



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(8): 750-753
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www.thepharmajournal.com

Received: 01-06-2022

Accepted: 05-07-2022

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Studies on quality of dragon fruit and lime juice blended RTS beverage

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Abstract

The present investigation was carried out at PHT Laboratory, Department of Fruit Science, College of Horticulture, Junagadh Agricultural University, Junagadh. The experiment was conducted in Completely Randomized Design (factorial) with twenty-two treatment combinations and three replications. The blending proportions of dragon fruit juice and lime fruit juice were 100:0, 90:10, 80:20, 70:30, 60:40, 50:50, 40:60, 30:70, 20:80, 10:90 and 0:100 and stored at ambient condition and refrigerated condition. Efforts were made to find out its effect on bio-chemical composition. It was observed that, there was a gradual increase in TSS, total sugars, acidity and while, contradictory decrease in ascorbic acid and pH. Based on the results, the treatment 70:30 (Dragon fruit juice: lime juice) was found more acceptable along with 0:100(Dragon fruit juice: lime juice) in case of observative parameters.

Keywords: Dragon fruit, lime, blending, RTS, storage

Introduction

Dragon fruit (*Hylocereus* sp.) is native to Southern Mexico and Central America. Commonly known as Pitaya. It has unique appearance, sweet taste, and crunchy texture. Its taste is like a combination of a kiwi or watermelon fruit and the flavor is mildly sweet with subtle earthy notes. It is being grown commercially in Israel, Vietnam, Taiwan, Nicaragua, Australia and the United States (Merten, 2003) [9]. Fruits are rich in Vitamin C (2.5 mg), Protein (1.18 g), Iron (0.74 g) and rich in antioxidants like flavonoids, phenolic acid, and beta- cyanin. Fruits are naturally fat free and high in fiber, lowers blood sugar levels, strengthens immune system. Seeds are rich in essential fatty acids, improves gastrointestinal and cardiovascular health, reduces high blood pressure, improves respiratory system function, helps to prevent diabetes, removes heavy metals from the body and brings down cholesterol levels.

Lime (*Citrus aurantifolia*) is one of the most popular citrus fruits in the world with its native tropical and subtropical South-East Asia grown for their edible acidic fruits which are sour, round and bright green in color. Largely cultivated in Andhra Pradesh, Maharashtra, Tamil Nadu, Gujarat, Rajasthan, Bihar and to a limited extent in other states covering an area of 3,27,280 ha and 3,548,390 MT of production (NHB 2020). They are rich in Vitamin C (29.1 mg), Vitamin A (50 IU), Calcium (33 mg) and rich in antioxidants in human body, including flavonoids, limonoids, kaempferol, quercetin, and ascorbic acid. It reduces heart disease risk, prevents kidney stone formation, aids iron absorption and lowers the risk of certain cancers.

To improve the nutritional quality of RTS by value addition *i.e.*, by blending of dragon fruit and lime juice, thereby increasing the value of both fruits. Nowadays many fruits are wasted due to many reasons, this waste can be avoided by many means and one such way is blending. Many people don't consume few fruits, which are highly nutritious but acidic in nature, like citrus. Hence this fruit can be utilized to prepare RTS blends. With this background, the present study was conducted to ascertain the Studies on quality of dragon fruit and lime juice blended RTS beverage.

Materials and Methods

The present investigation was carried out at PHT Laboratory, Department of Fruit Science, College of Horticulture, Junagadh Agricultural University, Junagadh in the year 2021-2022. The experiment was conducted in Completely Randomized Design (factorial) with twenty-two treatment combinations and three replications. Dragon fruits and lime utilized in this research were procured from nearby market, Junagadh, Gujarat. Fully grown, healthy and ripe fruits were purchased. The fruits were cleaned under running water to eliminate dirt and dust particles.

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After cleaning, dragon fruits were peeled and chopped to little pieces. To extract clear juice, the cut pieces were placed in a mixer. In case of lime, the fruits were washed and cut into two halves, then squeezed with the help of juicer. Juice extracted from both fruits was strained through a muslin cloth. The extracted dragon fruit juice was blended with lime juice in the desired ratios. To the blended juice known quantity of sugar was added to maintain total soluble solids of 10 °Brix and the final volume of blended RTS was made up by adding water. The acidity of the blend was kept around 0.3% by using citric acid. Finally, a preservative (Sodium benzoate) chemical was added in a measured dosage. To get a product of uniform quality, the prepared RTS blend was sieved once more through a muslin cloth. The product was filled immediately into pre-sterilized bottles of 200 ml capacity, sealed airtight with one-inch headspace and heat treated in boiling water bath before being cooled to room temperature. The cooled bottles were labelled and stored at room temperature and in the refrigerator (4 °C) for two months. The observations were recorded at 15 days intervals. A digital refractometer was used to estimate TSS in dragon fruit blended with lime RTS beverage. Sugars in the RTS sample was estimated using Fehling's solution A and B. using the procedure outlined by (Lane and Eynon, 1923), titrable acidity was determined by titrating the juice against N/10 NaOH using phenolphthalein as indicator and expressed in percentage. 2,6-Dichlorophenol-indophenol visual titration method was used to determine ascorbic acid in RTS, expressed as mg/100 ml. pH was measured using a digital pH meter.

Statistical analysis

Statistical analysis of data of various characters were carried out as per Completely Randomized Design (CRD) with factorial concept. Analysis of variance was worked out using standard statistical procedures as described by Panse and Sukhatme (1985) ^[11].

Results and Discussion Total Soluble Solids (°Brix)

From Table 1, it was found that blending proportions and storage conditions had significant influence on TSS but the interaction was found non-significant. Treatment B4 - 70:30 (Dragon fruit juice: lime juice) showed highest TSS of 13.59 °Brix which was statistically at par with treatment B5 - 60:40 (Dragon fruit juice: lime juice) with TSS of 13.38 °Brix by the end of 60th day and lowest was recorded in the treatment B1 - 100:0 (Dragon fruit juice: lime juice) with TSS of 12.02 °Brix. There was an increasing trend in TSS along the storage period, this might be due to hydrolysis of polysaccharides into monosaccharides and soluble disaccharides. It was higher under S1 - Ambient condition (13.01 °Brix) than in S2 - concerning total sugars in the RTS blends, showed that treatment B4 - 70:30 (Dragon fruit juice: lime juice) had the highest percentage of total sugars (19.73%) which was statistically at par with treatment B5 - 60:40 (Dragon fruit juice: lime juice) (19.44%) by the end of 60th day. Lowest was recorded in the treatment B11 - 0:100 (Dragon fruit juice: lime juice) with sugars 16.99%. Higher percentage was observed in S1 - Ambient condition (18.8%) compared to S2-

Refrigerated condition (4 °C) *i.e.*, 18.3%. Total sugars in the treatments increased with time, might be due to hydrolysis of insoluble polysaccharides and inversion of sugars. The results were in conformity with Sindhumathi *et al.* (2017) in papaya and mango juice blend and Yuthika (2016) in guava and papaya RTS blend.

Titrable acidity (%)

The data displayed in Table 1, revealed that blending proportions and storage conditions had significant influence on Titrable acidity but the interaction was found non-significant. lowest acidity was recorded in the treatment B1 - 100:0 (Dragon fruit juice: lime juice) with 0.52% by the end of 60th day. It was at par with B2 - 90:10 (Dragon fruit juice: lime juice) with 0.56%. Although, highest titrable acidity of 0.85% was recorded in the treatment B11 - 0:100 (Dragon fruit juice: lime juice) by the end of 60th day. Lowest content of acidity was observed in S1 - Ambient condition (0.66%) compared to S2 - Refrigerated conditions (4 °C) with 0.67%. Increase of lime in the treatments and formation of organic acids by decomposition of polysaccharides or by breakdown of pectic substances might be the reason. The results were in coherence with the findings of Selvi *et al.* (2013) ^[13] in guava-lime-ginger based RTS beverage, Priyanthi *et al.* (2008) ^[12] in olive RTS and Ameda, S. (2021) ^[11] in lime blended aloe RTS.

Ascorbic acid (mg/100 ml)

Data pertaining to ascorbic acid in table 2 showed that blending proportions and storage conditions had significant influence on ascorbic acid, but the interaction was found non-significant. B11 - 0:100 (Dragon fruit juice: lime juice) had highest ascorbic acid content of 11.80 mg/100 ml which was statistically at par with treatment B10 - 10:90 (Dragon fruit juice: lime juice) with 11.29 mg/100 ml ascorbic acid by the end of 60th day.

Lowest content was noted in the treatment B₁ - 100:0 (Dragon fruit juice: lime juice) with 8.82 mg/100 Refrigerated condition (4 °C) (12.68 °Brix), by the end of ml. S1 Ambient condition (10.19 mg/100 ml), had better 60th day. Higher temperatures under ambient conditions led to faster reactions may be the probability. The results were in line with findings of Vishal *et al.* (2013) ^[15] in banana and kinnow RTS, Animesh and Jimi (2017) ^[2] in guava pulp with pineapple juice blend and Hamid *et al.* (2017) ^[5] in mulberry RTS drink.

Total sugars (%)

It was found that blending proportions and storage conditions had significant influence on Total sugars but the interaction was found non-significant. Table 1 retention of ascorbic acid content than Refrigerated condition (4 °C) (10.44 mg/100 ml) because it is highly sensitive to light exposure. With the increase in lime proportion, the ascorbic acid content also increased among the treatments, but declined with storage, this might be due to its degradation into dehydro-ascorbic acid or furfural. The results were in harmony with discovery of Vikram and Sikarwar (2018) ^[14] in kinnow - aonla blend and Kesavanath *et al.* (2015) ^[7] in star fruit and sweet orange juice blend.

Table 1: Effect of different proportions and storage conditions on TSS, total sugars and acidity of dragon fruit and lime juice blended RTS beverage

Tr.	TSS (oBrix)					Total sugars (%)					Titrable acidity (%)				
	1 st day	15 th day	30 th day	45 th day	60 th day	1 st day	15 th day	30 th day	45 th day	60 th day	1 st day	15 th day	30 th day	45 th day	60 th day
B1	10.02	10.58	10.77	11.15	12.02	17.63	17.79	17.71	17.96	18.12	0.25	0.31	0.38	0.46	0.52
B2	10.60	11.16	11.35	11.73	12.59	17.74	17.88	17.83	18.02	18.16	0.29	0.35	0.42	0.50	0.56
B3	10.98	11.54	11.72	12.11	12.97	18.29	18.43	18.38	18.57	18.71	0.30	0.36	0.43	0.51	0.57
B4	11.60	12.16	12.35	12.73	13.59	19.30	19.45	19.40	19.59	19.73	0.32	0.38	0.45	0.53	0.59
B5	11.39	11.95	12.14	12.52	13.38	19.02	19.16	19.11	19.30	19.44	0.34	0.40	0.47	0.55	0.61
B6	11.17	11.73	11.92	12.30	13.16	18.84	18.99	18.93	19.12	19.27	0.38	0.44	0.51	0.59	0.65
B7	11.30	11.86	12.05	12.43	13.29	19.13	19.27	19.22	19.41	19.54	0.43	0.49	0.56	0.64	0.70
B8	10.39	10.95	11.13	11.51	12.37	17.27	17.41	17.35	17.55	17.67	0.47	0.53	0.60	0.68	0.73
B9	10.46	11.02	11.21	11.59	12.45	17.60	17.74	17.69	17.89	18.02	0.50	0.56	0.63	0.71	0.77
B10	10.74	11.30	11.49	11.87	12.73	17.82	17.96	17.91	18.10	18.24	0.53	0.59	0.66	0.74	0.80
B11	10.70	11.26	11.45	11.83	12.79	16.61	16.74	16.68	16.88	16.99	0.58	0.64	0.71	0.79	0.85
S.Em.±	0.19	0.26	0.22	0.06	0.22	0.29	0.29	0.25	0.32	0.32	0.007	0.007	0.011	0.014	0.01
CD at 5%	0.73	0.99	0.84	0.24	0.83	1.1	1.12	0.95	1.24	1.2	0.026	0.028	0.042	0.052	0.02
S1	11.00	11.56	11.75	12.13	13.01	18.4	18.5	18.4	18.7	18.8	0.39	0.45	0.52	0.60	0.66
S2	10.70	11.26	11.44	11.82	12.68	17.8	18	18	18.1	18.3	0.41	0.47	0.54	0.62	0.67
S.Em.±	0.08	0.11	0.09	0.21	0.09	0.12	0.13	0.11	0.14	0.13	0.003	0.003	0.005	0.006	0.004
CD at 5%	0.31	0.42	0.36	0.82	0.35	0.47	0.48	0.40	0.53	0.51	0.011	0.012	0.018	0.022	0.008

Table 2: Effect of different proportions and storage conditions on ascorbic acid and pH of dragon fruit and lime juice blended RTS beverage

Tr.	Ascorbic acid (mg/100 ml)					pH				
	1 st day	15 th day	30 th day	45 th day	60 th day	1 st day	15 th day	30 th day	45 th day	60 th day
B1	9.53	9.30	9.14	8.96	8.82	3.45	3.40	3.38	3.33	3.27
B2	9.74	9.51	9.35	9.17	9.03	3.43	3.38	3.36	3.31	3.25
B3	10.10	9.86	9.71	9.53	9.38	3.33	3.28	3.26	3.21	3.15
B4	10.68	10.45	10.29	10.11	9.97	3.08	3.03	3.01	2.96	2.90
B5	10.83	10.60	10.44	10.26	10.12	2.97	2.92	2.90	2.85	2.79
B6	11.18	10.95	10.79	10.60	10.47	2.82	2.77	2.75	2.70	2.64
B7	11.40	11.17	11.01	10.83	10.69	2.69	2.64	2.62	2.57	2.51
B8	11.58	11.35	11.19	11.01	10.87	2.56	2.51	2.49	2.44	2.38
B9	11.71	11.49	11.32	11.14	11.01	2.45	2.39	2.38	2.33	2.27
B10	12.00	11.77	11.61	11.43	11.29	2.40	2.35	2.33	2.28	2.22
B11	12.51	12.28	12.12	11.94	11.80	2.38	2.33	2.31	2.26	2.20
S.Em.±	0.21	0.18	0.2	0.22	0.19	0.06	0.08	0.07	0.02	0.018
CD at 5%	0.78	0.67	0.75	0.83	0.71	0.24	0.29	0.26	0.07	0.07
S1	10.9	10.67	10.51	10.33	10.19	2.91	2.86	2.84	2.79	2.73
S2	11.15	10.92	10.76	10.58	10.44	2.83	2.78	2.76	2.71	2.65
S.Em.±	0.09	0.08	0.08	0.09	0.08	0.03	0.03	0.03	0.06	0.06
CD at 5%	0.33	0.29	0.32	0.35	0.3	0.10	0.12	0.11	0.24	0.24

pH

From the table 2, it is clear that blending proportions and storage conditions had significant influence on pH, but the interaction was found non-significant. B1 -100:0 (Dragon fruit juice: lime juice) had the highest pH of 3.27 *i.e.*, lower acidity which was at par with treatment B2 - 90:10 (Dragon fruit juice: lime juice) (3.25) While, treatment B11 - 0:100 (Dragon fruit juice: lime juice) had the lowest pH of 2.20 with higher acidness in the RTS. Among storage conditions highest pH of 2.73 was found in S1 - Ambient condition and lowest in S2 - Refrigerated condition (4 °C) with 2.65 pH. Decrease in the pH values might be due to addition of lime in the RTS and production of acetic acid and lactic acid in ambient conditions leading to higher acidness and lower pH values as they are inversely related. The results were coinciding with the findings of foke *et al.* (2018) ^[4] in dragon fruit RTS, Hossain *et al.* (2017) ^[6] in jackfruit aloe blended RTS and Ankita *et al.* (2021) ^[3] in kinnow-aonla beverage.

Conclusion

On the basis of the result obtained from this present study, it could be concluded that dragon fruit and lime juice blended at

70:30 ratio recorded highest TSS (13.59 °Brix) with highest total sugars (19.73%). Whereas lowest titrable acidity (0.52%) and highest pH (3.27) was noticed in 100:0 (Dragon fruit juice: lime juice). Highest ascorbic acid content (11.80 mg/100 ml) was recorded in 0:100 (Dragon fruit juice: lime juice). RTS blends could be stored for 60 days period under ambient conditions while refrigerated conditions (4 °C) had better retention of ascorbic acid content.

Acknowledgement

The authors are very much thankful to the Department of Fruit Science, College of Horticulture, J.A.U., Junagadh for providing necessary facilities and well-maintained laboratory.

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