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Studies on Preparation of Toffee from Guava

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Abstract

The present investigation was carried out to develop a technology for preparation of toffee from guava pulp and study the changes in chemical composition and sensory properties of toffee during storage at ambient temperature as well as refrigerated condition. Preliminary studies were carried out to standardize the optimum levels of ingredients like sugar 500 g, fat 100 g, SMP 100 g and salt 5 g, respectively per kg of guava pulp. Toffees was prepared from this combination was found to be better than other combinations in respect to organoleptic properties and nutritional quality. The yield of fresh toffees was ranged from 0.884 to 1.222 kg per kg guava pulp and various combinations of ingredients used in the toffee preparation. The toffees prepared were wrapped in metallic coated polythene wrapper, packed in 200 gauge polythene bags and stored at ambient (27 ± 2 ^{0}C) as well as refrigerated (5 ± 2 ^{0}C) condition for 90 days. The stored samples were drawn periodically at 30 days interval for organoleptic and chemical analysis. The chemical composition indicated that the fresh toffees contained on an average moisture 9.79 per cent, TSS 78.87 ^{0}Brix, titrable acidity 0.43 per cent, total sugars 72.53 per cent, reducing sugar 47.28 percent and ascorbic acid 89.35 mg/100 g. The mean score of fresh toffees for colour and appearance was 8.30, texture 8.10, flavour 8.25, taste 8.25 and overall acceptability 8.50 on 9 point hedonic scales. The cost of fresh toffee was ranged from Rs. 130 to 162 per kg for various combinations of ingredients. The storage study indicated that the TSS, reducing sugars and total sugars increased with the advancement of storage period, while moisture content, ascorbic acid and acidity decreased. The rates of increase or decrease were relatively higher at ambient temperature than the refrigerated condition. The toffee prepared from 500 g sugar, 100 g fat, 100 g SMP per kg of pulp was found superior over other combinations in respect of organoleptic properties throughout storage period. However, toffees were found to be acceptable even after 90 days storage at ambient as well as refrigerated conditions.

Keywords: Guava, Toffee, Nutritional value, Sensory properties.

Introduction

Guava (*Psidium guajava L.*) is a member of dicotyledonous, family Myrtaceae, having Tropical America origin. It is important tropical fruit crop. It is a small tree or shrub of 2 to 8 m in height with wide spreading branches (Singh, 1988). India leads the world in guava production (Singhal, 1996). Guava crop in India occupies an area of 2.20 lakh hectare with annual production 25.72 lakh MT having productivity 11.70 MT/ha (2010). Maharashtra ranks second in production in India (Bijay Kumar, 2011). Major guava producing states are Uttar Pradesh, Maharashtra, Bihar, Andra Pradesh, Gujarat, Madhya Pradesh, and Karnataka. Guava is an important commercial horticultural crop in Maharashtra with an area of 33,469 ha, with production of 2.58 lakh MT and productivity 7.80 MT/ha (Bijay Kumar, 2011).

The sensory quality and nutritional value of guava fruits are influenced by physical and biochemical changes during maturation/ripening. Fully ripped guava fruits have very strong flavour therefore, it is unsuitable to use as a table purpose. Fruit is rich source of vitamin C (100-260 mg/100 g) and also good

in minerals like phosphorus, calcium, etc. The fresh fruit contains 83 per cent moisture, 1 per cent protein with an energy value of 67.78 cal/100 g fruit (Singh *et al*, 1976). In some countries, the fruit is used for curing diarrhea. Guava is normally consumed fresh as a desert fruit. However, guava is highly perishable and cannot be stored for longer period. Moreover considerable proportion of the produce is lost during post-harvest linkage (Chavan, 2014; Chavan and Ahire, 2014). It is, therefore, imperative to develop suitable technology for processing and preservation of such surplus produce.

Guava pulp had very strong flavour and higher amount of Vitamin C content. Therefore, it will be very wrathful to mix guava pulp with other fruit pulp having less flavour to form combination of both to yield good quality processed fruit product. Toffee is one of the confectionery products. It is reported that pulpy fruits like mango, guava, papaya, fig, jack fruit etc. can be utilized for preparation of toffee, such fruit toffees naturally are very nutritious as they contains most of the constituents of the fruit from which they are prepared (Jain *et al.*, 1958). However, very little work is done on mixed fruit toffees. It is possible to prepare the toffee combining guava pulp and other ingredients to get desired properties from fruit toffee. It is, therefore proposed to utilize guava fruits with various combinations for preparation of toffee and study their nutritional and organoleptic properties.

Materials and Methods

The fully matured and ripened guava fruits (Cv. Sardar) were obtained from the All India Co-ordinated Research Project on Arid Fruit Crops of the Department of Horticulture, M.P.K.V, Rahuri. These fruits were brought to the laboratory of the Department of Food Technology for further research work.

Chemicals: Most of the chemicals used in this investigation were of analytical grade obtained from M/s. Qualigens Fine Chemicals Mumbai, M/s. S. d. Fine Chemicals, Mumbai and M/s. Loba Chemicals Mumbai.

Additives: Cane sugar, hydrogenated fat, salt, skimmed milk powder, black gram Flour (BGF) and semolina were obtained from local market and used as ingredients for preparation of guava fruit toffee.

Packaging materials: Butter paper and metallic film coated polythene wrappers and polythene 200 guage bags were obtained from local market.

Extraction of pulp: Selected fully ripped guava fruits were washed under tap water, surface dried and cut into pieces and were passed through the home scale pulping machine to obtain homogenous pulp with seed. To remove seed the content was poured on screen/sieve (60 meshes) and rubbed with gentle hand to get fine pulp.

Standardization of toffee recipe: Guava toffees were first prepared by using 11 combinations of different levels of ingredients per kg pulp and control as shown in Table 1.

Table 1: Various combinations of ingredients per kg pulp taken for preparation of guava fruit toffee

Treatment No	Guava pulp (%)	Sugar (g/kg)	Fat (g/kg)	SMP (g/kg)	BGF (g/kg)	Semolina (g/kg)	Salt (g/kg)	Ranking for further study
T_1	100	500	25	25	100	400	5	-
T_2	100	500	50	50	100	400	5	-
T_3	100	500	100	100	100	400	5	T_1
T_4	100	750	25	25	100	400	5	-
T_5	100	750	50	50	100	400	5	T_2
T_6	100	750	100	100	100	400	5	-
T_7	100	1000	25	25	100	400	5	-
T_8	100	1000	50	50	100	400	5	-
T_9	100	1000	100	100	100	400	5	-
T_{10}	100	500	100	100	-	-	5	T_3
T_{11}	100	750	50	50	-	-	5	T_4

* SMP: Skim milk powder, BGF: Black Gram Flour

The levels of ingredients per kg pulp were finalized by sensory evaluation of toffees by a panel of minimum ten semi-trained judges using 1 to 9 point Hedonic Scale (Amerine *et al*., 1965). The homogenized pulps were taken into stainless steel container and mixed well, other ingredients such as sugar, butter fat, skimmed milk powder, Black Gram Flour, Semolina, as per the treatment were mixed into pulp. The mixture was heated till the TSS of content reached to 80 ^{0}Brix. Salt was dissolved in small quantity of water and mixed in the above mixture and again heated till TSS of content reached 82-83 ^{0}Brix. The heated mass was transferred in stainless steel plate which was already smeared with fat and product was spread into a thin sheet of 1 to 2 cm thickness. This was allowed to cool and set for two to three hr. and then the solid sheet was cut into cubes of 1.5 to 2.5 cm (Parpia, 1967) with stainless steel knife.

Chemical analysis of toffee: The toffee prepared by standard method was chemically analyzed for moisture, TSS, acidity, total sugars, reducing sugars, titratable acidity and ascorbic acid contents using standard methods of AOAC (1990).

Sensory evaluation of toffees: The sensory evaluations of guava toffees were carried out according to the standard procedure (Amerine *et al.*, 1965) on a 1 to 9 point Hedonic Scale. The mean score of minimum 10 semi trained judges for each quality parameter *viz*., colour and appearance, texture, taste, flavour and overall acceptability was calculated.

Cutting strength of guava toffee: The cutting strength of toffee was measured using HDP/BS blade of texture analyzer. The individual samples of guava toffee were placed on the platform and the blade was attached to the instrument. The absolute peak force of the resulting curve was considered as cutting strength of the guava toffee (Singh *et al*., 1990).

Packaging and storage of toffees: The prepared toffees were packed in metallic paper, kept in 200 gauge plastic bags, sealed and stored for three months at ambient (27±2 ^{0}C) and refrigerated temperature (5±2 ^{0}C) and periodically at 30 days interval evaluated for their organoleptic properties and chemical composition.

Microbial quality of toffees: Microbial count was recorded by using standard plate count (SPC) technique. The Nutrient agar was used as growth medium and Petridis were incubated at 37±5 ^{0}C for 48 hrs for formation of bacterial colonies. The colonies were counted with magnifying lence. Total count was taken along with pin point colonies (Harrigon and Mccance, 1967).

Statistical analysis: All experiments were carried out by using Completely Randomized Design (CRD). The data obtained in the present investigation were analyzed for the statistical significance according to the procedure given by Panse and Sukhatme (1967).

Results and Discussion

Physico-chemical properties of guava fruits: The guava fruit (Sardar) have greenish yellow colour, 138g average weight of fruits, 4.63 cm diameter and contained 85.61 per cent moisture, 12.00 ^{0}Brix(TSS), 0.81 per cent acidity, 7.11 per cent total sugar, 5.1 per cent reducing sugar and 243 mg/100g ascorbic acid (Table 2).

Table 2: Physico-chemical properties of guava fruits

I.	**Physical parameters (Fruits)**	**Content**
1.	Colour	Greenish yellow
2.	Average weight of fruits (g)	138.00
3.	Diameter (cm)	4.63
4.	Recovery of pulp	93.6
5.	Other materials (skin and seeds)	6.4
II.	**Chemical parameters (pulp)**	
1.	Moisture (%)	85.61
2.	Total soluble solids (^{0}Brix)	12.00
3.	Acidity (%)	0.81
4.	Reducing sugar (%)	5.1
5.	Total sugar (%)	7.11
6.	Ascorbic acid (mg/100g)	243

***Recovery of pulp from guava*:** The recovery of guava pulp was recorded as 93.6 per cent by using screens. The recovery of guava pulp was recorded as 65 per cent by using the pulper (Pol, 2001).

***Organoleptic evaluation of preliminary prepared of guava toffees*:** Preliminary trials were conducted to select the appropriate levels of ingredients per kg guava pulp for toffee preparation (Table 3). These prepared toffees were organoleptically evaluated using semi-trained judges and best two and other two for comparison as a control were promoted for further storage study on the basis of their higher level of overall acceptability scores. Keeping black gram flour, Semolina and salt as constant per kg pulp in treatment T_1 to T_9 and treatment T_{10}, T_{11} are control. Treatments were finalized with different levels of ingredients per kg pulp as shown in Table 1. From various combinations, combination number three (T_3) and combination number five (T_5) were selected as a best combination and combination number ten (T_{10}) and eleven (T_{11}) were taken as control because in these treatments black gram flour and semolina were not used. These flour treatments were taken for further storage study.

Table 3: Organoleptic evaluation of preliminary prepared guava toffees

Treatment	Sensory score					Remarks
	Colour and appearance	Texture	Flavour	Taste	Overall acceptability	
T_1	7.00	7.40	7.20	7.00	7.00	Not selected
T_2	7.00	7.20	7.00	7.20	7.20	Not selected
T_3	8.20	8.00	8.20	8.00	8.40	Selected for further study
T_4	7.20	7.20	7.40	7.60	7.80	Not selected
T_5	8.00	7.80	8.00	7.80	8.20	Selected for further study
T_6	7.60	7.60	7.40	7.60	8.00	Not selected
T_7	7.40	7.20	7.20	7.40	7.80	Not selected
T_8	7.40	7.40	7.20	7.40	7.60	Not selected
T_9	7.20	7.20	7.60	7.20	7.20	Not selected
T_{10}	8.60	8.40	8.60	8.80	8.80	Selected for further study
T_{11}	8.40	8.20	8.20	8.40	8.60	Selected for further study
Mean	7.64	7.60	7.64	7.67	7.87	-
SE +	0.521	0.455	0.464	0.512	0.472	-
CD at 5 %	NS	NS	NS	NS	NS	-

Yield and chemical composition of fresh guava toffee

Average yield of toffee: The treatment T_1 gave 1.144 kg/kg toffee yield while T_2 gave 1.222 kg/kg toffee yield to guava pulp. The treatment T_3 and T_4 gave toffee yield 0.884 kg and 0.960 kg/kg pulp respectively. The variation in the yield of fruit toffee was due to the variation in the level of ingredients used while preparation of toffees. In those toffees black gram flour and semolina are used they gave higher yield than control because they increase the solid material in the toffees (Table 4). It was reported that the yield of fig toffee ranged from 1.218 to 1.220 kg/kg of pulp (Khandekar *et al.*, 2005). Also the yield of guava toffees was reported as 1.410 to 1.360 kg/kg of pulp (Pol, 2001). It was reported that, the yield of custard apple toffee increased to 1.35 kg/kg of pulp with increase in sugar level (Dhumal *et al.*, 1996). The yield of fig and guava mixed toffee was reported 1.210 to 1.220 kg/kg of pulp (Kohinkar, *et al*., 2012). The yield of aonla and ginger mixed toffee was reported 1.240 to 1.124 kg/kg of pulp (Nalage, *et al*., 2014). The yield of Guava and Strawberry mixed toffee was reported 0.868 to 0.787 kg/kg of pulp (Chavan *et al.*, 2015).

Table 4: Yield and chemical composition of fresh guava toffees

Treatment	Yield (kg/kg of pulp)	Moisture (%)	TSS (^{0}Brix)	Acidity (%)	Total sugars (%)	Reducing sugars (%)	Ascorbic acid (mg/100 g)
T_1	1.144	10.13	78.26	0.36	71.00	45.05	87.96
T_2	1.222	10.34	78.33	0.42	71.46	46.91	88.64
T_3	0.884	9.31	79.37	0.46	73.54	48.35	89.44
T_4	0.960	9.37	79.51	0.49	74.11	48.83	91.36
Mean	1.053	9.79	78.87	0.43	72.53	47.28	89.35
S.E. $\pm$	-	0.030	0.089	0.020	0.884	0.268	0.169
CD at 5 %	-	0.089	0.267	0.062	NS	0.804	0.507

*NS = Non-significant

T_1 = 500 g sugar, 100 g fat, 100 g SMP, 100 g BGF, 400 g semolina per kg guava pulp.

T_2 = 750 g sugar, 50 g fat, 50 g SMP, 100 g BGF, 400 g semolina per kg guava pulp.

T_3 = 500 g sugar, 100 g fat, 100 g SMP (Control) per kg guava pulp.

T_4 = 750 g sugar, 50 g fat, 50 g SMP (Control) per kg guava pulp.

Chemical composition of fresh toffees

Moisture content: The average moisture content of guava toffees was 9.79 per cent. Treatment T_1 content 10.13 per cent, T_2 10.34 per cent, T_3 9.31 per cent and T_4 9.37 per cent respectively. There was a significant difference in moisture content of toffee. The toffees in which black gram flour and semolina were used they are holding higher amount of moisture than the other toffees. Due to higher amount of protein and starch content in above ingredients were responsible for the holding higher amount of moisture. Pol (2001) reported that the moisture content of guava toffee ranged from 8.30 to 8.50 per cent. The moisture content of fig toffees was recorded within the range of 8.40 to 8.50 per cent (Khandekar *et al.*, 2005). The moisture content of mango toffees was reported as 8.62 per cent (Kerawala and Siddappa, 1963a), banana toffees 8.10 to 8.50 (Dhumal *et al.*, 2003), sapota toffees 8.30 to 8.80 per cent, aonla toffees 12.68 per cent (Domale *et al.*, 2008), fig and guava mix fruit toffees 8.80 to 8.69 per cent (Kohinkar, *et al*., 2012), aonla and ginger mix fruit toffees 8.60 to 8.38 per cent (Nalage *et al*., 2014). Guava and Strawberry mixed fruit toffees 8.31 to 8.84 per cent (Pawar, 2013 and Chavan *et al.*, 2015).The results obtained in the present study are in agreement with literature.

Total soluble solids (TSS, ^{0}Brix): The TSS content of guava toffees ranged from 78.26 to 79.51 ^{0}Brix. Treatment T_1 contained 78.26, T_2 78.33, T_3 79.37 and T_4 79.51 ^{0}Brix. There was a significant difference between the TSS of treatments. Those toffees are containing higher moisture content gives lower amount of TSS than the other toffees. The toffees prepared without black gram flour and semolina gave higher TSS (Table 4). The TSS of fig toffees was ranged from 82.50 to 83.75 ^{0}Brix (Khandekar *et al.*, 2005). The TSS of guava fruit toffee was ranged from 82.10 to 82.40 ^{0}Brix (Pol, 2001). The TSS of custard apple toffee ranged from 82.40 to 82.80 ^{0}Brix (Dhumal *et al.*, 1996). TSS of fig and guava toffee ranged from 82.5 to 84.10 ^{0}Brix (Kohinkar, *et al*., 2012). TSS of aonla and ginger toffee ranged from 82.40 to 84.35 ^{0}Brix (Nalage *et al*., 2014). TSS of guava strawberry mixed fruit toffee ranged from 82.40 to 82.64 ^{0}Brix (Chavan *et al.*, 2015). The results obtained in the present study are in agreement with the literature.

Acidity: The acidity of guava toffee ranged from 0.36 to 0.49 per cent. The treatment T_1 had 0.36, T_2 0.42, T_3 0.46 and T_4 0.49 per cent acidity. There was a significant difference between the acidity content in various toffees prepared by different ingredients of treatments. The acidity of mango fruit toffee made by using Bengal gram flour was reported 0.24 to 0.28 per cent (Kerawala and Siddappa, 1963d). The acidity of banana toffee ranged from 0.169 to 0.211 per cent, papaya toffee 0.31 to 0.40 per cent (Diwate, 2002), fig toffee was reported in range of 0.235 to 0.256 per cent (Khandekar *et al.*, 2005). The acidity of tamarind, mango, and papaya mixed fruit toffee was 0.260 per cent (Nale *et al*., 2007). The acidity of aonla and ginger toffee ranged from 0.465 to 0.390 per cent (Nalage *et al*., 2014). The acidity of guava and strawberry mixed fruit toffee was 0.26 to 0.30 per cent (Chavan *et al.*, 2015). The results obtained in the present investigation are concurrent with literature.

Total sugars: The total sugars of guava toffee ranged from71.00 to 74.11 per cent. The treatment T_4 had maximum amount of total sugars than the other treatments because in this treatment sugar addition was up to 750g/kg pulp and there is no black gram flour and semolina. The tamarind, mango, papaya mixed fruit toffee had total sugars content of 55.67 to 60.13 per cent (Nale *et al*., 2007). Similarly aonla toffee contained 35.51 per cent total sugars (Domale *et al.*, 2008). It was reported that the total sugars content of mango toffees was 67.30 per cent (Kerawala and Siddappa, 1963a), custard apple toffee 72.20 to 78.90 per cent (Dhumal *et al.*, 1996), carrot toffee 73.40 to 78.50 per cent, banana toffees 72.44 to 75.22 per cent, aonla and ginger mixed toffee was 55.67 to 60.13 per cent (Nalage *et al*., 2014), guava and strawberry mixed toffee was 74.07 to 72.82 per cent (Chavan *et al.*, 2015).

Reducing sugars: The reducing sugars of guava toffee ranged from 45.05 to 48.83 per cent. The treatment T_4 had maximum amount of reducing sugars than the other treatments. The reducing sugars content in guava toffees prepared by (Pol, 2001) with skim milk powder and sugar were 49.93 per cent initially. Similar observations were recorded by Kausal *et al.* (2001) in apple pomace toffees. The findings in the present investigation are in corroboration with those of Khandekar *et al*., (2004) in case of toffees that showed gradual increase of reducing sugars from 38.69 to 39.34 per cent over 90 days of storage.

Ascorbic acid: The ascorbic acid content of fresh guava toffees ranged from 87.96 to 91.36 mg/100g. The treatment T_4 contained maximum amount of ascorbic acid than other treatments. The ascorbic acid content of bael toffee was 2.15 mg/100 g (Reena *et al.*, 2007), aonla fruit toffee 322.53 mg/100 g (Domale *et al.*, 2008), custard apple toffee 7.12 to 7.50 mg/100 g (Mundhe *et al.*, 2008), and aonla and ginger mixed toffee 145.90 to107.42 mg/100 g (Nalage et al., 2014) and guava and strawberry mixed fruit toffee 88.53 to 59.32 mg/100 g (Chavan *et al.*, 2015).

Textural properties of guava toffee: The textural analysis of guava toffee was taken at 0 and 90 days. At 0 days treatment T_1, T_2, T_3 and T_4 showed force required for cutting was 10.77 N, 29.11 N, 69.72 N and 90.04 N respectively. After 3 month storage at ambient temperature treatment T_3 and T_4 showed force required for cutting was 71.45 N and 93.10 N respectively. Treatment T_1 and T_2 are contained black gram flour and semolina absorbs more moisture and therefore are spoiled due to microbial growth. While at refrigerated temperature treatment T_1, T_2, T_3 and T_4 required force for cutting was 11.53 N, 30.13 N, 70.50 N and 92.08 N respectively. The maximum force was required for treatment T_4 i.e. 92.08 N while minimum force was required for treatment T_1 i.e. 11.53 N at refrigerated storage.

Sensory properties of fresh guava toffees:

Colour and appearance: The score for colour and appearance was 8.20, 8.00, 8.60 and 8.40 for treatments T_1, T_2 T_3 and T_4, respectively (Table 5). The toffee prepared by using 500 g sugar, 100 g fat and 100 g skim milk powder per kg pulp of treatment T_3 scored highest (8.60), while toffee T_2 with 750 g sugar, 50 g fat, 50 g skim milk powder, Black Gram Flour 100 g and 400 g semolina scored minimum score (8.00). The score for colour and appearance was reported in between 8.83 to 8.33 to the fig toffee (Khandekar *et al.*, 2005). The score for tamarind, mango, papaya blended toffee ranged from 8.00 to 8.80, the score improves with increase in mango pulp (Nale et al., 2007). The score for fig and guava mixed toffees was ranged from 8.60 to 8.00 (Kohinkar *et al*., 2012). The score for aonla and ginger mixed toffees was ranged from 8.25 to 8.68 (Nalage *et al*., 2014) and the score for guava and strawberry mixed toffees was 8.10 to 8.39 (Chavan *et al.*, 2015).

Table 5: Sensory score of fresh toffees prepared from guava pulp

Treatment	Sensory score				
	Colour and appearance	Texture	Flavour	Taste	Overall acceptability
T_1	8.20	8.00	8.20	8.00	8.40
T_2	8.00	7.80	8.00	7.80	8.20
T_3	8.60	8.40	8.60	8.80	8.80
T_4	8.40	8.20	8.20	8.40	8.60
Mean	8.30	8.10	8.25	8.25	8.50
S.E. ±	0.561	0.659	0.6	0.6	0.418
CD at 5 %	NS	NS	NS	NS	NS

*Nine point Hedonic scale; Ten semi-trained judges were used for sensory evaluation.
*NS = Non-Significant. Treatments are as per table no 4.

Texture: The average score for texture of guava toffees was in the range of 7.80 to 8.40 for treatment T_1, T_2, T_3 and T_4. The toffees with 500 g sugar, 100 g fat, 100 g SMP scored maximum (8.40), while toffee with 750 g sugar, 50 g fat, 50 g SMP, 100 g BGF, 400 g semolina scored minimum (7.80). The score for fresh fig toffees ranged from 8.67 to 8.83 (Khandekar *et al.*, 2005). The texture score of mango, tamarind (50 : 50) was maximum than whole tamarind toffees (Nale *et al*., 2007). The score for texture of guava fruit toffees ranged from 7.80 to 8.00 (Pol, 2001), fig and guava fruit toffees ranged from 8.20 to 8.70 (Kohinkar *et al*., 2012). The score for aonla and ginger mixed toffees was ranged from 8.22 to 8.57 (Nalage *et al*., 2014) and the score guava and strawberry mixed toffees was ranged from 7.98 to 8.05 (Chavan *et al.*, 2015).The results obtained in the present study are concurrent to literature.

Flavour: Flavour score for guava toffee ranged from 8.20 to 8.60. The treatment T_3 i.e. 500 g sugar, 100 g fat, 100 g SMP scored significantly maximum (8.60), while treatment T_2 scored minimum (8.00). It was reported that the flavour score for fig toffees flavour ranged from 8.17 to 8.50 (Khandekar *et al.*, 2005), 7.50 to 8.12 for sapota toffee and 8.13 to 8.38 for papaya toffee (Diwate, 2002). The blended toffee prepared from tamarind and mango (50 : 50) score maximum (8.65) as compared to whole tamarind toffee (8.00) (Nale et al., 2007), flavour score for fig and guava mixed fruit toffee ranged from 8.20 to 8.70 (Kohinkar *et al*., 2012), flavour score for aonla and ginger mixed toffees was ranged from 8.20 to 8.67 (Nalage, 2012) and flavour score for guava and strawberry mixed fruit toffees was ranged from 8.11 to 8.32 (Chavan *et al.*, 2015).

Taste: The taste scores for fresh guava toffees ranged from 7.80 to 8.80. The treatment T_3 had significantly maximum score of 8.80 over the treatments T_1, T_2, T_4. The sensory score for taste of fresh guava toffee ranged from 7. 80 to 8.00 (Pol, 2001), papaya toffee 8.13 to 8.38 score for taste was ranged from 8.00 to 8.85 (Nale et al., 2007). The sensory score for taste of aonla and ginger mixed toffees was ranged from 8.00 to 8.60 (Nalage *et al*., 2014) and the sensory score from guava and strawberry mixed fruit toffees was ranged from 8.14 to 8.56 (Chavan *et al.*, 2015). The results of the present study are in agreement with that of literature.

***Overall acceptability*:** There was no significant difference among the treatment for overall acceptability score. The toffee of treatment T_3 recorded maximum (8.80) followed by treatment T_4 (8.60), T_1 (8.40) and T_2 (8.20). This might be due to better colour and appearance, texture, flavour, taste and different level of ingredients per kg guava pulp. The overall acceptability score was reported 7.80 to 8.00 for guava toffee (Pol, 2001), fig toffee 8.50 to 8.67 (Khandekar *et al.*, 2005), tamarind toffee 7.34 to 8.86 (Doiphode, 2004), Nale (2006) was reported that tamarind : mango blended toffee score maximum (8.70) than whole tamarind toffee (8.15), mixed fruit toffee of aonla and ginger the overall acceptability score was reported 8.20 to 8.50 (Nalage *et al*., 2014) and mixed fruit toffee of guava and strawberry the overall acceptability score was reported 8.13 to 8.20 (Chavan *et al.*,2015).

Changes in chemical composition of guava toffee during storage

The guava toffee stored at ambient (27±2 ^{0}C) and refrigerated (5±2 ^{0}C) condition for the period of 90 days. T_1 and T_2 samples contained black gram flour and semolina respectively spoiled due to microbial growth at ambient storage within one month so these treatments were discarded for further study.

Moisture: There was significant decrease in moisture content of toffee during storage for different treatments. The minimum moisture loss was recorded in treatment T_3 from 9.31 to 8.20 per cent and from 9.31 to 8.34 per cent at ambient and refrigerated condition, respectively (Table 6). The rate of loss of moisture was faster at ambient temperature than refrigerated condition. This is due to the temperature difference in the storage conditions. At ambient temperature the treatment T_3 showed least moisture loss from 9.31 to 8.20 per cent followed by treatment T_4 from, 9.37 to 8.41 per cent at the end of storage period. At refrigerated condition the least loss of moisture content was found in treatment T_2, 10.34 to 9.10 per cent, followed by treatment T_1, 10.13 to 9.13, T_4, 9.37 to 8.47 and T_3, 9.31 to 8.34 at end of 90 days of storage period. The statistical analysis showed the significant effect on moisture content during storage. The decrease in moisture content during storage was reported 0.43 per cent in mango fruit toffees (Kerawala and Siddappa, 1963a), banana toffee from 8.83 to 7.62, sapota toffee from 8.31 to 7.62 (Pawar, 2001), guava toffee from 8.40 to 7.65 (Diwate, 2002), fig toffee from 8.45 to 7.41 (Khandekar *et al.*, 2005), tamarind and mango blended toffee from 15.13 to 12.90 per cent (Nale et al., 2007), aonla toffee from 12.68 to 10.87 (Domale *et al.*, 2008), aonla and ginger mixed toffee from 8.48 to 7.89 per cent (Nalage *et al*., 2014). The guava and strawberry mixed fruit toffee from 8.73 to 8.57 per cent (Chavan *et al.*, 2015).

Table 6: Effect of storage period and pulp combinations on chemical composition of guava toffee after 3 months storage

Treatment	Moisture (%)		TSS (%)		Acidity (%)		Reducing sugars (%)		Total sugars (%)		Ascorbic acid (mg/100g)		Standard plate count (log cfu/g)	
	A	R	A	R	A	R	A	R	A	R	A	R	A	R
T_1	-	9.13	-	78.95	-	0.27	-	48.26	-	73.05	-	80.96	-	1.5
T_2	-	9.10	-	79.53	-	0.29	-	50.71	-	73.62	-	82.24	-	1.5
T_3	8.20	8.34	81.85	80.10	0.33	0.36	51.86	51.23	76.35	75.21	82.72	83.68	2.5	1.5
T_4	8.41	8.47	81.97	80.15	0.38	0.40	52.85	51.98	76.49	76.15	83.68	84.48	2.5	1.5
Mean	8.31	8.76	81.91	79.68	0.36	0.33	52.36	50.54	76.42	74.51	83.20	82.84	2.5	1.5
SE ±	0.004	0.025	0.002	0.145	0.025	0.017	0.134	0.186	1.332	1.622	0.195	0.178	-	0.00
C. D. 5% (n=3)	0.014	0.075	0.007	0.437	NS	0.052	0.439	0.559	NS	NS	0.639	0.536	-	NS

A=Ambient (27 ± 2 ^{0}C), R=Refrigerated (5 ± 2 ^{0}C). Treatments are as per table no 4.

Total soluble solids (TSS): The mean of TSS of four toffees prepared from guava increases from 78.87 to 81.91 at ambient temperature and 78.87 to 79.68 ^{0}Brix at refrigerated storage conditions, respectively. There was significant increase in the T.S.S. of toffees in different treatments. The increase in T.S.S. of toffees might be due to decrease in moisture content during storage period at both conditions. At ambient temperature, the treatment T_4 showed maximum increase in T.S.S. from 79.51 to 81.97 ^{0}Brix, followed by 79.37 to 81.85 ^{0}Brix for treatment T_3. At refrigerated temperature T.S.S. content of treatment T_4 increased from 79.51 to 80.15 ^{0}Brix followed by treatment T_3 from 79.37 to 80.10 ^{0}Brix, 78.33 to 79.53 ^{0}Brix for treatment T_2 and 78.26 to 78.95 ^{0}Brix at end of 90 days storage period for treatment T_1. There was increase in TSS while storage period toffees. This might be due to decrease in moisture content during storage. The statistical analysis showed that the treatment and storage period had significant effect on total soluble solids content. The increase in the T.S.S. content during storage period was reported in sapota toffee from 82.25 to 82.55 ^{0}Brix, papaya toffee from 83.75 to 84.00 ^{0}Brix (Diwate, 2002), guava toffee from 82.25 to 82.56 ^{0}Brix (Pol, 2001), banana toffee from 82.25 to 82.55 ^{0}Brix, fig toffee from 83.13 to 83.92 ^{0}Brix (Khandekar *et al.*, 2005), tamarind : mango blended toffee from 84.48 to 85.96 ^{0}Brix (Nale et al., 2007), aonla toffee from 84.44 to 85.46 ^{0}Brix (Domale *et al.*, 2008), aonla and ginger mixed toffee from 83.66 to 85.13 ^{0}Brix (Nalage *et al.*, 2014) and guava and strawberry mixed toffee from 83.21 to 83.54 ^{0}Brix (Chavan *et al.*, 2015). The results obtained in the present investigation are in agreement to the literature.

Acidity: There was significant decrease in the per cent acidity of toffee at both storage conditions. At ambient condition, maximum decrease was observed in treatment T_3, 0.46 to 0.33 per cent followed by treatment T_4, 0.49 to 0.38 per cent. At refrigerated condition the acidity per cent was decrease merely in treatment T_4, 0.49 to 0.40 per cent followed by treatment T_3, 0.46 to 0.36 per cent, treatment T_2, 0.42 to 0.29 and T_1, 0.36 to 0.27 per cent. The rate of decrease in per cent acidity was faster in ambient storage than the refrigerated storage. The statistical analysis showed that the treatment had significant effect on acidity content during storage except at 90 and 60 days for ambient and refrigerated storage respectively. The decrease in acidity content was reported in fig toffee from 0.246 to 0.226 per cent (Khandekar *et al.*, 2005), tamarind : mango blended toffee from 2.60 to 2.02 per cent (Nale *et al.*, 2007), banana toffee from 0.191 to 0.172 per cent, papaya toffee from 0.34 to 0.32 per cent (Diwate, 2002), aonla and ginger mixed toffee from 0.420 to 0.400 per cent (Nalage *et al.*, 2014) and guava and strawberry mixed toffee from 0.30 to 0.26 (Chavan *et al.*, 2015). The results obtained in present investigation are in agreement to the literature.

Total sugars: At ambient temperature, maximum increase in total sugar content was observed in treatment T_4 from 74.11 to 76.49 per cent followed by treatment T_3 from 73.54 to 76.35 per cent during 90 days storage. At refrigerated temperature, maximum increase was observed in treatment T_4 from 74.11 to 76.15 per cent followed by treatment T_3 from, 73.54 to 75.21 per cent, treatment T_2 from, 71.46 to 73.62 and treatment T_1 from 71.00 to 73.05 per cent. The rate of increase of total sugars content was faster at ambient temperature than refrigerated temperature. The increase in total sugars toffee was due to loss of in moisture in both the storage conditions. The statistical analysis showed non significant effect on total sugar content during the advancement of storage. The increase in total sugars content was reported in guava toffee from 73.85 to 74.12 per cent (Pol, 2001), sapota toffee from 73.85 to 74.12 per cent, banana toffee from 73.71 to 74.08 per cent, fig toffee from 74.79 to 75.12 per cent (Khandekar *et al.*, 2005), aonla and ginger mixed toffee from 52.72 to 53.41 per cent (Nalage *et al*., 2014) and guava and strawberry mixed toffee from 73.12 to 74.15 per cent (Chavan *et al.*, 2015). The results obtained in the present investigation are in agreement to the literature.

Reducing sugars: There was significant increase in the reducing sugar content of guava toffees during storage but non-significant at 60 days storage at ambient conditions. At ambient temperature, maximum increase in reducing sugar content was observed in treatment T_4 from 48.83 to 52.85 per cent followed by treatment T_3 from, 48.35 to 51.86 per cent at the end of 90 days storage. At refrigerator temperature, maximum increase was observed for treatment T_4, 48.83 to 51.98 per cent followed by treatment T_3, 48.35 to 51.23 per cent, treatment T_2 46.91 to 50.71 per cent and treatment T_1, 45.05 to 48.26 per cent. The rate of increase of reducing sugars content was faster at ambient temperature than refrigerated temperature. The increase in reducing sugars content in guava toffee due to loss in moisture in both the storage conditions. The statistical analysis showed that the significant effect on reducing sugar content. The findings in the present investigation are in corroboration with those of Khandekar *et al*, (2005) in case of fig toffees that showed gradual increase in reducing sugars from 38.69 to 39.34 per cent over 90 days of storage.

Ascorbic acid: There was significant decrease in the ascorbic acid content of guava toffees. At ambient temperature, maximum decrease was observed in T_4 from 91.36 to 83.68 mg/100 g followed by treatment T_3 from 89.44 to 82.72 mg/100 g. At refrigerated condition the ascorbic acid content decreased merely in treatment T_3 from 89.44 to 83.68 mg/100 g followed by treatment T_2 from 88.64 to 82.24 mg/100 g, treatment T_4 from 91.36 to 84.48 mg/100 g and treatment T_1 from 87.96 to 80.96 mg/100 g. The rate of decrease in ascorbic acid was more in ambient temperature than refrigerated temperature. The statistical analysis showed that the treatment had significant effect on ascorbic acid content at ambient and refrigerated condition except at 30 days storage. The decrease in ascorbic acid content was reported in aonla toffee from 322.53 to 320.78 mg/100 g (Domale *et al.*, 2008), guava toffee from 98.20 to 94.13 mg/100 g (Shivakumar *et al.*, 2007), aonla and ginger mixed toffee from 124.45 to 121.67 (Nalage *et al*., 2014) and guava and strawberry mixed toffee from 64.06 to 62.66 mg/100 g (Chavan *et al.*, 2015). The results obtained in the present investigation are in agreement to the literature.

Changes in sensory properties of guava toffee during storage

Colour and appearance: A gradual decrease in score from 8.60 to 8.20, 8.40 to 7.80 with respect to treatment T_3 and T_4 during 90 days of storage at ambient temperature, while toffees in refrigerated temperature showed score decreased from 8.20 to 8.00, 8.00 to 7.60, 8.60 to 8.40, 8.40 to 8.00 with respect to T_1, T_2, T_3 and T_4 used in the present study (Table 7). The maximum score observed for treatment T_3 i.e. 8.40 at 90 days at refrigerated temperature, while minimum score was observed for treatment T_4 i.e. 7.80 at 90 days of ambient temperature. The organoleptic score for colour and appearance decreases non-significantly during storage of 90 days. The colour deterioration is more in ambient temperature than the refrigerated. This might be the temperature effect on colour and appearance as well as surrounding environment. The retention of good colour and appearance was observed in 500 g sugar, 100 g fat, 100 g SMP (treatment T_3) than other treatment i.e. treatment T_4. The statistical analysis showed that the treatment and storage period had non significant effect on colour and appearance. It was reported that colour and appearance score decreases with respect to storage as period advances in banana toffee from 7.85 to 6.18, grape toffee from 8.18 to 7.50 (Rokade, 1999), sapota toffee from 8.18 to 6.76 (Pawar, 2001), guava toffee from 8.00 to 7.30 (Pol, 2001), fig toffee from 8.58 to 7.25 (Khandekar *et al.*, 2004), aonla and ginger mixed toffee from 8.49 to 8.04 (Nalage *et al*., 2014), guava and strawberry mixed fruit toffee from 8.29 to 7.90 (Chavan *et al.*, 2015). The results obtained in the present investigation are parallel to the literature.

Table 7: Sensory quality of guava toffees after 3 months storage*

Treatment	Colour and appearance		Flavour		Texture		Taste		Overall acceptability		Ranks	
	A	R	A	R	A	R	A	R	A	R	A	R
T_1	-	8.00	-	7.80	-	7.60	-	7.60	-	8.00	-	3
T_2	-	7.60	-	7.60	-	7.40	-	7.60	-	7.80	-	4
T_3	8.20	8.40	8.20	8.40	8.00	8.20	8.20	8.40	8.20	8.40	1	1
T_4	7.80	8.00	7.80	8.00	7.60	7.80	8.00	8.20	8.00	8.20	2	2
Mean	8.00	8.00	8.00	7.95	7.80	7.85	8.10	7.95	8.10	8.10	-	-
SE ±	0.70	0.282	0.70	0.463	0.173	0.591	0.412	0.393	0.412	0.530	-	-
C. D. 5% (n=10)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-	-

A=Ambient (27 ± 2 ^{0}C), R=Refrigerated (5 ± 2 ^{0}C); *Nine point hedonic scale, Ten semi-trained judges were used for sensory evaluation, Treatments are as per table no 4.

Texture: A gradual decrease in score was found from 8.40 to 8.00, 8.20 to 7.60 with respect to treatment T_3 and T_4 at the end of storage (90 days) at ambient temperature. While toffee stored at refrigerated condition showed score on texture decreases from 8.00 to 7.60, 7.80 to 7.40, 8.40 to 8.20 and 8.20 to 7.80 with respect to T_1, T_2 T_3 and T_4. The maximum score was observed for treatment T_3 i.e. 8.20 at 90 day refrigerated temperature, while minimum score was observed for treatment T_4 i.e. 7.60 at 90 days of ambient temperature. The decrease in texture score is faster in ambient temperature than refrigerated temperature. At ambient conditions more moisture loss makes toffee harder than the refrigerated condition ultimately gets fewer score. In general texture was good in treatment T_3 (500 g sugar, 100 g fat, 100 g SMP) than T_1 (500 g sugar, 100 g fat, 100 g SMP, 100 g BGF, 400 g semolina), T_2 (750 g sugar, 50 g fat, 50 g SMP, 100 g BGF, 400 g semolina) and T_4 (750 g sugar, 50 g fat, 50 g SMP) in both ambient and refrigerated storage conditions. The statistical analysis showed that the treatment and storage period had non significant effect on texture of guava toffee. It was reported that the texture score decreases with respect to storage in banana toffee from 7.76 to 6.40, sapota toffee from 8.37 to 6.58 (Pawar, 2001), guava toffee from 7.90 to 6.50 (Pol, 2001), fig toffee from 8.35 to 8.20 (Khandekar *et al.*, 2005), tamarind : mango blended toffee (Nale et al., 2007), aonla and ginger mixed toffee from 8.56 to 7.99 (Nalage *et al.*, 2014) and 8.02 to 7.62 for guava and strawberry mixed toffee (Chavan *et al.*, 2015). The results obtained in the present investigation are parallel to the literature.

Flavour: A gradual decrease in flavour score was observed from 8.60 to 8.20, 8.20 to 7.80 at the end of storage (90 day) at ambient temperature for treatment T_3 and T_4 respectively. While, toffee stored in refrigerated condition score on flavour decreases from 8.20 to 7.80, 8.00 to 7.60, 8.60 to 8.40 and 8.20 to 8.00 with respect to treatment T_1, T_2, T_3, and T_4 at the end of storage (90 day). The maximum score was observed for treatment T_3 i.e. 8.40 at 90 day of refrigerated storage, while minimum score was observed for treatment T_4 i.e. 7.80 at 90 days of ambient temperature storage. The score for flavour decreases significantly during 90 days storage. The decreases of flavour score was faster in ambient storage than refrigerated storage. This effect is mostly due to the temperature difference in the storage condition. The retention of significantly good flavour was observed in treatment T_3 (500 g sugar, 100 g fat, 100 g SMP) than treatment T_1, T_2 and T_4 at both ambient and refrigerated storage. It was reported that flavour score decreases with respect to storage in banana toffee from 7.96 to 6.40, sapota toffee from 7.98 to 6.62 (Pawar, 2001), guava toffee from 7.90 to 7.36 (Pol, 2001), fig toffee from 8.34 to 7.09 (Khandekar *et al.*, 2005), tamarind : mango blended toffee from 8.35 to 7.20 (Nale et al., 2007), aonla and ginger mixed toffee from 8.51 to 8.19 (Nalage *et al.*, 2014) and guava and strawberry mixed toffee from 8.22 to 7.78 (Chavan *et al.*, 2015).

Taste: There was decrease in taste score from 8.80 to 8.20, 8.40 to 8.00 with respect to treatment T_3 and T_4 at the end of storage (90 day) at ambient temperature. While, toffees stored in refrigerated condition score on taste decreased from 8.00 to 7.60, 7.80 to 7.60, 8.80 to 8.40 and 8.40 to 8.20 with respect to treatment T_1, T_2, T_3 and T_4. The maximum score was observed for treatment T_3 i.e. 8.40 at 90 days of refrigerated

storage, while significantly minimum score was observed for treatment T_4 i.e. 8.00 at 90 days ambient storage. The score for taste decreases significantly during 90 days storage. The decrease rate of taste score was faster in ambient than refrigerated condition. This is due to temperature effect and moisture loss during storage condition. Good taste score was observed in treatment T_3 (500 g sugar, 100 g fat, 100 g SMP) than treatment T_1, T_2, and T_4 in both ambient and refrigerated storage at the end of 3 months storage period. The statistical analysis showed that the treatment and storage period had non significant effect on taste score. It was reported that taste score with respect to storage period in banana toffee from 7.98 to 6.22, sapota toffee from 8.02 to 6.28 (Pawar, 2001), guava toffee from 7.90 to 7.35 (Pol, 2001), fig toffee from 8.75 to 7.09 (Khandekar *et al.*, 2005), tamarind : mango blended toffee from 8.45 to 7.35 (Nale et al., 2007), aonla and ginger mixed toffee from 8.31 to 7.97 (Nalage *et al*., 2014), and guava and strawberry mixed toffee from 8.32 to 8.10 (Chavan *et al.*, 2015).The results obtained in the present investigations are parallel to the literature.

Overall acceptability: A gradual decrease in overall acceptability score was observed from 8.80 to 8.20, 8.60 to 8.00 for treatment T_3 and T_4 respectively at the end of 90 days storage at ambient condition. While, toffee stored in refrigerated condition score on overall acceptability decreases from 8.40 to 8.00, 8.20 to 7.80, 8.80 to 8.40 and 8.60 to 8.20 for the treatment T_1, T_2, T_3 and T_4 respectively. The maximum score was observed for treatment T_3 i.e. 8.20 at 90 days at ambient condition. The score for overall acceptability decreases significantly during 90 days storage. The statistical analysis showed that the treatment and storage period had non significant effect on overall acceptability. The overall acceptability score of guava toffee was higher for treatment T_3 (500 g sugar, 100 g fat, 100 g SMP) than treatment T_1, T_2 and T_4 in both ambient and refrigerated condition at the end of 3 month storage period. This is might be due to better score on colour and appearance, flavours, texture and taste and taste of the Treatment T_3. It was reported that overall acceptability score decrease with respect to storage in banana toffee from 8.72 to 8.26, sapota toffee from 8.57 to 8.37 (Pawar, 2001), guava toffee 7.40 to 7.90 (Pol, 2001), fig toffee from 8.59 to 8.13 (Khandekar *et al.*, 2005) tamarind : mango from 8.40 to 7.15 blended toffee (Nale et al., 2007), aonla toffee 8.49 to 7.42 (Domale *et al.*, 2008), aonla and ginger mixed toffee from 8.34 to 8.06 (Nalage *et al*., 2014), and guava and strawberry mixed toffee from 8.16 to 7.76 (Chavan *et al.*, 2015). The results obtained in present investigation are parallel to the literature.

Microbial quality: The microbial count was taken at 0, 30, 60 and 90 days were observed on nutrient agar. At the initial period there was no growth observed but after one month storage period treatment T_1 and T_2 showed standard plate count for room temperature as 8 x 10^5, 9 x 10^5, respectively. The microbial growth observed in treatment T_1 and T_2 due to the content of Black Gram Flour, Semolina and higher moisture content in ambient temperature. Therefore, T_1 and T_2 samples (spoiled samples) were discarded from the storage study after one month. After 3 month storage period treatment T_3 and T_4 showed standard plate count for room temperature as 2 x 10^5 and 2.66 x 10^5 respectively, while treatment T_1, T_2, T_3 and T_4 showed standard plate count for refrigerated temperature was 1.66 x 10^5, 1.33 x 10^5, 1 x 10^5, 1.5 x 10^5 respectively. The results indicated that the standard plate count directly proportional to moisture content in toffee. Although refrigerated toffee had higher moisture but due to low temperature the microbes attack on toffee in very low percentage. The acceptability of the product by the panel members after 3 months storage confirms that the minimum changes which might have occurred due to microbes were in safe limits for human consumption. At present there are no standard limits of safe level of microbes to compare with prepared guava fruit toffees. Aruna *et al.* (2000) reported that the papaya toffees stored at room temperature showed 3 x 10^2 CFU/g bacterial growth. Standard plate count of fig toffee was reported from 11 x 10^3 to 23 x 10^3/g (Khandekar *et al.*, 2005). In case of tamarind toffee the standard plate count was reported from 35 x 10^3 to 56 x 10^3 (Nale et al., 2007). In case of aonla and ginger toffee the standard plate count was reported from 9 x 10^5 to 5 x 10^5 (Nalage *et al*., 2014) and in case of guava and strawberry mixed toffee the standard plate count reported from 7 x 10^5 to 5 x 10^5 (Chavan *et al.*, 2015).

Economics of toffee making: The cost of production of guava toffee ranged from Rs. 130.00 to 162.00 per kg. These costs did not include rent, transport charges, sale commission, local taxes etc. Toffee prepared from T_1 (500 g sugar, 100 g fat, 100 g SMP, 100 g BGF, 400 g Semolina, 5g salt per kg guava pulp) was costlier than toffee prepared from T_2 (750 g sugar, 50 g fat, 50 g SMP, 100 g BGF, 400 g Semolina, 5g salt), T_3 (500 g sugar, 100 g fat, 100 g SMP, 5g salt) and T_4 (750 g sugar, 50 g fat, 50 g SMP, 5g salt per kg guava pulp). It was due to the higher cost of fat and SMP. However, there was significant

difference in cost of toffee making among the treatments. These costs are for laboratory (small) scale preparation of toffee.

Conclusion

The results obtained in the present investigation indicated that, better quality guava toffee with 500 g sugar, 100 g fat, 100 g SMP and 5g common salt per kg guava pulp can be prepared. The cost of toffee was ranged from Rs. 130 to 162 per kg. Toffee could be stored in good condition beyond 90 days at ambient temperature as well as refrigerated condition.

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