Original Research Article

Value addition and standardization of recipe on dragon fruit jelly (*Hylocerous undatusnm* L.)

Abstract

The present investigation entitled "Value addition and standardization of recipe on dragon fruit jelly (*Hylocerous undatus* L.)" 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_0 = (**Control)** Dragon fruit extract 1000ml+sugar 550g, $\mathbf{T_1}$ =Dragon fruit extract 1000ml + Mint 2.5g + sugar 550g $\mathbf{T_2}$ =Dragon fruit extract 1000ml + Mint 5g + sugar 550g , $\mathbf{T_3}$ =Dragon fruit extract 1000ml + Mint 7.5g + sugar 550g, $\mathbf{T_4}$ =Dragon fruit extract 1000ml + Cardamom 2g + Sugar 550g, $\mathbf{T_5}$= Dragon fruit extract 1000ml + Cardamom 3g + Sugar 550g, $\mathbf{T_6}$ = Dragon fruit extract 1000ml + Cardamom 4g + Sugar 550g, $\mathbf{T_7}$ = Dragon fruit extract 1000ml + Ginger 2.5g + Sugar 550g, $\mathbf{T_8}$ =Dragon fruit extract 1000ml + Ginger 5g + Sugar 550g and $\mathbf{T_9}$ =Dragon fruit extract 1000ml + Ginger 7.5 g + Sugar 550g. Study results revealed that, there was significant statistical variation TSS(ºBrix) , Reducing Sugar(%), Non Reducing Sugar(%), total Sugar(%) , titrable acidity (%), pH , ascorbic acid(mg/100gm), and Benefit cost Ratio. Maximum TSS (67.01 ºBrix), 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 $\mathbf{T_6}$ = Dragon fruit extract 1000ml + Cardamom 4g + Sugar 550g. Basis on this study Treatment T_6 can be suggested to farmers to obtain better quality and higher benefit in jelly production.

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;). 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 megalathus, which has white flesh and a yellow peel, Hylocereus undatus, whidersch 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). “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 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 .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), and 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%.

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). 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.

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.

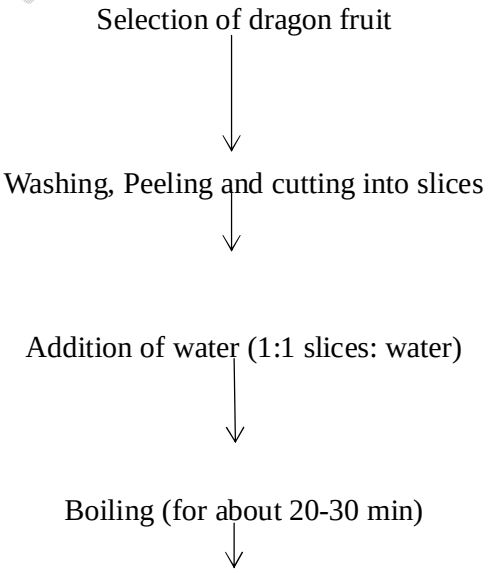
Table 1 Treatments Details

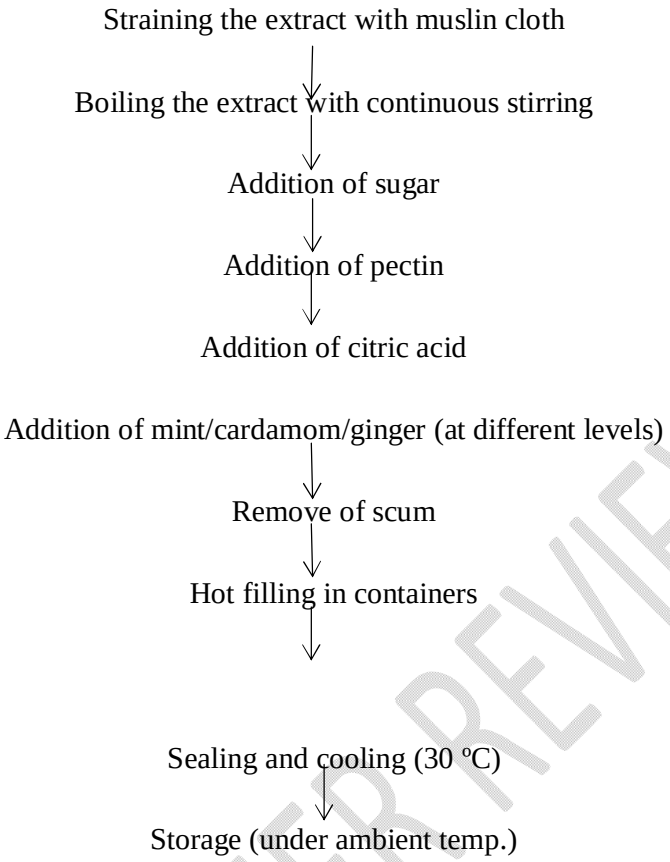
NOTATIONS	TREATMENT COMBINATION
T_0	(**Control)** Dragon fruit extract 1000ml+sugar 550g
T_1	Dragon fruit extract 1000ml + Mint 2.5g + sugar 550g
T_2	Dragon fruit extract 1000ml + Mint 5g + sugar 550g
T_3	Dragon fruit extract 1000ml + Mint 7.5g + sugar 550g
T_4	Dragon fruit extract 1000ml + Cardamom 2g + Sugar 550g
T_5	Dragon fruit extract 1000ml + Cardamom 3g + Sugar 550g
T_6	Dragon fruit extract 1000ml + Cardamom 4g + Sugar 550g
T_7	Dragon fruit extract 1000ml + Ginger 2.5g + Sugar 550g
T_8	Dragon fruit extract 1000ml + Ginger 5g + Sugar 550g
T_9	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" [Panchal et al. 2018].

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" [Panchal et al. 2018].

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.

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 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 method.

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 F- tested at 5% level of significance.

Results and Discussion

Physico-chemical parameters

The data showed maximum TSS content in dragon fruit jelly was recorded in T6with 67.01 ^{0}B followed by with 66.83 ^{0}B and the minimum was recorded in T0 with 64.62 ^{0}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, (Table 1.).

The maximum pH value in dragon fruit jelly was recorded in T_6 with 4.41 followed by T_4 with 4.32 and the minimum was recorded in T_0 (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, (Table 1.).

The maximum acidity % content in dragon fruit jelly was recorded in with 0.62 % followed by T4 with 0.59 % and the minimum was recorded in T0 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 , (Table 1.).

The maximum ascorbic acid (mg/100g) content in dragon fruit jelly was recorded in T6 (Dragon fruit extract 1000ml + Cardamom 4g + Sugar 550g) with 2.44 mg/100g followed by T4 (Dragon fruit extract 1000ml + Cardamom 2g + Sugar 550g) with 2.36 mg/100g and the minimum was recorded in T9 with 1.71mg/100g.

The maximum reducing content in dragon fruit jelly was recorded in T6 at 36.16 % followed by T4 with 34.11 % and the minimum was recorded in T0 (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 T6 with 35.92 % followed by T4 with 35.67 % and the minimum was recorded in T0 (Control) with 34.12 %.

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 T5(Dragon fruit extract 1000ml + Cardamom 2g + Sugar 550g) with 6.71 and the minimum was recorded in T0 (Control) with 5.50. Fruit products' quality is compromised when the color of the products deteriorates as a result of enzymatic and non-enzymatic interactions on pigment during storage. It could be attributed to non enzymatic reactions, which occur between nitrogenous compounds and sugars or organic acid and organic acids with sugars. Syed et al. (2011) showed similar outcomes for products based on sweet orange. 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. With longer storage times, a diminishing tendency for flavor, taste, and texture was seen. Degradation of flavor and volatile chemical components may be to blame for this. It can be attributed to non-enzymatic interactions between organic acids and sugars or between organic acids and nitrogenous substances. Syed et al. (2011) in products based on sweet orange reported similar outcomes.

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 acid and organic acids with sugars. Syed et al. (2011) showed similar results 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” [**Syed et al. (2011)]** 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”. [**Syed et al. (2011)]**

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”. [**Syed et al. (2011**)] .

Table2 :Relation between various parameters and various treatments.

TREATMENTS	TSS (0Brix)	pH	Reducing sugars (%)	Nonreducing sugar (%)	Total sugars (%)	Titrable 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	

Conclusion

The current findings lead to the conclusion 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 and refrigerated conditions up to 3 months storage period.

Ethical Approval

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

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