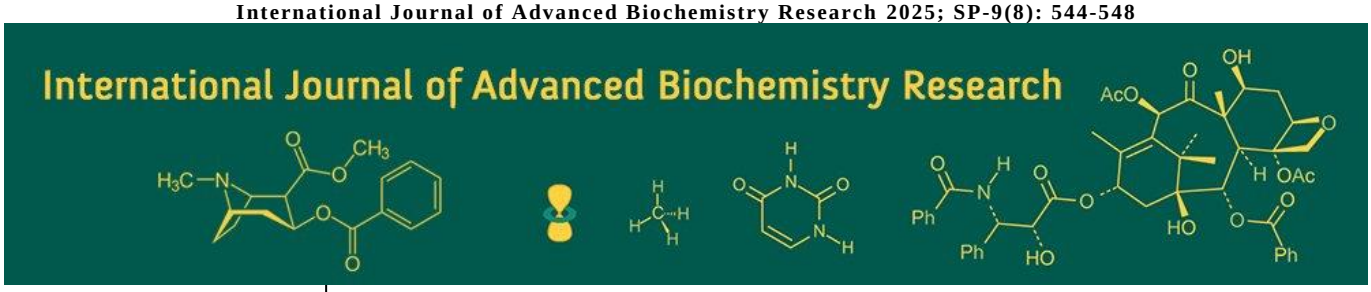

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Studies on the effect of wrapping materials on quality of wood apple toffees

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Abstract
The present investigation was carried out to know the effectiveness of different wrapping materials *viz*., butter paper wrapper, 12 µ toffee wrapper, 25 µ toffee wrapper, Butter paper + 12 µ toffee wrapper, Butter paper + 25 µ toffee wrapper on storage behavior and quality parameters of wood apple fruit toffee under ambient storage. Significant differences were observed in toffees with respect to physico chemical constituents and sensory attributes among the different wrapping materials used during the storage period of 6 months. Minimum changes with respect to TSS (76.80 to 76.87°B), total sugars (60.23 to 60.37%), moisture content (13.73 to 13.63%), ascorbic acid (1.62 to 1.46 mg/100 g) and acidity (2.23 to 2.15%) were observed in toffees wrapped with butter paper +25 µTW. The toffee wrapped in butter paper followed by 12 and 25 µTW retained sensory qualities throughout the storage period. The toffees wrapped directly with 12 and 25 µTW were not found suitable since, toffee corrodes the wrapper and the metal sticks to the toffee and cause discoloration.

Keywords: Toffee, butter paper, toffee wrapper

Introduction
The wood apple (*Feronia limonia* Swingle) an underutilized fruit belongs to the family Rutaceae, native of dry plains of India, Pakistan and Sri Lanka. The fruit is known for its excellent flavor and nutritive value, and has a great potential for value addition. A wide variety of value-added products can be prepared from this fruit including beverages, jam, jelly and leather (Gorabal, 2020) [5]. The fruit is not popular as a dessert fruit because it exhibits difficulty while eating as it has a hard shell, sticky texture and abundant seeds. Therefore, it is not easily marketed in fresh form and should be processed into acceptable products (Gowda, 2017) [6]. Toffee is one of the confectionary nutritional products, has a chewy texture and is a good source of dietary fibre and natural sugar hence product is liked by all age groups peoples (Bhokre *et al.*, 2010) [2]. Nowadays global demand for fruit-based toffees was increasing day by day (Domale *et al.*, 2008) [4]. The toffee can be better utilized as a vehicle to promote consumption and utilization of wood apple fruit, which have otherwise less market demand and quite limited shelf life. Maintaining the quality of products during storage is crucial, as it determines their storage stability. Toffee wrappers serves both functional and aesthetic purposes, they play several crucial roles in preserving the quality, safety and marketability of the product. To preserve the nutritional value and sensory qualities of fruit toffees, several wrapping materials are used. Therefore, the goal of the current study was to examine how various wrapping materials affected the quality of wood apple sweet and spicy toffees.

Material and Methods
The wood apple pulp was extracted from the fully ripe wood apple fruits. The extracted pulp was homogenized by hand crushing. It was then passed through the strainer to separate seeds and fibre. This pulp was homogenized again using a blender to make fine pulp, which provides a good texture to the fruit toffees. For the preparation of sweet toffees, the pulp extracted from wood apple fruits was boiled for 10 minutes with continuous stirring. It was then mixed with powdered cane sugar, liquid glucose, milk powder, hydrogenated fat, pectin, salt and citric acid.

For the preparation of spicy toffee, sugar and water (1:1) were boiled for 10 minutes with continuous stirring. Then it was blended with the same quantity of wood apple pulp along with spice mixture (red chilli powder, coriander powder and cumin powder), garlic powder and rock salt.
In both the toffee preparation, after reaching the end point (75°B), the hot pulpy mixture was spread evenly on the drying trays to a thickness of 5 mm and dried at 65±2 °C for 12 hours in an electric tray drier. After drying to optimum moisture content (15 to 20%), the dried sheets were cut into toffee of equal size of 3 X 1.5 cm and wrapped different wrapping materials *Viz.*, W_1-Butter paper wrapper (BP), W_2-12-micron toffee wrapper (12 µTW), W_3-25-micron toffee wrapper (25 µTW), W_4-Butter paper + 12 micron toffee wrapper (BP + 12 µTW) and W_5-Butter paper + 25 micron toffee wrapper (BP + 25 µTW). The wrapped toffees were further packed in a 200 gauge polythene bag and then stored for six months at ambient condition.

Result and Discussion

Moisture (%): Moisture content is an important characteristic parameter in the fruit toffee that governs the quality, safety, palatability and shelf life. It is evident from Table 1 that among the fruit toffees, spicy toffee (T_2) recorded the minimum per cent of moisture (12.90%) whereas, sweet toffee (T_1) recorded the maximum per cent of moisture (14.07%) at 6 MAS. It might be due to the presence of skim milk powder and hydrogenated fat in sweet toffees not easily leaves the moisture. Mean moisture per cent showed a decreasing trend (13.66 to 13.48%). Results obtained were in accordance with Akhtar *et al.* (2014) in apple date fruit bar; and Kumar *et al.* (2015) in papaya leather.
Among the different wrapping materials, the maximum decrease in the moisture content (13.33%) of the fruit toffee was noticed in butter paper wrapper (W_1) whereas, minimum decrease in the moisture content (13.63%) was observed in BP + 25 µTW (W_5) after 6 MAS. It is mainly due to butter paper was high permeable to oxygen and water diffusion and high-water vapor transmission rate (WVTR) when compared to other wrapping materials. Similar results were observed by Kumar *et al.* (2005) [10] in guava leather, Kuchi *et al.* (2014) [8] in guava jelly bar and Kuchi *et al.* (2017) [9] in banana burfi in which lower moisture loss was observed in aluminum foil compared to butter paper wrapper. The interaction effects between the wrapping materials and toffees, spicy toffees wrapped in BP + 25 µTW recorded a minimum decrease in moisture whereas, butter paper wrapped fruit toffees showed maximum loss of moisture. Similar results were observed in banana burfi by Kuchi *et al.* (2017) [9] where butter paper wrapped burfi recorded a maximum decrease in moisture when compared to aluminum wrapped burfi. It may be due to the impermeable property of the wrapper to moisture content.

Total soluble solids and sugars: It is evident from Table 1 that among the fruit toffees, spicy toffee (T_2) recorded the highest total soluble solids and total sugars. Mean TSS and total sugars showed an increasing trend during the storage period of 6 months. An increase in TSS and sugars of fruit toffees might be due to acid hydrolysis of insoluble polysaccharides especially gums and pectin into soluble sugars (Kumar *et al.*, 2019) [11]. Another reason may be due to a decrease in moisture content during storage (Kohinkar *et al.*, 2012) [7].

Among the different wrapping materials, a minimum increase in the TSS, total sugars was observed in BP + 25 µTW (W_5) whereas, a maximum increase was noticed in butter paper wrapper (W_1). It is mainly due to the low water vapor transmission rate (WVTR) and gas transmission when compared to other wrapping materials. This property of wrapping material slows down the conversion of non-reducing sucrose into reducing sugars (glucose and fructose) and the loss of moisture was also minimum, thus retards the inversion of polysaccharides. Similar results were observed by Kuchi *et al.* (2017) [9] in banana burfi; Kumar *et al.* (2005) [10] in guava leather. The interaction effects between the wrapping materials and spicy toffees packed in BP + 25 µTW recorded a minimum increase in TSS and total sugars during storage.

Titratable acidity: The decrease in the titratable acidity in all the treatments was noticed during storage irrespective of the fruit toffees, wrapping materials and their interaction (Table 2). Among the wrapping materials, maximum retention of titratable acidity (2.15%) was noticed in BP + 25 µTW (W_5) and BP + 12 µTW (W_4) whereas, minimum retention of titratable acidity (2.12%) was registered in butter paper and 12 µTW it may be due to the high excessive rupturing strength of 12 µTW during the storage period. Apart from this, in toffees wrapped with double-layer wrappers, the reactions between acids and minerals may be at a very slow rate, hence maximum retention of titratable acidity was noticed in W_5 and W_4. A similar observation was made on jackfruit leather by Kumar *et al.*, 2005 [10] in guava leather and Kuchi *et al.* (2014) [8] in guava jelly bar.

Ascorbic acid: Ascorbic acid content decreased as the storage period increases. The mean value of ascorbic acid decreased from 1.59 to 1.40 mg/100 g during 6 MAS (Table 2). The ascorbic content of the fruit toffees significantly differed with wrapping materials over the storage period. Among various wrapping materials, BP + 25 µTW (W5) retained maximum ascorbic acid content (1.62, 1.53 and 1.46 mg/100 g, respectively) at 2, 4 and 6 MAS, which was mainly due to the usage of double-layer wrappers leads to high barrier properties to the oxygen and moisture transmission rate. Aluminium foil act as a good barrier against light, water and oxygen and butter paper in a little extent. Whereas, in butter paper wrapper minimum retention of ascorbic acid was found (1.55, 1.42 and 1.33 mg/ 100 g) at 2, 4 and 6 MAS, respectively. Similar findings were noticed by Kuchi *et al.* (2017) [9] in banana burfi and Kumar *et al.* (2005) [10] in guava leather. Among interaction effects, spicy toffee wrapped with butter paper and 25 µTW retained maximum ascorbic acid content (1.81 mg/100 g) whereas, minimum retention (1.33 mg/100 g) was observed in sweet toffee wrapped in butter paper. The results of the present investigation are by the findings of Manimegalai *et al.* (2001) [14] in jackfruit bar.

Non enzymatic browning (OD): The NEB increased as the storage period increases, the mean value of NEB increased from 1.01, 1.02 and 1.03 OD during 2, 4 and 6 MAS, respectively (Table 2). The NEB of the fruit toffees significantly differed with wrapping materials over the storage period. A rise in NEB during storage may be due to the formation of furfural and hydroxyl furfural by aerobic

and anaerobic degradation of ascorbic acid, sugars and organic acids (Kumar *et al.*, 2019) [11]. Another reason may be the phenolic compounds get easily oxidized during storage and give brown pigment. The decrease in acidity, ascorbic acid content and storage at higher temperature are other factors responsible for NEB. The same type of findings was noticed by Deepika *et al.* (2016) [3] in aonla based fruit bars and Sucheta *et al.* (2018) [18] in guava and mango toffee.

The NEB of fruit toffee significantly differed with wrappers over the storage period. Among the different wrapping materials, a minimum increase (1.01 OD) in the NEB was observed in BP + 25 µTW (W_5) whereas, a maximum increase (1.06 OD) was noticed in butter paper wrapper (W_1) at 6 MAS. It is mainly due to the low water vapor transmission rate (WVTR) and gas transmission when compared to other wrapping materials. This property of wrapping material slows down the conversion of sucrose into sugars. The interaction effects between the wrapping materials and toffees, spicy toffees packed in BP + 25 µTW recorded a minimum NEB of the fruit toffees.

Organoleptic evaluation: Storage life refers to the end of consumer's acceptability, and it is the time at which the majority of consumers are displaced with the product (Labuza and Schmid, 1985) [13]. From the consumer's point of view, the color and appearance, flavor, taste, texture are very important for the marketability of the fruit toffees.

Among the fruit toffees, spicy toffee recorded the highest score for sensory parameters whereas, sweet toffee recorded minimum sensory scores. Among the different wrapping materials highest score for color and appearance, taste, flavor, texture and overall acceptability were recorded in treatment W_5 (BP + 25 µTW) followed by W_4 (BP + 12 µTW) whereas, the minimum score was recorded in W_2 (12 µTW) and W_3 (25 µTW) in 4 and 6 MAS. The retention of organoleptic quality and nutritional quality parameters was more in toffees wrapped with butter paper followed by 12 or 25 µTW. This may be directly correlated with the, lower rate of deteriorative changes, which were high in the toffees wrapped with butter paper or 12 or 25 µTW alone.

Maximum loss of sensory values were noticed in toffees wrapped with 12 µTW, this may be due to the thinner gauge of a wrapper having a higher water vapor transmission rate and gas transmission rate and suffering from the pinhole formation that does not provide an effective barrier against gases and liquids when compared to heavier gauge toffee wrapper (Schricker, 1982) [15]. The same results were also noticed in toffees wrapped in 25 µTW, due to the high acidic property of wood apple pulp, corrodes the wrapper and cause discoloration. Among interaction effects, higher overall acceptability scores were obtained for treatment T_2W_5-Spicy + BP + 25 µTW (7.81) which was on par with T_2W_4-Spicy + BP + 12 µTW (7.75), T_1W_5-Sweet + BP + 25 µTW (7.67), T_1W_4-Sweet + BP + 12 µTW (7.63) whereas the minimum was observed in toffee wrapped with 12 µTW and 24 µTW. Kumar *et al.* (2005) [10] noticed that the least sensory scores were observed in samples packed in aluminum foil when compared to the butter paper-wrapped guava fruit bar.

Table 1: Effect of different wrapping material on the moisture content, total soluble solids (TSS) and total sugars of wood apple toffees

Treatments	Moisture content (%)			TSS (ºB)			Total sugars (%)		
	2 MAS	4 MAS	6 MAS	2 MAS	4 MAS	6 MAS	2 MAS	4 MAS	6 MAS
Factor I: Fruit toffees									
T_1	14.26	14.19	14.07	76.14	76.19	76.22	59.18	59.27	59.34
T_2	13.07	12.98	12.90	77.50	77.53	77.56	61.30	61.36	61.43
Mean	13.66	13.58	13.48	76.82	76.86	76.89	60.24	60.32	60.39
S.Em±	0.003	0.003	0.003	0.002	0.002	0.003	0.007	0.005	0.004
C.D. @ 1%	0.013	0.013	0.011	0.009	0.009	0.012	0.029	0.020	0.018
Factor II: Wrapping material									
W_1	13.57	13.45	13.33	76.84	76.88	76.92	60.26	60.35	60.41
W_2	13.64	13.52	13.41	76.84	76.87	76.91	60.25	60.33	60.40
W_3	13.67	13.58	13.47	76.82	76.87	76.90	60.25	60.32	60.39
W_4	13.72	13.66	13.58	76.81	76.85	76.88	60.24	60.31	60.37
W_5	13.73	13.70	13.63	76.80	76.83	76.87	60.23	60.30	60.37
Mean	13.66	13.58	13.48	76.82	76.86	76.89	60.24	60.32	60.39
S.Em±	0.005	0.005	0.004	0.003	0.004	0.005	0.011	0.008	0.007
C.D. @ 1%	0.021	0.020	0.017	0.014	0.014	0.019	NS	0.032	0.028
Interaction (T X W)									
T_1W_1	14.18	14.07	13.92	76.16	76.20	76.25	59.20	59.31	59.37
T_1W_2	14.23	14.12	13.98	76.16	76.20	76.23	59.19	59.28	59.35
T_1W_3	14.27	14.18	14.07	76.14	76.19	76.23	59.18	59.27	59.35
T_1W_4	14.30	14.26	14.16	76.13	76.17	76.21	59.18	59.26	59.32
T_1W_5	14.31	14.29	14.22	76.12	76.16	76.20	59.17	59.25	59.33
T_2W_1	12.95	12.83	12.74	77.51	77.55	77.58	61.32	61.39	61.45
T_2W_2	13.04	12.92	12.83	77.51	77.53	77.58	61.31	61.37	61.45
T_2W_3	13.07	12.98	12.87	77.50	77.54	77.56	61.32	61.36	61.43
T_2W_4	13.13	13.05	12.99	77.49	77.52	77.55	61.29	61.35	61.41
T_2W_5	13.15	13.10	13.04	77.48	77.50	77.54	61.28	61.35	61.40
Mean	13.66	13.58	13.48	76.82	76.86	76.89	60.24	60.32	60.39
S.Em±	0.007	0.007	0.006	0.005	0.005	0.007	0.016	0.011	0.010
C.D. @ 1%	0.029	0.028	0.024	0.020	0.020	0.026	0.065	0.045	0.040

The initial moisture content, TSS and sugars: T_1 = 14.32%, 76.12 ºB & 59.12% T_2 = 13.16%, 77.46 ºB & 61.25%, respectively

T_1-Sweet toffee, T_2-Spicy toffee, W_1-Butter paper wrapper (BP), W_2-12-micron toffee wrapper (12 µTW), W_3-25-micron toffee wrapper (25 µTW), W_4-Butter paper + 12 micron (BP + 12 µTW) toffee wrapper, W_5-Butter paper + 25 micron (BP + 25 µTW) toffee wrapper, MAS: Months after storage, TW: Toffee wrapper.

Table 2: Effect of different wrapping material on the titratable acidity, ascorbic acid and non enzymatic browning (NEB) of wood apple toffees

Treatments	Titratable acidity (%)			Ascorbic acid (mg/100 g)			NEB (OD value)		
	2 MAS	4 MAS	6 MAS	2 MAS	4 MAS	6 MAS	2 MAS	4 MAS	6 MAS
Factor I: Fruit toffees									
T_1	2.15	2.10	2.07	1.39	1.30	1.21	1.21	1.22	1.24
T_2	2.31	2.26	2.20	1.79	1.67	1.59	0.81	0.82	0.83
Mean	2.23	2.18	2.13	1.59	1.49	1.40	1.01	1.02	1.04
S.Em±	0.003	0.002	0.002	0.007	0.006	0.005	0.0003	0.0003	0.0003
C.D. @ 1%	0.010	0.007	0.009	0.030	0.023	0.020	0.001	0.001	0.001
Factor II: Wrapping material									
W_1	2.23	2.16	2.12	1.55	1.42	1.33	1.03	1.04	1.06
W_2	2.22	2.15	2.12	1.59	1.48	1.38	1.02	1.03	1.05
W_3	2.24	2.19	2.14	1.60	1.49	1.39	1.01	1.03	1.04
W_4	2.22	2.20	2.15	1.61	1.53	1.43	1.01	1.01	1.02
W_5	2.23	2.20	2.15	1.62	1.53	1.46	1.01	1.01	1.01
Mean	2.23	2.18	2.13	1.59	1.49	1.40	1.01	1.02	1.04
S.Em±	0.004	0.003	0.003	0.012	0.009	0.008	0.0005	0.0005	0.0005
C.D. @ 1%	0.016	0.010	0.014	0.047	0.036	0.032	0.002	0.002	0.002
Interaction (T X W)									
T_1W_1	2.14	2.09	2.05	1.33	1.20	1.11	1.22	1.23	1.25
T_1W_2	2.14	2.08	2.05	1.39	1.28	1.19	1.22	1.23	1.25
T_1W_3	2.15	2.10	2.07	1.40	1.32	1.20	1.21	1.23	1.25
T_1W_4	2.15	2.12	2.07	1.42	1.36	1.25	1.21	1.22	1.22
T_1W_5	2.15	2.11	2.08	1.42	1.35	1.28	1.20	1.21	1.22
T_2W_1	2.31	2.24	2.18	1.76	1.63	1.55	0.83	0.85	0.86
T_2W_2	2.30	2.22	2.18	1.78	1.67	1.57	0.82	0.83	0.85
T_2W_3	2.32	2.27	2.20	1.79	1.65	1.58	0.81	0.83	0.83
T_2W_4	2.30	2.27	2.22	1.79	1.69	1.60	0.80	0.81	0.82
T_2W_5	2.31	2.28	2.21	1.81	1.71	1.63	0.81	0.81	0.81
Mean	2.23	2.18	2.13	1.59	1.49	1.40	1.01	1.02	1.04
S.Em±	0.006	0.004	0.005	0.017	0.013	0.011	0.001	0.001	0.001
C.D. @ 1%	0.023	0.015	0.020	0.067	0.052	0.045	0.003	0.003	0.003

Initial titratable acidity, ascorbic acid & NEB values: T_1 = 2.18%, 1.54mg/100g & 1.20 T_2 = 2.37%, 1.90 mg/100g & 0.80 respectively

T_1-Sweet toffee, T_2-Spicy toffee, W_1-Butter paper wrapper (BP), W_2-12-micron toffee wrapper (12 µTW), W_3-25-micron toffee wrapper (25 µTW), W_4-Butter paper + 12 micron (BP + 12 µTW) toffee wrapper, W_5-Butter paper + 25 micron (BP + 25 µTW) toffee wrapper, MAS: Months after storage, TW: Toffee wrapper.

Table 3: Effect of different wrapping material on the colour and appearance, flavour and taste of wood apple toffees

Treatments	Colour and appearance			Flavor			Taste		
	2 MAS	4 MAS	6 MAS	2 MAS	4 MAS	6 MAS	2 MAS	4 MAS	6 MAS
Factor I: Fruit toffees									
T_1	7.67	6.38	5.00	8.10	6.90	5.48	8.13	6.48	4.93
T_2	8.53	7.07	5.50	7.33	6.15	4.62	8.15	6.57	5.05
Mean	8.10	6.73	5.25	7.72	6.53	5.05	8.14	6.53	4.99
S.Em±	0.057	0.066	0.07	0.074	0.066	0.083	0.061	0.063	0.031
C.D. @ 1%	0.227	0.264	0.28	0.296	0.264	0.335	NS	NS	NS
Factor II: Wrapping material									
W_1	8.00	7.67	7.42	7.58	7.33	7.08	7.92	7.42	6.96
W_2	8.00	2.00	1.00	7.58	2.50	1.33	8.00	1.00	1.00
W_3	8.08	7.79	2.00	7.75	7.50	1.83	8.17	7.88	1.00
W_4	8.21	8.08	7.92	7.83	7.63	7.46	8.29	8.17	8.00
W_5	8.21	8.08	7.92	7.83	7.67	7.54	8.33	8.17	8.00
Mean	8.10	6.73	5.25	7.72	6.53	5.05	8.14	6.53	4.99
S.Em±	0.089	0.104	0.11	0.116	0.104	0.132	0.097	0.100	0.049
C.D. @ 1%	NS	0.417	0.45	NS	0.42	0.530	0.390	0.404	0.198
Interaction (T X W)									
T_1W_1	7.67	7.33	7.00	8.00	7.67	7.50	7.83	7.17	6.67
T_1W_2	7.50	2.00	1.00	8.00	3.00	1.67	8.00	1.00	1.00
T_1W_3	7.67	7.25	2.00	8.17	7.83	2.67	8.17	7.92	1.00
T_1W_4	7.75	7.67	7.50	8.17	8.00	7.75	8.33	8.17	8.00
T_1W_5	7.75	7.67	7.50	8.17	8.00	7.83	8.33	8.17	8.00
T_2W_1	8.33	8.00	7.83	7.17	7.00	6.67	8.00	7.67	7.25
T_2W_2	8.50	2.00	1.00	7.17	2.00	1.00	8.00	1.00	1.00
T_2W_3	8.50	8.33	2.00	7.33	7.17	1.00	8.17	7.83	1.00
T_2W_4	8.67	8.50	8.33	7.50	7.25	7.17	8.25	8.17	8.00
T_2W_5	8.67	8.50	8.33	7.50	7.33	7.25	8.33	8.17	8.00
Mean	8.10	6.73	5.25	7.72	6.53	5.05	8.14	6.53	4.99
S.Em±	0.126	0.15	0.16	0.165	0.147	0.186	0.137	0.142	0.070
C.D. @ 1%	0.509	0.590	0.636	0.662	0.590	0.750	NS	0.571	0.281

Initial colour and appearance, flavor & taste values: T_1 = 7.75, 8.33 & 8.33 T_2 = 8.33, 7.50 & 8.33, respectively

T_1-Sweet toffee, T_2-Spicy toffee, W_1-Butter paper wrapper (BP), W_2-12-micron toffee wrapper (12 µTW), W_3-25-micron toffee wrapper (25 µTW), W_4-Butter paper + 12 micron (BP + 12 µTW) toffee wrapper, W_5-Butter paper + 25 micron (BP + 25 µTW) toffee wrapper, MAS: Months after storage, TW: Toffee wrapper, NS = Non significant

Table 4: Effect of different wrapping material on the texture and overall acceptability of wood apple toffees

Treatments	Texture			Overall acceptability		
	2 MAS	4 MAS	6 MAS	2 MAS	4 MAS	6 MAS
Factor I: Fruit toffees						
T_1	7.57	6.13	4.72	7.87	6.48	5.03
T_2	7.97	6.40	4.90	8.00	6.55	5.02
Mean	7.77	6.27	4.81	7.93	6.51	5.03
S.Em±	0.071	0.071	0.046	0.031	0.028	0.036
C.D. @ 1%	0.285	NS	NS	0.126	NS	NS
Factor II: Wrapping material						
W_1	7.67	7.50	7.17	7.79	7.48	7.16
W_2	7.75	1.00	1.00	7.83	1.63	1.08
W_3	7.75	7.58	1.00	7.94	7.69	1.46
W_4	7.83	7.58	7.38	8.04	7.86	7.69
W_5	7.83	7.67	7.50	8.05	7.90	7.74
Mean	7.77	6.27	4.81	7.93	6.51	5.03
S.Em±	0.112	0.112	0.072	0.050	0.044	0.057
C.D. @ 1%	NS	0.450	0.290	0.199	0.176	0.231
Interaction (T X W)						
T_1W_1	7.50	7.33	7.00	7.75	7.38	7.04
T_1W_2	7.50	1.00	1.00	7.75	1.75	1.17
T_1W_3	7.50	7.33	1.00	7.88	7.58	1.67
T_1W_4	7.67	7.50	7.25	7.98	7.83	7.63
T_1W_5	7.67	7.50	7.33	7.98	7.83	7.67
T_2W_1	7.83	7.67	7.33	7.83	7.58	7.27
T_2W_2	8.00	1.00	1.00	7.92	1.50	1.00
T_2W_3	8.00	7.83	1.00	8.00	7.79	1.25
T_2W_4	8.00	7.67	7.50	8.10	7.90	7.75
T_2W_5	8.00	7.83	7.67	8.13	7.96	7.81
Mean	7.77	6.27	4.81	7.93	6.51	5.03
S.Em±	0.158	0.158	0.102	0.070	0.062	0.081
C.D. @ 1%	NS	0.636	0.411	0.282	0.249	0.327

Initial textue and overall acceptability values: T_1 = 7.67 & 8.14 T_2 = 8.00 & 8.16, respectively

T_1-Sweet toffee, T_2-Spicy toffee, W_1-Butter paper wrapper (BP), W_2-12-micron toffee wrapper (12 µTW), W_3-25-micron toffee wrapper (25 µTW), W_4-Butter paper + 12 micron (BP + 12 µTW) toffee wrapper, W_5-Butter paper + 25 micron (BP + 25 µTW) toffee wrapper, MAS: Months after storage, TW: Toffee wrapper, NS = Non significant.

Conclusion

The toffees wrapped in butter paper followed by 12 and 25 µTW were found to be superior for nutritional and organoleptic attributes over other wrappers during a storage period of 6 months in the ambient condition. Wrapping with 12 and 25 µTW without butter paper was found unsuitable.

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