www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(12): 374-378

www.thepharmajournal.com
Received: 02-10-2023
Accepted: 13-11-2023

Gharat RV
M.Sc., Department of Fruit Science, College of Horticulture, DBSKKV, Dapoli, Maharashtra, India

Pawar CD
Professor, College of Horticulture, DBSKKV, Dapoli, Maharashtra, India

Kulkarni MM
Assistant Professor, Department of Fruit Science, College of Horticulture, DBSKKV, Dapoli, Maharashtra, India

Kadam JJ
Associate Professor, Department of Plant Pathology, College of Agriculture, Dapoli, Maharashtra, India

Kasture MC
Professor (I/C), Department of Soil Science and Agriculture Chemistry, College of Agriculture, Dapoli, Maharashtra, India

Galande AV
M.Sc., Department of Fruit science, College of Horticulture, DBSKKV, Dapoli, Maharashtra, India

Jagtap PS
M.Sc., Department of Fruit science, College of Horticulture, DBSKKV, Dapoli, Maharasthra, India

Jadhao RS
M.Sc., Department of Fruit Science, College of Horticulture, DBSKKV, Dapoli, Maharashtra, India

Corresponding Author:
Gharat RV
M.Sc., Department of fruit science, College of Horticulture, DBSKKV, Dapoli, Maharashtra, India

Changes in sensory quality of carbonated RTS beverage from kokum (*Garcinia indica* Choisy) during storage

Gharat RV, Pawar CD, Kulkarni MM, Kadam JJ, Kasture MC, Galande AV, Jagtap PS and Jadhao RS

Abstract
The investigation entitled "Changes in sensory quality of carbonated RTS beverage from kokum (*Garcinia indica* Choisy) during storage" was undertaken at Fruit and Vegetable Processing Unit, College of horticulture, Dapoli. Dist. Ratnagiri (M.S.) during 2022-23. Experiment was carried out in Factorial Completely Randomized Design (FCRD) with four treatments of carbonation levels *viz*. C_1-(30 psi), C_2-(40 psi), C_3-(50 psi) and C_4-(60 psi) and four treatments of juice-sugar levels *viz*. J_1-(kokum juice 25% + sugar 75%), J_2-(kokum juice 30% + sugar 70%), J_3-(kokum juice 35% + sugar 65%) and J_4-(kokum juice 40% + sugar 60%). Sensory qualities like colour, flavour and overall acceptability scores were taken and found significantly decreased during the storage period of 6 months. On basis of scores of overall acceptability shelf life of the product was found to be 6 months of all treatment combinations. Interaction C_3J_2 was found to be best with highest benefit cost ratio 2.53.

Keywords: Carbonation, kokum, storage

1. Introduction
Kokum (*Garcinia indica* Choisy) is one of the underexploited spice trees belonging to family Clusiaceae. As per a baseline survey (2010), about 1,000 ha area is occupied by kokum in Konkan region with production of 4,500 MT fruits. According to survey conducted by the Chief Conservator of Forest, out of the total 46,600 Kokum trees in the state of Maharashtra; 43,000 trees existed in the Ratnagiri and Sindhudurg districts. In south konkan 1,674 tonnes of fruits were reportedly used for dried kokum rind, 757 tonnes to make kokum syrup and 40 tonnes to make kokum butter (Annon., 2012) [2]. Kokum fruits are harvested in the start of rainy season. The fruits are picked when ripe, the rind is then removed and soaked in the juice of the pulp and then sun-dried to prepare amsol. Kokum helps to cure skin infections, wounds, dehydration, sunstroke, obesity, cancer and ulcer. Kokum contains compounds like HCA, garcinol, citric acid, malic acid, polyphenols, carbohydrates 1,3, anthocyanin pigments and ascorbic acid which have potential antioxidant properties. Novel value-added products of kokum are kokum sherbet mixture, kokum solkadhi mixture, kokum wine and kokum honey (Haldankar *et al*., 2022) [5]. Every year 35-40 percent of the fruits are lost due to uneven ripening and irregular picking. Other factors also cause a large amount of spoilage and fruit loss, like limited processing units and cold storage facilities, poor market channel and no government interventions for this crop. Using kokum in processing industry can solve these problems to a great extent. Kokum being seasonal in nature it becomes difficult to enjoy its refreshing flavour in off seasons. Processed products like carbonated beverages are quite popular both in India and abroad. Carbonated fruit-based beverage is a new concept which provides nutritional elements of the fruit along with natural pigments and flavour in addition to carbonation effects. Carbonation is the practice in which carbonated water is made by passing pressurized carbon dioxide through water (Wazed *et al*., 2021) [11]. Realising the significance of fruits as a key contributor to human well-being and as a less expensive and superior source of protective foods, their perishable nature and seasonality in production makes their preservation and year-round availability for human use. Hence, research on the preparation of fruit-based carbonated RTS drinks is crucial to replace synthetic carbonated beverages.

2. Materials and Methods
The investigation entitled "Studies on carbonated RTS beverage from kokum (*Garcinia indica*

Choisy)" was undertaken at Fruit and Vegetable Processing Unit, College of horticulture, Dapoli. Dist. Ratnagiri (M.S.) during 2022-23. Experiment was carried out in Factorial Completely Randomized Design (FCRD) with four treatments of carbonation levels *viz*. C_1-(30 psi), C_2-(40 psi), C_3-(50 psi) and C_4-(60 psi) and four treatments of juice-sugar levels *viz*. J_1-(kokum juice 25% + sugar 75%), J_2-(kokum juice 30% + sugar 70%), J_3-(kokum juice 35% + sugar 65%) and J_4-(kokum juice 40% + sugar 60%).

Kokum fruits of local types used for the experiment were obtained from the farm of College of Horticulture, Dapoli. Healthy, perfectly ripe and disease-free fruits were selected and washed thoroughly to remove dirt. After proper selection and washing fruits were used for extracting juice. The juice was extracted from the selected fruit rind after separation of seed and rind. The juice was strained from the residue through muslin cloth. As per the treatment details juice and sugar required for the preparation of carbonated RTS was calculated and taken into a stainless-steel vessel. Then the quantity of sugar, cumin powder and salt were added in the juice as per treatment. Slight heating was done to dissolve sugar into the juice. The T.S.S. and acidity was kept natural. No preservative was added. The quantity of syrup required (34 g) for 200 ml bottle was weighed and added into each pre-sterilized bottle. For preparation of carbonated RTS potable water was passed through sand filter and chilled at 4˚C temperature. Then this water was passed through the carbonator at 30, 40, 50, 60 psi CO_2 pressure as per the treatments and finally mixed with the syrup taken into the 200 ml capacity glass bottles and immediately sealed with sterilized crown caps. The carbonated RTS bottles were then stored at cold storage at 12±1˚C and tested for different sensory parameters at three months interval during storage period of 6 months.

2.1 Sensory evaluation

Sensory evaluation of carbonated RTS beverage was done at 3 months interval i.e., at 0, 3 and 6 months of storage. The sensory qualities in terms of colour and flavour were assessed by panel of 10 judges with 9-point Hedonic scale score (Amerine *et al*. 1965) [1]. At a time 16 samples were evaluated. The overall acceptability score was obtained by averaging the score of colour and flavour. The score above 5.5 showed acceptability of product within the score 1 to 9.

2.2 Shelf life

Shelf life of stored carbonated RTS beverage was decided on the basis of sensory evaluation score (average score) of the carbonated RTS. The carbonated RTS which recorded sensory score below 5.5 in 9-point Hedonic scale was rated as unacceptable and the shelf life was considered to be over. However, the carbonated RTS which recorded overall acceptability score (average score) above 5.5 were found to be acceptable.

2.3 Cost of production

The cost of producing one 200 ml bottle of carbonated RTS beverage was computed by taking into account the current prices of all the manufacturing inputs, including cost bottles, fruits, sugar, cumin powder, salt, labour costs, and packaging material. The price for sale of beverage were decided on the basis of prevailing market prices of different brands of kokum carbonated RTS beverage. The benefit cost ratio was calculated.

Statistical analysis of carbonated RTS beverage with critical difference (C.D.) at 1 percent level of probability was carried out using method suggested (Panse and Sukhatme, 1985) [8].

3. Results and Discussion

The data regarding the effect of carbonation levels, juice-sugar levels and their interactions on sensory parameters is presented below-

3.1 Colour

The data regarding colour score of carbonated RTS beverage is given in Table 1 and differ significantly with respect to carbonation and juice-sugar levels and their interaction throughout the storage period of 6 months. It is observed from the data that, there was a decreasing trend from 0 month (7.97) to 6 months (7.82) in the sensory score for colour during storage, irrespective of carbonation and juice-sugar levels. The decrease in colour scores may be due to the effect of oxidative reaction, enzymatic browning or temperature effect during storage period. Similar results are recorded by Hegde (2018) [6] in spiced carbonated drink by blending kokum, aonla and ginger juice. In case of carbonation levels scores for colour showed decreasing trend from C_1 to C_4, irrespective of juice-sugar levels. Decrease in colour score from C_1 to C_4 may be the effect of increase in CO_2 levels from C_1 to C_4 which might have affected original colour of beverage. During storage, treatment C_1 recorded highest scores for colour at '0' (8.21), 3 (8.13) and 6 (8.12) months and they were significantly superior over others. On the other hand, treatment C_4 recorded lowest scores for colour at '0' (7.66), 3 (7.59) and 6 (7.43) months of storage. With respect to juice-sugar levels scores for colour showed increasing trend from J_1 to J_4, irrespective of carbonation levels. The increase in juice percentage and decrease in sugar percentage from J_1 (kokum juice 25% + sugar 75%) to J_4 (kokum juice 40% + sugar 60%) might have imparted fruit colour in increasing trend with increase in juice percentage from J_1 to J_4. Even from J_1 to J_4 sugar percentage decreased. Hence, to dissolve sugar in juice heating period also decreased from J_1 to J_4. More the heating period more will be loss of colour. During storage, treatment J_4 recorded highest scores for colour at '0' (8.13), 3 (8.11) and 6 (8.06) months. Whereas, treatment J_1 recorded lowest scores for colour at '0' (7.79), 3 (7.76) and 6 (7.58) months of storage. Treatment J_4 was significantly superior over others during entire storage period. With respect to interaction of carbonation and juice-sugar levels, interaction C_1J_4 recorded maximum scores for colour at '0' (8.39), 3 (8.28) and 6 (8.28) months. C_1J_4 was at par with C_2J_4 (8.25) and C_2J_4 (8.16) at 0 and 3 months respectively. At 6 months C_1J_1, C_2J_3, C_3J_4 (8.00), C_1J_2 (8.10), C_1J_3 (8.12) and C_2J_4 (8.11) were at par with C_1J_4. Interaction C_4J_1 recorded minimum scores for colour at '0' (7.41), 3 (7.4) and 6 (7.1) months. Maximum colour score recorded by interaction C_1J_4 may be due to the combined effect to lower CO_2 level at C_1 and higher juice percentage at J_4.

3.2 Flavour

The data on changes in sensory score of flavour of carbonated RTS beverage during storage are represented in table 2. From the table it was observed that flavour scores for beverage decreased significantly from '0' (7.48) to 6 (7.37) months, irrespective of carbonation and juice-sugar levels. The

oxidative reaction, enzymatic browning, or temperature effect during storage might destroyed flavouring components during storage. The present findings are in line with that of Phanase (2015) [9] in jamun carbonated beverage during 90 days storage, Khan (2015) [7] in carbonated beverage from Alphonso mango during 6 months of storage. The results of sensory score for flavour with respect to carbonation levels were found significant at 0, 3 and 6 months of storage and showed increasing trend upto C_3 then decreased at C_4, irrespective of juice-sugar levels. The highest sensory score for flavour was recorded by C_3 at 0 (7.83), 3 (7.77) and 6 (7.65) months of storage period and was significantly superior over others. On the other hand, treatment C_4 recorded lowest flavour score at 0 (7.09), 3 (7.02) and 6 (6.95) months of storage period. With respect to juice-sugar levels scores for flavour differ significantly during entire storage and showed increasing trend from J_1 to J_2 then decreased upto J_4, irrespective of carbonation levels. It might be because of best combination of juice and sugar levels in J_1 and J_2. During storage, treatment J_2 recorded highest scores for flavour at '0' (7.73), 3 (7.69) and 6 (7.69) months. Whereas, treatment J_4 recorded lowest scores for flavour at '0' (7.19), 3 (7.11) and 6 (7.05) months of storage. Treatment J_2 was at par with treatment J_1 at 0 (7.67) and 3 (7.58) months and J_2 was significantly superior over others at 6 months of storage period. With respect to interaction of carbonation and juice-sugar levels scores for flavour differ significantly during entire storage period. At '0', '3' and '6' month, interaction C_3J_2 recorded maximum scores for flavour i.e. 8.35, 8.3 and 8.26, respectively and was significantly superior over others. Whereas, interaction C_4J_4 recorded minimum scores for flavour at '0' (6.89), 3 (6.78) and 6 (6.67) months of storage. In general maximum flavour scores recorded by interaction C_3J_2 may be due to combined effect of suitable CO_2 pressure at C_3 (50 psi) with good juice-sugar blend at J_2 (kokum juice 30% + sugar 70%).

3.3 Overall acceptability

The data presented in Table 3 indicates the changes in overall acceptability scores (average scores) of carbonated RTS beverage during storage. From the table it was observed that overall acceptability scores for beverage decreased significantly from '0' (7.73) to 6 (7.60) months, irrespective of carbonation and juice-sugar levels. Overall acceptability score may be decreased due to decrease in colour and flavour score of carbonated RTS beverage during storage. The presented findings are in line with that of Gawali (2017) [4] in cashew apple RTS during 6 months of storage, Phanase (2015) [9] in Jamun carbonated beverage during 90 days of storage and Bayna and Gowda (2013) [3] in sweet orange and kokum blended RTS beverage. With respect to carbonation levels overall acceptability results were found significant during entire storage period of 6 months and in general showed increasing trend upto C_3 then decreased at C_4, irrespective of juice-sugar levels. The highest sensory score for overall acceptability was recorded by C_3 at 0 (7.88), 3 (7.85) and 6 (7.75) months of storage period and was significantly superior over others at 3 months of storage and at par with C_1 (7.84) at o month. At 6 months, C_3 was at par with treatment C_1 (7.74) and C_2 (7.71). On the other hand, treatment C_4 recorded lowest overall acceptability score at 0 (7.38), 3 (7.31) and 6 (7.20) months of storage period. With respect to juice-sugar levels scores for overall acceptability differ significantly during entire storage and showed increasing trend from J_1 to J_2 then decreased till J_4, irrespective of carbonation levels. The highest score for overall acceptability was observed in the treatment J_2 having kokum juice 30% + sugar 70%. The highest score recorded by J_2 for overall acceptability at '0' (7.82), 3 (7.77) and 6 (7.73) months and was significantly superior over others. Whereas, treatment J_4 recorded lowest scores for overall acceptability at '0' (7.66), 3 (7.62) and treatment J_1 at 6 (7.53) months of storage. With respect to interaction of carbonation and juice-sugar levels scores for overall acceptability differ significant during entire storage period. At '0', '3' and '6' month interaction C_3J_2 recorded maximum scores for flavour (8.15, 8.10 and 8.03, respectively) and was significantly superior over others at 0 and 3 months. At 6 months of storage, interaction C_3J_2 was at par with C_2J_2 (7.89). Whereas, interaction C_4J_1 recorded minimum scores for overall acceptability at '0' (7.34) and 6 (7.12) months of storage. At 3 months C4J3 (7.25) recorded minimum score. The maximum overall acceptability scores recorded by interaction of higher carbonation levels (50 psi) and lower juice-sugar levels (kokum juice 30% + sugar 70%) may be due to the impact of colour and flavour score of RTS beverage during storage.

3.4 Shelf life

The shelf life of carbonated RTS beverages prepared from kokum and stored in cold storage condition was evaluated over a period of 6 months according to overall acceptability given in Table 3. It is observed from the Table 3 that, all the interactions obtained scores above 5.5 at 6 months of storage period, which indicates that the all interactions were acceptable upto 6 months of storage period i.e. it has shelf life of 6 months. Hence, the product had a shelf life of 6 months.

3.5 Cost of production of best carbonated RTS beverage

The data regarding cost of production is indicated in Table 4. On the basis of cost of production of best interaction it is seen that maximum benefit: cost ratio for production for 200 ml carbonated RTS beverage from kokum was recorded by interaction C_3J_2 (2.53).

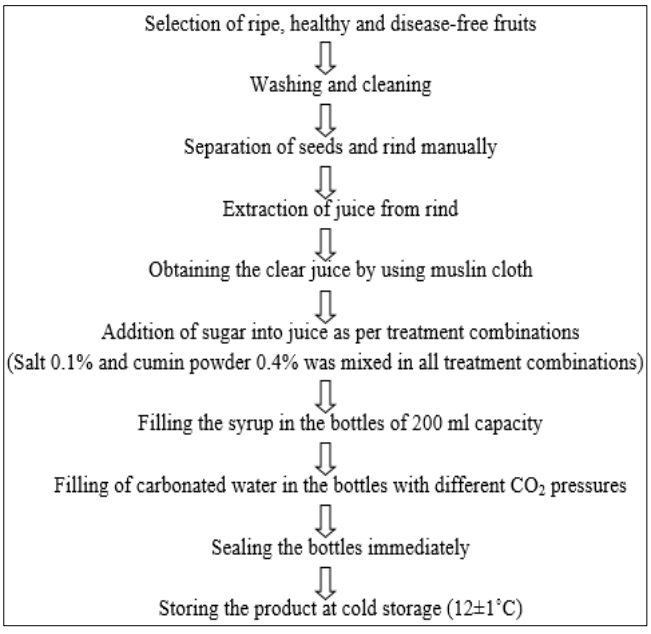

Fig 1: Preparation of carbonated RTS beverage from kokum fruits

Table 1: Changes in colour of carbonated RTS beverage from kokum during storage

Treatments (Carbonation level)	Colour														
	'0' month					'3' month					'6' month				
	Juice-sugar level					Juice-sugar level					Juice-sugar level				
	J_1	J_2	J_3	J_4	Mean	J_1	J_2	J_3	J_4	Mean	J_1	J_2	J_3	J_4	Mean
C_1	8.13	8.13	8.19	8.39	8.21	8.06	8.07	8.10	8.28	8.13	8.00	8.10	8.12	8.28	8.12
C_2	7.93	7.95	8.16	8.25	8.07	7.80	7.94	8.10	8.16	8.00	7.50	7.90	8.00	8.11	7.87
C_3	7.70	7.95	8.01	8.03	7.92	7.79	7.89	7.90	8.09	7.92	7.70	7.80	7.90	8.00	7.85
C_4	7.41	7.59	7.78	7.85	7.66	7.40	7.46	7.60	7.91	7.59	7.10	7.26	7.50	7.88	7.43
Mean	7.79	7.91	8.04	8.13	7.97	7.76	7.84	7.93	8.11	7.91	7.58	7.77	7.88	8.06	7.82
	S.Em. (±)		C.D. at 1%			S.Em. (±)		C.D. at 1%			S.Em. (±)		C.D. at 1%		
Carbonation level (C)	0.02		0.08			0.02		0.07			0.03		0.13		
Juice-sugar level (J)	0.02		0.08			0.02		0.07			0.03		0.13		
Interaction (C×J)	0.04		0.15			0.04		0.14			0.07		0.27		

Table 2: Changes in flavour of carbonated RTS beverage from kokum during storage

Treatments (Carbonation level)	Flavour														
	'0' month					'3' month					'6' month				
	Juice-sugar level					Juice-sugar level					Juice-sugar level				
	J_1	J_2	J_3	J_4	Mean	J_1	J_2	J_3	J_4	Mean	J_1	J_2	J_3	J_4	Mean
C_1	7.68	7.61	7.40	7.19	7.47	7.55	7.52	7.30	7.11	7.37	7.50	7.52	7.30	7.10	7.35
C_2	7.70	7.75	7.40	7.28	7.53	7.68	7.73	7.40	7.20	7.51	7.62	7.88	7.48	7.15	7.53
C_3	8.05	8.35	7.50	7.40	7.83	7.90	8.30	7.50	7.36	7.77	7.70	8.26	7.35	7.28	7.65
C_4	7.26	7.2	7.00	6.89	7.09	7.20	7.20	6.90	6.78	7.02	7.14	7.11	6.88	6.67	6.95
Mean	7.67	7.73	7.30	7.19	7.48	7.58	7.69	7.30	7.11	7.41	7.49	7.69	7.25	7.05	7.37
	S.Em. (±)		C.D. at 1%			S.Em. (±)		C.D. at 1%			S.Em. (±)		C.D. at 1%		
Carbonation level (C)	0.03		0.10			0.04		0.14			0.03		0.11		
Juice-sugar level (J)	0.03		0.10			0.04		0.14			0.03		0.11		
Interaction (C×J)	0.05		0.20			0.07		0.27			0.05		0.21		

Table 3: Changes in overall acceptability of carbonated RTS beverage from kokum during storage

Treatments (Carbonation level)	Overall acceptability														
	'0' month					'3' month					'6' month				
	Juice-sugar level					Juice-sugar level					Juice-sugar level				
	J_1	J_2	J_3	J_4	Mean	J_1	J_2	J_3	J_4	Mean	J_1	J_2	J_3	J_4	Mean
C_1	7.91	7.87	7.80	7.79	7.84	7.81	7.80	7.70	7.70	7.75	7.75	7.81	7.71	7.69	7.74
C_2	7.82	7.85	7.78	7.77	7.81	7.74	7.84	7.75	7.68	7.75	7.56	7.89	7.74	7.63	7.71
C_3	7.88	8.15	7.76	7.72	7.88	7.85	8.10	7.70	7.73	7.85	7.70	8.03	7.63	7.64	7.75
C_4	7.34	7.40	7.39	7.37	7.38	7.30	7.33	7.25	7.35	7.31	7.12	7.19	7.19	7.28	7.20
Mean	7.74	7.82	7.68	7.66	7.73	7.68	7.77	7.60	7.62	7.67	7.53	7.73	7.57	7.56	7.60
	S.Em. (±)		C.D. at 1%			S.Em. (±)		C.D. at 1%			S.Em. (±)		C.D. at 1%		
Carbonation level (C)	0.02		0.06			0.02		0.08			0.02		0.07		
Juice-sugar level (J)	0.02		0.06			0.02		0.08			0.02		0.07		
Interaction (C×J)	0.03		0.13			0.04		0.15			0.04		0.14		

Table 4: Cost of production of best carbonated RTS beverage

Sr. no.	Particulars	C_3J_2 (50 psi carbonation and kokum juice 30% + sugar 70%)
1.	Total variable cost	Rs. 35.22
2.	Total fixed cost	Rs. 0.27
3.	Cost of production of 1 Ltr. of carbonated RTS beverage	Rs. 35.48
4.	Cost of production of 200 ml of carbonated RTS beverage	Rs. 7.09
5.	Sell price of 200 ml of carbonated RTS beverage	Rs. 18
6.	B:C Ratio	2.53

4. Conclusion

From the above findings, it was concluded that interaction C_3J_2 (50 psi carbonation and kokum juice 30% + sugar 70%) was found to be best and the same interaction has recorded highest benefit cost ratio (2.53) which can be stored upto 6 months under cold storage (12±1˚C) condition.

5. References

1. Amerine MA, Pangborn RM, Rocssler EB. Principle of Sensory Evaluation of Food. Academic Press, London; c1965.
2. Anonymous. Resource book of Kokum (*Garcinia indica* Choisy). Western Ghats Kokum Foundation, Panaji – Goa; c2012.
3. Byanna CN, Doreyappa Gowda IN. Standardization of recipe for sweet orange and kokum blended RTS beverage preparation and storage. International Journal of agricultural. Sciences. 2013;9(2):561-566.
4. Gawali NK. Studies on post-harvest handling of cashew apple and standardization of cashew apple RTS beverage.

M. Sc. (Hort.) thesis submitted to Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri (M.S.); c2017.
5. Haldankar PM, Malshe KV, Shedge MS. Promotion of underutilized kokum (*Garcinia indica* Choisy) through scientific interventions: An overview. Journal of the Andaman Science Association. 2022;27(Special Issue):4-11.
6. Hegde PP. Development of spiced carbonated drink from kokum (*Garcinia indica* C.). Thesis submitted to the University of Horticultural Sciences, Bagalkot; c2018.
7. Khan SM. Studies on carbonated beverages from Alphonso mango (*Mangifera indica* L.). A M.Sc. (Agri.) thesis submitted to Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri (M.S.); c2015.
8. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. ICAR. Rev. Ed; c1985. p. 97-156.
9. Phanase SS. Standardization of Jamun (*Syzygium cuminii* L.) carbonated beverage. M. Sc. (PHM) thesis submitted to Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri (M.S.); c2015.
10. Ranganna S. Handbook of analysis and quality control for fruit and vegetable products. Tata Mc Graw – Hill Publishing company ltd., New Delhi, India; c1986. p. 9-105.
11. Wazed MA, Gupta MD, Deya SK, Majumdera RK, Amina Shabadur RS. Preparation and quality evaluation of carbonated guava fruit drinks produced from BARI Payera-4, Malaysian Journal of Halal Research Journal. 2021;4(2):55-59.