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Preparation and Evaluation of Peach-Soy Fruit Toffees

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Abstract

The peach-soy toffee was prepared from different blends of peach pulp and soy-slurry. The peach pulp and soybean slurry were blended in the ratios of 100:0, 95:5, 90:10, 85:15, 80:20, 75:25 and 70:30. The product was prepared as per the standard recipes and was stored for four months to ascertain changes in physico-chemical and sensory characteristics. The analysis of toffees revealed significant differences among different blends. In toffees, maximum moisture content of 17.17 per cent was recorded in B1 (100:0:: P:S). The highest TSS and titratable acidity of 12.23 0B and 1.62 per cent were recorded in B1 (100:0:: P:S), respectively. Reducing sugar (37.95 per cent) and total sugar (64.93 per cent) were also found to be highest in B1 (100:0:: P:S). It was observed that protein and fat contents of 3.43 and 8.66 per cent were recorded highest in B7 (70:30:: P:S), respectively, whereas highest ascorbic acid content of 21.80 mg/100 g was recorded in B7 (70:30:: P:S). Sensory evaluation of toffees revealed that the highest score of 8.30 was recorded in B4 (85:15:: P:S) and lowest score of 6.01 was recorded in B7 (70:30:: P:S). In general there was an increase in TSS, acidity and sugars and decrease in protein, fat and ascorbic acid contents and all sensory attributes during four months storage in different blends of toffees.

Keywords: Peach; Soybean; Toffee; Storage; Nutritional quality

Introduction

Like many other developing countries, India is also facing problem of malnutrition which is directly linked with the socio- economic status of population. Soybean (*Glycine max*) by virtue of its high protein (40-42%) content and generous amount of essential amino acids especially lysine, tryptophan and threonine, has been identified as a premier crop in finding solutions to problems of malnutrition [1]. Peach (*Prunus persica* (L.) Batsch) is a perishable stone fruit grown extensively in Jammu and Kashmir. Peach has excellent appearance and quality and is a good source of vitamins, minerals and sugars. Soy foods are one of the fastest growing categories in the food industry even as dairy to meat alternatives [2,3]. Soybeans are widely recognized by medical and health professionals for their health benefits. Soybeans protein has been found to reduce the risk of coronary heart disease when consumed as part of a diet low in saturated fat and cholesterol [3]. So, the protein rich edible products can be prepared by fortification with soybean. Fortification will help in yielding nutritious products at low costs and can significantly contribute in nutritional improvement of our population. Keeping these in view, the present investigation was undertaken to assess the preparation of peach-soy fruit toffee and to evaluate the appropriate blend of peach and soybean which will yield products of acceptable quality and storability. The storage changes in quality attributes of product were also studied.

Materials and Methods

Extraction of peach pulp

Ripe fruits of peach were obtained from the orchards of Division of Fruit Science, Udheywalla, SKUAST-Jammu. The fruits were washed in water to remove adherent foreign material and dust. Peach fruits were dipped in boiling lye solution (2 per cent NaOH) for five minutes. The fruits were then washed thoroughly under tap water. Subsequently, fruits were dipped in 5 per cent citric acid solution for five minutes to neutralize residual alkali from their surface. After neutralizing the fruits were again washed in running water. Peach fruits were cut into 4 to 6 pieces. Peach pulp was prepared by hot method [4] by adding water (100 ml/kg of fruit), steam pressured for 5-7 minutes and passed through a pulper. Extracted pulp free of stones and skin was filled in Food Grade PET jars after properly mixing 2000 ppm potassium metabisulphite for further use.

Preparation of soy slurry

Soybean used in this study was procured from the local market of Jammu. Soybeans were soaked in water over night, spread on trays for sprouting and water was sprinkled over beans every day. Within three days soybeans sprouted which were then dried and ground into flour.

Soy slurry: Soya slurry was prepared by mixing soy flour to water (1:5 w/v) in a blender, followed by heating to boiling (5 min) and passing through a pulper [5].

For fruit toffee preparation, peach pulp and soy slurry in different ratios as given were taken. Peach pulp alone served as a control. Peach-soy fruit toffee was then analysed for different physico-chemical characters as per treatment details: B1 (100:0), B2 (95:5), B3 (90:10), B4 (85:15), B5 (80:20), B6 (75:25) and B7 (70:30).

The other ingredients used were sugar (380 g), glucose (40 g), milk powder (80 g) and edible fat (50 g) per 500 g of the mixture. The prepared mixture was concentrated to about half of its volume by heating with continuous stirring, followed by addition of sugar, glucose, milk powder and edible fat. The mass was heated to a thick consistency (75-80^{0}B) followed by spreading as a sheet of 1 cm thickness on a fat smeared aluminium trays and dried for about 2 hours in a mechanical drier. Then it was cut into toffees of uniform size and wrapped first in butter paper followed by wrapping in toffee wrappers for storage studies. The acceptable treatment combinations of peach-soy fruit toffee, evaluated on the basis of sensory evaluation scores (Hedonic

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scale) were stored for a period of 4 months at room temperature and analyzed for physico-chemical changes and sensory characteristics at interval of 2 months.

Physico-chemical parameters like total soluble solids, titratable acidity, sugars (reducing and total), ascorbic acid, crude protein and crude fat were estimated by standard methods. Total soluble solids (%) were recorded with hand refractometer (1: 7 dilutions were done using distilled water and the results were interpreted as such), total titratable acidity was determined using 0.1 N sodium hydroxide solution to a faint pink color using phenolphthalein as an indicator, and expressed as per cent malic acid [6], sugars (%) were determined by Lane and Eyon method [7], ascorbic acid content (mg/100 g) was determined by the procedure using 2,6-dicholorophenol indophenols dye, crude proteins were estimated by the micro–Kjeldahl method [8] and crude fat was determined using a Soxhlet Extraction apparatus. The recorded data were subjected to statistical analysis by adopting completely randomized design (CRD).

Result and Discussion

The data pertaining to physico-chemical characteristics Table 1 of peach pulp had the total soluble solids and titratable acidity of fruit pulp was recorded as 11 ^{0}B and 0.60 per cent respectively. Crude protein in peach pulp was found to be 1.00 per cent whereas per cent fat for the same were recorded as 0.2. Reducing and total sugars for both the samples were found to be 8.28 per cent and 7.74 percent, while as ascorbic acid was found to be 5.6 mg/100 g respectively. The similar results have been reported by Joshi et al. [9] in peach fruit.

The data in Table 2 revealed that the soy-slurry recorded 86.34 per cent moisture, 6 ˚B TSS, 7.5 per cent protein and 3.45 per cent fat. Similar results were obtained by Chauhan et al. [5].

S. No.	Characteristics	Peach Pulp
1	Moisture (%)	88
2	TSS (^{0}B)	11
3	Titrated acidity (%)	0.60
4	Reducing sugar (%)	3.08
5	Total sugar (%)	7.74
6	Crude protein (%)	1.0
7	Fat (%)	0.2
8	Ascorbic acid (mg/100 g)	5.6

Table 1: Physico-chemical characteristics of peach fruit pulp.

S. No.	Characteristics	Soy-slurry (1:5)
1	Moisture (%)	86.34
2	TSS (^{0}B)	6.00
3	Crude protein (%)	7.21
4	Fat (%)	3.45

Table 2: Physico-chemical characteristics of soybean slurry.

Physico-chemical characteristics

The highest moisture content Table 3 of 17.17 per cent was recorded in control (B1) where as the lowest of 14.26 per cent in peach pulp and soy-slurry toffees of 70:30 ratio (B7). The study shows that by increasing the amount of soy product in peach pulp, the moisture content decreased. Swaya et al. [10] also reported a decrease in moisture content of soy fortified date bars as compared to control. Kaushal et al. [11] and Chauhan et al. [5] also reported similar results in their studies on soy enriched fruit bars.

The highest TSS content Table 3 was recorded in control (B1) and the lowest in peach pulp and soy-slurry toffees of 70:30 ratio (B7). The decreasing trend in TSS content might be due to the fortification of soy-slurry with peach pulp. Sharma [12] and Thakur [13] also reported earlier the similar results in their studies. Control (B1) recorded the highest acidity content which was statistically at par with peach pulp and soy-slurry toffees of 95:5 ratio (B2). The lowest acidity was recorded in 70:30 ratio (B7) which was statistically at par with B6 (75:25 ratio). The titratable acidity of peach-soy leather of different blends decreased with the increase in soy-slurry content [5]. Sharma [12], Thakur [13] and Kaushal et al. [11] also reported similar results in their studies. The highest reducing and total sugars of 37.95 and 64.93 per cent was recorded in control (B1) and the lowest of 33.44 and 61.59 per cent in 70:30 ratio of peach-soy toffees (B7) respectively. The sugars decreased significantly with the increase in soy-slurry.

The highest protein content Table 3 was recorded in peach-soy toffees of 70:30 ratio (B7) and the lowest in control (B1). The protein content of peach-soy toffees of different blends increased with the increase in soy-slurry. Chauhan et al. [5] and Kaushal et al. [11] also reported similar results in their studies, while the highest fat content of 8.66 per cent was registered in 70:30 ratio (B7) and the lowest of 8.33 per cent in control (B1). As the contents of soy-slurry in peach pulp increased, the fat content also increased. Sharma [12] and Thakur [13] also reported similar results in their studies.

As the content of sprouted soy-slurry in peach pulp increased, the ascorbic acid Table 3 content increased significantly. The highest ascorbic-acid content of 21.80 mg/100 g was found in peach pulp and soy-slurry toffees of 70:30 ratio (B7) and the lowest 15.04 mg/100 g was found in control (B1). Kaushal et al. [11] reported increase in ascorbic acid content of sprouted soy-slurry fortified fruit bars.

In the sensory evaluation, Table 4 the highest score was recorded in 85:15 ratio (B4) and the lowest score in 70:30 ratio (B7) for colour and texture in peach pulp and soy-slurry toffees which was at par with B6 (75:25 ratio) having score of 6.42. Similar results have been reported by

Blend (Peach: soy)	Moisture (%)	TSS* (^{0}B)	Titratable acidity (% malic acid)	Sugars (%)		Crude protein (%)	Fat (%)	Ascorbic acid (mg/100 g)
				Reducing	Total			
B1 (100:0)	17.17	12.23	1.62	37.95	64.93	2.53	8.33	15.04
B2 (95:5)	15.80	12.11	1.53	37.15	64.63	2.67	8.35	15.58
B3 (90:10)	15.44	12.07	1.44	36.27	64.27	2.84	8.39	16.12
B4 (85:15)	14.89	11.93	1.36	35.16	63.54	2.94	8.46	17.36
B5 (80:20)	14.81	11.87	1.32	34.32	62.66	3.17	8.53	18.90
B6 (75:25)	14.68	11.78	1.24	33.70	62.06	3.32	8.58	20.56
B7 (70:30)	14.26	11.72	1.19	33.44	61.59	3.43	8.66	21.80
CD (0.05)	**0.07**	**0.10**	**0.11**	**0.25**	**0.19**	**0.03**	**0.02**	**0.14**

Table 3: Physico chemical and nutritional characteristics of peach-soy toffee. *SS of diluted samples (1:7).

Kaushal et al. [11] in their studies. Maximum scores of 8.00 for flavour was recorded in 85:15 ratio of (B4) and the lowest score of 5.72 in peach pulp and soy-slurry toffees of 70:30 ratio (B7). The highest scores for B4 (85:15 ratio) might be assigned to a balanced proportion of peach and soy in the blend, there-by enhancing the flavour.

In case of overall acceptability, the highest score of 8.30 was recorded in 85:15 ratio (B4) and the lowest score of 6.01 in 70:30 ratio (B7) in peach-soy toffees respectively. The reason could be assigned to the fact that toffees prepared from 85:15 ratio of peach pulp and soy-slurry had a better consistency and flavour due to an ideal ratio of blend. Similar findings have been reported by Kaushal et al. [11] and Chauhan et al. [5].

Change in physico-chemical characteristics of peach-soy toffees during storage

The moisture content Table 5 of peach-soy toffees increased during storage period. The highest mean value of 18.29 per cent was recorded for control (B1) and the lowest mean value of 14.99 per cent for 70:30 ratio (B7) of peach-soy toffees. The mean value of 15.29 per cent at 0 day storage was increased to 17.42 per cent after 4 months. The increase in moisture content was due to high temperature in the external environment. The product might have absorbed the moisture from the external environment or due to chemical changes such as browning reaction [14,15].

Total soluble solids Table 5 of peach-soy toffees increased significantly during the storage period and this increase was also reported by Attri et al. [16], Pandey et al. [17], and Narayana et al. [18]. This increase in TSS during storage might be due to conversion of insoluble polysaccharides into sugars.

In case of acidity Table 5, the interaction between blends and storage period was non-significant, yet the blends registered an increase in acidity during 4 months of storage. Mir et al. [15] found a significant increase in acidity during storage in fortified mango bars. Sharma [12] and Thakur [13] reported similar results in fortified plum toffees and fortified apricot toffees respectively. The increase in acidity during storage could be ascribed to the formation of sulphurous acid from sulphur dioxide.

The protein percentage Table 6 decreased during storage period. The decrease in protein content during storage might be due to participation of proteins in Maillard reaction [19]. Decrease in protein content in soy-flour during storage has been reported in fortified plum bars by Sharma [12] and in fortified apricot bars by Thakur [13]. The fat contents also decreased during storage period. Decrease in fat content during storage might be due to oxidation of fat in the presence of moisture [20].

Ascorbic acid Table 6 showed a decreasing trend in all the blends over a period of 4 months at ambient conditions. The mean value of 17.91 mg/100 g at 0 day storage decreased to 11.75 mg/100 g after 4 months of storage. Decrease in ascorbic acid during storage might be due to its oxidation as reported by Upasana and Bhatia in bagugosha preserve, Sharma [12] in plum-soy toffees and Thakur [13] in apricot-soy toffees.

All the blends showed a significant increase in reducing sugars Table 7 after 4 months of storage. The increase in reducing sugars was due to hydrolysis of non-reducing sugars to reducing sugars [21]. Similar results were found by Narotam [22] in apple pomace toffees; Sharma [12] in fortified plum toffees; and Thakur [13] in fortified apricot toffees. Total sugars showed slight increase over 4 months of storage period from a mean value of 63.38 per cent to 63.65 per cent. The increase in total sugars was due to hydrolysis of starch and conversion of non reducing sugars into reducing sugars during storage

Blend (Peach: soy)	Colour	Texture	Flavour	Overall acceptability
B1 (100:0)	7.72	6.82	7.62	7.39
B2 (95:5)	7.55	7.30	7.17	7.43
B3 (90:10)	7.44	7.28	7.61	7.46
B4 (85:15)	8.61	8.30	8.00	8.30
B5 (80:20)	6.52	6.77	6.61	6.63
B6 (75:25)	6.42	6.50	5.97	6.29
B7 (70:30)	6.15	6.15	5.72	6.01
CD (0.05)	0.30	0.24	0.26	0.16

Table 4: Sensory evaluation scores of peach-soy toffee (Hedonic scale).

Blend (Peach: soy)	Storage period (months)											
	Moisture (%)				*Total soluble solids (°B)				Titratable acidity (%)			
	0	2	4	Mean	0	2	4	Mean	0	2	4	Mean
B1 (100:0)	17.17	17.30	20.40	18.29	12.23	12.62	13.17	12.67	1.62	1.81	1.83	1.75
B2 (95:5)	15.80	15.84	18.06	16.57	12.11	12.42	12.95	12.49	1.53	1.56	1.63	1.57
B3 (90:10)	15.44	15.56	17.65	16.22	12.07	12.30	12.73	12.37	1.44	1.49	1.56	1.50
B4 (85:15)	14.89	15.12	16.73	15.58	11.93	12.06	12.54	12.18	1.36	1.42	1.47	1.42
B5 (80:20)	14.81	15.07	16.58	15.49	11.87	11.99	12.44	12.10	1.32	1.34	1.41	1.36
B6 (75:25)	14.68	14.80	16.33	15.27	11.78	11.91	12.33	12.01	1.24	1.29	1.36	1.30
B7 (70:30)	14.26	14.50	16.20	14.99	11.72	11.81	12.20	11.91	1.19	1.22	1.30	1.24
Mean	15.29	15.46	17.42		11.96	12.16	12.62		1.39	1.45	1.51	

CD (0.05).
Blend=0.059=0.03=0.03.
Storage period=0.090=0.04=0.04.
Blend x Storage period=0.156=0.07=N.S.
*TSS of diluted samples (1:7).

Table 5: Effect of different blends and storage period on the moisture, total soluble solids and titratable acidity of peach-soy toffee.

Blend (Peach: soy)	Storage period (months)											
	Moisture (%)				*Total soluble solids (°B)				Titratable acidity (%)			
	0	2	4	Mean	0	2	4	Mean	0	2	4	Mean
B1 (100:0)	2.53	2.34	2.18	2.35	8.33	8.24	8.03	8.20	15.04	10.35	8.88	11.42
B2 (95:5)	2.67	2.48	2.30	2.48	8.35	8.27	8.07	8.23	15.58	11.07	9.54	12.06
B3 (90:10)	2.84	2.65	2.49	2.66	8.39	8.31	8.12	8.27	16.12	11.27	9.87	12.42
B4 (85:15)	2.94	2.76	2.59	2.76	8.46	8.36	8.18	8.33	17.36	12.32	11.03	13.57
B5 (80:20)	3.17	2.98	2.79	2.98	8.53	8.46	8.26	8.42	18.90	14.00	12.59	15.16
B6 (75:25)	3.32	3.14	2.95	3.14	8.58	8.50	8.30	8.46	20.56	15.51	14.12	16.73
B7 (70:30)	3.43	3.24	3.06	3.24	8.66	8.58	8.36	8.53	21.80	17.50	16.24	18.51
Mean	2.99	2.80	2.62		8.47	8.39	8.19		17.91	13.15	11.75	

CD (0.05).
Blend=0.059=0.03=0.03.
Storage period=0.090=0.04=0.04.
Blend x Storage period=0.156=0.07=N.S.
*TSS of diluted samples (1:7).

Table 6: Effect of different blends and storage period on the crude protein, fat and ascorbic acid of peach-soy toffee.

Blend (Peach: soy)	Storage period (months)							
	Sugars (%)							
	Moisture (%)				*Total soluble solids (°B)			
	0	2	4	Mean	0	2	4	Mean
B1 (100:0)	37.95	41.29	44.23	41.16	64.93	65.06	65.26	65.09
B2 (95:5)	37.15	40.58	43.54	40.42	64.63	64.73	64.96	64.77
B3 (90:10)	36.27	39.67	42.62	39.52	64.27	64.36	64.51	64.38
B4 (85:15)	35.16	38.44	41.39	38.33	63.54	63.61	63.85	63.67
B5 (80:20)	34.32	37.61	40.76	37.57	62.66	62.72	62.90	62.76
B6 (75:25)	33.70	36.53	39.69	36.64	62.06	62.14	62.35	62.18
B7 (70:30)	33.44	36.17	36.40	35.34	61.59	61.60	61.71	61.64
Mean	35.43	38.61	41.23		63.38	63.46	63.65	

CD (0.05)
Blend=0.059=0.089
Storage period=0.090=0.135
Blend x Storage period=0.156=N.S.

Table 7: Effect of different blends and storage period on sugars of peach-soy toffee.

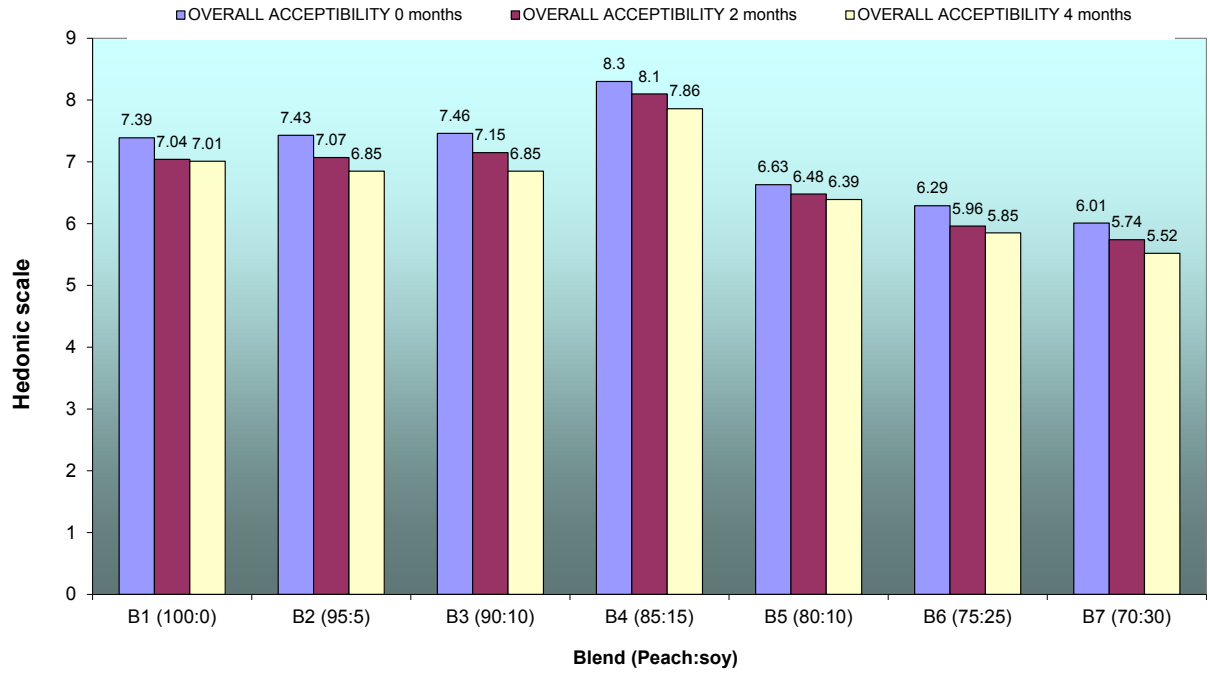

Figure 1: Effect of different blends and storage period on overall acceptability of peach-soy toffees.

Blend (Peach: soy)	Storage period (months)															
	Moisture (%)				*Total soluble solids (°B)				Titratable acidity (%)				Overall acceptability			
	0	2	4	Mean	0	2	4	Mean	0	2	4	Mean	0	2	4	Mean
B1 (100:0)	7.72	7.30	7.19	7.41	6.82	6.52	6.50	6.61	7.62	7.30	7.28	7.41	7.39	7.04	7.01	7.14
B2 (95:5)	7.55	7.50	7.11	7.39	7.30	7.08	6.97	7.12	7.17	6.64	6.47	6.76	7.43	7.07	6.85	7.12
B3 (90:10)	7.44	7.30	6.97	7.24	7.28	6.85	6.61	6.91	7.61	7.30	6.97	7.29	7.46	7.15	6.85	7.15
B4 (85:15)	8.61	8.30	8.17	8.36	8.30	8.28	8.05	8.21	8.00	7.71	7.37	7.69	8.30	8.10	7.86	8.09
B5 (80:20)	6.52	6.44	6.36	6.44	6.77	6.55	6.50	6.61	6.61	6.44	6.30	6.45	6.63	6.48	6.39	6.50
B6 (75:25)	6.42	6.28	6.08	6.26	6.50	6.19	6.00	6.23	5.97	5.47	5.41	5.62	6.29	5.96	5.85	6.03
B7 (70:30)	6.15	5.97	5.65	5.93	6.15	5.77	5.54	5.82	5.72	5.47	5.36	5.52	6.01	5.74	5.52	5.76
Mean	7.20	7.01	6.79		7.02	6.75	6.60		6.96	6.61	6.46		7.07	6.80	6.62	

CD (0.05)
Blend=0.105=0.112=0.128=0.066.
Storage period=0.160=0.171=0.196=0.1.
Blend x Storage period=N.S=N.S=N.S=N.S.

Table 8: Effect of different blends and storage period on sensory attributes of peach-soy toffee (Hedonic scale).

as reported by Ragab [21] in apricot Jam; Sharma [12] in fortified plum toffees; and Thakur [13] in fortified apricot toffees.

Sensory evaluation

Mean score evaluation for colour showed a decreasing trend during 4 months of storage. This decrease in appeal for colour was probably due to browning reactions occurring in the product Figure 1. The present study showed that with the increase in soy-slurry (above 15 per cent) the appeal for colour decreased. With the increase in storage period mean score for texture decreased upto 4 months of storage which indicated a decrease in appeal for texture of peach-soy toffees. The mean score evaluation for flavour decreased from 6.96 to 6.46 after 4 months of storage which might be attributed to various chemical changes and loss of volatiles. Moreover, B4 (85:15 ratio) showed the highest mean score of 7.69 for flavour after 4 months of storage where as B7 (70:30 ratio) showed the lowest mean score of 5.52, which was probably due to higher proportion of soy flour in the toffees.

Overall acceptability of the peach-soy toffees Table 8 showed a reduction in the mean score after 4 months of storage period. Mir et al. [15] also reported a decrease in sensory scores of soy fortified mango bars during 6 months of storage. The peach-soy toffee of 85:15 ratios recorded the maximum scores for overall acceptability and was adjudged as the best blend with regard to acceptability and storability.

Conclusion

In general there was an increase in TSS, acidity and sugars and decrease in protein, fat and ascorbic acid contents and all sensory attributes during four months storage in different blends of toffees.

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