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Effect of different edible coating materials on quality and shelf life of guava (*Psidium guajava* L.) cv. L- 49

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Abstract
The present investigation was to study the suitable edible coating material and their concentration and shelf-life evaluation of guava fruits. An experiment comprised of 10 treatments consisting of post-harvest treatments of chitosan (0.5, 1, 2, 2.5 %), aloe-vera gel 100%, coconut oil 100%, olive oil 100% and control. Among all treatments T_1 (Coconut oil 100%) recorded significantly higher marketable fruit retained percentage (87.55%), Specific gravity (0.82%), fruit volume (125.80 ml), fruit length and diameter (6.21, 6.56 cm), respectively during storage period compared to other treatments. It can be conclude that use of 100% coconut oil can improve the shelf life of guava fruits in ambient storage condition.

Keywords: Guava, coconut oil, aloe-vera, ascorbic acid, shelf life, and coating

Introduction
Guava (*Psidium guajava* L.) is an important fruit crop grown under a wide range of tropical and subtropical regions in the world. It is commonly known as 'The apple of the tropics' belongs to the family Myrtaceae. It is native to tropical America stretching from Mexico to Peru and was introduced in India by the Portuguese during 17th century (Mitra and Bose, 2001) [8]. In India, Guava is the fifth position after banana, mango, citrus and papaya in terms of area and production. The total area, production and productivity of guava in India is about 2.64 lakh hectares with 40.53 lakh tones production and 15.3 Mt/ha productivity, respectively (NHB, 2018).

The fruit is an excellent source of ascorbic acid and but has low energy (66 cal/100 g), Protein content (1%), about 17% dry matter and 83% moisture. The fruit is also rich in minerals like phosphorus (23.37 mg/100 g), Calcium (14-30 mg/100 g), lron (0.6-1.4 mg/100 g) as well as vitamins like Niacin, Pantothenic acid, Thiamine, Riboflavin and Vit. A. The guava, being a climacteric fruit crop, during maturing exhibits peaks of respiratory and ethylene. Owing to high metabolic activities the quality of guava fruits during storage is rapidly deteriorated. That reduces the marketing value of the fruits. Now a day's availability of modern technologies the percentage of post-harvest losses of fruit is less. These facilities are not widely accessible to a majority of farmers since most of the Indian farmers are small and marginal they are unable to work out costly post-harvest treatments as well as lack of awareness among farmers about these techniques.

Hence it is need to standardize alternative low-cost technologies to reduce post-harvest losses. Such techniques should be readily accessible, economically viable, and practical in terms of human safety. Among the different methods used to extend the low-cost technology alternative to shelf life, *i.e*., the application of edible coating (oil, wax, chemical) to fruit has received attention word wide as these coatings are maintaining quality even under normal storage condition (Bisen *et al*., 2012) [2]. Keeping all this in view, the present experiment was aimed to evaluate the effect of different edible coating materials on post harvest quality and shelf life of guava cv. L-49 fruits.

Material and Methods
The present investigation entitled, "Effect of different edible coating materials on quality and shelf-life of Guava (*Psidium guajava* L.) cv. L-49" was conducted during the period 2019-2020 in the laboratory of Department of Fruit Science, College of Horticulture, Mandsaur (M.P.). The experiment was conducted in Completely Randomized Design (CRD), comprising of 10 treatments with three replication.

The mature and uniform sizes of guava var. L-49 were procured from the Instructional cum Research Fruit Orchard and solutions prepared as per treatments for completing the experiments. Prior to the post harvest treatment, the fruits were washed in potable water. The fruits allowed to dry in shade prior to imposition of treatments. The details of the treatments include T_1: Coconut oil @ 100%, T_2: Olive oil @ 100%, T_3: Aloe-vera gel @ 100%, T_4: Chitosan @ 0.5%, T_5: Chitosan @1%, T_6: Chitosan @ 1.5%, T_7: Chitosan @ 2%, T_8: Coconut oil + Olive oil, T_9: Olive oil + Aloe-vera gel, T_{10}: Control. Each treatments was replicated thrice with 15 fruits in each replication. The observations on physical and quality parameters were recorded at an interval of 3 days.

Results and Discussion

Fruit length and diameter: The fruit length decreased gradually with the enhancement of storage period up to 12th days of storage. The maximum fruit length (6.21 cm) and fruit diameter (6.56 cm) was found in treatment T_1 (coconut oil 100%) respectively. whereas, minimum fruit length and fruit diameter was observed in untreated fruits *i.e.,* control. During the storage period, the reduction in fruit size could be due to the shrinking of fruits caused by transpiration, respiration rate (Table 1). The coconut oil inhibits the respiration rate and transpiration rate, resulting in better fruit size retention during storage. The result supported by Bisen *et al*. (2012) [2] and Nasrin *et al.* (2018) [9] in kagzi lime and mandarin fruits respectively.

Fruit Volume: The maximum fruit volume (125.80 ml) of guava fruits was observed in treatment T_1 (coconut oil 100%), followed by T_2 (olive oil 100%), T_6 (chitosan 1.5%), whereas, the minimum fruit volume (120.30) of guava fruits observed in treatment T_0 (control), respectively (Table 2). The coconut oil maintained the respiration rate and also prevents the transpiration loss from the fruits. These findings are accomplished consistent with the outcome of Nasrin *et al*. (2020) in lemon and Kumar *et al*. (2017) [7] in guava fruits.

Specific gravity: The specific gravity of the guava decreased continuously with advancement of the storage period. However coconut oil (T_1) coated fruits observed highest value of specific gravity in storage conditions compared to control. The decreased in the specific gravity due to decrease in weight and also volume of fruits is because of conversion of starch into sugar. The oil coating helps to barrier for the transpiration and respiration process it maintaining the weight and volume of fruits helpful to higher value of specific gravity (Table 2). Similar result was reported by Singh *et al*. (2017) [11] in guava fruits and Kaur *et al*. (2014) [5].

Fruit decay (%): All the treatments showed wide variation in decay percentage under the storage conditions. There was no decay till 6th day of storage after that spoilage seen in control fruits. No decayed fruits were observed among all treatments at the 12 days of storage period (Table 3). The fruit decay might be due to various fungi rot makes fruits soft and affected fruits as they develop bad odor and inherent biochemical changes. Results were recorded by Nasrin *et al*. (2018) [9], Farahi (2015) [3], and Singh *et al*. (2017) [11] in mandarin, grapes and guava fruits respectively.

Moisture loss (%): The treatment coating and storage period influences the moisture content of the fruits. Minimum loss moisture content observed in treatment T_1 (coconut oil 100%) 84.47 to 79.92% from initial to 12th day of storage. Maximum moisture lost in untreated guava *i.e.,* T_0 (Control) 84.29 to 76.33 % up to 12th day of storage period. During ripening, carbohydrates are hydrolyzed into sugars increasing osmotic transfer of moisture from peel to pulp (Table 3). These outcomes are in line with works of Hossain *et al*. (2014) [4] in guava and Krishna *et al.* (2017) [6] in guava fruits.

Physiological loss in weight (%): The physiological loss of weight increased in all treatments with advancement of storage. Minimum percentage of weight loss was observed in the treatment T_1 (coconut oil 100%) (10.42 %) during storage period over T_0 (control) *i.e.,* (16.93%) % respectively (Table 4). The rate at which water is lost depends on the water pressure gradient between the fruit tissue and the surrounding atmosphere and storage temperature. Edible coatings act as barriers, These results reflect the findings of previous researchers Pandey *et al*. (2010) [10] in guava fruits and Nasrin *et al*. (2018) [9] in Mandarin fruits.

Marketable fruit retained (%): All stored fruits loss their quality by storage periods. Maximum percentage of marketable fruits retained in the treatment T_1 (coconut oil 100%) from 3rd to 12th day of storage. Least percentage of marketable fruits observed in T_0 (control). Coconut oil treated fruits may be due to water loss rate reduced and low availability of oxygen within the fruits which, slow down the rate of ripening of fruits as well as changes colour (Table 4). These outcomes are in line with the reports of Pandey *et al*. (2010) [10] in guava fruits.

Conclusion

On the basis of result observed from this experiment it was conclude that coconut oil (100%) coating was found most effective postharvest treatment followed by olive oil (100%) and coconut oil + olive oil 50:50% coating which enhanced the shelf life and consumer acceptability of the stored guava fruits. The coconut oil (100%) treated fruits has more overall acceptability because this coating helped in improving the colour, taste, appearance and quality of fruits. Hence this technology could be more useful for increase shelf life of fruits, low cost and reduce the post harvest loss of fruits it also helps to reduce the use of harmful chemicals by growers and traders.

Table 1: Effect of post harvest treatments on fruit length and fruit diameter of guava cv. L- 49 during storage

Treatments	Fruit length (cm) Storage period (days)					Mean	Fruit diameter (cm) Storage period (days)					Mean
	0	3	6	9	12		0	3	6	9	12	
T1	6.34	6.30	6.25	6.18	5.99	6.21	6.80	6.75	6.56	6.35	6.30	6.56
T2	6.34	6.29	6.24	6.13	5.96	6.19	6.81	6.70	6.56	6.34	6.26	6.53
T3	6.33	6.28	6.22	6.16	5.88	6.18	6.77	6.66	6.54	6.33	6.25	6.51
T4	6.31	6.26	6.21	6.18	6.01	6.19	6.72	6.65	6.50	6.30	6.23	6.48
T5	6.31	6.27	6.23	6.15	5.88	6.16	6.70	6.62	6.48	6.37	6.30	6.49
T6	6.33	6.29	6.21	6.11	5.98	6.18	6.71	6.51	6.36	6.30	6.23	6.42
T7	6.32	6.27	6.19	6.12	5.94	6.17	6.64	6.50	6.32	6.25	6.19	6.39
T8	6.29	6.25	6.22	6.19	6.03	6.20	6.74	6.62	6.40	6.30	6.25	6.46
T9	6.30	6.26	6.17	6.12	5.95	6.16	6.68	6.48	6.35	6.21	6.13	6.37
T10	6.30	6.22	5.95	5.60	5.47	5.91	6.71	6.38	6.25	6.16	6.11	6.32
SEm±	0.012	0.013	0.015	0.017	0.055		0.025	0.039	0.058	0.054	0.055	
C.D @ 5%	0.037	0.039	0.044	0.050	0.164		0.075	0.116	0.172	0.159	0.165	

Table 2: Effect of post harvest treatments on fruit volume and specific gravity of guava cv. L- 49 during storage

Treatments	Fruit volume (ml) Storage period (days)					Mean	Specific gravity Storage period (days)					Mean
	0	3	6	9	12		0	3	6	9	12	
T1	131.7	129.3	127.0	123.0	118.0	125.80	0.88	0.86	0.84	0.79	0.75	0.82
T2	131.0	127.0	124.7	120.0	116.0	123.73	0.88	0.85	0.83	0.77	0.74	0.81
T3	130.3	126.7	123.3	119.0	114.7	122.80	0.87	0.84	0.81	0.79	0.73	0.81
T4	127.7	125.7	121.3	118.7	113.7	121.40	0.87	0.83	0.79	0.74	0.72	0.79
T5	130.3	124.0	122.7	119.0	114.3	122.07	0.86	0.83	0.79	0.76	0.72	0.79
T6	131.7	125.7	123.3	120.3	114.0	123.00	0.86	0.83	0.78	0.77	0.74	0.80
T7	129.7	123.7	122.7	117.7	112.3	121.20	0.85	0.82	0.79	0.73	0.71	0.78
T8	130.0	127.0	122.3	118.3	111.0	121.73	0.85	0.80	0.78	0.75	0.73	0.78
T9	130.3	125.0	123.7	119.0	114.0	122.40	0.85	0.79	0.76	0.73	0.69	0.77
T10	128.3	126.3	121.7	117.3	111.0	120.93	0.84	0.77	0.73	0.69	0.64	0.73
SEm±	0.745	0.683	1.000	0.723	0.641		0.008	0.006	0.767	0.009	0.010	
C.D @ 5%	2.214	2.029	2.971	2.147	1.905		0.022	0.019	2.280	0.026	0.029	

Table 3: Effect of post harvest treatments on fruit decay (%) and moisture content (%) of guava cv. L- 49 during storage

Treatments	Fruit decay (%) Storage period (days)					Mean	Moisture content (%) Storage period (days)					Mean
	0	3	6	9	12		0	3	6	9	12	
T1	0.00	0.00	0.00	0.00	0.00	0.00	84.47	83.14	82.24	81.18	79.92	82.19
T2	0.00	0.00	0.00	0.00	0.00	0.00	84.40	82.45	82.15	81.09	79.86	81.99
T3	0.00	0.00	0.00	0.00	2.22	0.44	84.43	81.84	81.77	80.36	78.03	81.29
T4	0.00	0.00	0.00	0.00	2.22	0.44	84.42	81.16	81.08	80.49	79.93	81.42
T5	0.00	0.00	0.00	0.00	0.00	0.00	84.34	82.37	81.10	80.32	79.43	81.51
T6	0.00	0.00	0.00	0.00	0.00	0.00	84.37	82.41	81.28	80.26	79.01	81.47
T7	0.00	0.00	0.00	0.00	0.00	0.00	84.33	82.59	81.65	80.09	79.78	81.69
T8	0.00	0.00	0.00	0.00	0.00	0.00	84.31	82.95	81.27	80.51	77.53	81.31
T9	0.00	0.00	0.00	0.00	0.00	0.00	84.29	82.63	81.27	80.84	77.52	81.31
T10	0.00	0.00	4.44	6.66	13.44	4.91	84.29	81.97	81.16	79.66	76.33	80.68
SEm±	0.00	0.00	0.702	1.217	0.993		0.066	0.205	0.181	0.170	0.609	
C.D @ 5%	0.00	0.00	2.086	3.615	2.951		0.196	0.609	0.538	0.506	1.808	

Table 4: Effect of post harvest treatments on physiological loss in weight (%) and marketable fruit retained (%) of guava cv. L- 49 during storage

Treatments	Physiological loss in weight (%) Storage period (days)					Mean	Marketable fruit retained (%) Storage period (days)					Mean
	0	3	6	9	12		0	3	6	9	12	
T1	0.00	4.8	8.4	11.9	16.5	10.42	100.00	97.78	93.32	86.66	60.00	87.55
T2	0.00	5.6	9.8	12.8	18.5	11.65	100.00	97.78	88.88	80.00	55.55	84.44
T3	0.00	7.5	11.8	14.7	19.3	13.32	100.00	95.55	88.88	73.33	48.88	81.33
T4	0.00	8.2	12.9	18.5	23.6	15.80	100.00	91.11	86.66	66.66	42.22	77.33
T5	0.00	7.1	11.0	15.5	20.8	13.58	100.00	95.55	84.44	73.33	44.44	79.55
T6	0.00	5.2	9.0	13.0	21.8	12.22	100.00	95.55	77.78	75.55	48.89	79.55
T7	0.00	6.5	8.9	12.6	20.5	12.13	100.00	95.55	84.44	68.89	42.22	78.22
T8	0.00	7.6	11.8	16.6	22.8	14.68	100.00	97.78	84.44	75.55	55.55	82.66
T9	0.00	8.2	11.8	16.7	23.4	15.02	100.00	91.11	80.00	62.22	44.44	75.55
T10	0.00	8.9	13.5	19.6	25.7	16.93	100.00	86.66	73.33	53.33	26.66	68.00
SEm±	0.00	0.172	0.245	0.237	0.372		0.00	2.109	2.721	3.719	4.332	
C.D @ 5%	0.00	0.511	0.729	0.704	1.104		0.00	6.266	8.085	11.048	12.868	

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