Standardisation of Recipes for Preparation of Value-Added Products From Dragon Fruit (*Hylocereus undatus*)

Abstract

Dragon fruit is perishable in nature and is available only in season. Value added product from dragon fruit will be available throughout the year Product recipe needed to be developed for maintaining quality and acceptability to the consumers. The present experiment was carried out during 2022 in Post Harvest Laboratory of Department of Horticulture, SHUATS, Prayagraj. The experiment was conducted in Completely Randomized Design with 9 treatment replicated thrice. The treatments were **T_0 (**Control**),T_1 (**Strawberry Juice (20% of Total Fruit Juice content)**),T_2 (**Strawberry Juice (30% Of Total Fruit Juice content)**),T_3(**Strawberry Juice (50% of Total Fruit Juice content)**),T_4 (**Aloe Vera Gel (5% of Total Fruit Juice content)**),T_5 (**Aloe Vera Gel (10% of Total Fruit Juice content)**),T_6 (**Aloe Vera Gel (15% of Total Fruit Juice content)**),T_7 (**Kiwi Juice (20% of Total Fruit Juice)**),T_8 (**Kiwi Juice (30% of Total Fruit Juice)**),T_9 (**Kiwi Juice (50% of Total Fruit Juice)**).** On the basis of our experimental finding it was found that the treatment **T_3 : Strawberry Juice (50% of Total Fruit Juice content)** was found best in the terms of taste, shelf life , TSS, Ascorbic acid, Acidity and organoleptic parameters.

Keywords: RTS, Dragon fruit, Quality parameters, Organoleptic parameters and Benefit cost ratio.

Introduction

"Dragon fruit is a perennial, epiphytic tropical climbing cactus with a triangular fleshy jointed stems which belongs to family Cactaceae and of genus Hylocerous" (Cheah *et al.,* 2016; Tripathi *et al.,* 2014 and Gunasen *et. al.*, 2006). "There are three species of dragon fruit which include *Selenicereus megalathus* (white flesh with yellow peel dragon fruit), *Hylocereus undatus* (white-flesh with red peel dragon fruit) and *Hylocereus polyrhizus* (redflesh with red peel dragon fruit). *Hylocereus undatus* is the most cultivated and consumed species of dragon fruit. The fruits of this species present market demand, due to its very attractive sensory characteristics" (De Mello, 2014

"Kiwi fruit is introduced into the world in 20th century. In recent years, its production and consumption has increased" (Izali*et al.,* 2007). "The kiwifruit is unique because of its high nutritional content, different flavors, vitamins, minerals, antioxidants, phytochemicals and fiber content. In terms of nutrient content, the kiwifruit is amongst the richest fruits: it is also very valuable in terms of health. The fruit is also canned, dried, frozen, and used for the preparation of nectars" (Göksel and Atak 2016).

"Strawberry is an important fruit crop which belongs to family Rosaceae. It is characterized by fruity, sweet and tart flavor and is widely appreciated for its characteristic aroma, bright red fruit color and juicy texture" (Mehriz*et al*., 2013). "It is monoecious, short day, non climatric, aggregate, temperate type fruit. The edible portion of strawberry is succulent thalamus of the flower which include receptacle with numerous achenes" (Salaria and Salaria, 2009). The fruit can be used by developing techniques for the preparation of different value added products either in the form of whole fruit or pulp during peak harvesting season.

Aloe vera is perennial, drought resistant succulent plant commonly known as 'Ghrit-kumari' and 'Gheegwar'. It belongs to the Asphodelaceae or Liliaceae family, which historically has been used for a variety of medicinal purpose (Ramachandra and Rao, 2008).

Importance of the Product :Ready to Serve" drinks are of utmost importance as they provide convenience and efficiency in our fast-paced lives. These pre-packaged beverages eliminate the need for preparation or mixing, making them ideal for on-the-go consumption. They cater to busy individuals, ensuring instant refreshment without compromising quality or taste. Ready to Serve drinks offer a convenient solution for hydration, enjoyment, and quick energy replenishment in various settings

Materials and Methods

The area of Prayagraj district comes under subtropical belt in the south east of Utter Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46^{o}C-48^{o}C and seldom falls as low as 4^{o}C- 5^{o}C. The relative humidity ranges between 20 to 94 %. The average rainfall in this area is around 1013.4 mm annually. However, occasional precipitation is also not uncommon during winter months.

The experiment was conducted in Completely Randomized Design with 9 treatment replicated thrice with an objective to find out the quality and economics of the RTS. The treatments were **T_0 (**Control**),T_1 (**Strawberry Juice (20% Of Total

Fruit Juice content)),**T_2 (**Strawberry Juice (30% Of Total Fruit Juice content)),**T_3(**Strawberry Juice (50% Of Total Fruit Juice content)),**T_4 (**Aloe Vera Gel (5% Of Total Fruit Juice content)),**T_5 (**Aloe Vera Gel (10% Of Total Fruit Juice content)),**T_6 (**Aloe Vera Gel (15% Of Total Fruit Juice content)),**T_7 (**Kiwi Juice (20% Of Total Fruit Juice)),**T_8 (**Kiwi Juice (30% Of Total Fruit Juice)),**T_9 (**Kiwi Juice (50% Of Total Fruit Juice)).

Results and Discussion

The maximum Total soluble solid content in dragon fruit RTS was recorded in T_3 (Strawberry Juice (50% Of Total Fruit Juice content)) with 13.21 ^{0}B followed by T_9 (Kiwi Juice (50% Of Total Fruit Juice)) with 12.97 ^{0}B and the minimum was recorded in T_0 (Control) with 611.90 ^{0}B. "A slight increase in total soluble solids during storage might be due to conversion of polysaccharides (present in fruits) into sugars during hydrolysis process". **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 in aonla RTS beverage". (Jain et al., 2007)

The maximum acidity % content in dragon fruit RTS was recorded in T_3 (Strawberry Juice (50% Of Total Fruit Juice content)) with 0.51 % followed by T_9 (Kiwi Juice (50% Of Total Fruit Juice)) with 0.49 % and the minimum was recorded in T_0 (Control) with 0.49 %. "A slight increase in acidity during storage might be due to conversion of polysaccharides (present in fruits) into sugars during hydrolysis process". [14] 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 Ascorbic acid (mg/100g) content in dragon fruit RTS was recorded in T3 (Strawberry Juice (50% Of Total Fruit Juice content)) with 9.08 Ascorbic acid (mg/100g) followed by T9 (Kiwi Juice (50% Of Total Fruit Juice)) with 8.81 Ascorbic acid (mg/100g) and the minimum was recorded in T_0 (Control) with 5.12 Ascorbic acid (mg/100g). A slight increase in Ascorbic acid (mg/100g) 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 ascorbic acid (mg/100g) during the storage period (six months) and **(Jain *et al.,* 2007)** in aonla RTS beverage.

The maximum Total sugar (%) content in dragon fruit RTS was recorded in T_3 (Strawberry Juice (50% Of Total Fruit Juice content)) with 13.21 Total sugar (%) followed by T_9 (Kiwi Juice (50% Of Total Fruit Juice)) with 12.97 Total sugar (%) and the minimum was recorded in T_0 (Control) with 611.90 Total sugar (%). A slight increase in Total sugar (mg/100g) 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 total sugar (mg/100g) during the storage period (six months) and **(Jain *et al.,* 2007)** in aonla RTS beverage.

The maximum Reducing sugar (%) content in dragon fruit RTS was recorded in T_3 (Strawberry Juice (50% Of Total Fruit Juice content)) with 6.17 Reducing sugar (%) followed by T_9 (Kiwi Juice (50% Of Total Fruit Juice)) with 5.94 Reducing sugar (%) and the minimum was recorded in T_0 (Control) with 4.71 Reducing sugar (%). A slight increase in Reducing sugar (mg/100g) 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 Reducing sugar (mg/100g) during the storage period (six months) and **(Jain *et al.*, 2007)** in aonla RTS beverage.

The maximum Non reducing sugar (%) content in dragon fruit RTS was recorded in T_3 (Strawberry Juice (50% Of Total Fruit Juice content)) with 7.74 Non reducing sugar (%) followed by T_9 (Kiwi Juice (50% Of Total Fruit Juice)) with 7.51 Non reducing sugar (%) and the minimum was recorded in T_0 (Control) with 6.28 Non reducing sugar (%). A slight increase in Non reducing 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 Non reducing sugar (%) during the storage period (six months) and **(Jain *et al.*, 2007)** in aonla RTS beverage.

The maximum score of texture content in dragon fruit RTS was recorded in T_3 (Strawberry Juice (50% Of Total Fruit Juice content)) with 7.90 followed by T_9 (Kiwi Juice (50% Of Total Fruit Juice)) with 8.65 and the minimum score was recorded in T_0 (Control) with 6.74. Deterioration of texture and browning reactions caused by redox reactions catalyzed by polyphenol-oxidases 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 nonenzymatic 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 score of color content in dragon fruit RTS was recorded in T_3 (Strawberry Juice (50% Of Total Fruit Juice content)) with 8.50 followed by T_9 (Kiwi Juice (50% Of Total Fruit Juice)) with 8.17and the minimum score was recorded in T_0 (Control) with 6.43. Deterioration of color 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 score of Flavour content in dragon fruit RTS was recorded in T_3 (Strawberry Juice (50% Of Total Fruit Juice content)) with 8.20 followed by T_9 (Kiwi Juice (50% Of Total Fruit Juice)) with 7.70and the minimum score was recorded in T_0 (Control) with 6.00. Deterioration of Flavour 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 score of Aroma content in dragon fruit RTS was recorded in T_3 (Strawberry Juice (50% Of Total Fruit Juice content)) with 8.45 followed by T_9 (Kiwi Juice (50% Of Total Fruit Juice)) with 8.40and the minimum score was recorded in T_0 (Control) with 6.34. 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 nonenzymatic 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 score of Taste content in dragon fruit RTS was recorded in T_3 (Strawberry Juice (50% Of Total Fruit Juice content)) with 7.90 followed by T_9 (Kiwi Juice (50% Of Total Fruit Juice)) with 8.65and the minimum score was recorded in T_0 (Control) with 6.74. Deterioration of Taste 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 score of Overall acceptability content in dragon fruit RTS was recorded in T_3 (Strawberry Juice (50% Of Total Fruit Juice content)) with 8.28 followed by T_9 (Kiwi Juice (50% Of Total Fruit Juice)) with 7.93and the minimum score was recorded in T_0 (Control) with 6.09. Deterioration of Overall acceptability 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.

It is evident that the days to storage on Shelf life was influenced by different treatments at all successive stage of storage. There was significant differences between the treatments, among the treatment used T_3 (Strawberry Juice (50% Of Total Fruit Juice content)) with (46.66) have highest number of days in shelf life followed by T_9 (Kiwi Juice (50% Of Total Fruit Juice)) with (42.00) which were significantly superior then T_0 (Control) with (36.00) days.

It is evident that the cost benefit ratio was influenced by different treatments at all successive stage of storage. There was significant differences between the treatments, among the treatment used T_3 (Strawberry Juice (50% Of Total Fruit Juice content)) with (2.46) have highest cost benefit ratio followed by T_9 (Kiwi Juice (50% Of Total Fruit Juice)) with (2.29) which were significantly superior then T_0 (Control) with (1.76).

Conclusion

The study concluded that treatment T_3 : Strawberry Juice (50% Of Total Fruit Juice content) is best in all lab tests except the texture in which T_9 : Kiwi Juice (50% Of Total Fruit Juice content) is best. when compared with other treatments at the interval of

Initial days ,15 days, 30 days and 45 days at room temperature.

Table 1 Effect of different recipe on TSS, Acidity %, Ascorbic acid (mg/100g), Total Sugar % of dragon fruit RTS.

Symbol	TSS				Acidity %				Ascorbic acid				Total Sugar %			
	Initial	15 Days	30 DAYS	45 DAYS	Initial	15 DAYS	30 DAYS	45 DAYS	Initial	15 DAYS	30 DAYS	45 DAYS	Initial	15 DAYS	30 DAYS	45 DAYS
T_0	11.42	11.60	11.75	11.90	0.19	0.21	0.24	0.28	8.49	6.74	5.29	5.12	11.42	11.60	11.75	11.90
T_1	11.94	12.08	12.19	12.35	0.28	0.30	0.37	0.44	10.74	9.30	8.04	7.87	11.94	12.08	12.19	12.35
T_2	12.19	12.41	12.53	12.67	0.29	0.31	0.39	0.47	11.04	9.66	8.41	8.24	12.19	12.41	12.53	12.67
T_3	12.70	12.93	13.07	13.21	0.34	0.36	0.42	0.51	11.78	10.46	9.25	9.08	12.70	12.93	13.07	13.21
T_4	11.50	11.65	11.78	11.91	0.21	0.22	0.26	0.32	8.73	6.98	5.60	5.43	11.50	11.65	11.78	11.91
T_5	11.54	11.67	11.82	11.96	0.22	0.24	0.27	0.36	9.12	7.47	6.10	5.93	11.54	11.67	11.82	11.96
T_6	11.66	11.81	11.95	12.10	0.24	0.26	0.29	0.39	9.26	7.64	6.31	6.14	11.66	11.81	11.95	12.10
T_7	11.65	11.79	11.93	12.06	0.26	0.27	0.32	0.40	10.04	8.49	7.21	7.04	11.65	11.79	11.93	12.06
T_8	11.90	12.03	12.16	12.31	0.27	0.29	0.34	0.42	10.17	8.69	7.42	7.25	11.90	12.03	12.16	12.31
T_9	12.50	12.71	12.84	12.97	0.30	0.32	0.40	0.49	11.55	10.20	8.98	8.81	12.50	12.71	12.84	12.97
F-Test	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
S. Ed.	0.303	0.330	0.337	0.348	0.003	0.018	0.008	0.020	0.276	0.256	0.248	0.300	0.303	0.330	0.337	0.348
$C.D._{5\%}$	0.643	0.700	0.714	0.738	0.006	0.037	0.016	0.042	0.584	0.543	0.525	0.636	0.643	0.700	0.714	0.738
CV	16.62	18.082	19.072	19.072	0.161	0.968	1.075	1.075	15.101	14.030	16.434	16.434	16.621	18.082	19.072	19.072

Table 2 Effect of different recipe on Reducing sugar %, Non reducing sugar % and score of Texture, color and shelf life of dragon fruit RTS.

Symbol	Reducing sugar				Non reducing sugar				Texture				Color				Shelf life
	Initial	15 DAYS	30 DAYS	45 DAYS	Initial	15 DAYS	30 DAYS	45 DAYS	Initial	15 DAYS	30 DAYS	45 DAYS	Initial	15 DAYS	30 DAYS	45 DAYS	
T_0	4.23	4.39	4.55	4.71	5.80	5.96	6.12	6.28	7.00	6.94	6.84	6.74	6.17	6.27	6.37	6.43	36.00
T_1	5.10	5.28	5.46	5.63	6.67	6.85	7.03	7.20	7.34	7.30	7.14	6.99	6.42	6.57	6.73	6.77	39.30
T_2	5.20	5.39	5.58	5.80	6.77	6.96	7.15	7.37	8.00	7.90	7.70	7.40	6.83	7.13	7.33	7.43	40.83
T_3	5.43	5.69	5.95	6.17	7.00	7.26	7.52	7.74	8.74	8.50	8.14	7.90	8.08	8.27	8.33	8.50	46.66
T_4	4.49	4.66	4.83	4.99	6.06	6.23	6.40	6.56	7.17	7.10	7.00	6.90	6.33	6.43	6.53	6.60	41.33
T_5	4.57	4.75	4.93	5.10	6.14	6.32	6.50	6.67	7.74	7.64	7.44	7.24	6.67	6.87	7.07	7.17	41.67
T_6	4.83	4.96	5.09	5.26	6.40	6.53	6.66	6.83	8.37	8.30	8.04	7.74	7.17	7.47	7.73	7.80	42.63
T_7	4.93	5.07	5.21	5.38	6.50	6.64	6.78	6.95	7.57	7.44	7.27	7.07	6.50	6.70	6.87	7.00	41.36
T_8	5.00	5.13	5.26	5.43	6.57	6.70	6.83	7.00	8.17	8.10	7.94	7.57	7.00	7.37	7.53	7.60	41.61
T_9	5.28	5.50	5.72	5.94	6.85	7.07	7.29	7.51	8.07	8.90	8.84	8.65	7.33	7.57	7.93	8.17	42.00
F-Test	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
S. Ed.	0.272	0.344	0.384	0.372	0.346	0.328	0.360	0.401	0.406	0.417	0.375	0.335	0.328	0.329	0.423	0.464	0.698
$C.D._{5\%}$	0.577	0.730	0.813	0.789	0.734	0.695	0.764	0.849	0.861	0.883	0.794	0.710	0.696	0.698	0.896	0.984	1.479
CV	14.91	18.855	20.394	20.394	18.972	17.947	21.947	21.947	22.240	22.814	18.356	18.356	17.973	18.025	25.434	25.434	38.214

Table 3 Effect of different recipe on score of flavor, aroma, taste and overall acceptability and benefit cost (B:C) ratio of dragon fruit RTS.

Symbol	Flavor				Aroma				Taste				Overall acceptability				B:C ratio
	Initial	15 DAYS	30 DAYS	45 DAYS	Initial	15 DAYS	30 DAYS	45 DAYS	Initial	15 DAYS	30 DAYS	45 DAYS	Initial	15 DAYS	30 DAYS	45 DAYS	
T_0	5.50	5.70	5.90	6.00	5.75	5.87	6.00	6.34	7.00	6.94	6.84	6.74	5.63	5.77	5.91	6.09	1.76
T_1	6.10	6.20	6.40	6.60	6.27	6.48	6.72	6.98	7.34	7.30	7.14	6.99	6.10	6.25	6.49	6.67	2.02
T_2	6.70	7.00	7.10	7.20	7.08	7.30	7.53	7.82	8.00	7.90	7.70	7.40	6.73	7.01	7.21	7.37	2.20
T_3	7.60	7.80	8.00	8.20	7.80	8.02	8.15	8.45	8.74	8.50	8.14	7.90	7.74	7.91	8.09	8.28	2.46
T_4	5.70	5.90	6.10	6.20	6.02	6.13	6.38	6.66	7.17	7.10	7.00	6.90	5.85	6.01	6.17	6.32	1.85
T_5	6.50	6.60	6.90	7.00	6.93	7.15	7.40	7.68	7.74	7.64	7.44	7.24	6.51	6.75	6.99	7.17	1.93
T_6	7.20	7.40	7.50	7.60	7.64	7.86	8.03	8.30	8.37	8.30	8.04	7.74	7.15	7.41	7.59	7.74	2.02
T_7	6.30	6.40	6.70	6.80	6.75	6.87	7.25	7.63	7.57	7.44	7.27	7.07	6.34	6.52	6.75	7.00	1.98
T_8	6.90	7.20	7.40	7.50	7.36	7.58	7.86	8.15	8.17	8.10	7.94	7.57	6.92	7.23	7.43	7.56	2.07
T_9	7.40	7.60	7.60	7.70	7.80	8.00	8.10	8.40	8.07	8.90	8.84	8.65	7.37	7.59	7.75	7.93	2.29
F-Test	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	
S. Ed.	0.482	0.492	0.519	0.558	0.431	0.446	0.472	0.490	0.406	0.417	0.375	0.335	0.454	0.466	0.493	0.513	
$C.D._{5\%}$	1.021	1.042	1.101	1.182	0.914	0.945	1.001	1.039	0.861	0.883	0.794	0.710	0.962	0.989	1.046	1.088	
CV	26.389	26.929	30.539	30.539	23.611	24.428	26.856	26.856	22.240	22.814	18.356	18.356	24.841	25.551	28.106	28.106	

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