www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(5): 746-751

www.thepharmajournal.com
Received: 10-03-2023
Accepted: 15-04-2023

Saniya
Department of Horticulture, RCA, MPUAT, Udaipur, Rajasthan, India

RA Kaushik
Department of Horticulture, RCA, MPUAT, Udaipur, Rajasthan, India

Shalini Pilania
Department of Horticulture, RCA, MPUAT, Udaipur, Rajasthan, India

Deepak Rajpurohit
Department of Processing and Food Engineering, CTAE, MPUAT, Udaipur, Rajasthan, India

Corresponding Author:
Saniya
Department of Horticulture, RCA, MPUAT, Udaipur, Rajasthan, India

Standardization and organoleptic evaluation of custard apple leather and ice cream

Saniya, RA Kaushik, Shalini Pilania and Deepak Rajpurohit

Abstract
Value addition has the genuine potential to augment the earnings for all the growers and stakeholders. In the present study, leather and ice cream recipes were standardized and analysed for organoleptic attributes. The aim of this work was to develop shelf stable leather and ice cream which can be stored for longer period of time and can be good choice for consumers. Leather prepared with T3 (65% custard apple + 35% sugar + 0.5% citric acid) treatment was most accepted among all the treatments. Recipe (T1=15% custard apple + 15% sugar) had highest score and accepted as best recipe. The score for organoleptic traits were declined as storage advanced. The recipes and storage period had significant effect on organoleptic properties of leather and ice cream. All the recipes of leather and ice cream were acceptable throughout the storage period. Custard apple has great potential in developing various processed products.

Keywords: Custard apple, organoleptic quality, leather, storage, ice cream

1. Introduction
Custard apple (*Annona squamosa* L.), member of Annonaceae family originated from West Indies. It is widely cultivated all over the world in tropical and sub tropical regions (Kabele Ngiefu *et al*. 1977) [16]. It is known for its unique taste, flavour and gritty textured pulp. The edible portion is 28–37% of the total fruit weight and seeds correspond to 23–40% (Leal 1990). Fruits are nutritionally and medicinally rich which contains vitamins and mineral matter with caloric value of 75 KCal/100g. Custard apple contains natural sugar and hence make great nutritious snacks and even desserts and finds immense applications in the preparations of various beverages and ice-cream (Chikhalikar *et al.* 2000) [9]. In India, it can be seen growing wildly as well as cultivated in tropical and subtropical part of the country (Gopalan *et al*. 1987). India holds 45,000 ha. area with an annual production of 387 thousand MT. In Rajasthan, area and production under custard apple is 0.5 thousand ha and 4.60 thousand MT, respectively (Anonymous, 2022) [1]. It is found wildly and cultivated and growing gregariously in several districts of Rajasthan (Udaipur, Chittorgarh, Dungarpur, Banswara, Rajsamand and Jhalawar) in the form of land races. Udaipur division alone accounts 112 ha. area with 1067 MT production for the of custard apple in the state. It is the source of livelihood for tribals in Rajasthan. Custard apple takes 4-6 days in ripening after harvest. It is very perishable commodity due to fast ripening which leads to short shelf life (Biale and Barcus 1970) [7]. Ripe fruits can be stored only for 2-3 days without decay (Pereira *et al.* 2011) [23]. Fruits get deteriorated rapidly after harvest due to high respiration and ethylene evolution. Therefore, it is imperative to develop simple, appropriate and cost effective technologies so that products from this delicious fruit can be prepared and marketed with sustainable efforts to make farming more profitable and also it can generate employment in rural areas and promote establishment of cottage agro industries. Standardization of product recipes and organoleptic analysis are strongly interlinked. Organoleptic evaluation is used to figure out the consumers choice for resultant processed product by examining appearance, texture, taste and overall acceptability on the basis of hedonic scale. Hence, the present study was therefore undertaken to utilize nutritional aspect of this fruit by standardizing the recipes of leather and ice cream and to determine the organoleptic attributes of the developed products.

2. Materials and Methods
The experiment was conducted at the post harvest laboratory, Department of Horticulture, RCA, MPUAT, Udaipur. The custard apple pulp was procured from Jovaki Agro Food India Pvt. Ltd. Udaipur. Milk, cream and skim milk powder having brand name Amul was

purchased from local market. Sugar and Stablizer were brought from local market. The pulp was used for preparation of various recipes of leather and ice cream. Experimental details are given below.

2.1 Treatment Details

Custard apple products such as leather and ice cream were developed as per FPO specifications. The treatment comprised 3 recipes for each product.

Treatment combinations for leather

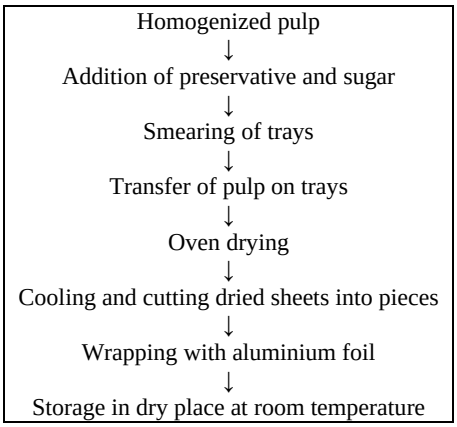
Treatment	Custard apple (%)	TSS (%)	Acidity (%)
T1	100	0	0.5
T2	75	25	0.5
T3	65	35	0.5

Treatment combinations for ice cream

Treatment	Custard apple (%)	TSS (%)
T1	15	15
T2	20	15
T3	25	15

2.2 Preparation of Leather

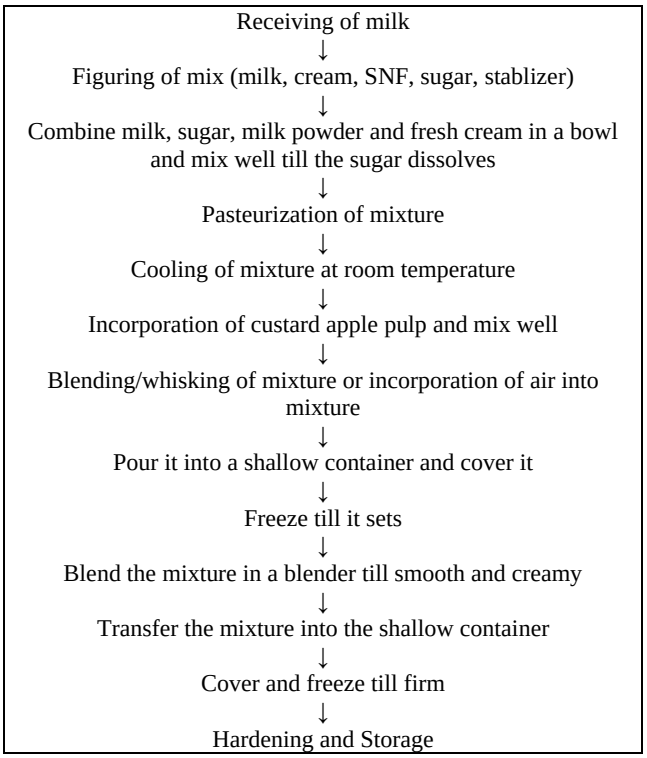
Custard apple leather was prepared by altering the levels of custard apple pulp and sugar. The extracted pulp was taken out from the freezer and defrozed at room temperature. The desired concentration of pulp (100%, 75%, 65%) was homogenized and added with sugar (0%, 25%, 35%), citric acid (0.5%), pectin (1%) and potassium metabisulphite (0.1g). The mixed samples were then poured and spread evenly on smeared stainless steel trays to facilitate uniform drying. The pulp loaded trays were placed in pre heated oven at 55ºC temperature. After achieving 15-20% moisture content, drying was stopped and dried sheets were packed in aluminium foil and stored for up to 150 days at room temperature to analyse organoleptic attributes.



Flow chart for preparation of custard apple leather

2.3 Preparation of ice cream

Custard apple pulp was taken for formulating ice cream recipes at 15%, 20%, 25% concentration. The desired quantity of ingredients were calculated using the algebraic method (Bhandari, 2001). All the recipes were formulated with sugar (15%), fat (10%), SNF (11%) and stabilizer (0.3%). Combine milk, sugar, milk powder and fresh cream in a bowl and mix well till the sugar dissolves and pasteurized the mixture. The pulp was incorporated to each mixture after cooling as per treatment. Blend the mixture for air incorporation. After whisking, each mixture was kept in fridge till it sets. The mixture was again blended to attain soft and smooth texture. Transfer the each mixture into deep freezer for hardening and storage.



Flow chart for preparation of ice-cream

2.4 Sensory evaluation of the leather and ice cream

The products were labelled and stored at room temperature to study the stability and consumer acceptability of the products. The samples of leather and ice cream recipes were taken at monthly interval (0, 30th, 60th, 90th, 120th, 150th days of storage) and analyzed for appearance, texture, taste and overall acceptability. The organoleptic evaluation was carried out using hedonic scoring test. Hedonic scale is described by Ihekoronye and Ngoddy (1985) [14] was used. Panelist were instructed to score 9 for extremely like and 1 for dislike extremely.

2.5 Statistical analysis

The observations were recorded with three treatments and five replications to standardize the best recipe. The data collected were statistically analyses by the standard procedure given by Panse and Sukhatme (1985) [22] by using Completely Randomized Design (CRD).The results were analysed by statistical methods and data are reported as means ± standard deviation of the means. Differences at $p \leq 0.05$ were considered as statistically significant.

3. Results and Discussion

3.1 Organoleptic analysis of processed custard apple leather and ice cream during storage

The leather and ice cream prepared from custard apple pulp were stored at room temperature and at -40^{O}C temperature in deep freezer, respectively for 150 days. Organoleptic evaluation was done by panellists on the basis of 9 point hedonic scale. Data regarding appearance, texture, taste and overall acceptability of leather and ice cream is presented in

Table 1 to 4 and illustrated in Fig. 1 to 2, respectively. Table 1 to 4 clearly stated that all the organoleptic parameters were found to be declining during the storage period in leather and ice cream recipes.

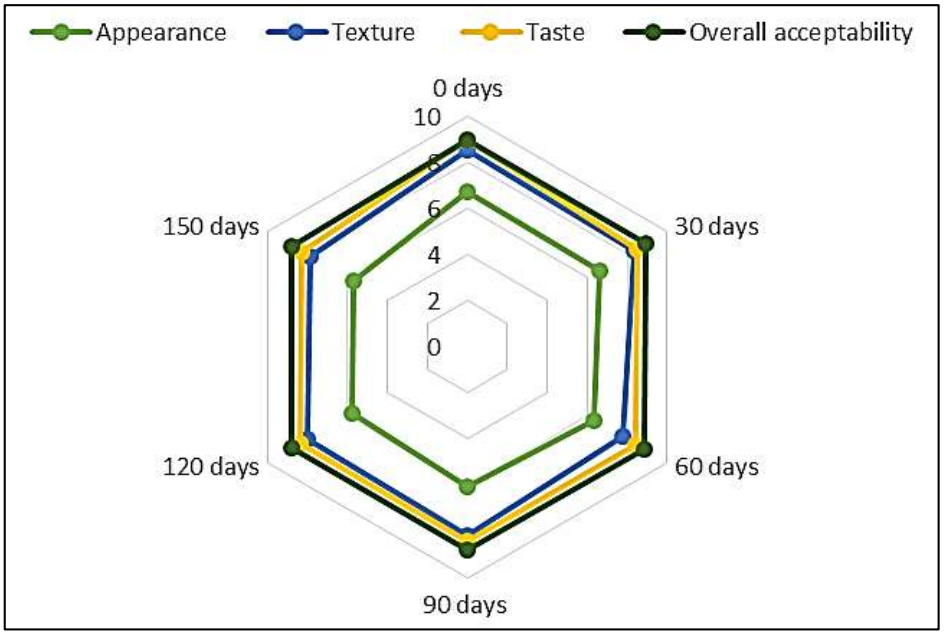


Fig 1: Organoleptic characteristics of best accepted recipe of leather during storage period

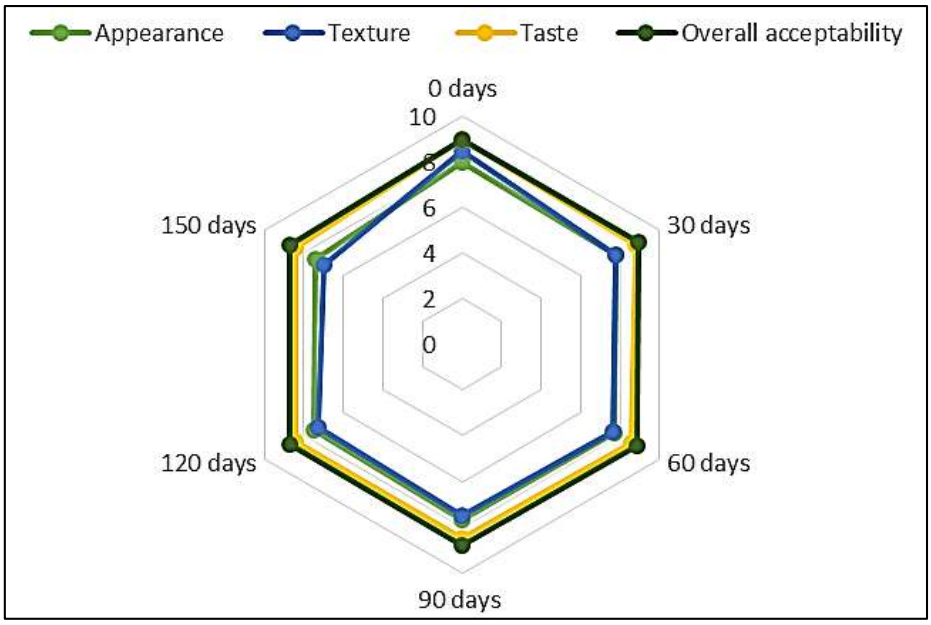


Fig 2: Organoleptic characteristics of best accepted recipe of ice cream during storage period

3.2 Organoleptic analysis of custard apple leather during storage

The data with respect to organoleptic traits of the recipes of leather are given in Table 1, 2.

Table 1: Effect of different recipes on appearance and texture of leather

Observation / Treatment	Appearance						Texture					
	0	30	60	90	120	150	0	30	60	90	120	150
T1	7.71	6.85	6.74	6.46	6.11	5.96	7.50	7.72	7.61	7.44	7.30	7.19
T2	6.90	6.74	6.67	6.34	6.30	5.86	7.80	7.76	7.65	7.52	7.48	7.35
T3	6.70	6.65	6.36	6.03	5.73	5.66	8.55	8.35	7.75	8.15	8.00	7.83
SEm	0.12	0.12	0.13	0.11	0.15	0.16	0.17	0.17	0.12	0.15	0.16	0.20
CD @ 5%	0.38	0.39	0.42	0.36	0.47	0.50	0.52	0.53	0.39	0.47	0.49	0.62

Table 2: Effect of different recipes on taste and overall acceptability of leather

Observation / Treatment	Taste						Overall acceptability					
	0	30	60	90	120	150	0	30	60	90	120	150
T1	8.33	8.26	8.00	7.91	7.83	7.71	8.08	7.50	7.45	7.42	7.35	7.25
T2	8.50	8.40	8.35	8.22	8.08	7.75	8.45	8.39	8.32	8.28	8.21	8.00
T3	9.00	8.50	8.45	8.40	8.35	8.26	9.00	8.95	8.88	8.81	8.76	8.75
SEm	0.15	0.08	0.13	0.16	0.13	0.12	0.19	0.14	0.13	0.15	0.12	0.10
CD @ 5%	0.46	0.24	0.41	0.51	0.40	0.37	0.60	0.43	0.42	0.48	0.38	0.30

The highest (7.71, 6.85, 6.74, 6.46, 6.11 and 5.96) mean score for appearance of leather was recorded at 0, 30, 60, 90, 120 and 150 days in T1 (100% custard apple pulp + 0% sugar + 0.5 citric acid) while lowest (6.70, 6.65, 6.36, 6.03, 5.73 and 5.66) was recorded in T3 (65% custard apple pulp + 35% sugar + 0.5 citric acid). During storage a slight degradation in sensory quality was observed. Blessing and Ekwunife (2015) [8] found no significant difference among the treatments of mixed fruit leather. Result are in conformity with the findings of Dinkar (2015) [10] in custard apple toffee.

Treatments significantly affected the texture of the developed product. In leather, maximum (8.55, 8.35, 7.75, 8.15, 8.00 and 7.83) and minimum (7.80, 7.72, 7.61, 7.44, 7.30 and 7.19) score for texture were noted at0, 30, 60, 90, 120 and 150 days of storage in T3 (65% custard apple pulp + 35% sugar + 0.5 citric acid) and T1 (100% custard apple pulp + 0% sugar + 0.5 citric acid). Blessing and Ekwunife (2015) [8] reported no significant difference at (p40.05) among the samples in their textures. Different researchers have said that the texture of product can modify by the addition of pulp, sugar, citric acid and pectin (Heikal *et al.* 1972) [13] and (Attri *et al.* 2014) [3]. A comparative study of leather drying by Bandaru and Bakshi (2021) [4] obtained maximum rating and smoother texture with tray dried leather followed by hot air oven, sun drying and microwave oven. Observed results are in agreement with Basha (2015) [5] in guava leather.

The taste of custard apple leather remained palatable only up to 150 days for all the treatments. The mean score for taste of leather was highest (9.00, 8.50, 8.45, 8.40, 8.35 and 8.26) in T3 (65% custard apple pulp + 35% sugar + 0.5 citric acid) whereas lowest in T3 (100% custard apple pulp + 0% sugar + 0.5 citric acid) at 0 days, 30 days, 60 days, 90 days, 120 days and 150 days. Taste score was declined due to loss of ascorbic acid during processing as it is heat sensitive vitamin. Results are in conformity with Ashaye *et al*. (2005) [2] in paw paw and guava leather, Jain and Nema (2007) [15] in guava leather, Dinkar (2015) [10] in custard apple toffee and Singh *et al.* (2019) [25] in plum leather.

The data for overall acceptability of leather was obtained maximum (9.00, 8.95, 8.88, 8.81, 8.76 and 8.75) and minimum (8.08, 7.50, 7.45, 7.42, 7.35 and 7.25) with T3 (65% custard apple pulp + 35% sugar + 0.5 citric acid) and T1 (100% custard apple pulp + 0% sugar + 0.5 citric acid), respectively, at 0, 30, 60, 90, 120 and 150 days of storage. The decrease in the overall acceptability of products might be due to reduction in appearance, texture and taste during storage period. Data identical with the findings of Sravanthi (2004) [26] in custard apple toffee, Singh *et al.* (2019) [25] in plum leather and Mahesh *et al*. (2021) [18] in dragon fruit leather.

3.3 Organoleptic analysis of custard apple ice cream during storage

The data with respect to organoleptic traits of the recipes of ice cream are given in Table 3, 4.

Table 3: Effect of different recipes on appearance and texture of ice cream

Observation / Treatment	Appearance						Texture					
	0	30	60	90	120	150	0	30	60	90	120	150
T1	8.00	7.80	7.70	7.66	7.50	7.44	8.50	7.80	7.65	7.52	7.30	7.00
T2	8.66	7.96	7.85	7.80	7.66	7.61	7.85	7.40	7.12	7.00	6.88	6.70
T3	8.85	8.70	8.60	8.55	8.50	8.46	7.00	6.75	6.85	6.66	6.49	6.35
SEm	0.13	0.12	0.12	0.11	0.18	0.14	0.10	0.10	0.16	0.12	0.15	0.14
CD @ 5%	0.40	0.39	0.39	0.36	0.57	0.46	0.31	0.31	0.51	0.38	0.48	0.45

Table 4: Effect of different recipes on taste and overall acceptability of ice cream

Observation / Treatment	Taste						Overall acceptability					
	0	30	60	90	120	150	0	30	60	90	120	150
T1	9.00	8.75	8.60	8.52	8.45	8.40	9.00	8.90	8.85	8.79	8.72	8.68
T2	8.00	7.70	7.60	7.53	7.47	7.45	8.50	8.35	8.16	8.05	7.75	7.50
T3	7.80	7.66	7.50	7.35	7.10	7.00	8.00	7.50	7.45	7.37	7.32	7.25
SEm	0.10	0.11	0.13	0.18	0.21	0.15	0.12	0.17	0.12	0.12	0.13	0.15
CD @ 5%	0.31	0.35	0.42	0.58	0.67	0.46	0.37	0.53	0.37	0.40	0.41	0.47

Highest mean value (8.85, 8.70, 8.60, 8.55, 8.50 and 8.46) of ice cream for appearance was observed in T1 (15% custard apple pulp + 15% sugar) at 0 days, 30 days, 60 days, 120 days and 150 days. Similarly minimum score (8.00, 7.80, 7.70, 7.66, 7.50 and 7.44) for appearance of ice cream was observed with T3 (25% custard apple pulp + 15% sugar). The ice cream remained acceptable throughout the storage in all the treatments. The results are in conformity with the findings of Vitthalrao (2011) [28] on custard apple kulfi, Vijayrao (2014) [27] and Makwana *et al*. (2018) [20] in custard apple ice cream.

The maximum rating (8.50, 7.80, 7.65, 7.52, 7.30 and 7.00) for texture was observed with T1 (15% custard apple pulp + 15% sugar) and least value with (7.00, 6.75, 6.85, 6.66, 6.49 and 6.35) T3 (25% custard apple pulp + 15% sugar) at 0 days,30 days, 60 days, 120 days and 150 days. The score was observed to be decreasing during storage period. The results are similar with of Yadav (2010) [29], Vitthalrao (2011) [28] and Vijayrao (2014) [27] on custard apple ice cream.

Ice cream had maximum score (9.00, 8.75, 8.60, 8.52, 8.45 and 8.40) and minimum score (7.80, 7.66, 7.50, 7.35, 7.10 and 7.00) at 0 days, 30 days, 60 days, 120 days and 150 days with T1 (15% custard apple pulp + 15% sugar) and T3 (25% custard apple pulp + 15% sugar). The taste of processed products influenced due to pulp concentration. The reduction in taste ratings were reported in all the recipes of each products as the storage period advanced, it might occured due to pH and acid alteration, excess of sweetners. Identical findings were recorded by Pinto *et al*. (2004) [24] in ginger ice cream and Vitthalrao (2011) [28] on custard apple kulfi.

Highest score (9.00, 8.90, 8.85, 8.79, 8.72 and 8.68) for overall acceptability of ice cream was recorded in T1 (15% custard apple pulp + 15% sugar) at 0, 30, 60, 120 and 150 days whereas lowest rating (8.00, 7.50, 7.45, 7.37, 7.32 and 7.25) was recorded with T3 (25% custard apple pulp + 15% sugar). The overall acceptability of processed products were declined with time interval. Similar results were reported by Yadav *et al.* (2010) [29], Gaikwad *et al.* (2014) [11], Vijayrao (2014) [27] and Makwana *et al.* (2018) [20] in custard apple ice cream. Palich (1995) [21] and Mahran *et al*. (1987) [19] studied the storage studies and concluded that with the passage of time, sensory quality of ice cream gets deteriorated.

4. Conclusion

Custard apple has very unique flavour and good nutritional and medicinal properties. Custard apple can be used as table purpose as well as processed products. Thus, it can be used in developing various processed product. Leather prepared with T3 (65% custard apple + 35% sugar + 0.5% citric acid) treatment was most accepted among all the treatments. Recipe, T1 (15% custard apple + 15% sugar) had highest score for texture, taste and overall acceptability and accepted as best recipe. All the recipes of leather and ice cream were acceptable throughout the storage duration. On the basis of organoleptic attributes, both the products were acceptable during the storage and can be recommended as best shelf stable products.

References

1. Anonymous. First advance estimates of area and production of horticultural crops; c2022. https://agricoop.nic.in. 2021-2022
2. Ashaye OA, Babalola SO, Babalola OA, Aina JO. Chemical and organoleptic characteristics of paw-paw and guava leathers. Journal of Agriculture and Sciences. 2005;1(1):50-51.
3. Attri S, Dhiman AK, Kaushal M, Sharma R. Development and storage stability of papaya(*Carica papaya* L) toffee and leather. International Journal of Farm Sciences. 2014;4(3):117-125.
4. Bandaru H, Bakshi M. Effect of different drying conditions on the quality of apple and guava fruitleather. The Pharma Innovation Journal. 2021;10(8):233-237.
5. Basha SJ. Standardization and preparation of guava leather. M.Sc. thesis, MPKVV, Rahuri (MH); c2015.
6. Bhandari V. Ice cream: Manufacture and technology. Tata MacGrow Hill Publishing Company, New Delhi, India; c2001. p. 6-18.
7. Biale JB, Barcus DE. Respiratory patterns in tropical fruits of the Amazon. Brastin Tropical Science. 1970;12(2):93-104.
8. Blessing I Offia-Olua, Ekwunife OA. Production and evaluation of the physico-chemical and sensory qualities of mixed fruit leather and cakes produced from apple (*Musa Pumila*), banana (*Musa Sapientum*), pineapple (*Ananas Comosus*). Nigerian Food Journal. 2015;33:22–28.
9. Chikhalikar NV, Sahoo AK, Singhal RS, Kulkarni PR.Studies on frozen pourable custard apple (*Annona squamosa* L.) pulp using cryoprotectants, Journal of the Science of Food and Agriculture. 2000;80:1339-1342.
10. Dinkar BP. Preparation of toffee from custard apple (*Annona squamosa* L.) pulp. M.Sc (Food Tech.) thesis, MPKVV, Rahuri (MH), 2015.
11. Gaikwad S, Pawar S, Karanjkar LM, Gajarlawar SJ. Preparation of low fat custard apple ice-cream using preservative. 2nd International Conference on Agricultural & Horticultural Sciences. Hyderabad, India, 2014.
12. Gopalan C, Ramasastri BV, Balasubramanyam SC. Nutritive Value of Indian Foods. National Institute of Nutrition, Hyderabad, 1991, 55-72.
13. Heikal HA, El-Sanafiri NY, Shooman MA. Some factors affecting quality of dried mangosheets. Agricultural Research Review. 1972;50:185-194.
14. Ihekoronye AI, Ngoddy PO. Integrated Food Science and Technology ft the Tropics. London: MacMillan Ltd. P, 1985, 180-189.

15. Jain PK, Nema PK. Processing of pulp of various cultivars of guava (*Psidium guajava* L.) for leather production. Agriculture Engineering International CIGRE journal, 2007, 9.
16. Kabele Ngiefu CK, Paquot C, Vieux A. Les plantes à huile du Zaïre. 3. Familles botaniques fournissant des huiles d'insaturation relativement élevée. Oléagineux. 1977;32(12):535–537.
17. Leal F. Sugar apple. In Nagy S, Shaw PE, Wardowski WF (Eds.). Tropical and Subtropical Fruits—Composition, properties and uses. Lake Alfred, Florida: Florida Science Source Inc, 1990, 149−158.
18. Mahesh A, Champawat PS, Mudgal VD, Jain SK. Development of dragon fruit leather. International Journal of Chemical Studies. 2021;SP-9(2):71-75.
19. Mahran GA, El-Ahomy HA, El-Bagoury EH, Sayed AF. Effect of storage temperature of milk fat on ice cream quality. Egyptian Journal of Food Science. 1987;15:65-73.
20. Makwana A, Varu DK, Malam VR, Bhad M, Maheta P. Effect of different concentrations ofcustard apple pulp on the properties of ice cream. HortFlora Research Spectrum. 2018;7(2):126-132.
21. Palich P. Study of changes in quality of icecream during storage. Chlodnictwo. 1994; 29:21-5 (Food Science Technology Abstract. 1995;27:109.
22. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research Publication, 1985, 87-89.
23. Pereira MCT, NietscheS, Costa MR, Crane JH, Corsato CDA, Mizobutsi EH. Anonaceas: pinha, atemoia e graviola. Informe Agrope; c2011.
24. Pinto SV, Jana AH, Solanky MJ. Ginger juice based herbal ice cream and its physicochemical and sensory characteristics. International Journal of Dairy Science. 2004;57:315–318.
25. Singh A, Sonkar C, Shingh S. Studies on development of process and product of plum fruit leather. International Journal of Food Science and Nutrition. 2019;4(5):74-79.
26. Sravanthi T, Waghrey K, Daddam JR. Studies on preservation and processing of custard apple (*Annona squamosa* L.) pulp. International Journal of Plant, Animal and Environmental Sciences. 2014;4(3):676-682.
27. Vijayrao DS. Studies on processing of custard apple for preparation of ice cream and milk shake. MPKV, Rahuri (MH), 2014.
28. Vitthalrao WM. Studies on Preparation of kulfi blended with custard apple pulp. M.Sc. thesis, MKV, Parbhani (MH), 2011.
29. Yadav CM, Karanjkar LM, Kashid UB. Effect of assimilation of custard apple (*Annona squamosa* L.) pulp on chemical quality and cost of ice-cream. J Dairying. Foods & H.S. 2010;29(2):86-91.