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Studies on the development and storage of cocoa -*mulhati* guava based products

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ABSTRACT

Cocoa-*mulhati* guava toffee/ bar/nuggets are concentrated product having good nutritive value, appeal and are consumed readily as a confectionery product. The varying amount of ingredients such as sugar, skim milk powder and *mulhati* were added to guava pulp for formulating cocoa-*mulhati* guava product. The prepared products were subjected to physico-chemical (total soluble solids, ascorbic acid, acidity, sugars and total phenols) and nutritional analysis. The value added products (toffee/ bar/ nuggets) were also evaluated for colour, appearance, flavor, taste, texture and overall acceptability. Cocoa- *mulhati*-guava based product (toffee/bar/nuggets) prepared with 1 kg guava pulp, 600 g sugar, 150 g skim milk powder and 40 g of *mulhati* powder was found to be best in terms of sensory acceptance. It was found to have moisture, fat, protein and carbohydrate of 7.8 percent, 16 percent, 0.1 percent and 76 percent respectively. Total soluble solids, total and reducing sugars increased significantly with increase in storage time. Value added products were found to be acceptable even after three months of storage period; however, there was decrease in ascorbic acid, total phenols and overall acceptability of products during storage period.

Key words: Cocoa, Guava, *Mulhati* powder, Shelf life, Value added products.

INTRODUCTION

Guava (*Psidium guajava* L.) is a member of the large Myrtaceae family. It is claimed to be the fourth most important fruit in terms of area and production after mango, banana and citrus. India is the major producer of guava in the world (Jagtiani *et al.* 1998). Guava has the highest content of vitamin C (ascorbic acid) which is useful in combating free radicals and oxidation that curbs many degenerative diseases. Guava has wide applications such as ready to serve beverage, flavoring agent in candies and cakes, biscuits, chocolate bars, etc (Kadam *et al.,* 2012). Guava can be consumed fresh or can be processed into juice, nectar, pulp, jam, jelly, slices in syrup, fruit bar or dehydrated products, as well as being used as an additive to other fruit juices or pulps (Leite *et al.* 2006). But with the changing consumer attitudes, demands and emergence of new market products, it has become imperative for producers to develop products, which have nutritional as well as health benefits. In this context, guava has excellent digestive and nutritive value, pleasant flavor, high palatability and availability in abundance at moderate price. The fresh fruit has limited shelf life therefore it is necessary to utilize the fruit for making different products to increase its availability over an extended period and to stabilize the price during the glut season.

Guava pulp can be used as base for the preparation of different value added products by combining it with different sources with enhance functional properties. One such source is *Glycyyrhiza glabra* (L.) commonly called *Mulhati or Liquorice,* the root of the this plant species, has been used medicinally for more than 4000 years (Aoki *et al.,* 2005). The genus *glycyrrhiza* consists of approximately 30 species, in which six species produce a sweet saponin glycyrrhizic acid (GA), and they are widely used in Asia countries. These medicinal plants were used as flavorings, sweeteners and as herbal medicine, and they were also used for improving health, detoxification and cures for injury. Glycyrrhizic acid (GA), the most studied active constituent of *mulhati*, is a sweet-tasting material. The constituent is 50 times sweeter than sugar, making it a widely used as a sweetening additive in the food industry (Cinatl *et al.,* 2003). In many countries, GA is used as a major therapeutic agent to treat chronic viral hepatitis and allergic dermatitis. It is also known to have anti-inflammation, anti-ulcer, anti-hepatotoxic and antivirus activities (Tian *et al.,* 2008)

Consequently guava often marked as "super-fruits", rich in high profile nutrients and thus supplemented with *Mulhati* which serves to provide sweetness and medicinal benefits, a technological attempt was being made to produce a low cost value added food product with enhanced functional and nutritional profile. Therefore the main objective of this study was to develop a cocoa-*mulhati* based guava products with balanced nutrition as well as to study the changes occurring in physico-chemical parameters and sensory attributes in order to assess the shelf- stability of the product.

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MATERIALS AND METHODS

Good quality fresh, mature and healthy guava was bought from the local orchards of Haryana Agricultural University, Hisar (Haryana), India. The diseased free fruit was selected and washed with water in order to remove dust, dirt and any other foreign material. Mulhati powder was prepared by grinding the dried roots and underground stems of the plant *Glycyrrhiza glabra* (L.) Glucose, skim milk powder, butter and sugar was procured from the local market. All chemicals used were of analytical reagent grade and procured from companies.

Fresh guava fruits and its value added products were analyzed for different physico-chemical and nutritional parameters**.**

Physico-chemical parameters*:* The guava fruits were analyzed for several physico-chemical parameters such as fruit weight (g), pulp weight (g) and pulp recovery (%).
The value added products formulated were analyzed for the following parameters given below:

Proximate composition: Moisture, total protein, total fat and total ash were estimated by AOAC (2005) methods.

Reducing sugars: The titrimetric method of Lane and Eynon described by Ranganna (1986) was adopted for estimation of reducing sugars using methylene blue as an indicator and colour is changed to brick red colour under the heat (indication point of percent of sugar in sample).

Total sugars: Lane and Eynon described by Ranganna (1986) were also used for estimation of total sugars. The value of non-reducing sugars was recorded by the subtracting the value of reducing sugars from total sugars.

Ascorbic acid: The titrimetric method described as 3% metaphosphoric acid and titrated against standard 2-6 dichlorophenol indophenols dye solution was adopted for determination of ascorbic acid. The titrable acidity of guava products was estimated by titrating against 0.1N NaOH solution using phenolphthalein as an indicator, light pink colour is taken as indication of acid of guava products.

Total phenols (mg/100 g): were determined by Folin Ciocalteu Method.

TSS: The Total Soluble Solids (TSS) value of the guava products were recorded by using hand refractometer having range of 0-32 °Brix
Initially and periodically, stored cocoa-*mulhati* guava products were analyzed for total soluble solids, total sugars, reducing sugars, acidity, ascorbic acid and total phenols values (George *et al.,* 2005).

Processing methods and preparation of cocoa-*mulhati* based guava products (toffee, bar, nuggets)
Ripe guava fruits were washed with water and pulp was extracted with the help of pulper. For extracting pulp, guava fruits were cut into small pieces, heated up to 70 ^{0}C and passed through fruit pulper to get the homogenous pulp. The pulp was cooked till its contents become one-third of its original volume. At this stage, requisite amount of cocoa, sugar, commercial glucose, mulhati powder and butter were added to the pulp and contents were cooked again till mass became sufficiently solid and start leaving sides of the vessel. Skim milk powder dissolved in lukewarm water was mixed with cooked mass and it was again cooked for 2-3 minutes. It was finally rolled into sheets (0.50 to 0.75 cm thick) on a smeared tray and left for cooling for 5-6 hours. The different value added products (toffee, bar, nuggets) prepared were cut to suitable size and shape. Then the products were wrapped in suitable packaging material and stored in polythene bags for evaluating quality and sensory attributes for three months storage period. (Figure 1)

Preparation of different combinations of the cocoa-*mulhati* guava products*:* For the study, different combinations of sugar (600-900 g), skim milk powder (150-200 g) and *mulhati* powder (20, 30, 40, 50 and 60 g/kg of pulp) as main ingredients were added to guava fruit pulp (1 kg) to prepare toffee, bar and nuggets. While the fixed percent of glucose (100 g), butter (100 g) and cocoa (1 g) as a flavouring agent was added to the formulation (Table 1). All the three value added products prepared were differ only in the shape while the ingredients and preparation method used was almost similar in all the three products.

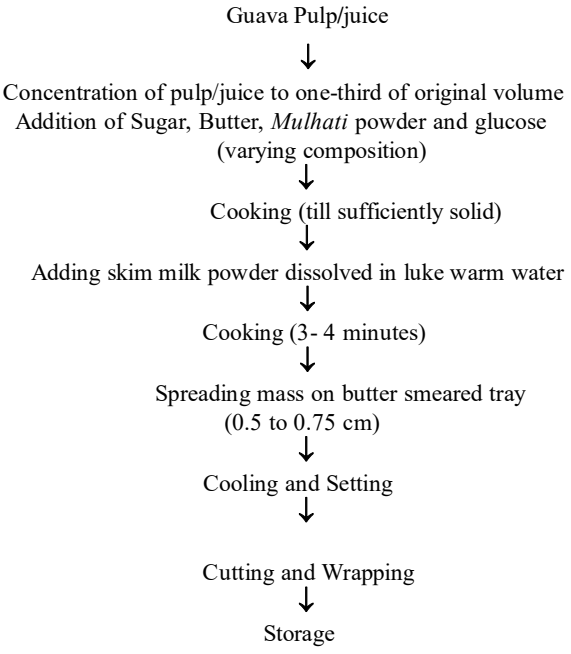

Figure 1: Process flow chart for preparation of value added cocoa- *mulhati* guava products

Table 1: Different guava product formulated* with varying amount of mulhati powder

Recipe	Guava Pulp(kg)	Sugar (g)	Skim milk powder (g)	Glucose (g)	Butter (g)	Mulhati powder(g/kg of pulp)
T_{20}*	1	600	150	100	100	20
T_{30}	1	600	150	100	100	30
T_{40}	1	600	150	100	100	40
T_{50}	1	600	150	100	100	50
T_{60}	1	600	150	100	100	60

Packing of toffee/bars/nuggets: The prepared value added guava products were wrapped with butter paper (toffee) and aluminum foil (bar/nuggets) and then packed in a transparent polythene bags.

Sensory evaluation: Sensory evaluation was carried out in cocoa- *mulhati* based guava products by trained panel of judges (10 nos.) on a 9 point Hedonic scale grading 9 for excellent and 1 for highly disliked samples.

Statistical analysis: All the reported values are the mean of three replicates and Experimental results were subjected to analysis of variance (ANOVA) technique and thus analyzed according to two factorial completely randomized design. The critical difference value at 5 percent level was used for making comparison among different treatments during storage.

RESULTS AND DISCUSSION

Cocoa-mulhati guava based products prepared with 1 kg guava pulp, 600 g sugar, 150 g skim milk powder, 100 g butter, 100g glucose and 40 g of mulhati powder was found to be best in terms of sensory acceptance with sensory score of 8 on 9 point hedonic scale.

Cocoa-mulhati guava products had 7.8 % moisture, 0.1% total protein, 16% fat, 0.1% total ash and 76.05 % carbohydrate (by difference). While the total sugar, reducing sugars, non-reducing sugars, crude fibre was found to be 70.52%, 38.90 %, 31.62 % and 0.15% respectively. It was also found to have 0.1 mg of calcium and 0.02 g of iron. Cocoa-mulhati guava products provides 426.48 Kcal of energy/100 g which is computed from proximate composition of the bar by taking the value of 4, 4 and 9 Kcal for carbohydrate, protein and fat respectively.

Physico-chemical characteristics of fresh guava fruits: Fresh guava fruits were analyzed for different physico-chemical characteristics and the results are recorded in the Table 2. Data show that in fresh guava fruits, average fruit weight (71 g/fruit), pulp recovery (72 %), pulp weight (720 g/kg fruit), total soluble solids (10.33 %), total sugars (6.83 %) and reducing sugars (3.5 %), acidity (0.45 %), pectin (0.85 %), total phenols (2.40 mg/100 g), ascorbic acid (155 mg/100 g), moisture content (80.25 %), pectin (0.85 mg/ 100 g) were recorded. Similar results were observed by Jain and Asati (2004) on different cultivars of guava fruits.

Changes in physico-chemical parameters of the cocoa-*mulhati* guava products

Physico-chemical properties such as Total Soluble Solids (TSS), Total Sugars, Reducing sugars, Acidity, Ascorbic acid and Total phenols of cocoa-*mulhati* guava products were studied and results were reported.

Changes in total soluble solids (%): The maximum total soluble solids (TSS) of 73.3 percent was observed in T_{50} while minimum TSS of 72.1 percent was observed in T_{20}. From Table 3 it is observed that there was a slight increase ($p \leq 0.05$) in total soluble solids (TSS) of the cocoa-*mulhati* guava products during three month storage period and there was no significant effect of different treatments on TSS of the guava products. Storage has significant effect on quality of the guava products. Interaction between treatment and storage was, found non-significant. A high total soluble solid recorded in cocoa-*mulhati* guava products was mainly due to the fact that sugar was added during processing of these products. Increase in TSS during storage might be due to the conversion of starch into sugars and degradation of pectin substances of pulp into soluble solids. Gayathtri and Uthira (2008) also reported an increase in TSS in protein enriched mango-papaya blended fruit bar. In a similar result, Phimpharian *et al.* (2011) reported an increase in TSS (from 82.42-86.9) in pineapple leather snack. Bhardwaj (2013) also observed an increase in TSS values in stored kinnow juice.

Changes in total sugars (%): Total sugars were recorded maximum (67. 44%) in T_{50}, while minimum (65.52 %) in T_{20}. Data reveal (Table 3) that there was no significant effect of different treatments but storage period has significant

Table 2: Physico-chemical characteristics of fresh guava fruits.

Parameters	Mean ± Standard Deviation
Fruit weight (g/fruit)	71 ± 3.35
Moisture (%)	80.25 ± 1.27
Pulp recovery (%)	72 ± 1.91
Pulp weight (g/kg fruit)	720 ± 2.08
Total soluble solids (%)	10.33 ± 0.15
Total sugars (%)	6.83 ± 0.02
Reducing sugars (%)	3.5 ± 0.01
Pectin (mg/100g)	2.40 ± 0.02
Acidity (%)	0.45 ± 0.035
Total phenols (mg/100 g)	2.40 ±0.02
Ascorbic acid (mg/100g)	155 ± 0.90

Values are the average ± standard error of three replications

Table 3: Changes in the physico-chemical parameters of cocoa-*mulhati guava* products during storage

Treatments	*Physico-chemical Parameters*	*Storage period (days)*[#]				
		0	**30**	**60**	**90**	**Mean**
*T_{20}	***Total Soluble Solids***	73.0	73.1	73.3	73.0	72.1
T_{30}	***(TSS)*** **(°Brix)**	72.9	73.3	73.2	72.9	73.1
T_{40}		72.6	73.1	73.4	73.4	73.1
T_{50}		73.1	73.2	73.7	73.3	73.3
T_{60}		72.6	73.0	73.4	73.5	73.1
Mean		**72.9**	**73.1**	**73.4**	**73.2**	
C.D at 5 %	*Treatments =N.S.*	*Storage = 0.32; Treatment ×Storage = N.S.*				
T_{20}		63.65	63.55	66.92	67.95	65.52
T_{30}	***Total Sugars (%)***	64.78	65.65	65.78	68.05	66.06
T_{40}		64.53	65.53	66.91	67.32	66.82
T_{50}		65.91	66.78	68.05	69.03	67.44
T_{60}		64.78	65.56	66.77	67.92	66.26
Mean		**64.73**	**65.41**	**66.88**	**68.65**	
C.D at 5 % Treatments =N.S.		*Storage =2.83; Treatment ×Storage = N.S.*				
T_{20}		19.52	20.16	20.53	20.80	20.25
T_{30}		19.02	19.84	20.24	20.87	19.99
T_{40}	***Reducing Sugars***	19.69	20.43	20.58	20.97	20.26
T_{50}	***(g/100 g)***	19.36	20.41	20.47	20.91	20.20
T_{60}		19.33	20.17	20.40	20.99	20.22
Mean		**19.38**	**20.20**	**20.37**	**20.78**	
C.D at 5 % Treatments =N.S.		*Storage =0.57 ; Treatment ×Storage = N.S.*				
T_{20}		0.48	0.45	0.43	0.43	0.45
T_{30}	***Acidity (%)***	0.48	0.46	0.43	0.41	0.44
T_{40}		0.46	0.45	0.42	0.41	0.43
T_{50}		0.47	0.45	0.43	0.42	0.43
T_{60}		0.48	0.46	0.42	0.43	0.43
Mean		**0.47**	**0.45**	**0.42**	**0.42**	
C.D at 5 % Treatments =0.01		*Storage = 0.02; Treatment ×Storage = N.S.*				
T_{20}	***Total Phenols***	1.50	1.42	1.39	1.36	1.41
T_{30}	***(mg/100g)***	1.82	1.60	1.42	1.27	1.52
T_{40}		1.82	1.50	1.37	1.25	1.48
T_{50}		1.71	1.68	1.40	1.10	1.47
T_{60}		1.82	1.76	1.50	1.19	1.56
Mean		**1.73**	**1.59**	**1.41**	**1.32**	
C.D at 5 % Treatments = 0.21		*Storage = 0.19; Treatment ×Storage =0.42*				

**Treatments with subscripts represent mulhati in g/kg of pulp*

[#]*Values are mean of three replicates*

effect on total sugars of cocoa-*mulhati* guava products. However, interaction between treatment and storage period was found non-significant.

Total sugar was increased during storage period is due to solubilization of pulp constituents and hydrolysis of polysaccharides including pectin and starch materials. Similar types of observation for total sugar of various products have been reported by Kaushal *et al.* (2001) in apple pomace toffees, Bhardwaj (2013) in stored kinnow juice and Bal *et al*. (2014) in guava nectar.

Changes in reducing sugars (%): Maximum reducing sugars (20.26 %) was recorded in T_{40} and minimum (19.99 %) was found in $T_{30.}$ It is evident from the table 3 that there was a significant increase ($p \leq 0.05$) in reducing sugars with increase in storage period. There was no significant effect of different treatments on reducing sugars of cocoa-*mulhati* guava products. However, interaction between treatment and storage period was found non-significant ($p > 0.05$). Reducing sugars of fruit products generally increase during storage. The increase in reducing sugars might be due to inversion of non-reducing sugars into reducing sugars or hydrolysis of polysaccharides. The increase in reducing sugars has also been observed during storage of mango leather by Rao and Roy (1980) and Sharma *et al.* (2013) in apricot fruit bar. Similar results have been recorded in sapota -papaya bar (Sreemathi *et al.,* 2008), in apricot - soy toffees (Thakur *et al.,* 2007) , in aonla toffees (Domale *et al.,* 2008) and sapota candy (Divya *et al.,* 2014)

Changes in acidity (%): Maximum acidity (0.45 %) was recorded in T_{20} and minimum (0.43 %) was found in $T_{50.}$ The data pertaining to acidity (Table 3) reveals that there was significant effect of different treatments on acidity of cocoa-*mulhati* guava products. Acidity also decreased significantly ($p \leq 0.05$) during the storage period. However, interaction between treatment and storage period was found non-significant. Acidity decreased significantly in cocoa-*mulhati* guava products during the storage period. Conversion of acids into sugar resulted in lowering of acidity in guava products during storage. The decrease in acidity may also be attributed to the chemical interaction between organic constituents of the fruit induced by temperature and action of enzymes during storage as well as due to chemical degradation. The acidity decreased with increase in sugar level as found by Dhumal *et al.* (1996). The results are in conformity with earlier findings of Tripathi *et al.* (1988) in aonla candy and Jain *et al.* (1988) in aonla preserve.

Changes in ascorbic acid (mg/100g): Ascorbic acid was found maximum (25.57 mg/100g) in T_{20} while minimum (25.08 mg/100 g) in T_{30}. The data presented in table 3 reveals that storage period significantly ($p \leq 0.05$) affected the ascorbic acid content of cocoa-*mulhati* guava products but treatment has no effect on quality of guava product. However, interaction between treatment and storage period was found non-significant. Ascorbic acid of cocoa-*mulhati* guava products decreased significantly ($p \leq 0.05$) during the entire storage period of three months. This reduction might be due to oxidation of ascorbic acid into dehydroascorbic acid by oxygen. These losses of ascorbic acid were attributed to the effect of processing, storage time and exposure to light. Jain and Nema (2007) noticed loss of ascorbic acid during study of guava leather (176.27- 104.87mg/g). Similar results have been reported by Sreemathi *et al.* (2008) in sapota -papaya bar, Kadam *et al.* (2012) in guava nectar, sapota candy, Divya *et al.* (2014) in sapota candy and Shakoor *et al.* (2015) in guava bar.

Changes in total phenols: Total phenols were recorded maximum (1.56 mg/100g) in T_{60} and minimum (1.41 mg/100g) in T_{20}. The data presented in Table 3 reveal that treatment and storage period significantly ($p \leq 0.05$) affected the total phenol content of cocoa-*mulhati* guava products. However, interaction between treatment and storage period was found non-significant. Phenolic compounds play an important role in determining the color, taste and flavor of a product. The phenolic compounds are highly volatile and easily oxidized. The phenols are oxidized to o-semiquinone radicals or o-quinones molecules, which are highly reactive to give brown products of high molecular weight. A gradual decrease in total phenols was recorded during storage of cocoa-*mulhati* guava products which might be due to their condensation into brown pigments (Fennema, 1976). Similar observations were recorded by Waskar and Khurdiya (1987) in phalsa beverages.

Changes in sensory attributes (color and appearance, taste, flavor and overall acceptability): Cocoa-*mulhati* guava products were subjected to sensory evaluation soon after the preparation and after 15, 30, 45, 60, 75, 90 days of storage by a panel of ten judges following the hedonic rating scale as described by Rangana (1986). The products were evaluated for color and appearance, flavor, taste, texture and overall acceptability. The overall acceptability of the confectionary was based on the mean scores obtained from all the sensory characters. The characters with mean score values of 6 or more out of 9 were considered acceptable.

The data in Table 4 shows that there was a significant effect of different treatments and storage period on sensory attributes *(color and appearance, taste, flavor and overall acceptability)* of cocoa-*mulhati* guava products. There was significant ($p \leq 0.05$) decrease in color and appearance, taste, flavor and overall acceptability with increase in duration of storage. Cocoa-*mulhati* guava products with treatment T_{60} scored maximum value (7.8) while the treatment T_{30} scored minimum value (7.5) for color and appearance while the treatment T_{40} scored maximum value (7.8) whereas a minimum score (5.5) was observed in treatment T_{60} for taste. For flavor, the maximum value of 7.8 was found in treatments T_{40} and T_{20} while treatment T_{60} scored minimum value (5.4). Overall acceptability of cocoa-*mulhati* guava products decreased from 7.9 to 5.2 during 90 days of storage. A significant decrease ($p \leq 0.05$) in overall acceptability was found during the storage period. However the organoleptic score of $T_{20,}$ T_{30} and T_{40} remained above the acceptable level even after storage period of 90 days. There was gradual decrease in overall acceptability score of custard apple toffees with the increase in sugar from 500 g to 750 g which further decreased at 1000 g sugar level (Dhumal *et al.,* 1996). There was a gradual decrease in organoleptic score of guava products during storage at ambient temperature. Temperature plays an important role in inducing certain biochemical changes which leads to the discoloration and thus masks the original color, taste, flavor and overall acceptability. These findings were in accordance with Cherian and Cherian (2003) for papaya-mango blended leather, Sivakumar *et al.* (2007) for guava toffee, Domale *et al.* (2008) for aonla pulp toffees, Padmashree *et al.* (2012) for protein rich composite cereal bar, Bali *et al.* (2014) for guava nectar, Patel *et al.* (2014) for aonla murabba, Shakoor *et al.* (2015) for guava bar and Ingle *et al.* (2016) for sugar free aonla candy.

Table 4: Changes in the sensory attributes of cocoa-*mulhati* guava products during storage

Treatments	*Sensory Attributes*	*Storage period (days)*[#]							
		0	**15**	**30**	**45**	**60**	**75**	**90**	**Mean**
[*]T_{20}	***Color and appearance***	8.0	7.8	8.2	7.2	8.1	7.8	7.7	7.8
T_{30}		8.2	7.9	7.6	7.5	7.4	7.3	7.0	7.5
T_{40}		8.0	7.7	7.7	7.6	7.6	7.2	7.1	7.6
T_{50}		8.5	8.1	7.7	7.5	7.4	7.3	7.3	7.7
T_{60}		8.5	8.3	7.9	7.8	7.6	7.5	7.0	7.8
Mean		**8.2**	**8.0**	**7.9**	**7.5**	**7.6**	**7.4**	**7.2**	
C.D at 5 %	*Treatments =0.18*	*Storage =0.21; Treatment ×Storage = 0.037*							
T_{20}		7.8	8.0	8.0	7.8	7.5	7.0	7.0	7.5
T_{30}		8.0	7.9	7.6	7.8	7.8	7.6	7.0	7.7
T_{40}	***Taste***	8.0	7.9	7.9	8.0	7.8	7.6	7.5	7.8
T_{50}		5.7	5.8	5.7	5.7	5.3	5.5	5.5	5.6
T_{60}		5.7	5.5	5.6	5.2	5.4	5.2	5.3	5.4
Mean		**7.0**	**7.1**	**7.0**	**6.9**	**6.8**	**6.6**	**6.5**	
C.D at 5 %	*Treatments =0.19*	*Storage =0.10; Treatment ×Storage = N.S.*							
T_{20}		8.0	7.8	8.0	7.5	7.8	7.8	7.7	7.8
T_{30}		7.8	8.0	7.8	7.7	7.8	7.5	7.0	7.6
T_{40}	***Flavor***	7.9	8.0	7.9	7.8	7.8	7.7	7.5	7.8
T_{50}		5.7	5.8	5.6	5.6	5.3	5.5	5.5	5.6
T_{60}		5.6	5.5	5.6	5.3	5.6	5.3	5.3	5.5
Mean		**7.0**	**6.8**	**7.0**	**6.8**	**6.9**	**6.8**	**6.6**	
C.D at 5 %	*Treatments =0.17*	*Storage =0.15; Treatment ×Storage = N.S.*							
T_{20}		8.1	7.9	7.8	7.5	7.3	7.2	7.2	7.5
T_{30}		8.0	8.0	7.8	7.8	7.8	7.7	7.7	7.8
T_{40}	***Overall Acceptability***	8.2	8.1	8.0	7.8	8.0	7.8	7.7	7.9
T_{50}		5.5	5.0	5.5	5.1	5.1	5.1	5.0	5.2
T_{60}		5.1	5.3	5.1	5.4	5.3	5.1	5.0	5.2
Mean		**7.0**	**6.7**	**6.8**	**6.7**	**6.7**	**6.6**	**6.5**	
C.D at 5 %	Treatments =0.27	Storage =0.29; Treatment ×Storage = 0.07							

[*]Treatments with subscripts represent mulhati in g/kg of pulp

[#]Values are mean of three replicates

CONCLUSION

Cocoa-*mulhati* guava based product prepared with 1 kg guava pulp, 600 g sugar, 150 g skim milk powder and 40 g of *mulhati* powder were found to be best in terms of sensory acceptance. It was found to have moisture, fat, protein and carbohydrate of 7.8 per cent, 16 per cent, 0.1 per cent and 76 per cent respectively. Total soluble solids, total and reducing sugars increased significantly with increase in storage time. Value added products were found to be acceptable even after three months of storage period; however, there was decrease in ascorbic acid, acidity, total phenols and overall acceptability of products during storage period.

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