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Effects of modified atmosphere packaging on microbial load of fresh cut guava fruits at different packaging material (LDPE and PP) and different storage temperature

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ABSTRACT

The study of infant feeding practices was conducted to find out the current feeding practices of infants in rural areas of Parbhani. The effect of socio-economic status of the family and educational status of mothers on feeding practices was observed. The survey of 130 women having the infants of 3-18 months were randomly selected and personally interviewed. It was evident from the results that 46.9 per cent rural mothers were giving the pre-lacteal foods to infants. Foods other than milk, like biscuits, rice with milk, rice with dal, forex, cerelax, chapatti, bread were given to 51.53 per cent infants after six months of age. It was observed that 70.42 per cent of low income group mothers breastfed their infants upto age of 18 months and 82.53 per cent illiterate mothers breastfed their infants up to age of 18 months that means there was direct effect on socio-economic status of the family and educational status of mothers on infant feeding practices.

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Key Words : Modified atmosphere packaging, Fresh cut, Guava fruit

INTRODUCTION

The International Fresh-cut Produce Association (IFPA) defines fresh-cut produce as "any fruit or vegetable or combination thereof that has been physically altered from its original form, but remains in a fresh state" (IFPA and PMA, 1999). Fresh cut fruits are products with minimal processing, modified by cutting, washing, packaging and refrigeration. Fresh-cut produce sales are estimated to be $10 billion, which is 10 per cent of the total produce sales (Bett *et al.,* 2001). India is the second largest producer of fruits after China. Guava *(Psidium guajava)* is the fourth most widely grown fruit crop in India. The popular varieties of guava are Allahabad Safeda, Lucknow-49, Nagpur seedless and Dharwar. Bihar is the leading state in guava production followed by Andhra Pradesh, and Uttar Pradesh. The other states where guava is grown widely are Gujarat, Karnataka, Punjab and Tamil Nadu.

Today's consumer is demanding for foods that require minimal process, for example, fresh-cut fruits and vegetable (FCFV). This is mainly because of busy lifestyles, an increase in health consciousness and increased purchasing power of the consumer.

The present study was carried out with the following objective: to assess the microbial load of modified atmosphere packaged fresh cut guava fruit at different packaging material (LDPE and PP) and different storage temperatures (refrigeration $4^{o}\pm1^{o}$C and room $30^{o}\pm2^{o}$C temperature).

METHODOLOGY

Fresh mature guava fruit at various stages of ripeness, free from surface damage were procured from the local markets. Modified atmosphere packaging instrument were utilized in the present study. (Quick Seal MAP 250 PN and Vacuum sealing machine Sevana, India). Fresh cut guava fruits were packed in 2 different types of polymeric films, polypropylene (PP) film of 16 cm x 22 cm size and low density polyethylene (LDPE) film of 19 cm x 24 cm size.

Washing and slicing of guava fruit:

All guava fruits were pre-cleaned with tap water, removed unwanted part with a stainless steel knife and then sliced (diameter of 8 cm, thickness of 0.7 cm and weight of one slice 23.3 g) with a stainless steel knife.

Modified atmosphere packaging:

Guava fruit slices were packed in polypropylene bag (16 cm x 22 cm) and low density polyethylene bag (19 cm x 24 cm size.) under different gas concentrations as mentioned below using MAP1 (10 % CO_2, 5% O_2 and 80% N_2), MAP2 (10% N_2 5% O_2 and 80% CO_2) and MAP3 (40 % CO_2, 10% O_2 and 50% N_2). The headspace contents of oxygen (%) and carbon dioxide (%) in the packs were determined using a gas analyzer (Check point 2 CO_2 and O_2 analyser, PBI Dansensor, Ringsted, Denmark).

Determination of microbial load of fresh cut guava slices:

Microbiological analysis was done as per method of John and Alicia (2001). 10 g of fresh cut guava fruit slice was homogenized with 50 ml of distilled water. It was filtered using filter paper and serial dilution was carried out. Aliquots from each dilution were plated on Nutrient agar and Potato dextrose agar. Nutrient agar plates were incubated at 37° Cfor 48 hours and Potato dextrose agar plates were incubated at 30°C for 72 hours. After incubation period, the plates were observed for colonies and counted, accordingly.

OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation as well as well as relevant discussion have been presented under following heads :

Microbial load:

Microbial load is the most important factor that affects the quality of fresh-cut guava fruit. The observations in respect to microbial load (Total plate count, CFU/g) of MA packaged fresh cut guava fruit in low density polypropylene (LDPE) and polypropylene (PP) films stored at refrigeration (4±1 °C) and room (30±2 °C) temperatures are shown in Tables 1, 2, 3, 4, respectively.

Microbial load of fresh cut guava fruit packed in LDPE film and stored at refrigerated temperature for 7 days was found to be increasing towards the end of the storage period in all the three treatments of gas studied (Table 1). When compared to fresh cut guava fruit packed without MAP treatment (control, 32% increase), the increase in moisture content of MA packaged fresh cut guava fruit was high. 33 per cent of moisture content was found to be increased after 7th day of storage at refrigerated temperature in fresh cut guava fruit packed with MAP 1 and MAP 2 in LDPE film when compared to MAP 3 (30% increase).

The same trend of increase in microbial load was assessed for fresh cut guava fruit packed in LDPE film and stored at room temperature for 4 days (Table 2). Microbial load of fresh cut guava fruit packed in LDPE film under MAP 1 and MAP 2 treatments was found to increase up to 32 per cent when the storage period was extended up to 4 days at room temperature. On the other hand, 34 per cent of increase in moisture content was observed in fresh cut guava fruit packed in LDPE film

Table 1 : Effect of MAP on microbial load (Total plate count, CFU/g) of fresh cut guava fruit packed in LDPE films at refrigerated temperature (4 ±1 °C) during storage

Storage period	1 Day	3 Day	5 Day	7 Day
Control	8.75±0.15*	9.51±0.15	10.11±0.15	10.68±0.15
MAP 1	5.32±0.15	6.11±0.15	7.87±0.15	8.01±0.15
MAP 2	6.82±0.15	8.15±0.15	9.10±0.15	10.13±0.15
MAP 3	5.90±0.15	6.34±0.15	7.98±0.15	8.54±0.15

*All the values are mean ± standard deviation, n = 3

MAP_1-(10 % CO_2, 5% O_2 and 80% N_2), MAP_2-(10% N_2, 5% O_2 and 80% CO_2) and MAP_3-(40 % CO_2, 10% O_2 and 50% N_2)

Table 2 : Effect of MAP on microbial load (Total plate count, CFU/g) of fresh cut guava fruit packed in LDPE films at room temperature (30±2 °C) during storage

Storage period	1 Day	3 Day	5 Day	7 Day
Control	9.75±0.15*	10.98±0.15	11.75±0.15	12.71±0.15
MAP 1	6.58±0.15	7.69±0.15	8.78±0.15	9.73±0.15
MAP 2	7.22±0.15	9.76±0.15	10.79±0.15	11.34±0.15
MAP 3	6.67±0.15	8.39±0.15	9.50±0.15	10.20±0.15

*All the values are mean ± standard deviation, n = 3

MAP_1-(10 % CO_2, 5% O_2 and 80% N_2), MAP_2-(10% N_2, 5% O_2 and 80% CO_2) and MAP_3-(40 % CO_2, 10% O_2 and 50% N_2)

Table 3 : Effect of MAP on microbial load (Total plate count, CFU/g) of fresh cut guava fruit packed in PP films at refrigerated temperature (4±1 °C) during storage

Storage period	1 Day	3 Day	5 Day	7 Day
Control	8.69±0.03*	9.48±0.33	10.07±0.45	10.79±0.01
MAP 1	5.29±0.02	6.07±0.33	7.83±0.03	7.89±0.42
MAP 2	6.78±0.25	8.11±0.05	9.06±0.45	10.09±0.49
MAP 3	5.84±0.44	6.29±0.38	7.92±0.09	8.46±0.11

*All the values are mean ± standard deviation, n = 3

MAP_1-(10 % CO_2, 5% O_2 and 80% N_2), MAP_2-(10% N_2, 5% O_2 and 80% CO_2) and MAP_3-(40 % CO_2, 10% O_2 and 50% N_2)

Table 4 : Effect of MAP on microbial load (Total plate count, CFU/g) of fresh cut guava fruit packed in PP films at room temperature (30±2 °C) during storage

Storage period	1 Day	3 Day	5 Day	7 Day
Control	9.65±0.05*	10.86±0.45	11.55±0.10	12.51±0.34
MAP 1	6.49±0.02	7.56±0.25	8.65±0.32	9.69±0.22
MAP 2	7.12±0.35	9.66±0.33	10.57±0.44	11.29±0.15
MAP 3	6.78±0.44	8.55±0.45	9.58±0.35	10.35±0.03

*All the values are mean ± standard deviation, n = 3

MAP_1-(10 % CO_2, 5% O_2 and 80% N_2), MAP_2-(10% N_2, 5% O_2 and 80% CO_2) and MAP_3-(40 % CO_2, 10% O_2 and 50% N_2)

under MAP 3. 35 per cent increase in moisture content was examined for fresh cut guava fruit packed in LDPE without any treatment (control) and stored at room temperature for 4 days.

Microbial load of fresh cut guava fruit packed in PP film and stored at refrigerated temperature for 7 days was examined to be increasing in all the three treatments of gas studied (Table 3). When compared to fresh cut guava fruit packed without MAP treatment (control, 32% increase), the increase in microbial load content of MA packed fresh cut guava fruit was high. 19 per cent of moisture was found to increase after 7th day of storage at refrigerated temperature in fresh cut guava fruit packed with 10 % CO_2, 5% O_2 and 80% N_2 (MAP 1) in PP films when compared to other two treatments (30% increase in MAP 2 and 28% increase in MAP 3).

The same trend of increase in microbial load was observed for fresh cut guava fruit packed in PP films and stored at room temperature for 4 days (Table 4). Microbial load of fresh cut guava fruit packed in PP films under MAP 1 treatment was observed to increase up to 22 per cent when the storage period was extended up to 4 days at room temperature. 33 per cent and 34 per cent of increase in moisture content were observed in fresh cut guava fruit packed in PP films under MAP 2 and MAP 3 treatments, respectively. 36 per cent increase in moisture content was examined for fresh cut guava fruit packed in PP films without any treatment (control) and stored at room temperature for 4 days. Monolopoulou *et al*. (2009) have also made investigations on the influence of modified atmosphere packaging of green bell peppers.

Conclusion:

It has been observed that the fresh cut guava fruit packed under different concentrations of gases was decreased throughout the study. On the other hand bacterial load was found to be increased throughout the study. Conversion of total sugars into organic acids by bacteria may be one of the reasons for the observed changes in fresh cut guava fruit packed under modified atmosphere during the storage period. Comparing other treatments, shelf-life of fresh cut guava fruit can be extended up to 7 days with 10 % CO_2, 5% O_2 and 80% N_2 treatment (MAP 1) in low density polyethylene films at 4°±1°C as storage temperature. The trend towards the use of natural compounds as antimicrobial and antioxidant agents to coat the fresh cut fruits might present an area for further research since the consumer would prefer these compounds over other chemical compounds. Treatments to increase the nutritional quality of the fresh cut fruits present an area of opportunity for fresh cut processors to deliver an advantage over fresh fruit; trend that is supported by the consumer's demand to have richer or equal products to fresh fruits.

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