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Studies on Sensory Quality and Shelf Life of Guava Cv. Khaja Influenced by Packaging Materials

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ABSTRACT

The guava fruits harvested at mature green stage was packed in different microns of LDPE packages (25µ LDPE, 50µ LDPE, 75µ LDPE and 100µ LDPE) placed in ambient condition where as control was without packaging. The fruits were examined for shelf-life, Physiological loss in weight and organoleptic quality at different days of storage. The results revealed that fruits cv. Khaja packed in 75µ LDPE followed by 100µ LDPE under ambient condition proved to be the best treatments among all the treatments which not only extended the shelf life and increased marketable fruits but also reduced the post –harvest losses without adversely affecting the fruit quality of guava .These treatments are found obviously easy for practical application for extending the shelf life of guava.

Key words: *Guava, Khaja, Shelf Life, Sensory Quality*

INTRODUCTION

Guava (*Psidium guajava* L.), having 2n=22, belongs to the family Myrtaceae and is native of Mexico it is originated in Brazil. It is a perennial tree of tropics and subtropics offering great economic potential[13]. It is commercially cultivated in Pakistan, Bangladesh, India, Thailand, Mexico, Brazil, USA and several other tropical and subtropical countries of the world[16].

In India guava grown in an area of 268 thousand hectors with the production of 3668 thousand MT production[2,12].

Guava fruits are rich in high-profile nutrients. With its unique flavor, taste, and health-promoting qualities, the fruit easily fits in the new functional foods category, often called "Super-fruits". Guava fruit contain Carbohydrates 14.3 gm. Protein 2.55 gm. Calcium 8 mg, Vitamin-C 228 mg, Vitamin-A 624 IU, Lycopene 5204µg, Energy 68 Kcal, and anti-oxidant property 496 mg/100 gram fruit.

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Guava has limited storage potential at ambient conditions, which leads to glut in market and poor return to the growers. Moreover, overripe fruit at ambient conditions lead to lot of wastage and economic losses.

The low temperature in winter months interferes with growth and developmental process of fruits leading to irregular supply or availability of guava fruits in the market[10]. Therefore, guava fruits are required to be managed appropriately from November to March in order to get a regulated market supply. This can be attained with judicious use of post-harvest treatment, followed by storage at appropriate temperature and relative humidity. Various attempts have been made to extend the storage life of guava with use of various chemicals and packaging materials[7]. Among these, the use of packaging materials for storage is always preferred because it is free from any harmful residual effects on human health. Polyethylene film creates a modified atmosphere within the packaging, thereby reducing the transpirational losses and respiration rate.

The packaging of guava fruits in polyethylene film minimizes the post-harvest losses and chilling injury and therefore ensures better quality of fruits during cold storage. Hence, the present studies were planned to standardize the technology for storage of surplus fruit in cold storage with the use of different packaging materials.

Postharvest losses can be minimized by adopting proper postharvest handling practices and better understanding of biochemical control of fruit ripening. Postharvest life of fruits and vegetables can be extended by using LDPE. LDPE films are commonly used to minimize weight loss, reduce abrasion, damage and delay fruit ripening.

MATERIALS AND METHODS

The present investigation carried out in the laboratory of Department of Post Harvest Technology of Horticultural Crops, faculty of horticulture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia.

SOURCE OF MATERIAL

Well developed mature fruits of guava cv. Local (Khaja) were harvested at green stage in the morning from the well maintained orchard at Ghoragacha village and immediately brought to the laboratory of Department of Post Harvest Technology of Horticultural Crops.

PREPARATION OF FRUITS BEFORE TREATMENT

Evenly mature green fruits, free from mechanical damage and blemishes were sorted out. The fruits were then well washed with running tap water to remove the dirt, soil and other foreign matters and pre treatment with $Ca(ClO)_2$. After washing, the excess moisture was drained out from the fruits and then dried lightly at room temperature. Precaution is taken while handling the produce to minimize abrasion and bruising.

EXPERIMENTAL DETAILS

Treatment details:

T_1 = 25μ LDPE packaging
T_2 = 50μ LDPE packaging
T_3 = 75μ LDPE packaging
T_4 = 100μ LDPE packaging
T_5 = Control (without packaging)

Design of experiment: Completely Randomized Design.

No. of treatments : 5
No. of replication : 4
Variety : Guava cv. Khaja (local)
Each treatment 10 bags except control (T5)

STORAGE CONDITION

The fruits were stored in cool, dry place on racks at room temperature in the laboratory of post harvest technology of horticultural crops, during the period from December 2015 to January 2016. The maximum and minimum temperature during the period at ambient condition varied from 28.15^0 C and 18.85^0 C respectively and relative humidity from 49 to 86% during the period of storage.

OBSERVATION

Observations were recorded on shelf life and Organoleptic evaluation was carried out on the basis of fruit appearance (colour), taste and flavor.

Shelf life (Days)

When fruits showed symptoms of over ripening by shriveling and over- softening, that duration was considered as the optimum shelf life of fruit and expressed in days.

Organoleptic Quality

Organoleptic Quality was estimated on the basis of scoring, as per the hedonic scale ranging from 9 to 1, where 9 being the most favorable one noted as 'like extremely' and 1 being the least acceptable determined as 'dislike extremely'.

Hedonic scale for evaluating organoleptic quality

Scales and scores	Acceptability
9	Like extremely
8	Like very much
7	Like moderately
6	Like slightly
5	Neither like or dislike
4	Dislike slightly
3	Dislike moderately

STATISTICAL ANALYSIS

The analysis of the data obtained in experiment was analyzed by completely randomized design with 4 replications by adopting the statistical procedure of Gomez and Gomez[5].

RESULTS AND DISSCUSSION

SHELF LIFE

Shelf life of the guava fruits as affected by different gauges of LDPE packing materials were presented in Table- 1

There was significant difference was observed among the treatments for shelf life. Significantly the maximum shelf life (13.95 days) was recorded in fruits packed in T_3–75 µ LDPE bags followed by fruits of T_4–100 µ LDPE (13.50 days). Significantly the minimum shelf life fruit was observed in fruits of T_5-control (6.23).This might be due to accumulation or maintenance of high relative humidity in the polythene bags there by reduced rate of transpiration.

Table 1: Effect of packaging material on shelf life-marketability of guava fruits in storage

Treatments		Shelf life(days)
T1	25 µ LDPE	11.33
T2	50 µ LDPE	12.83
T3	75µ LDPE	13.95
T4	100 µ LDPE	13.5
T5	Control	6.23
SE.m(±)		0.05
CD (0.05%)		0.152

Colour change

Colour change of the guava fruits as affected by different gauges LDPE packing materials were presented in Table -2.

On the 0th day of storage the guava fruits are in green colour. The colour of guava fruits kept in T_3–75 µ LDPE obtained uniform yellow on after 12th day of storage was observed and it maintain the light green up to 12th day. Fruits packed in T_4–100 µ LDPE recorded light yellow color on the 12th day of observation. In control fruits obtained light yellow colour on the 6th day of storage after the colour changes to fully yellow followed by yellow with gray patches was observed after 6th day of storage. On 8th day the fruits softened earlier compared to other treatments due to early formation of carotenoid pigments loss of tissue turgidity[8].

Colour development was closely associated with climacteric peak in all the treatments and in control. The colour development which started prior to the onset of climacteric was completed at the peak climacteric[9]. The earliest visual sign of ripening was a change in colour primarily due to disappearance of chlorophyll at peak and post climacteric stage.

Colour is one of the most important criteria of quality of most fruits. The changes in colour of mango peel green to breaker are the most obvious changes which occur during, storage of fruits. Change of peel colour during ripening and senescence of fruits involves chlorophyll degradation or qualitative and quantitative alternation of the green pigment into other pigments. During colour change the pulp becomes softer and sweeter as the ratio of the sugar to starch increased and the characteristics aroma is produced.

The findings of Rao and Rao[14] provide a strong support for the present findings. This may be due to build up of relative humidity inside the cover. The polythene bags causing formation of carotenoid pigments due to enhanced humidity and micro climate.

Robinson[15] stated that during colour changes, the pulp of the fruit became softer and sweeter as the ratio of sugars to starch increased and the characteristics aroma was produced.

Table 2: Effect of packaging material on surface colour of guava fruits in storage

Treatments		Storage period (days)						
		0	2	4	6	8	10	12
T1	25 µ LDPE	------	Green	light green	light green	Light yellow	light yellow	Uniform Yellow
T2	50 µ LDPE	-------	Green	Light green	light green	light yellow	light yellow	light yellow
T3	75 µ LDPE	-------	Green	Green	light green	light green	light green	light green
T4	100 µ LDPE	--------	Green	green	light green	light green	light green	Light yellow
T5	Control	---------	Green	light green	light yellow	Fully yellow	Yellow+gery patches	Yellow+gery patches

Texture content

Change in texture content of the guava fruits as affected by different gauges LDPE packing materials were presented in Table -3.

The texture of guava fruits packed in different gauges of LDPE bags changes their texture in the manner of hard to semi hard, semi hard soft, soft, over soft .The guava fruits packed in T_3–75 µ LDPE obtained soft texture after 12th day of storage and it maintain semi hard texture up to 12th day of storage and the fruits packed in T_4–100 µ LDPE & T_2–50 µ LDPE maintain semi hard texture up to 10th day of storage but in control the fruits obtained soft texture on the 8th day of storage later turned to over soft texture on the10 and 12th day of storage.

Table 3: Effect of packaging material on surface texture of guava fruits in storage

Treatments		Storage period (days)						
		0	2	4	6	8	10	12
T1	25 µ LDPE	------	Hard	semi hard	semi hard	Semi hard-soft	Semi hard-soft	Soft
T2	50 µ LDPE	------	Hard	hard	semi hard	semi hard	semi hard	Semi hard-soft
T3	75 µ LDPE	------	Hard	hard	semi hard	semi hard	semi hard	semi hard
T4	100 µ LDPE	------	Hard	hard	semi hard	semi hard	semi hard	semi hard
T5	Control	------	Hard	semi hard	semi hard	soft	over soft	over soft

Sensory evaluation (Organoleptic evaluation)

Effect of different packing treatments on organoleptic score (10 point scale) for guava are presented in Table-4

Among the treatment fruits packed in T_3 -75 µ LDPE recorded highest organoleptic rating on the 2nd,4th ,6th ,8th ,10th ,12th ,(9.00, 8.75, 8.25, 8.00, 7.75, 7.50) respectively. which was on par with T_4 -100 µ LDPE on the 2nd,4th ,6th ,8th ,10th ,12th ,(9.00, 8.50, 8.25, 8.00, 7.75, 7.25) respectively Whereas, fruits in T_5 control recorded a minimum organoleptic score on the 2nd,4th ,6th ,8th ,10th ,12th ,(8.00, 7.25, 6.25,4.50,3.50,2.25) respectively.

The score for organoleptic evaluation decreased with increase in storage period. This might be due to the breakdown of ascorbic acid during storage of products[11] and Amerine *et al*[1].

Table 4: Effect of packaging material on sensory evaluation of guava fruits at different days in storage

Treatments		**Storage period (days)**						
		0	2	4	6	8	10	12
T1	25 µ LDPE	-----	8.750	8.500	8.250	7.750	7.500	7.250
T2	50 µ LDPE	-----	8.500	8.250	8.000	7.750	7.500	7.250
T3	75 µ LDPE	-----	9.000	8.750	8.250	8.000	7.750	7.500
T4	100 µ LDPE	-----	9.000	8.500	8.250	8.000	7.750	7.250
T5	Control	-----	8.000	7.250	6.250	--	--	--
SE.m(±)		-----	0.171	0.266	0.224	0.329	0.274	0.365
CD (0.05%)		------	0.579	0.810	0.680	1.001	0.833	1.111

Physiological loss in weight (%)

The data on changes in physiological loss in weight (PLW) of guava as influenced different gauge LDPE packing materials were presented in table-5.

Weight losses increased significantly in all the treatments with increase in storage period. However, the increase had been at a reduced rate in all the treated fruits as compared to control.

The percentage of PLW values further increased up to 12th day till the end of shelf life.

Significant difference was observed among the treatments for PLW. On 2th day of storage significantly the lowest PLW (%) was recorded in T_3–75 µ LDPE (1.07) followed by T_4–100 µ LDPE (1.68) and T_2–50 µ LDPE (2.10) significantly highest PLW (%) was recorded in (T_5) control (2.95).

On 4th day of storage significantly the lowest PLW (%) was recorded in T_3–75 µ LDPE (2.02) followed by T_4–100 µ LDPE (2.19) and T_2–50 µ LDPE (2.31) significantly highest PLW (%) was recorded in (T_5) control (3.41). On 6th day of storage also similar trend was observed. However significantly the lowest PLW (%) was recorded in T_3–75 µ LDPE (2.99) followed by T_4–100 µ LDPE (3.13) and T_2–50 µ LDPE (3.26) significantly highest PLW (%) was recorded in (T_5) control (5.09).

On 8th day of storage also similar trend was observed. Significantly the lowest PLW (%) was recorded in T_3–75 µ LDPE (3.18) followed by T_4–100 µ LDPE (3.88) and T_2–50 µ LDPE (3.26) significantly highest PLW (%) was recorded in (T_1) 25µLDPE (4.95).On 10th day of storage also similar trend was observed. Significantly the lowest PLW (%) was recorded in T_3–75 µ LDPE (3.79) followed by T_4–100 µ LDPE (4.15) and T_2–50 µ LDPE (4.35) significantly highest PLW (%) was recorded in (T_1) 25µLDPE (5.13).

On 12th day of storage significantly the lowest PLW (%) was recorded in T_3–75 µ LDPE (4.16) followed by T_4–100 µ LDPE (4.34) and T_2–50 µ LDPE (5.09) significantly highest PLW (%) was recorded in (T_1) 25µLDPE (5.25).

The PLW indicates the progress of ripening in climacteric fruits, higher the PLW more the ripening in the present investigation it was observed that PLW of guava fruits increased with the storage periods irrespective of the treatments.

The present experimental findings have revealed that, there was lower PLW in fruits kept in 75u gauge LDPE bags .This might be due to lower rate of transpiration, oxygen depletion, and CO_2 accumulation in the polythene bags reaching on equilibrium and as a result the respiratory process was slowed down[6]. Similar results were reported by Gautam and Neeraja[4], Borkar *et al* [3] and Polythene cover thickness and PLW was inversely proportional.

Table 5: Effect of packaging material on PLW (%) of guava fruits in storage

Treatments		Storage period (days)						
		0	2	4	6	8	10	12
T1	25 µ LDPE	-----	2.34	3.355	3.97	4.958	5.13	5.25
T2	50 µ LDPE	-------	2.105	2.310	3.268	4.125	4.358	5.093
T3	75 µ LDPE	-------	1.075	2.025	2.99	3.188	3.798	4.163
T4	100 µ LDPE	--------	1.683	2.198	3.138	3.883	4.15	4.343
T5	Control	------	2.958	3.418	5.095	--	--	--
SE.m(±)		------	0.03	0.031	0.058	0.207	0.352	0.452
CD (0.05%)		----	0.064	0.067	0.125	0.445	1.069	1.375

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