Effect of Storage Conditions and Period on the Organoleptic Properties of Value Added Ready-To-Serve (RTS) Beverage from Starfruit

ABSTRACT

The experiment was carried out to study the effect of storage conditions and period on the organoleptic properties of starfruit RTS beverage with the objective to evaluate the shelf life of starfruit RTS beverage. The prepared starfruit RTS beverages were stored at ambient room temperature condition and refrigerated condition for a period of 30 days. During the storage, the change in organoleptic properties *viz.* colour, taste, flavour and overall acceptability was recorded to evaluate the shelf life of the starfruit RTS beverage. The shelf life studies revealed that although there was a change in the organoleptic properties of starfruit RTS beverage samples after 30 days of storage, the changes were less remarkable in the refrigerated storage condition compared to those of the ambient room temperature storage condition. The refrigeration extended the shelf life of the starfruit RTS beverage up to 30 days.

Keywords: *Beverage, Organoleptic properties, Shelf life, Starfruit, Storage*

INTRODUCTION

India's diverse climate indeed contributes to the availability of a wide variety of fresh fruits and vegetables throughout the year. The country's geographical diversity, with regions ranging from tropical to temperate, allows for the cultivation of a vast array of produce. Star fruit is one such tropical fruit that can be found in India (Maurya *et al.* 2023). Carambola also commonly known as star fruit (*Averrhoa carambola* L.) is an underutilized attractive fruit of the family Oxalidaceae. It is a subtropical evergreen tree, usually 6 to 9 m in height. The fruit has distinctive ridges running down its sides which in cross section appear in form of a star hence called as 'Star fruit' having light to dark yellow in colour and smooth with a waxy cuticle while the flesh is light yellow, translucent, crisp and very juicy, with or without fiber (Margen, 1992).

Starfruit can be consumed in two stages – when it is still green and unripe, it can be used in

savory dishes, often cooked or pickled as a vegetable. When it ripens, it turns yellow and is enjoyed as a sweet and juicy fruit. Starfruit is indeed a versatile fruit with various culinary and potential medicinal uses. Starfruit is rich in nutrients such as vitamin C, vitamin A, potassium, and dietary fiber. It is low in calories, making it a healthy addition to your diet (Maurya *et al.* 2023). This fruit has the potential to be a great source of antioxidants due to its high levels of phenolic antioxidants (Saghir *et al.* 2013). This fruit has anti-inflammatory activity, anti-ulcer activity, ~~hypoglycaemic~~hypoglycemic activity as well as antimicrobial activity. Incorporating this fruit into our diet can provide approximately 30% of our daily requirement of Vitamin C in just 100g (Cabrini *et al.* 2011 and Ferreira *et al.* 2008).

The shelf life of a food can be defined as the time period within which the food is safe to consume and/or has an acceptable quality to consumers (Fu and Labuza, 1997). Shelf-life of food products can be regarded as the period of time during which a product could be stored until it becomes unacceptable from safety, nutritional, or sensory perspectives. Shelf-life estimation of food products and beverages has become increasingly important in recent years due to technological developments and the increase in consumer interest in eating fresh, safe and high quality products (Giménez *et al.* 2012).

The present study aimed to evaluate the effect of storage conditions and period on the organoleptic properties of value-added starfruit RTS beverage and to assess its shelf life by storing it under refrigerated and ambient conditions for 30 days.

MATERIALS AND METHODS

The experiment was conducted in the Post Harvest Technology Laboratory, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India, during the year 2022-2024. The experiment was laid out in Randomized Block Design (RBD) with seven treatments and three replications. The treatments were T_0 (Control), T_1 (Starfruit Juice + Ginger Juice 2%), T_2 (Starfruit Juice + Mint Juice 2%), T_3 (Starfruit Juice + Aloe vera Juice 2%), T_4 (Starfruit Juice + Lemongrass Juice 2%), T_5 (Starfruit Juice + Basil Juice 2%), T_6 (Starfruit Juice + Rosemary Juice 2%).

Methodology for Evaluation of Shelf Life of Starfruit RTS Beverage

Six values added starfruit RTS beverages along with the control were filled into 250 ml plastic bottles and stored at ambient room temperature condition (15-30^{o}C) and refrigerated condition (4-6^{o}C) for a period of 30 days. The stored starfruit RTS beverage were analyzed at

an interval of 15 days for a period of 30 days. During the storage, the change in organoleptic properties *viz.* colour, taste, flavour and overall acceptability was recorded to evaluate the shelf life of the starfruit RTS beverage.

Methodology for Evaluation of Organoleptic Properties of Starfruit RTS Beverage

The starfruit RTS beverages were evaluated for various organoleptic properties *viz.* colour, taste, flavour and overall acceptability. The samples were analyzed using the 9-point hedonic scale rating method by a panel of five judges at an interval of 15 days for a period of 30 days. Each sample was assessed and given a score by the ~~panelists~~panellists on a scale of 1-9 for each parameter. The mean scores of all samples from all five ~~panelists~~panellists were tabulated and statistically analyzed to evaluate effect of storage conditions and period on organoleptic properties of value added RTS beverage from starfruit.

RESULTS AND DISCUSSION

Shelf Life of Starfruit RTS Beverage

The significant changes in organoleptic properties were observed over an increased storage period under ambient room temperature conditions, whereas no remarkable changes were observed over the same period under refrigerated conditions. The starfruit RTS beverage stored at ambient room temperature exhibited decreased acceptability after 15 days, becoming unacceptable by 30 days. The starfruit RTS beverage stored in refrigerated conditions maintained acceptability after 15 days but showed decreased acceptability by 30 days. The refrigeration extended the shelf life of the starfruit RTS beverage up to 30 days.

Similar findings were reported by Goyal and Kumar (2017) reported that the RTS beverage was found superior under refrigeration condition as compared to room temperature; Behera *et al.* (2017) reported that the changes were less remarkable in refrigerated storage as compared

to those of ambient storage; Shagiwal and Deen (2022) reported that the organoleptic quality was decreased during storage under both ambient and refrigerated temperatures; Das *et al.* (2021) reported that the organoleptic characters showed a gradual decreasing during storage due to the increasing time, temperature and enzymes activity at room temperature; Hamid *et al.* (2017) reported that the sensory scores of drink decreased significantly during storage and retained better in refrigerated storage conditions than ambient conditions.

Effect of Storage Conditions and Period on Colour of Starfruit RTS Beverage

The data recorded on the effect of storage conditions and period on colour of ~~strafruit~~starfruit RTS beverage is presented in table 1. The organoleptic score for colour showed significant differences among different treatments during storage at 0, 15, and 30 days. The maximum organoleptic score for colour 8.3 was reported to be reduced to 3.7 for ambient conditions and 7.3 for refrigerated conditions after 30 days of storage. As the storage period increased, a notable decline in organoleptic score for colour was observed in ambient conditions, whereas a slight decline in organoleptic score for colour was observed in refrigerated conditions. Similar results were reported by Ram *et al.* (2011) during storage of blended aonla and bael RTS beverage.

Effect of Storage Conditions and Period on Taste of Starfruit RTS Beverage

The data recorded on the effect of storage conditions and period on taste of ~~strafruit~~starfruit RTS beverage is presented in table 2. The organoleptic score for taste showed significant differences among different treatments during storage at 0, 15, and 30 days. The maximum organoleptic score for taste 8.7 was reported to be reduced to 3.3 for ambient conditions and 8.0 for refrigerated conditions after 30 days of storage. As the storage period increased, a significant decrease in organoleptic score for taste was observed in ambient conditions, whereas a subtle decrease in organoleptic score for taste was observed in refrigerated conditions. Similar results were reported by Jain and Khurdiya (2004) during storage of Indian gooseberry blended RTS beverage.

Effect of Storage Conditions and Period on Flavour of Starfruit RTS Beverage

The data recorded on the effect of storage conditions and period on flavour of ~~strafruit~~starfruit RTS beverage is presented in table 3. The organoleptic score for flavour showed significant differences among different treatments during storage at 0, 15 and 30 days. The maximum organoleptic score for flavour 8.3 was reported to be reduced to 3.3 for ambient conditions and 7.3 for refrigerated conditions after 30 days of storage. As the storage

period increased, a marked decrease in organoleptic score for flavour was observed in ambient conditions, whereas a modest decrease in organoleptic score for flavour was observed in refrigerated conditions. Similar results were reported by Kumar *et al.* (2008) during storage of musambi RTS beverage.

Effect of Storage Conditions and Period on Overall acceptability of Starfruit RTS Beverage

The data recorded on the effect of storage conditions and period on overall acceptability of ~~strafruit~~starfruit RTS beverage is presented in table 4. The organoleptic score for overall acceptability showed significant differences among different treatments during storage at 0, 15 and 30 days. The maximum organoleptic score for overall acceptability 8.7 was reported to be reduced to 3.7 for ambient conditions and 8.0 for refrigerated conditions after 30 days of storage. As the storage period increased, a notable decrease in organoleptic score for overall acceptability was observed in ambient conditions, whereas a marginal decrease in organoleptic score for overall acceptability was observed in refrigerated conditions. Similar results were reported by Pandey *et al.* (2004) during storage of guava RTS beverage.

Table 1: Effect of Storage Conditions and Period on Colour of Starfruit RTS Beverage

COLOUR						
Treatment	Ambient Conditions			Refrigerated Conditions		
	0 DAYS	**15 DAYS**	**30 DAYS**	**0 DAYS**	**15 DAYS**	**30 DAYS**
T_0	6.0	3.3	2.3	6.0	5.7	5.0
T_1	8.3	5.3	3.7	8.3	8.0	7.3
T_2	7.7	5.0	3.0	7.7	7.3	7.0
T_3	6.3	4.3	2.7	6.3	6.7	6.3
T_4	7.3	4.3	2.7	7.3	7.0	7.0
T_5	7.0	4.7	2.7	7.0	7.0	6.7
T_6	6.7	5.0	2.3	6.7	6.3	6.3
F-test	**S**	**S**	**S**	**S**	**S**	**S**

SDS.Ed (+/-)	0.51	0.50	0.35	0.51	0.44	0.36
CV	8.85	13.36	15.47	8.85	7.90	6.69
CD at 5%	1.11	1.09	0.76	1.11	0.96	0.78

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147 ***Table 2: Effect of Storage Conditions and Period on Taste of Starfruit RTS Beverage***

TASTE						
Treatment	Ambient Conditions			Refrigerated Conditions		
	0 DAYS	15 DAYS	30 DAYS	0 DAYS	15 DAYS	30 DAYS
T_0	5.3	3.7	1.7	5.3	5.0	4.7
T_1	8.7	6.0	3.3	8.7	8.3	8.0
T_2	7.7	6.0	3.0	7.7	7.3	7.0
T_3	6.3	5.0	3.0	6.3	6.0	6.0
T_4	7.3	5.3	2.7	7.3	7.0	6.7
T_5	6.7	4.7	2.3	6.7	6.3	6.3
T_6	7.7	5.7	2.7	7.7	7.3	7.0
F-test	S	S	S	S	S	S
SDS.Ed (+/-)	0.64	0.52	0.42	0.64	0.38	0.33
CV	11.09	12.26	19.48	11.09	6.85	6.11
CD at 5%	1.40	1.13	0.92	1.40	0.82	0.71

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150 ***Table 3: Effect of Storage Conditions and Period on Flavour of Starfruit RTS Beverage***

FLAVOUR						
Treatment	Ambient Conditions			Refrigerated Conditions		
	0 DAYS	15 DAYS	30 DAYS	0 DAYS	15 DAYS	30 DAYS
T_0	6.0	4.3	2.0	6.0	5.7	5.3
T_1	8.3	5.7	3.3	8.3	8.0	7.3
T_2	8.0	5.7	2.7	8.0	7.7	7.0
T_3	6.3	5.3	2.3	6.3	6.0	5.7
T_4	7.3	5.3	2.7	7.3	6.7	6.3
T_5	6.7	5.7	2.3	6.7	6.3	6.0
T_6	7.3	5.3	2.3	7.3	7.0	6.7

F-test	S	S	S	S	S	S
SDS.Ed (+/-)	0.61	0.40	0.38	0.61	0.50	0.40
CV	10.51	9.83	17.36	10.51	9.13	7.83
CD at 5%	1.34	0.88	0.82	1.34	1.10	0.88

Table 4: Effect of Storage Conditions and Period on Overall acceptability of Starfruit RTS Beverage

OVERALL ACCEPTABILITY						
Treatment	Ambient Conditions			Refrigerated Conditions		
	0 DAYS	15 DAYS	30 DAYS	0 DAYS	15 DAYS	30 DAYS
T_0	5.7	4.0	2.0	5.7	5.3	5.0
T_1	8.7	5.7	3.7	8.7	8.3	8.0
T_2	7.7	5.3	2.7	7.7	7.3	7.0
T_3	6.7	5.0	3.0	6.7	6.3	6.3
T_4	7.3	4.7	2.7	7.3	7.0	6.7
T_5	7.0	4.3	2.7	7.0	6.7	6.3
T_6	7.7	4.7	2.3	7.7	7.3	7.0
F-test	S	S	S	S	S	S
SDS.Ed (+/-)	0.67	0.40	0.41	0.67	0.43	0.33
CV	11.41	10.31	18.57	11.41	7.63	6.02
CD at 5%	1.47	0.88	0.90	1.47	0.94	0.71

CONCLUSION

The shelf life studies observed significant changes in organoleptic properties over an increased storage period under ambient room temperature conditions. The starfruit RTS beverages stored at ambient room temperature exhibited decreased acceptability after 15 days, becoming unacceptable by 30 days. However, no remarkable changes in organoleptic properties were observed over an increased storage period under refrigerated conditions. The starfruit RTS beverage stored in refrigerated conditions maintained acceptability after 15 days but showed decreased acceptability by 30 days. The shelf life studies revealed that refrigeration extended the shelf life of the starfruit RTS beverage up to 30 days. Therefore, it is recommended to store the starfruit RTS beverage in refrigerated conditions to achieve

maximum shelf life and sensory acceptability.

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