded in T<sub>0</sub> (Control) with 34.12 %. The non-reducing sugar of guava jam show an increasing trend in all treatment

**Comment [JCFDR14]:** Discussion of the results should follow the sequence of characteristics that are presented in Table 2.

**Comment [JCFDR15]:** t is not necessary to highlight in bold for quotations

**Comment [JCFDR16]:** T<sub>7</sub> also has the same value.

**Comment [JCFDR17]:** T<sub>3</sub> with the same value

**Comment [JCFDR18]:** It does not exist in the references. Big mistake.

**Comment [JCFDR19]:** You should have put in the table the sequence you are discussing here

**Comment [JCFDR20]:** Same value has the T<sub>8</sub>

**Comment [JCFDR21]:** These results do not correlate with Cardamom composition in terms of higher acid content! Stay to research and discuss.

**Comment [JCFDR22]:** remove that point

**Comment [JCFDR23]:** T<sub>1</sub> and T<sub>3</sub> showed lower values.

**Comment [JCFDR24]:** Guava jam! If referencing, cite the source.

during storage and it may be due to increase in time interval and temperature, similar reading was recorded by in citrus juice.

**Comment [JCFDR25]:** It was not made with citrus in this work, in this sense, it is necessary to cite the reference.

The maximum total sugar content in dragon fruit jelly was recorded in T6 with 72.08 % followed by T4 with 69.78 % and the minimum was recorded in T0 with 65.64%. A slight increase in total sugar during storage might be due to conversion of polysaccharides (present in fruits) into sugars during hydrolysis process. This finding agreed with the finding of Vikram and Prasad (2014) compositional changes in value-added Kinnow-Aonla RTS revealed that there was increase in the level of TSS during the storage period (six months) and (Jain et al., 2007) in aonla RTS beverage.

#### **Organoleptic parameter:-**

The maximum colour and appearance value in dragon fruit jelly was recorded T6 (Dragon fruit extract 1000ml + Cardamom 4g + Sugar 550g) with 8.45% followed by T4 (Dragon fruit extract 1000ml + Cardamom 2g + Sugar 550g) with 6.71 and the minimum was recorded in T0 (Control) with 5.50. Deterioration of colour due to enzymatic and non-enzymatic reactions on pigment during storage of fruit products impair the quality of the products. It could be attributed to non enzymatic reactions, which occur between nitrogenous compounds and sugars or organic acid and organic acids with sugars. Similar results were reported by Syed et al. (2011) in sweet orange-based products.

**Comment [JCFDR26]:** With the exception of the 'Flavour and taste' parameter, the other determinations in this item must be compiled in a single paragraph, even if it is long, because the author exhaustively repeats the phrase 'It could be attributed to non enzymatic reactions, which occur between nitrogenous compounds and sugars or organic acid and organic acids with sugars. Similar results were reported by Syed et al. (2011) in sweet orange-based products'.

**Comment [JCFDR27]:** Wrong finding. There are five treatments that were superior to the above

The maximum flavor and taste value in dragon fruit jelly was recorded T6 with 8.67 followed by T4 with 8.46 and the minimum was recorded in T0 with 6.05. The decreasing trend was observed for flavour, taste and texture with increase storage period. This might be due to degradation of volatile substance and flavor constituents. Similar result was reported by Nayak et al., (2011) in aonla segments-in-syrup prepared from stored fruits. Jain et al. (2007) in aonla RTS beverage. It could be attributed to non enzymatic reactions, which occur between nitrogenous compounds and sugars or organic acid and organic acids with sugars. Similar results were reported by Syed et al. (2011) in sweet orange-based products.

**Comment [JCFDR28]:** t does not exist in the references. Big mistake.

The maximum consistency value in dragon fruit jelly was recorded T6 with 8.26 followed by T4 with 7.91 and the minimum was recorded in T0 (Control) with 6.08. Deterioration of consistency due to enzymatic and non-enzymatic reactions on pigment during storage of fruit products impair the quality of the products. It could be attributed to non enzymatic reactions, which occur between nitrogenous compounds and sugars or organic

**Comment [JCFDR29]:** Repeating the same sentence from the previous paragraph is not a good idea. I recommend rewriting or removing this repetition of the sentence.

acid and organic acids with sugars. Similar results were reported by **Syed et al. (2011)** in sweet orange based products.

The maximum transparency value in dragon fruit jelly was recorded T6 with 8.34 followed by T4 with 7.92 and the minimum was recorded in T0 with 6.24. Deterioration of transparency due to enzymatic and non-enzymatic reactions on pigment during storage of fruit products impair the quality of the products. It could be attributed to non enzymatic reactions, which occur between nitrogenous compounds and sugars or organic acid and organic acids with sugars. Similar results were reported by **Syed et al. (2011)** in sweet orange based products

The maximum aroma value in dragon fruit jelly was recorded T6 with 6.08 followed by T4 with 5.84 and the minimum was recorded in T0 (Control) with 3.95. Deterioration of aroma due to enzymatic and non-enzymatic reactions on pigment during storage of fruit products impair the quality of the products. It could be attributed to non enzymatic reactions, which occur between nitrogenous compounds and sugars or organic acid and organic acids with sugars. Similar results were reported by **Syed et al. (2011)** in sweet orange based products.

The maximum overall acceptability value in dragon fruit jelly was recorded T6 with 8.58 followed by T4 with 8.34 and the minimum was recorded in T0 with 6.45. The maximum number of days for shelf life of the product among the treatment used was found to be T6 with (89.65) days have highest shelf life mean value followed by T9 with (88.91 days) which were significantly superior than T0 with (76.56) days. Deterioration of enzymatic and non-enzymatic reactions on pigment during storage of fruit products impair the quality of the products. It could be attributed to non enzymatic reactions, which occur between nitrogenous compounds and sugars or organic acid and organic acids with sugars. Similar results were reported by **Syed et al. (2011)** in sweet orange based products.

## Conclusion

It can be concluded from the present findings that the better quality of dragon fruit jelly can be prepared by using Dragon fruit extract 1000ml + Cardamom 4g + Sugar 550g with better organoleptic properties as well as chemical composition and good storage stability at both storage (ambient and refrigerated) conditions up to 3 months storage period.

**Comment [JCFDR30]:** Where were these two storage conditions mentioned! As far as I know, only in natural environment conditions.

## References

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**Comment [JCFDR31]:** Many references that are found in the text are missing, constituting a serious error and leaving some of the item 'References'

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**Vikram, B. and Prasad, V.M. (2014).** Studies on Value Added Kinnow - Aonla Blended Ready to Serve Beverage. *J. Food Process Technol.*, 5 (1): 288-292.

Comment [JCFDR32]: Está fora de ordem