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Studies on chemical parameters of protein fortified Sapota based mixed fruit bar

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Abstract
Fruit bars are dried sheets of fruit pulp with a sweet taste and soft rubbery feel. The protein fortified sapota based mixed fruit bar was prepared and evaluated at the Department of Post-harvest Technology, KRC, College of Horticulture Arabhavi, Karnataka, India during 2020-21. The prepared fruit bars were stored for 90 days under ambient storage conditions and evaluated for changes in chemical parameters at monthly intervals. The total soluble solids (TSS), total and reducing sugar content of fruit bars were found to increase marginally. Whereas, the moisture, water activity, ascorbic acid, titratable acidity, non-reducing sugars, β-carotene and protein content were decreased with the advancement of storage period.

Keywords: Fruit bar, protein fortification, total soluble solids

Introduction
The Sapota (*Manilkara zapota* L.) belongs to the family Sapotaceae, is commonly found in tropical America. It has round to egg-shaped appearance with brown skin and light brown to reddish-brown flesh which is delicate and pleasant. The climacteric fruit, sapota has sandy or gritty texture, slight musky flavour and excellent taste (Kute and Shete, 1995) [15]. Other tropical fruits that claim superiority in terms of nutritional and commercial importance are papaya (*Carica papaya* L.) and guava (*Psidium guajava* L.). Papaya is also regarded as the "wonder fruit of tropics and subtropics". It was originated in Mexico. The fruit is a good source of vitamins including thiamine, riboflavin, nicotinic acid and vitamin A (2020 IU/100 g) (Jain *et al.*, 2011) [8]. It is rich source of carotene which is a precursor of vitamin A. Guava is popularly known as ‘poor man's apple’ and common fruit found in tropical and subtropical areas in the world. It is a tropical American native. It has hardy nature, prolific bearing, rich in vitamin C and minerals (Kadam *et al.*, 2012) [9].
Fruit bars are dried sheets of fruit pulp with a sweet taste and soft rubbery feel. The addition of essential nutrients that were originally inadequate or lost during processing is referred as food fortification. Fruits that are typically low in protein and fat can be supplemented with protein-rich products such as whey protein and soya protein (Kumar *et al.*, 2017) [13].
Sapota fruits do not have an appealing colour, texture and general customer acceptability because of gritty texture and dark brown coloured fruit pulp. As a result, key fruits such as papaya and guava can be added to boost the nutritional value of the product while retaining its colour, flavour, texture and general acceptability. Blending these fruits, on the other hand, may be more cost-effective approach (Jain *et al.*, 2011) [8]. Therefore, in the present investigation, efforts are made to develop a sapota based protein fortified mixed fruit bar which is nutrient rich and highly palatable.

Material and Methods
An experiment was carried out at the Department of Post Harvest Technology, KRC College of Horticulture, Arabhavi (UHS, Bagalkot), Karnataka during 2020-21. The ripe fruits of kalipatti variety were purchased from city market of Gokak of Belagavi district. The fruit bars were prepared as per the procedure mentioned in Fig. 1.
The products were analyzed for moisture content and water activity using a moisture analyser (Model: P1019319, A & D Company Limited, Japan) and digital water activity meter (Model: Novasia AG, Switzerland) respectively. TSS (°B) was measured by using an ‘Erma’ hand refractometer after necessary corrections. Titratable acidity (%) and ascorbic acid (mg/100 g) content was estimated as per the modified procedure of AOAC (Anon., 1984) [1].

Reducing sugars were estimated as per the Dinitro - salicylic acid method (Miller, 1972) [17]. The total sugars content was estimated as per the procedure given in AOAC (Anon., 1984) [1]. The percent non-reducing sugars were obtained by subtracting the values of reducing sugars from that of total sugars. β-carotene present in mixed fruit bars were estimated using petroleum ether method (Ranganna, 2003) [21]. Protein content in papaya guava bar sample was estimated by using Lowry's (1951) [16] method. The total bacterial and fungal count was taken as per the method of Harrigan and Mc-Cance (1966). The data recorded on the Physico-chemical and organoleptic parameters were subjected to statistical analysis in CRD. The interpretation of data was carried out in accordance with Panse and Sukhatme (1985) [19]. The level of significance used in 'F' test was p=0.01.

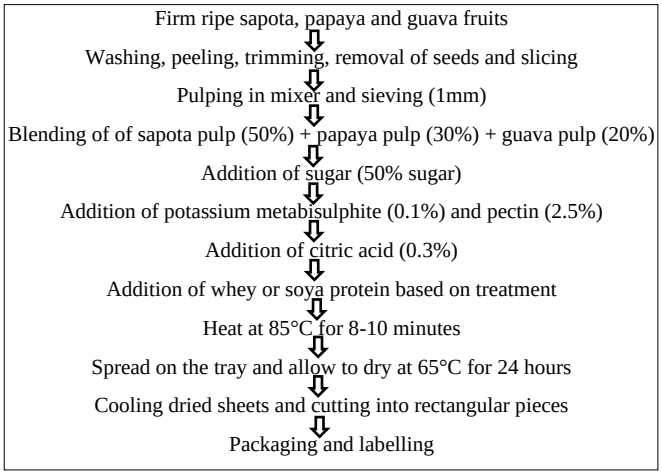

Fig 1: Flowchart for preparation of protein fortified Sapota based mixed fruit bar

Treatment details

The treatment (T_4) has obtained highest sensory score was considered as most acceptable blend (Sapota 50%, papaya 30% and guava 20%) and this treatment from experiment I is further used as best treatment (control) in current experiment. The design of this experiment was factorial completely randomized design (FCRD) with fourteen treatments and two replications.

Table 1: Protein fortified Sapota based mixed fruit bar prepared by incorporating a different level of protein and stored in packaging materials

Factor I – Protein percentage	
A_1	Best treatment (Control)
A_2	Best treatment + Whey protein concentrate (5%)
A_3	Best treatment + Whey protein concentrate (10%)
A_4	Best treatment + Whey protein concentrate (15%)
A_5	Best treatment + Soya protein isolate (5%)
A_6	Best treatment + Soya protein isolate (10%)
A_7	Best treatment + Soya protein isolate (15%)
Factor II – Packaging materials	
B_1	Aluminium laminated pouches (ALP)
B_2	LDPE 200 gauge

Results and Discussion

Effect of different treatments on the chemical parameters of protein fortified Sapota based mixed fruit bar

Moisture (%): The nutritional quality of protein fortified Sapota based mixed fruit bar was affected with the advancement in storage period. The minimum moisture percent of 17.37 and 17.35 was observed in A_4B_2 (A_1 + WPC 15% in LDPE) whereas, maximum moisture percent of 17.54 and 17.51 was found in A_1B_1 (control in ALP) at 60 and 90 DAS, respectively (Table 2). This could be due to the evaporation of water from the fruit bar during storage (Ashaye *et al*., 2005 and Bhatt and Jha., 2015) [3, 5]. Similar observations were made by Shakoor *et al.* (2015) [22] and Gorabal (2020) [6] in wood apple fruit bar. The water activity and titratable acidity of fruit bar decreased during the storage period with no significant differences with respect to interaction.

Ascorbic acid (mg/100 g)

The maximum ascorbic acid content (91.48, 89.17 and 87.80 mg/100 g) recorded in A_1B_1 (control in ALP) whereas, minimum (79.16, 75.47 and 73.71 mg/100 g) was observed in A_4B_2 (A_1 + WPC 15% in LDPE) at 60 and 90 DAS respectively (Table 3). This may be due to the conversion of ascorbic acid to di-hydroxy ascorbic acid. Similar findings were reported in guava nectar by Karanjalker *et al.* (2013) [10] and Jamun fruit bar by Sood and Bandral (2015) [24].

TSS (°B)

The maximum TSS (71.74 and 71.76°B) was observed in A_4B_2 (A_1 + WPC 15% in LDPE) whereas, the minimum TSS (66.95 and 67.06°B) was recorded in A_1B_1 (control in ALP) at 60 and 90 DAS respectively (Table 4), which is due to acid hydrolysis of insoluble polysaccharides especially gums and pectin into soluble sugars (Kumar *et al*., 2019) [14], the results were in accordance with the findings of Kohinkar *et al*. (2012) [12] in fig and guava toffee and Gorabal (2020) [6] in wood apple fruit bar.

Sugars (%)

The maximum total sugars of 55.28 and 55.60 percent was observed in A_4B_2 (A_1 + WPC 15% in LDPE) whereas, the minimum total sugars of 54.30 and 54.58 was recorded in A_1B_1 (Control in ALP) at 60 and 90 DAS respectively (Table 5). The maximum reducing sugars of 19.64 and 19.81 percent was observed for A_4B_2 (A_1 + WPC 15% in LDPE) whereas, minimum reducing sugars of 17.93 in A_1B1 (Control in ALP) and 18.29 A_5B_1 (A_1 + SPI 5% in ALP) percent was recorded at 60 and 90 respectively (Table 6). The maximum non-reducing sugars of 34.68 and 34.65 percent was noticed in A_5B_2 (A_1 + SPI 15% in LDPE) whereas, minimum non-reducing sugars content of 33.86 and 33.24 percent was registered in A_4B_2 (A_1 + WPC 15% in LDPE) at 60 and 90 DAS respectively (Table 7). The changes are due to acid hydrolysis of insoluble polysaccharides especially gums and pectin into soluble sugars, the results were in accordance with the findings of Kohinkar *et al*. (2012) [12] in fig and guava toffee. The increase in the total and reducing sugars content of fruit bar could be due to acid hydrolysis of insoluble polysaccharides especially gums and pectin into soluble sugars. On the other hand, the non-reducing sugars were decreased during storage period, this might be due to inversion. The results were in accordance with the findings of papaya toffee and leather by Attri *et al.* (2014) [4], fortified mango bar by Parekh *et al.* (2014) [20] and wood apple fruit bar by Gorabal (2020) [6].

β-carotene (µg/100 g): The maximum β-carotene content of

948.73 and 935.96 µg/100 g was observed in A_1B_1 (Control in ALP) whereas, minimum β-carotene of 921.99 and 914.20 µg/100 g was found in A_4B_2 (A_1 + WPC 15% in LDPE) at 60 and 90 DAS respectively (Table 8) due to the thermo-labile and photosensitive nature (Mir and Nath, 1993) [18]. The decrease in total carotenoids was also in conformity with a report on sea buckthorn leather by Kaushal *et al.* (2013) [11] and papaya toffee and leather by Attri *et al.* (2014) [4].

Protein (%)

The maximum protein content of 5.35, 5.25 and 5.20 percent was observed in A_7B_1 (A_1 + SPI 15% in ALP) whereas, minimum protein percent was 0.49, 0.47 and 0.42 percent in A_1B_2 (control in LDPE) at 30, 60 and 90 DAS respectively (Table 9). This is due to the participation of proteins in the Maillard reaction (Anju *et al.*, 2014) [2]. The results of the present investigation are in accordance with the findings of Sharma (1997) [23] in plum soy products and Thakur and Neema (1997) [25] in apricot soy products and Kaushal *et al.* (2013) [11] in sea buckthorn leather.

No microbial growth was observed during the storage period. Ensuring that, the product was safe even after 90 days of storage, because of the less moisture, low water activity of spicy toffee and high acidic nature of pulp.

Table 2: Influence of different percentage of proteins and packaging materials on moisture content (%) of Sapota based mixed fruit bar during storage period

Treatments	Initial		30 DAS			60 DAS			90 DAS		
			B1	B2	Mean	B1	B2	Mean	B1	B2	Mean
A_1: Control	17.65		17.61	17.58	17.59	17.54	17.51	17.52	17.51	17.46	17.48
A_2: A_1 + WPC 5%	17.62		17.59	17.55	17.57	17.52	17.49	17.50	17.47	17.44	17.45
A_3: A_1 + WPC 10%	17.57		17.51	17.47	17.49	17.47	17.43	17.45	17.42	17.40	17.41
A_4: A_1 + WPC 15%	17.49		17.45	17.43	17.44	17.40	17.37	17.38	17.40	17.35	17.37
A_5: A_1 + SPI 5%	17.61		17.56	17.52	17.54	17.51	17.46	17.48	17.46	17.43	17.44
A_6: A_1 + SPI 10%	17.55		17.50	17.47	17.48	17.45	17.41	17.43	17.43	17.38	17.40
A_7: A_1 + SPI 15%	17.51		17.48	17.45	17.46	17.42	17.38	17.40	17.40	17.36	17.38
Mean	17.57		17.52	17.49		17.47	17.43		17.44	17.40	
	S.Em±	C. D. @ 1%	S.Em±	C. D. @ 1%		S.Em±	C. D. @ 1%		S.Em±	C. D. @ 1%	
Treatment (A)	0.003	0.014	0.004	0.015		0.002	0.007		0.003	0.014	
Packaging (B)	-	-	0.002	0.008		0.001	0.004		0.002	0.007	
Interaction (A×B)	-	-	0.005	NS		0.002	0.011		0.005	0.020	

A_1 (Control) - Sapota (50%) + Papaya (30%) + Guava (20%)
WPC - Whey Protein Concentrate SPI - Soya Protein Isolate
B_1 - Aluminium laminated pouch B_2 - Low density polyethylene
NS - Non Significant DAS - Days after Storage

Table 3: Influence of different percentage of proteins and packaging materials on ascorbic acid (mg/100 g) content of Sapota based mixed fruit bar during storage period

Treatments	Initial		30 DAS			60 DAS			90 DAS		
			B_1	B_2	Mean	B_1	B_2	Mean	B_1	B_2	Mean
A_1: Control	95.97		91.48	90.06	90.77	89.17	88.39	88.78	87.80	85.69	86.74
A_2: A_1 + WPC 5%	90.95		88.68	88.04	88.36	84.20	83.89	84.04	80.90	78.90	79.90
A_3: A_1 + WPC 10%	86.60		83.44	83.01	83.22	81.09	80.50	80.79	78.80	77.10	77.95
A_4: A_1 + WPC 15%	82.07		79.57	79.16	79.36	76.11	75.47	75.79	74.30	73.71	74.01
A_5: A_1 + SPI 5%	93.17		91.16	90.28	90.72	87.71	86.18	86.94	84.42	82.08	83.25
A_6: A_1 + SPI 10%	88.77		85.69	84.38	85.03	82.41	82.04	82.22	80.10	78.11	79.10
A_7: A_1 + SPI 15%	85.39		81.20	81.07	81.13	77.66	76.57	77.12	75.89	73.11	74.50
Mean	88.99		85.89	85.14		82.62	81.86		80.31	78.38	
	S.Em±	C. D. @ 1%	S.Em±	C. D. @ 1%		S.Em±	C. D. @ 1%		S.Em±	C. D. @ 1%	
Treatment (A)	0.05	0.21	0.02	0.07		0.01	0.04		0.01	0.06	
Packaging (B)	-	-	0.01	0.04		0.01	0.02		0.01	0.03	
Interaction (A×B)	-	-	0.02	0.10		0.02	0.06		0.02	0.08	

Table 4: Influence of different percentage of proteins and packaging materials on TSS (°B) of Sapota based mixed fruit bar during storage period

Treatments	Initial	30 DAS			60 DAS			90 DAS		
		B_1	B_2	Mean	B_1	B_2	Mean	B_1	B_2	Mean
A_1: Control	66.83	66.90	66.93	66.91	66.95	66.98	66.96	67.06	67.09	67.07
A_2: A_1+ WPC 5%	68.31	68.38	68.40	68.39	68.43	68.46	68.44	68.44	68.48	68.46
A_3: A_1 + WPC 10%	70.15	70.26	70.31	70.28	70.30	70.34	70.32	70.35	70.37	70.36
A_4: A_1 + WPC 15%	71.25	71.68	71.72	71.70	71.69	71.74	71.71	71.72	71.76	71.74
A_5: A_1 + SPI 5%	67.21	67.28	67.31	67.29	67.31	67.32	67.31	67.34	67.36	67.35
A_6: A_1 + SPI 10%	69.15	69.30	69.31	69.30	69.33	69.35	69.34	69.36	69.41	69.38
A_7: A_1 + SPI 15%	71.10	71.14	71.19	71.17	71.15	71.21	71.18	71.18	71.23	71.20

Mean	69.14		69.27	69.31		69.30	69.34		69.35	69.38	
	S.Em±	C. D. @ 1%	S.Em±	C. D. @ 1%		S.Em±	C. D. @ 1%		S.Em±	C. D. @ 1%	
Treatment (A)	0.070	0.297	0.004	0.016		0.004	0.015		0.003	0.011	
Packaging (B)	-	-	0.002	0.008		0.002	0.008		0.001	0.006	
Interaction (A×B)	-	-	0.005	NS		0.005	0.021		0.004	0.016	

A_1 (Control) - Sapota (50%) + Papaya (30%) + Guava (20%)
WPC - Whey Protein Concentrate SPI - Soya Protein Isolate
B_1 - Aluminium laminated pouch B_2 -Low density polyethylene
NS - Non Significant DAS - Days after Storage

Table 5: Influence of different percentage of proteins and packaging materials on total sugars (%) of sapota based mixed fruit bar during storage period

Treatments	Initial		30 DAS			60 DAS			90 DAS		
			B_1	B_2	Mean	B_1	B_2	Mean	B_1	B_2	Mean
A_1: Control	54.06		54.13	54.19	54.16	54.30	54.33	54.31	54.58	54.62	54.60
A_2: A_1 + WPC 5%	54.38		54.52	54.54	54.53	54.77	54.81	54.79	54.95	54.98	54.96
A_3: A_1 + WPC 10%	54.62		54.86	54.90	54.88	54.96	54.98	54.97	55.13	55.16	55.14
A_4: A_1 + WPC 15%	54.89		54.92	54.97	54.94	55.26	55.28	55.27	54.79	55.60	55.19
A_5: A_1 + SPI 5%	54.21		54.42	54.47	54.44	54.65	54.69	54.67	54.76	54.79	54.78
A_6: A_1 + SPI 10%	54.31		54.53	54.56	54.54	54.71	54.73	54.72	54.86	54.92	54.89
A_7: A_1 + SPI 15%	54.50		54.65	54.67	54.66	54.77	54.81	54.79	54.88	54.92	54.90
Mean	54.42		54.57	54.61		54.77	54.80		54.85	55.00	
	S.Em±	C. D. @ 1%	S.Em±	C. D. @ 1%		S.Em±	C. D. @ 1%		S.Em±	C. D. @ 1%	
Treatment (A)	0.003	0.011	0.004	0.017		0.002	0.008		0.041	0.175	
Packaging (B)	-	-	0.002	0.009		0.001	0.004		0.022	0.094	
Interaction (A×B)	-	-	0.006	NS		0.003	0.011		0.058	0.248	

A_1 (Control) - Sapota (50%) + Papaya (30%) + Guava (20%)
WPC - Whey Protein Concentrate SPI - Soya Protein Isolate
B_1 - Aluminium laminated pouch B_2 -Low density polyethylene
NS - Non Significant DAS - Days after Storage

Table 6: Influence of different percentage of proteins and packaging materials on reducing sugars (%) of sapota based mixed fruit bar during storage period

Treatments	Initial		30 DAS			60 DAS			90 DAS		
			B_1	B_2	Mean	B_1	B_2	Mean	B_1	B_2	Mean
A_1: Control	17.18		17.71	17.74	17.72	17.93	17.95	17.94	18.32	18.35	18.33
A_2: A_1 + WPC 5%	17.85		18.16	18.20	18.18	18.52	18.56	18.54	18.81	18.84	18.82
A_3: A_1 + WPC 10%	18.43		18.73	18.75	18.74	18.84	18.91	18.87	19.24	19.28	19.26
A_4: A_1 + WPC 15%	18.97		19.25	19.29	19.27	19.60	19.64	19.62	19.80	19.81	19.80
A_5: A_1 + SPI 5%	17.59		17.83	17.85	17.84	18.16	18.19	18.17	18.29	18.33	18.31
A_6: A_1 + SPI 10%	17.81		17.97	17.99	17.98	18.31	18.34	18.32	18.53	18.58	18.55
A_7: A_1 + SPI 15%	17.96		18.35	18.38	18.36	18.54	18.59	18.56	18.85	18.89	18.87
Mean	17.97		18.28	18.31		18.55	18.59		18.83	18.86	
	S.Em±	C. D. @ 1%	S.Em±	C. D. @ 1%		S.Em±	C. D. @ 1%		S.Em±	C. D. @ 1%	
Treatment (A)	0.005	0.019	0.006	0.026		0.004	0.016		0.003	0.011	
Packaging (B)	-	-	0.003	0.014		0.002	0.009		0.001	0.006	
Interaction (A×B)	-	-	0.009	NS		0.005	0.023		0.004	0.015	

A_1 (Control) - Sapota (50%) + Papaya (30%) + Guava (20%)
WPC - Whey Protein Concentrate SPI - Soya Protein Isolate
B_1 - Aluminium laminated pouch B_2 -Low density polyethylene
NS - Non Significant DAS - Days after Storage

Table 7: Influence of different percentage of proteins and packaging materials on non-reducing sugars (%) of Sapota based mixed fruit bar during storage period

Treatments	Initial		30 DAS			60 DAS			90 DAS		
			B_1	B_2	Mean	B_1	B_2	Mean	B_1	B_2	Mean
A_1: Control	35.03		34.63	34.59	34.61	34.55	34.56	34.55	34.45	34.46	34.45
A_2: A_1 + WPC 5%	34.70		34.52	34.54	34.53	34.44	34.44	34.44	34.34	34.33	34.34
A_3: A_1 + WPC 10%	34.38		34.34	34.32	34.33	34.31	34.26	34.29	34.09	34.10	34.09
A_4: A_1 + WPC 15%	34.12		33.90	33.89	33.89	33.88	33.86	33.87	34.01	33.24	33.62
A_5: A_1 + SPI 5%	34.78		34.78	34.76	34.77	34.67	34.68	34.67	34.64	34.65	34.65
A_6: A_1 + SPI 10%	34.68		34.74	34.73	34.74	34.58	34.57	34.58	34.53	34.51	34.52
A_7: A_1 + SPI 15%	34.71		34.48	34.49	34.48	34.42	34.41	34.41	34.23	34.23	34.23
Mean	34.63		34.48	34.47		34.41	34.40		34.33	34.22	
	S.Em±	C. D. @ 1%	S.Em±	C. D. @ 1%		S.Em±	C. D. @ 1%		S.Em±	C. D. @ 1%	
Treatment (A)	0.005	0.022	0.006	0.027		0.004	0.018		0.039	0.167	

Packaging (B)	-	-	0.003	0.014	0.002	0.010	0.021	0.089
Interaction (A×B)	-	-	0.009	NS	0.006	0.026	0.055	0.236

A_1 (Control) - Sapota (50%) + Papaya (30%) + Guava (20%)
WPC - Whey Protein Concentrate SPI - Soya Protein Isolate
B_1 - Aluminium laminated pouch B_2 -Low density polyethylene
NS - Non Significant DAS - Days after Storage

Table 8: Influence of different percentage of proteins and packaging materials on β-carotene content (µg/100 g) of Sapota based mixed fruit bar during storage period

Treatments	Initial		30 DAS			60 DAS			90 DAS		
			B_1	B_2	Mean	B_1	B_2	Mean	B_1	B_2	Mean
A_1: Control	967.85		954.90	947.97	951.43	948.73	938.92	943.82	935.96	933.04	934.50
A_2: A_1 + WPC 5%	961.71		950.17	945.20	947.68	937.07	932.05	934.56	931.30	925.35	928.32
A_3: A_1 + WPC 10%	954.23		940.80	937.56	939.18	933.09	927.93	930.51	927.42	923.04	925.23
A_4: A_1 + WPC 15%	950.95		938.66	934.12	936.39	925.19	921.99	923.59	919.28	914.20	916.74
A_5: A_1 + SPI 5%	960.79		949.34	944.91	947.12	941.29	938.08	939.68	932.26	928.91	930.58
A_6: A_1 + SPI 10%	957.02		945.34	941.41	943.37	937.97	934.85	936.41	930.09	927.83	928.96
A_7: A_1 + SPI 15%	952.31		938.81	935.93	937.37	930.56	926.98	928.77	924.76	920.61	922.69
Mean	957.83		945.43	941.01		936.27	931.54		928.72	924.71	
	S.Em±	C. D. @ 1%	S.Em±	C. D. @ 1%		S.Em±	C. D. @ 1%		S.Em±	C. D. @ 1%	
Treatment (A)	0.143	0.607	0.006	0.026		0.004	0.016		0.003	0.011	
Packaging (B)	-	-	0.003	0.014		0.002	0.009		0.001	0.006	
Interaction (A×B)	-	-	0.009	NS		0.005	0.023		0.004	0.015	

A_1 (Control) - Sapota (50%) + Papaya (30%) + Guava (20%)
WPC - Whey Protein Concentrate SPI - Soya Protein Isolate
B_1 - Aluminium laminated pouch B_2 -Low density polyethylene
NS - Non Significant DAS - Days after Storage

Table 9: Influence of different percentage of proteins and packaging materials on protein content (%) of Sapota based mixed fruit bar during storage period

Treatments	Initial		30 DAS			60 DAS			90 DAS		
			B_1	B_2	Mean	B_1	B_2	Mean	B_1	B_2	Mean
A_1: Control	0.59		0.55	0.49	0.52	0.51	0.47	0.49	0.45	0.42	0.43
A_2: A_1 + WPC 5%	1.29		1.24	1.21	1.22	1.21	1.18	1.19	1.18	1.14	1.16
A_3: A_1 + WPC 10%	1.63		1.60	1.58	1.59	1.56	1.53	1.54	1.50	1.45	1.47
A_4: A_1 + WPC 15%	3.25		3.20	3.16	3.18	3.15	3.12	3.13	3.10	3.08	3.09
A_5: A_1 + SPI 5%	2.55		2.41	2.34	2.37	2.15	2.11	2.13	2.10	2.06	2.08
A_6: A_1 + SPI 10%	4.75		4.54	4.43	4.48	4.34	4.30	4.32	4.31	4.24	4.27
A_7: A_1 + SPI 15%	5.85		5.35	5.15	5.25	5.25	5.21	5.23	5.20	5.16	5.18
Mean	2.84		2.69	2.62		2.59	2.56		2.54	2.50	
	S.Em±	C. D. @ 1%	S.Em±	C. D. @ 1%		S.Em±	C. D. @ 1%		S.Em±	C. D. @ 1%	
Treatment (A)	0.016	0.070	0.013	0.053		0.001	0.004		0.004	0.015	
Packaging (B)	-	-	0.007	0.029		0.001	0.002		0.002	0.008	
Interaction(A×B)	-	-	0.018	0.075		0.001	0.006		0.005	0.022	

A_1 (Control) - Sapota (50%) + Papaya (30%) + Guava (20%)
WPC - Whey Protein Concentrate SPI - Soya Protein Isolate
B_1 - Aluminium laminated pouch B_2 -Low density polyethylene
NS - Non Significant DAS - Days after Storage

Conclusion

From the above results, protein fortified sapota based mixed fruit bar prepared from recipe having whey protein concentrate (15%) packed in aluminium laminated pouches was found to be superior with respect to protein percentage, packaging and interaction in terms of chemical parameters.

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