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Effect of different edible coatings on physical attributes of Guava (*Psidium guajava* L.) fruits during different storage periods

Mohni Parmar, Gurjar PKS, Amit Kumar and Khushboo Namdev

Abstract
The experiment was carried out to enhance the shelf life of guava fruits through individual and combined application of different edible castings *viz.;* olive oil, sesame oil, tulsi leaf extract, *aloe vera* gel, chitosan, calcium gluconate and sodium alginate during 2020-2021 to 2021-2022. To evaluate the effect of different edible coatings on physical attributes on guava fruits during different storage periods. The experiment was laid out in completely randomized design comprised of 20 treatments with 3 replication. The result indicated that all the edible coatings treatments were significantly effective for physical parameters *viz.*; fruit weight and fruit volume expect specific gravity as compared to control (without coating) in pooled data. Among all the treatments of edible coatings, application of treatments T_{18} (olive oil 100% + chitosan 2%) was recorded maximum fruit weight (177.44, 174.64, 170.03, 163.57, 160.17, 156.30 and 150.37 g) and fruit volume (174.16, 172.45, 164.01, 157.47, 153.42, 148.38 and 143.84 ml) which was closely at par with treatment T_{19} and T_{17} as compared to other treatments at 2, 4, 6, 8, 10, 12 and 14 days after storage, respectively in pooled basis.

Keywords: guava, edible coatings, olive oil, sesame oil and chitosan

Introduction
Guava (*Psidium guajava* L.) is India's fifth most significant fruit crop after Mango, Banana, Papaya, and Citrus, and a popular fruit crop throughout tropical and subtropical climates because of its easy availability at reasonable prices. It is known as "apple of the tropics", and for its nutritional value it is also referred to as a "super fruit" (Nimisha *et al*., 2013) [9]. Guava is popular among farmers because they are hardy and adaptable to several different soil and climatic conditions.

Guava is cultivated in 265,000 ha areas with an estimated average production of 4054,000 MT (NHB 2018). The guava producing states include Uttar Pradesh, Maharashtra, Madhya Pradesh, Bihar, West Bengal, Punjab, Gujarat, Karnataka and Andhra Pradesh. However, the average post harvests loss of guava in India about 15.88% (CIPHET Jha *et al.,* 2015) [6].

Guava being a climacteric fruit ripens rapidly after the harvest therefore has short shelf life. Once it is fully ripe, the fruit becomes soggy and consumer preference and marketing quality deteriorate rapidly. Fruits are excellent source of ascorbic acid, but have low energy 66cal /100 g, protein content 1%, 17% dry matter and 83% moisture. Guava fruit is also rich in minerals like phosphorous (23.37%), calcium (14-30 mg/100 g) as well as vitamin like niacin, pantothenic acid, thiamine, riboflavin and vitamin A (Bose *et al*., 1999) [2]. Many preserved products like Juice, RTS, Nectar, Cheese, Squash, Jam and Jelly are also available at the market.

Guava is highly perishable and has a limited shelf life of 4-5 days after harvest due to intense metabolic activities. At room temperature, guava fruit becomes fully ripe within 3-5 days. Due to fruit's perishability, controlling ripening is crucial for extending its shelf life after harvest. A room temperature of 6-8 °C and a relative humidity of 90-95% can extend the shelf life of fruits by up to two weeks. Guava being a climacteric fruit ripens quickly after harvest, thus having a short shelf life. Once it is fully ripe, the fruit becomes soggy and consumer preference and marketing quality deteriorate rapidly.

Fruits and vegetables can be further prolonged by applying edible coatings (Turhan, 2009) [10]. Edible coatings and films may be defined as protective layers created around food surfaces by application of a solution prepared from biodegradable polymers such as polysaccharides, proteins, lipids or their combinations.

Different kinds of commercial edible coatings are widely available in the market and are used to prevent moisture loss and to develop the shine of fruits and vegetables (Dhaka, 2018) [3]. It is used to prevent moisture loss, increase shelf life, improve handling properties, and minimize packing material requirements during transport.

Material and Methods

The present experiment was conducted during winter season 2020-2021 and 2021-2022 at the Post- harvest Laboratory, Department of Horticulture, R.V.S.K.V.V., Gwalior (M.P.). The guava fruits of winter season crop were harvested at 80% mutuality (colour break stage) and collected in plastic crates covered with a thick layer of guava leaves and brought to the laboratory. Fruits with uniform size and colour were selected whereas blemished. Prior to the post-harvest treatment, the fruits were washed in portable water. The fruits were then allowed to dry in shade. Combined coatings were prepared taking the distilled water in a beaker and calculation of each chemical needed for one litre solvent was done except olive oil (100 ml), sesame oil (100 ml) coatings and accordingly, coating were prepared for dip treatment of guava. The detail of the treatments includes; T_0: Control (Without coating), T_1: *Aloe vera* gel 100%, T_2: Sesame oil 100%, T_3: Tulsi leaves extract, T_4: Olive oil 100%, T_5: Calcium gluconate 2%, T_6: Chitosan 2%, T_7: Sodium alginate 2%, T_8: *Aloe vera* gel 100% + Calcium gluconate 2%, T_9: *Aloe vera* gel 100% + Chitosan 2%, T_{10}: *Aloe vera* gel 100% + Sodium alginate 2%, T_{11}: Sesame oil 100% + Calcium gluconate 2%, T_{12}: Sesame oil 100% + Chitosan 2%, T_{13}: Sesame oil 100% + Sodium alginate 2%, T_{14}: Tulsi leaves extract + Calcium gluconate 2%, T_{15}: Tulsi leaves extract + Chitosan 2%, T_{16}: Tulsi leaves extract + Sodium alginate 2%, T_{17}: Olive oil 100% + Calcium gluconate 2%, T_{18}: Olive oil 100% + Chitosan 2% and T_{19}: Olive oil 100% + Sodium alginate 2%, the fruits were kept at ambient temperature conditions. Ten fruits were dipped in each solution for 10 minutes and then air dried except olive oil and sesame oil. In case of olive oil and sesame oil coatings, fruits were coated 3 to 4 time with the help of brush and left for air drying. The experiment was carried out in three replicates. The observations on physical parameters were recorded at 2, 4, 6, 8, 10, 12 and 14 days of storage.

Fruit Weight

Three fruits per treatment from each replication were weighed on electronic balance and average weight of fruit was obtained and expressed in grams.

Fruit Volume

The volume of the fruit was measured by the water displacement method. Three fruits per treatment per replication were dipped in a large jar containing water up to the rim. The amount of water displaced by fruit was collected in a tray and was measured by a measuring cylinder. The average volume per fruit was determined by dividing the total volume of displaced water with number of fruits and expressed in milliliters.

Specific Gravity

Specific gravity was calculated by dividing the average weight by average fruit volume.

$$\text{Specific gravity} = \frac{Avrage\ fruit\ weight}{Average\ fruit\ volume}$$

Result and Discussion

Fruit weight (g) at 2 to 14 days of storage

By interpretation of data which is presented in table 1 indicates that all the edible coatings treatments was recorded significantly higher fruit weight as compared to control (without coating) in pooled analysis.

It is evident from pooled data, the maximum fruit weight (177.44, 174.64, 170.03, 163.57, 160.17, 156.30 and 150.37 g) at 2, 4, 6, 8, 10, 12 and 14 days after storage was found under the treatment T_{18} (olive oil 100% + chitosan 2%) which was found significantly superior over the other treatments. It was at par to T_{19} (olive oil 100% + sodium alginate 2%) and T_{17} (olive oil 100% + calcium gluconate 2%). However, the minimum fruit weight (172.95, 167.63, 159.12, 149.11, 137.84, 128.51 and 120.95) at 2, 4, 6, 8, 10, 12 and 14 days after storage was recorded in treatment T_0 (control). The reason behind this may be that due to the combined effect of olive oil and chitosan served as semi permeable membrane around the fruit surface, reduced moisture loss and prevented cellular disintegration by maintaining protein and nucleic acid synthesis thus delaying senescence. Application of edible coatings *viz*.; olive oil and chitosan also helped in reducing respiratory rate and maintained tissue rigidity and checking moisture loss from fruit surface. Similar finding was recorded by Jagadeesh *et al.*, (2001) [5], Krishna, R.K. and Sudhakar, R.D.V. (2014) [8], Fekry (2018) [4] and Kamboj P. and Kaur, A. (2018) [7] on guava fruit.

Fruit volume (ml) at 2 to 14 days of storage

By interpretation of data which is presented in table 2 indicates that all the edible coatings treatments was recorded significantly higher fruit weight as compared to control (without coating) in pooled data.

It is evident from pooled data that the maximum fruit volume (174.16, 172.45, 164.01, 157.47, 153.42, 148.38 and 143.84 ml) at 2, 4, 6, 8, 10, 12 and 14 days after storage was found under the treatment T_{18} (olive oil 100% + chitosan 2%) which was found significantly superior over the other treatments. It was at par with T_{19} (olive oil 100% + sodium alginate 2%) and T_{17} (olive oil 100% + calcium gluconate 2%). However, the minimum fruit volume (163.56, 159.74, 146.44, 135.68, 126.25, 121.45 and 110.05 ml) at 2, 4, 6, 8, 10, 12 and 14 days after storage was recorded in treatment T_0 control (without coating). The combined application of olive oil and chitosan shows that reduction the moisture loss resulting in a lower loss of turgidity. Thus, the process of ripening is slowed down and the firmness is maintained with minimum shrinkage due to lowered released of ethylene. This might be the reason for minimum reduction of volume in coated fruits. Similar results were also seen by Fekry (2018) [4].

Specific gravity (g/ml) at 2 to 14 days of storage

A perusal of flushing data on specific gravity which is presented in table 3. The data on specific gravity indicates that all the treatments were recorded none significantly result at 2 to 14 days of storage in pooled basis.

Table 1: Effect of different edible coatings on fruit weight (g) of guava at 2 to 14 days of storage in ambient condition

	Storage intervals	0 Days			2 Days			4 Days		
	Treatments	**Ist year**	**IInd year**	**Pooled**	**Ist year**	**IInd year**	**Pooled**	**Ist year**	**IInd year**	**Pooled**
T_0	Control (Without coating)	180.00	186.00	183.00	172.96	172.95	172.95	167.66	167.59	167.63
T_1	*Aloe vera gel* (100%)	180.00	186.00	183.00	174.37	174.35	174.36	170.19	170.09	170.14
T_2	Sesame oil (100%)	180.00	186.00	183.00	176.21	176.18	176.19	173.52	173.45	173.48
T_3	*Tulsi* leaves extract	180.00	186.00	183.00	174.32	174.30	174.31	169.75	169.70	169.73
T_4	Olive oil (100%)	180.00	186.00	183.00	176.41	176.44	176.42	173.65	173.86	173.76
T_5	Calcium gluconate 2%	180.00	186.00	183.00	174.50	174.55	174.53	170.65	170.55	170.60
T_6	Chitosan 2%	180.00	186.00	183.00	176.11	176.14	176.12	173.30	173.21	173.26
T_7	Sodium alginate 2%	180.00	186.00	183.00	174.63	174.65	174.64	171.07	170.98	171.03
T_8	*Aloe vera* gel (100%) + Calcium gluconate 2%	180.00	186.00	183.00	175.27	175.30	175.28	172.44	172.31	172.37
T_9	*Aloe vera* gel (100%) + Chitosan 2%	180.00	186.00	183.00	175.89	175.93	175.91	173.00	172.97	172.99
T_{10}	*Aloe vera* gel (100%) + Sodium alginate 2%	180.00	186.00	183.00	175.57	175.62	175.59	172.80	172.84	172.82
T_{11}	Sesame oil (100%) + Calcium gluconate 2%	180.00	186.00	183.00	176.51	176.54	176.53	173.88	173.78	173.83
T_{12}	Sesame oil (100%) + Chitosan 2%	180.00	186.00	183.00	176.93	176.94	176.94	174.26	174.18	174.22
T_{13}	Sesame oil (100%) + Sodium alginate 2%	180.00	186.00	183.00	176.66	176.64	176.65	174.10	174.05	174.08
T_{14}	*Tulsi* leaves extract + Calcium gluconate 2%	180.00	186.00	183.00	174.70	174.73	174.71	171.51	171.46	171.48
T_{15}	*Tulsi* leaves extract + Chitosan 2%	180.00	186.00	183.00	175.08	175.10	175.09	172.13	172.04	172.09
T_{16}	*Tulsi* leaves extract + Sodium alginate 2%	180.00	186.00	183.00	174.95	174.94	174.95	171.75	171.68	171.71
T_{17}	Olive oil (100%) + Calcium gluconate 2%	180.00	186.00	183.00	177.19	177.23	177.21	174.38	174.26	174.32
T_{18}	Olive oil (100%) + Chitosan 2%	180.00	186.00	183.00	177.42	177.45	177.44	174.68	174.61	174.64
T_{19}	Olive oil (100%) + Sodium alginate 2%	180.00	186.00	183.00	177.29	177.32	177.30	174.51	174.46	174.49
	S.E. (m)	-	-	-	0.590	0.524	0.395	0.562	0.600	0.411
	c.d. (5%)	NS	NS	NS	1.687	1.497	1.105	1.606	1.714	1.151

	Storage intervals	6 Days			8 Days			10 Days		
	Treatments	**Ist year**	**IInd year**	**Pooled**	**Ist year**	**IInd year**	**Pooled**	**Ist year**	**IInd year**	**Pooled**
T_0	Control (Without coating)	159.15	159.09	159.12	149.21	149.00	149.11	138.14	137.54	137.84
T_1	*Aloe vera gel* (100%)	161.56	161.51	161.54	151.12	151.03	151.07	141.92	141.49	141.71
T_2	Sesame oil (100%)	167.00	166.94	166.97	159.74	159.67	159.71	152.00	150.79	151.40
T_3	*Tulsi* leaves extract	160.40	160.37	160.39	150.65	150.70	150.68	140.66	137.28	138.97
T_4	Olive oil (100%)	167.43	167.41	167.42	160.27	160.31	160.29	153.15	153.40	153.28
T_5	Calcium gluconate 2%	162.07	161.98	162.02	151.96	152.02	151.99	142.58	141.83	142.21
T_6	Chitosan 2%	166.43	166.37	166.40	159.27	159.22	159.24	150.98	150.67	150.82
T_7	Sodium alginate 2%	163.22	163.18	163.20	152.56	152.47	152.51	143.83	141.71	142.77
T_8	*Aloe vera* gel (100%) + Calcium gluconate 2%	165.17	165.13	165.15	156.41	156.34	156.38	148.27	148.69	148.48
T_9	*Aloe vera* gel (100%) + Chitosan 2%	165.79	165.77	165.78	158.57	158.48	158.53	149.97	149.93	149.95
T_{10}	*Aloe vera* gel (100%) + Sodium alginate 2%	165.67	166.22	165.95	157.66	157.60	157.63	149.30	148.19	148.75
T_{11}	Sesame oil (100%) + Calcium gluconate 2%	167.91	167.84	167.87	160.84	160.80	160.82	153.79	151.30	152.54
T_{12}	Sesame oil (100%) + Chitosan 2%	168.74	168.70	168.72	161.81	161.83	161.82	155.78	155.44	155.61
T_{13}	Sesame oil (100%) + Sodium alginate 2%	168.42	168.38	168.40	161.43	161.39	161.41	154.99	155.90	155.45
T_{14}	*Tulsi* leaves extract + Calcium gluconate 2%	163.86	163.82	163.84	153.80	153.71	153.76	145.68	144.32	145.00
T_{15}	*Tulsi* leaves extract + Chitosan 2%	164.67	164.62	164.64	155.50	155.44	155.47	147.40	146.70	147.05
T_{16}	*Tulsi* leaves extract + Sodium alginate 2%	164.26	164.21	164.24	154.82	154.77	154.80	146.30	146.44	146.37
T_{17}	Olive oil (100%) + Calcium gluconate 2%	169.17	169.18	169.18	162.35	162.38	162.37	157.92	156.83	157.37
T_{18}	Olive oil (100%) + Chitosan 2%	170.00	170.07	170.03	163.61	163.52	163.57	159.98	160.36	160.17
T_{19}	Olive oil (100%) + Sodium alginate 2%	169.34	169.37	169.36	162.80	162.71	162.76	158.68	159.76	159.22
	S.E. (m)	0.871	0.964	0.650	1.249	1.720	1.063	2.252	1.337	1.310
	c.d. (5%)	2.489	2.756	1.819	3.568	4.917	2.976	6.437	3.823	3.667

	Storage intervals	12 Days			14 Days		
	Treatments	**Ist year**	**IInd year**	**Pooled**	**Ist year**	**IInd year**	**Pooled**
T_0	Control (Without coating)	128.57	128.44	128.51	121.06	120.83	120.95
T_1	*Aloe vera gel* (100%)	132.92	132.51	132.72	125.92	125.53	125.72
T_2	Sesame oil (100%)	147.16	146.68	146.92	136.54	136.66	136.60
T_3	*Tulsi* leaves extract	131.61	132.63	132.12	124.98	125.52	125.25
T_4	Olive oil (100%)	148.39	149.11	148.75	139.10	138.86	138.98
T_5	Calcium gluconate 2%	135.06	134.94	135.00	126.31	125.71	126.01
T_6	Chitosan 2%	145.94	145.34	145.64	135.82	135.34	135.58
T_7	Sodium alginate 2%	135.38	136.40	135.89	127.57	127.09	127.33
T_8	*Aloe vera* gel (100%) + Calcium gluconate 2%	139.06	139.96	139.51	133.00	133.10	133.05
T_9	*Aloe vera* gel (100%) + Chitosan 2%	144.46	144.82	144.64	134.92	134.08	134.50
T_{10}	*Aloe vera* gel (100%) + Sodium alginate 2%	142.95	142.89	142.92	133.66	134.68	134.17
T_{11}	Sesame oil (100%) + Calcium gluconate 2%	149.88	149.70	149.79	141.74	141.08	141.41
T_{12}	Sesame oil (100%) + Chitosan 2%	152.38	152.44	152.41	145.58	145.76	145.67
T_{13}	Sesame oil (100%) + Sodium alginate 2%	151.30	151.96	151.63	144.10	145.12	144.61

T_{14}	*Tulsi* leaves extract + Calcium gluconate 2%	136.57	136.63	136.60	129.68	129.50	129.59
T_{15}	*Tulsi* leaves extract + Chitosan 2%	138.52	138.27	138.39	131.90	131.72	131.81
T_{16}	*Tulsi* leaves extract + Sodium alginate 2%	137.58	136.94	137.26	130.39	130.99	130.69
T_{17}	Olive oil (100%) + Calcium gluconate 2%	153.38	152.78	153.08	147.83	148.79	148.31
T_{18}	Olive oil (100%) + Chitosan 2%	156.09	156.50	156.30	150.22	150.51	150.37
T_{19}	Olive oil (100%) + Sodium alginate 2%	154.51	153.66	154.08	149.17	150.13	149.65
	S.E. (m)	1.907	1.862	1.333	2.129	2.065	1.483
	c.d. (5%)	5.452	5.323	3.732	6.085	5.901	4.152

Table: 2 Effect of different edible coatings on fruit volume (ml) of guava at 2 to 14 days of storage in ambient condition

	Storage intervals	**0 Days**			**2 Days**			**4 Days**		
	Treatments	**Ist year**	**IInd year**	**Pooled**	**Ist year**	**IInd year**	**Pooled**	**Ist year**	**IInd year**	**Pooled**
T_0	Control (Without coating)	164.00	174.00	169.00	164.14	162.98	163.56	160.64	158.83	159.74
T_1	*Aloe vera gel* (100%)	164.00	174.00	169.00	164.92	163.10	164.01	161.56	160.05	160.81
T_2	Sesame oil (100%)	164.00	174.00	169.00	169.07	167.53	168.30	167.12	165.20	166.16
T_3	*Tulsi* leaves extract	164.00	174.00	169.00	164.62	163.05	163.84	161.25	159.30	160.28
T_4	Olive oil (100%)	164.00	174.00	169.00	169.34	168.02	168.68	165.80	164.55	165.18
T_5	Calcium gluconate 2%	164.00	174.00	169.00	165.02	163.25	164.14	162.23	160.30	161.27
T_6	Chitosan 2%	164.00	174.00	169.00	168.56	167.33	167.95	165.96	163.10	164.53
T_7	Sodium alginate 2%	164.00	174.00	169.00	165.63	163.50	164.57	162.66	160.90	161.78
T_8	*Aloe vera* gel (100%) + Calcium gluconate 2%	164.00	174.00	169.00	166.05	165.67	165.86	164.76	162.30	163.53
T_9	*Aloe vera* gel (100%) + Chitosan 2%	164.00	174.00	169.00	168.12	167.20	167.66	165.73	162.75	164.24
T_{10}	*Aloe vera* gel (100%) + Sodium alginate 2%	164.00	174.00	169.00	167.72	166.00	166.86	165.24	163.88	164.56
T_{11}	Sesame oil (100%) + Calcium gluconate 2%	164.00	174.00	169.00	169.83	168.57	169.20	166.50	166.13	166.32
T_{12}	Sesame oil (100%) + Chitosan 2%	164.00	174.00	169.00	170.89	169.85	170.37	168.78	167.85	168.32
T_{13}	Sesame oil (100%) + Sodium alginate 2%	164.00	174.00	169.00	170.23	169.25	169.74	168.46	167.25	167.86
T_{14}	*Tulsi* leaves extract + Calcium gluconate 2%	164.00	174.00	169.00	166.46	163.70	165.08	163.22	161.33	162.28
T_{15}	*Tulsi* leaves extract + Chitosan 2%	164.00	174.00	169.00	166.86	164.80	165.83	164.31	162.25	163.28
T_{16}	*Tulsi* leaves extract + Sodium alginate 2%	164.00	174.00	169.00	165.89	164.48	165.19	163.76	161.75	162.76
T_{17}	Olive oil (100%) + Calcium gluconate 2%	164.00	174.00	169.00	172.04	171.48	171.76	171.34	169.90	170.62
T_{18}	Olive oil (100%) + Chitosan 2%	164.00	174.00	169.00	174.63	173.68	174.16	172.68	172.22	172.45
T_{19}	Olive oil (100%) + Sodium alginate 2%	164.00	174.00	169.00	172.32	171.87	172.09	170.93	170.20	170.57
	S.E. (m)	-	-	-	2.049	2.329	1.551	2.493	2.795	1.873
	c.d. (5%)	NS	NS	NS	5.856	6.655	4.343	7.126	7.987	5.244

	Storage intervals	**6 Days**			**8 Days**			**10 Days**		
	Treatments	**Ist year**	**IInd year**	**Pooled**	**Ist year**	**IInd year**	**Pooled**	**Ist year**	**IInd year**	**Pooled**
T_0	Control (Without coating)	144.20	148.67	146.44	133.10	138.25	135.68	126.25	131.54	128.90
T_1	*Aloe vera gel* (100%)	147.70	151.58	149.64	138.70	142.89	140.80	130.25	134.89	132.57
T_2	Sesame oil (100%)	155.25	159.65	157.45	149.65	153.89	151.77	142.00	145.52	143.76
T_3	*Tulsi* leaves extract	146.55	149.73	148.14	136.05	140.78	138.42	126.06	134.06	130.06
T_4	Olive oil (100%)	156.05	160.32	158.19	150.70	155.78	153.24	142.15	146.89	144.52
T_5	Calcium gluconate 2%	149.75	153.16	151.46	140.10	145.12	142.61	132.15	137.14	134.65
T_6	Chitosan 2%	154.05	159.22	156.64	148.75	153.26	151.01	141.65	145.16	143.41
T_7	Sodium alginate 2%	150.70	153.55	152.13	141.80	146.75	144.28	132.55	137.43	134.99
T_8	*Aloe vera* gel (100%) + Calcium gluconate 2%	152.65	157.45	155.05	146.20	150.78	148.49	137.35	142.55	139.95
T_9	*Aloe vera* gel (100%) + Chitosan 2%	153.80	157.78	155.79	147.30	151.85	149.58	140.20	144.86	142.53
T_{10}	*Aloe vera* gel (100%) + Sodium alginate 2%	152.95	156.87	154.91	147.65	151.48	149.57	139.70	144.63	142.17
T_{11}	Sesame oil (100%) + Calcium gluconate 2%	157.20	162.85	160.03	151.75	156.21	153.98	142.75	148.57	145.66
T_{12}	Sesame oil (100%) + Chitosan 2%	159.40	163.69	161.55	152.60	157.68	155.14	145.73	151.66	148.70
T_{13}	Sesame oil (100%) + Sodium alginate 2%	158.70	163.42	161.06	152.35	156.57	154.46	144.60	150.87	147.74
T_{14}	*Tulsi* leaves extract + Calcium gluconate 2%	151.35	154.75	153.05	143.10	150.04	146.57	134.60	139.76	137.18
T_{15}	*Tulsi* leaves extract + Chitosan 2%	152.00	155.38	153.69	145.15	150.18	147.67	137.15	142.06	139.61
T_{16}	*Tulsi* leaves extract + Sodium alginate 2%	151.75	155.09	153.42	144.25	149.65	146.95	136.10	141.89	139.00
T_{17}	Olive oil (100%) + Calcium gluconate 2%	160.75	165.12	162.94	153.05	159.54	156.30	148.90	154.78	151.84
T_{18}	Olive oil (100%) + Chitosan 2%	161.25	166.76	164.01	154.50	160.43	157.47	150.00	156.84	153.42
T_{19}	Olive oil (100%) + Sodium alginate 2%	161.00	165.32	163.16	153.65	159.92	156.79	149.15	156.15	152.65
	S.E. (m)	3.495	4.061	2.679	4.367	4.510	3.139	4.833	4.929	3.452
	c.d. (5%)	9.990	11.608	7.502	12.482	12.891	8.790	13.814	14.087	9.665

	Storage intervals	**12 days**			**14 DAY**		
	Treatments	**Ist year**	**IInd year**	**Pooled**	**Ist year**	**IInd year**	**Pooled**
T_0	Control (Without coating)	119.00	123.89	121.45	107.40	112.69	110.05
T_1	*Aloe vera gel* (100%)	121.85	126.48	124.17	112.40	117.23	114.82
T_2	Sesame oil (100%)	137.15	143.16	140.16	127.70	134.76	131.23
T_3	*Tulsi* leaves extract	121.25	125.73	123.49	110.80	115.78	113.29
T_4	Olive oil (100%)	139.00	143.67	141.34	130.40	137.65	134.03

T_5	Calcium gluconate 2%	122.00	127.43	124.72	113.40	117.67	115.54
T_6	Chitosan 2%	135.20	141.56	138.38	125.55	130.71	128.13
T_7	Sodium alginate 2%	122.10	128.69	125.40	115.20	119.89	117.55
T_8	*Aloe vera* gel (100%) + Calcium gluconate 2%	130.60	135.43	133.02	122.65	125.37	124.01
T_9	*Aloe vera* gel (100%) + Chitosan 2%	134.55	140.67	137.61	124.65	128.44	126.55
T_{10}	*Aloe vera* gel (100%) + Sodium alginate 2%	132.25	138.74	135.50	123.00	128.01	125.51
T_{11}	Sesame oil (100%) + Calcium gluconate 2%	139.75	145.87	142.81	132.50	139.43	135.97
T_{12}	Sesame oil (100%) + Chitosan 2%	142.65	148.76	145.71	135.40	142.34	138.87
T_{13}	Sesame oil (100%) + Sodium alginate 2%	140.60	146.21	143.41	134.10	130.78	132.44
T_{14}	*Tulsi* leaves extract + Calcium gluconate 2%	125.55	131.71	128.63	117.05	121.23	119.14
T_{15}	*Tulsi* leaves extract + Chitosan 2%	129.00	134.67	131.84	120.65	124.76	122.71
T_{16}	*Tulsi* leaves extract + Sodium alginate 2%	128.70	132.28	130.49	118.35	122.89	120.62
T_{17}	Olive oil (100%) + Calcium gluconate 2%	143.10	150.13	146.62	137.75	142.93	140.34
T_{18}	Olive oil (100%) + Chitosan 2%	145.00	151.76	148.38	140.90	146.78	143.84
T_{19}	Olive oil (100%) + Sodium alginate 2%	143.30	150.46	146.88	139.60	146.34	142.97
	S.E. (m)	5.061	5.548	3.755	6.430	6.597	4.606
	c.d. (5%)	14.466	15.857	10.514	18.376	18.855	12.897

Table 3: Effect of different edible coatings on specific gravity (g/ml) of guava at 2 to 14 days of storage in ambient condition

	Storage intervals	**0 Days**			**2 Days**			**4 Days**		
	Treatments	**Ist year**	**IInd year**	**Pooled**	**Ist year**	**IInd year**	**Pooled**	**Ist year**	**IInd year**	**Pooled**
T_0	Control (Without coating)	1.10	1.07	1.09	1.06	1.06	1.06	1.04	1.06	1.05
T_1	*Aloe vera gel* (100%)	1.10	1.07	1.09	1.05	1.07	1.06	1.05	1.06	1.06
T_2	Sesame oil (100%)	1.10	1.07	1.09	1.05	1.05	1.05	1.04	1.05	1.04
T_3	*Tulsi* leaves extract	1.10	1.07	1.09	1.06	1.07	1.07	1.05	1.07	1.06
T_4	Olive oil (100%)	1.10	1.07	1.09	1.04	1.05	1.05	1.05	1.06	1.05
T_5	Calcium gluconate 2%	1.10	1.07	1.09	1.06	1.07	1.07	1.05	1.06	1.06
T_6	Chitosan 2%	1.10	1.07	1.09	1.05	1.05	1.05	1.04	1.06	1.05
T_7	Sodium alginate 2%	1.10	1.07	1.09	1.05	1.07	1.06	1.05	1.06	1.06
T_8	*Aloe vera* gel (100%) + Calcium gluconate 2%	1.10	1.07	1.09	1.06	1.06	1.06	1.05	1.06	1.05
T_9	*Aloe vera* gel (100%) + Chitosan 2%	1.10	1.07	1.09	1.05	1.05	1.05	1.04	1.06	1.05
T_{10}	*Aloe vera* gel (100%) + Sodium alginate 2%	1.10	1.07	1.09	1.05	1.06	1.05	1.05	1.05	1.05
T_{11}	Sesame oil (100%) + Calcium gluconate 2%	1.10	1.07	1.09	1.04	1.05	1.04	1.04	1.05	1.05
T_{12}	Sesame oil (100%) + Chitosan 2%	1.10	1.07	1.09	1.04	1.04	1.04	1.03	1.04	1.04
T_{13}	Sesame oil (100%) + Sodium alginate 2%	1.10	1.07	1.09	1.04	1.04	1.04	1.03	1.04	1.04
T_{14}	*Tulsi* leaves extract + Calcium gluconate 2%	1.10	1.07	1.09	1.05	1.07	1.06	1.05	1.06	1.06
T_{15}	*Tulsi* leaves extract + Chitosan 2%	1.10	1.07	1.09	1.05	1.06	1.06	1.05	1.06	1.05
T_{16}	*Tulsi* leaves extract + Sodium alginate 2%	1.10	1.07	1.09	1.06	1.06	1.06	1.05	1.06	1.06
T_{17}	Olive oil (100%) + Calcium gluconate 2%	1.10	1.07	1.09	1.03	1.03	1.03	1.02	1.03	1.02
T_{18}	Olive oil (100%) + Chitosan 2%	1.10	1.07	1.09	1.02	1.02	1.02	1.01	1.02	1.01
T_{19}	Olive oil (100%) + Sodium alginate 2%	1.10	1.07	1.09	1.03	1.03	1.03	1.02	1.03	1.02
	S.E. (m)	-	-	-	0.013	0.014	0.010	0.016	0.017	0.012
	c.d. (5%)	NS	NS	NS	NS	NS	NS	NS	NS	NS

	Storage intervals	**6 Days**			**8 Days**			**10 Days**		
	Treatments	**Ist year**	**IInd year**	**Pooled**	**Ist year**	**IInd year**	**Pooled**	**Ist year**	**IInd year**	**Pooled**
T_0	Control (Without coating)	1.07	1.09	1.08	1.08	1.10	1.09	1.05	1.08	1.06
T_1	*Aloe vera gel* (100%)	1.07	1.09	1.08	1.06	1.08	1.07	1.05	1.07	1.06
T_2	Sesame oil (100%)	1.05	1.06	1.05	1.04	1.06	1.05	1.04	1.05	1.05
T_3	*Tulsi* leaves extract	1.07	1.09	1.08	1.07	1.10	1.08	1.05	1.06	1.06
T_4	Olive oil (100%)	1.05	1.05	1.05	1.05	1.05	1.05	1.04	1.06	1.05
T_5	Calcium gluconate 2%	1.06	1.08	1.07	1.05	1.07	1.06	1.04	1.06	1.05
T_6	Chitosan 2%	1.05	1.07	1.06	1.04	1.06	1.05	1.04	1.05	1.05
T_7	Sodium alginate 2%	1.06	1.08	1.07	1.04	1.06	1.05	1.05	1.05	1.05
T_8	*Aloe vera* gel (100%) + Calcium gluconate 2%	1.05	1.08	1.06	1.04	1.06	1.05	1.04	1.07	1.06
T_9	*Aloe vera* gel (100%) + Chitosan 2%	1.05	1.08	1.06	1.04	1.07	1.05	1.04	1.06	1.05
T_{10}	*Aloe vera* gel (100%) + Sodium alginate 2%	1.06	1.08	1.07	1.04	1.07	1.05	1.04	1.06	1.05
T_{11}	Sesame oil (100%) + Calcium gluconate 2%	1.03	1.05	1.04	1.03	1.05	1.04	1.04	1.05	1.04
T_{12}	Sesame oil (100%) + Chitosan 2%	1.03	1.04	1.04	1.03	1.04	1.03	1.03	1.04	1.04
T_{13}	Sesame oil (100%) + Sodium alginate 2%	1.03	1.05	1.04	1.03	1.05	1.04	1.03	1.06	1.04
T_{14}	*Tulsi* leaves extract + Calcium gluconate 2%	1.07	1.08	1.08	1.05	1.06	1.05	1.05	1.06	1.05
T_{15}	*Tulsi* leaves extract + Chitosan 2%	1.07	1.07	1.07	1.04	1.06	1.05	1.05	1.06	1.05
T_{16}	*Tulsi* leaves extract + Sodium alginate 2%	1.07	1.07	1.07	1.04	1.06	1.05	1.04	1.07	1.05
T_{17}	Olive oil (100%) + Calcium gluconate 2%	1.03	1.04	1.03	1.02	1.04	1.03	1.03	1.03	1.03
T_{18}	Olive oil (100%) + Chitosan 2%	1.02	1.03	1.02	1.03	1.03	1.03	1.02	1.04	1.03
T_{19}	Olive oil (100%) + Sodium alginate 2%	1.03	1.03	1.03	1.02	1.03	1.03	1.02	1.04	1.03
	S.E. (m)	0.024	0.028	0.018	0.029	0.032	0.022	0.038	0.038	0.027

	c.d. (5%)	NS	NS	NS	NS	NS	NS	NS	NS	NS

	Storage intervals	12 Days			14 Days		
	Treatments	**Ist year**	**IInd year**	**Pooled**	**Ist year**	**IInd year**	**Pooled**
T_0	Control (Without coating)	1.04	1.06	1.05	1.03	1.13	1.08
T_1	*Aloe vera gel* (100%)	1.05	1.06	1.06	1.03	1.12	1.07
T_2	Sesame oil (100%)	1.03	1.04	1.03	1.02	1.05	1.03
T_3	*Tulsi* leaves extract	1.05	1.07	1.06	1.03	1.13	1.08
T_4	Olive oil (100%)	1.03	1.05	1.04	1.03	1.04	1.04
T_5	Calcium gluconate 2%	1.06	1.09	1.07	1.04	1.11	1.08
T_6	Chitosan 2%	1.03	1.06	1.04	1.02	1.06	1.04
T_7	Sodium alginate 2%	1.06	1.11	1.08	1.03	1.10	1.07
T_8	*Aloe vera* gel (100%) + Calcium gluconate 2%	1.03	1.08	1.05	1.02	1.09	1.05
T_9	*Aloe vera* gel (100%) + Chitosan 2%	1.03	1.06	1.04	1.04	1.07	1.05
T_{10}	*Aloe vera* gel (100%) + Sodium alginate 2%	1.03	1.08	1.06	1.04	1.10	1.07
T_{11}	Sesame oil (100%) + Calcium gluconate 2%	1.03	1.04	1.04	1.00	1.04	1.02
T_{12}	Sesame oil (100%) + Chitosan 2%	1.03	1.05	1.04	1.00	1.05	1.03
T_{13}	Sesame oil (100%) + Sodium alginate 2%	1.04	1.06	1.05	1.00	1.06	1.03
T_{14}	*Tulsi* leaves extract + Calcium gluconate 2%	1.04	1.07	1.06	1.03	1.11	1.07
T_{15}	*Tulsi* leaves extract + Chitosan 2%	1.03	1.07	1.05	1.07	1.11	1.09
T_{16}	*Tulsi* leaves extract + Sodium alginate 2%	1.05	1.06	1.05	1.02	1.12	1.07
T_{17}	Olive oil (100%) + Calcium gluconate 2%	1.03	1.05	1.04	1.01	1.07	1.04
T_{18}	Olive oil (100%) + Chitosan 2%	1.03	1.06	1.05	1.00	1.07	1.03
T_{19}	Olive oil (100%) + Sodium alginate 2%	1.03	1.05	1.04	1.00	1.08	1.04
	S.E. (m)	0.043	0.047	0.032	0.052	0.060	0.040
	c.d. (5%)	NS	NS	NS	NS	NS	NS

Conclusion

The investigation revealed that enhance the shelf life of guava fruits by using individual and combined application of different edible coatings *viz.;* olive oil, sesame oil, tulsi leaf extract, *aloe vera* gel, chitosan, calcium gluconate and sodium alginate were found significantly better on fruit weight and fruit volume except specific gravity as compared to control (without coating). By analyzing of data it can be concluded that the maximum fruit weight and fruit volume were recorded under the treatment T_{18} edible coatings of (olive oil 100% + chitosan 2%) was found most effective as compared to other treatments at 2 to 14 days of storage.

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