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Influence of storage duration on chemical changes in flavoured custard apple (*Annona squamosa* L.) shake

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Abstract
The present investigation entitled "Influence of Storage Duration on chemical changes in flavoured custard custard apple (*Annona squamosa* L.) Shake" The treatment consisted seven different concentration of custard apple pulp and milk *viz*. (T_0) 100: 0% (Control), (T_1) 70: 30%, (T_2) 65: 35%, (T_3) 60: 40%, (T_4) 70: 30%, (T_5) 65: 35%, T_6: 60: 40% custard apple pulp and milk for sweetening the shake 5% honey and 5% jiggery were used in treatments T_1, T_2, T_3 and T_4, T_5, T_6 respectively.
The results revealed that the chemical parameters was found to be significantly superior with respect to TSS of custard apple shake was found to be increased from 23.78 to 25.76 ^oBrix with increase in custard apple shake. Similarly total sugar, reducing sugar, sugar, ascorbic acid, protein and pH were also found to be increased with increase in percentage of custard apple shake. Whereas acidity and non-reducing of custard apple shake was found to be decreased with increase in percentage.
On the basis of present finding it can be concluded that the milk shake recipe prepared from 70% milk + 30% custard apple pulp + 5% Jaggery (T_4) has found to be best with respect to different quality parameter.

Keywords: Custard apple, milk, jaggery, honey, shake

Introduction
Custard apple (*Annona squamosa* L.) a member of Annonaceae family, popularly known as "sugar apple" or "sweet sop" or "fruit of poor people" is native to Tropical America, and is well distributed in the tropical, subtropical and arid zones of the world. In India it is called with different vernacular name like Sitaphal, Saripha etc.
Custard apple contains more calories (101 calories/ 100 g). Simple carbohydrates account for the majority of the calories. On the other hand, it is free from saturated fats and cholesterol. Custard apple has higher vitamin-C content (19.2 mg/100 g) than cherimoya. Custard apple is a good source of B-complex vitamins, particularly vitamin B_6 (17% pyridoxine per 100 g). Fruit also contain several polyphenolic antioxidants. Among them, the most prominent are Annonaceous acetogenins. Acetogenin compounds such as asimicin and annonacin are potent cytotoxins. These compounds have anti-cancer, anti-malarial, and de-worming properties (Custard apple Nutrition facts, n.d.).
Generally tribal people and farmers of Chhattisgarh harvest sugar apple fruits from the forest area and sell it at a very low price at either on the road side or nearby markets. Since they have no idea about the market demand of this fruit, they harvest fruit either when the fruits have attained improper maturity, or when the fruits are over ripened thus leading to considerable post harvest loses.
Custard apple is one of the most delightful and delicate fruit. Despite it's delightful flavour and high nutritive value, it fetches a low price due to market glut. Browning during the storage of fruits or it's pulp, is a major draw back its post – harvest life. Therefore, processing is the only option for increasing its shelf life. This technique not only extends the life of perishable goods, but it also generates a better market than fresh fruit. It aids in the removal of surplus product from the market during the post-harvest season, price stabilization, and the maintenance of a store of fruits to fulfill consumption during off-seasons.
Milk shake is a cold beverage prepared from milk and ice. It is consideredas perfect health diet drink having low fat and sugar percentage and higher MSNF (milk solids not fat) composition than ice cream (Sharma and Gupta, 1978) [23]. Fruit pulp can be added to make it more tasty and healthful. Fruit juice outlets in various regions of India sell milk shakes throughout the year (Sharma and Gupta, 1978) [23]. Blending milk with other fruits to create sweet and appealing products is becoming more popular.

Custard apple pulp having pleasant aroma and flavor, sweet with moderate acidity could be an excellent source for dessert, milkshakes and ice-creams.

Material and Method

The experiment material *i.e* custard apple fruits were procured from the local market of Kanker district of Chhattisgarh. Uniform sized fruit having optimum maturity were selected and brought to the laboratory for preparation of product and further studies. The pulp was extracted manually and the seeds were removed from pulp by rubbing it on steel mesh. After removal of seed the pulp was filtered through muslin cloth. All the ingredients *viz*., pulp, milk and honey or jaggery were taken as per treatments in mixer grinder and then blending was done for 1 to 2minutes.Sodium benzoate was used 0.1% as preservative to preserve the custard apple shake to enhance the shelf life of processed product and stored in refrigerator. Experiment was conducted during 2021-22 at Horticulture Processing Lab, Department of Fruit Science, IGKV, Raipur. It is conducted under CRD with 7 treatment and 3 replication. Treatment were T_0 100% Milk (Control); $T_1$70% milk + 30% Custard apple pulp + 5% Honey; T_2 65% milk + 35% Custard apple pulp + 5% Honey; T_3 60% milk + 40% Custard apple pulp + 5% Honey; $T_4$70% milk + 30% Custard apple pulp + 5% Jaggery; T_5 65% milk + 35% Custard apple pulp + 5% Jaggery; $T_6$60% milk + 40% Custard apple pulp +5% Jaggery;

T_0	100% Milk (Control)
T_1	70% milk + 30% Custard apple pulp + 5% Honey
T_2	65% milk + 35% Custard apple pulp + 5% Honey
T_3	60% milk + 40% Custard apple pulp + 5% Honey
T_4	70% milk + 30% Custard apple pulp + 5% Jaggery
T_5	65% milk + 35% Custard apple pulp + 5% Jaggery
T_6	60% milk + 40% Custard apple pulp +5% Jaggery

Preparation of custard apple shake

Custard apple milk shake was prepared as per the method (Bakane *et al.* 2016) [3] with slight modification. The flow chart of preparation of custard apple shake is shown in Fig.1

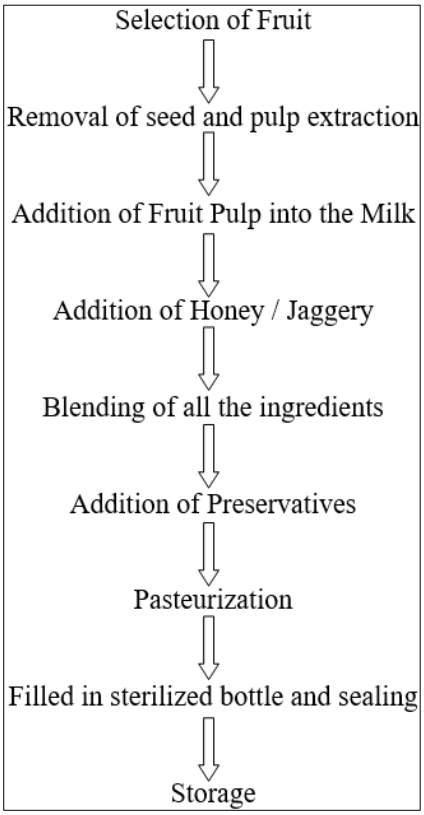

Fig 1: Flow chart of preparation of Custard apple shake

Chemical Characteristic of Custard Apple Milk Shake

Table 1: Physicochemical properties of custard apple shake

Treatments	TSSº Brix	Acidity (%)	pH	Ascorbic acid (mg/100g)	Total sugar (%)	Reducing Sugar (%)	Non-reducing Sugar (%)	Protein (%)
T_0	21.3	0.14	5.83	24.04	15.43	12.50	2.93	3.46
T_1	23.67	0.15	6.11	26.13	15.11	12.40	2.71	3.23
T_2	24.34	0.17	6.36	26.41	15.28	12.57	2.71	3.22
T_3	24.56	0.15	6.16	26.03	15.31	12.62	2.69	3.28
T_4	25.76	0.14	6.03	27.03	15.81	12.83	2.98	3.42
T_5	25.43	0.15	6.09	26.87	15.39	12.55	2.84	3.22
T_6	25.54	0.16	6.22	26.79	15.27	12.62	2.65	3.19
SEm±	0.010	0.005	0.008	0.01	0.014	0.024	0.012	0.005
CD (P=0.05)	0.029	0.016	0.023	0.03	0.043	0.072	0.037	0.016

Total soluble solid: (ºB)

The TSS of custard apple shake was slightly increased from 23.78 to 25.76º Brix with increase due to the current findings are consistent with the report, in that the total soluble solids in the custard apple shake grew steadily over time. Similar findings were reported by Poul *et al*. (2009) [17] and Bakane *et al*. (2016) [3], who found that total soluble solids increased with time.

Acidity (%)

The acidity of custard apple shake was moderately decrease from 0.22 to 0.14% may be due to conversion of acids to sugars (Pool *et al*., 1972) [18] and utilization of organic acid during respiration (Singh and Mathur, 1954) [22].

pH

The pH of custard apple shake during storage period was increased 5.70 to 6.36. The reduction in pH values is also due to retention of higher percentage of acidity to the pure milk was more than custard apple pulp during storage period. The present findings are close agreement with the findings recorded by the Pareek *et al.* (2011) [14] in custard apple shake.

Ascorbic acid (mg/100g)

The ascorbic acid of custard apple shake found to be increased from 21.89 to 27.03 This might be attributed to low temperature and high relative humidity in storage, which inhibited the rate of oxidation and metholic activity.

Total sugar (%)

The total sugar per cent of shake showed an increasing trend up to 45 days of storage. Increase in total sugar was found in 12.89 to 15.81%.This might be due to partial hydrolysis of complex carbohydrate. Similar results have also been reported by Jadhav *et al.* (2017) [6].

Reducing sugar (%)

The of custard apple shake during storage period was increased from 9.35 to 12.83%. The increase in reducing sugar corresponded to the increase in total soluble solids and ultimate decrease in non-reducing sugar in the storage period. Similar findings were also reported by the Sharma and Singh (2005) [20], Singh *et al.* (2011) [21] in custard apple.

Non-reducing sugar (%)

Non-reducing sugar of custard apple shake during storage period was increased In the experiment, the non-reducing sugar percentage shows a decreasing trend with the increase from 3.54 to 2.98% in storage duration. This might be due to the inversion of non-reducing sugar into reducing sugar, as increase in reducing sugar was correlated with the decrease in non- reducing sugar. The increase in reducing sugar corresponded to the increase in total soluble solids and ultimate decrease in non-reducing sugar in the storage period. Similar findings were also reported by the Sharma and Singh (2005) [20], Patel *et al.* (2011) [15] in custard apple.

Protein (%)

Protein of custard apple shake during storage period was slightly increased from 2.80 to 3.42. Quantity of custard apple pulp is increased there was decrease in protein content, which might be due to less protein in custard apple pulp as compared to cow milk. The results are in conformity with the finding of Poul *et al.* (2010) [17] in custard apple milk shake. Kashid *et al*. (2005) [8] found the similar observation in golden milk shake from cows combined with safflower milk and also reported by Nakaya *et al.* (1991) [13].

Conclusion

The study concludes that ratio 70% cow milk + 30% custard apple pulp + 5% Jaggery for blending of custard apple shake was most acceptable for preparation of shake.

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