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A STUDY ON QUALITY EVALUATION OF MINIMALLY PROCESSED FRUITS AND VEGETABLES

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ABSTRACT

Today's society characterized by an increasing health consciousness and growing interest in the role of food for maintaining and improving human well-being and consumer health, in addition to their nutritional and sensory properties, foods are currently recognized as active and protective agents. Among the others, fresh-cut horticultural products stand out as convenient novel foods that fit the many feeds of a modern life style as they combine technical content with an innovative food concept. The international fresh-cut produce Association (IFPA) defines fresh-cut products as fruits or vegetables that have been trimmed and / or peeled and / or cut in to 100% usable product that is bagged or pre-packaged to offer consumers high nutrition, convenience, and flavour while still maintaining its freshness. In particular, fresh cut fruits attract consumers because they are fresh, nutritious, low priced, and ready-to-eat. As a consequence, a wide assortment of minimally processed fruits has been developed to meet consumers, needs for 'quick' and convenient products, and to benefit from fruits healthy image. Present study was carried out to know the microbiological quality of minimally processed fruits and vegetable. Acidity, pH and moisture content was estimated under physico-chemical properties and TPC and Yeasts and moulds count was analysed for minimally processed cabbage and Pineapple available in Tirupathi Super markets.

KEY WORDS : Micro organisms, TPC, Yeasts & moulds

INTRODUCTION

Consumers increasingly perceive fresh food as healthier than heat-treated food, which motivates a general search for new minimally fresh processed fruit and vegetables. However, despite the benefits derived from eating fresh foods, safety is still an issue of concern owing to a wide range of documented cases of contaminated fresh fruits and vegetables, which have caused large outbreaks of microbial infections. Minimally fresh processed fruit and vegetables are very perishable products, highly susceptible to deterioration, and minimal processing reduced shelf life leading to additional quality losses. Therefore, the derived processed produces are in fact more sensitive to disorders than the

original ones. Many factors affect the shelf-life and microbial quality of raw prepared fruit and vegetables, and include good agricultural practices, good hygienic practices during harvesting and handling, quality of washing water, processing technologies, packaging methods and materials, and processing, storage, transportation, distribution and retail sale temperatures. Common practices consist of the protection of the produce from damage caused by poor handling or machinery, foreign body contamination, and/or pest infestation. Minimal Fresh Processing of Vegetables, Fruits and Juices .

The USDA and FDA definitions for "fresh" and "minimally- processed" fruits and vegetables imply that fresh-cut (pre-cut) products have been freshly-cut, washed, packaged and maintained with

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refrigeration. Fresh-cut products are in a raw state and even though processed (physically altered from the original form), they remain in a fresh state, ready to eat or cook, without freezing, thermal processing, or treatments with additives or preservatives.

Fresh cut fruits and vegetables like cabbage and pine apple, sprouts are available in various super markets which are not hygienically packed and a study was carried out to know the microbiologically quality of minimally processed fresh cut fruits and vegetable, i.e Pine apple and Cabbage available in around places of Tirupathi Super markets of Andhra Pradesh, India.

MATERIALS AND METHODOLOGY

In the present study minimally processed fruits and vegetable i.e., pineapple and cabbage, were collected aseptically from local super markets and analyzed for physicochemical and microbial parameters. market survey, to know the availability, market demand, frequency of consumption etc., of minimally processed fruits and vegetables in local super market, Tirupathi and even Consumer survey was done to know the awareness, attitude and preferences towards minimally process foods and consumption etc. of minimally processed fruits and vegetables by consumers. The physico chemical parameters like, moisture, pH and acidity of minimally processed fruits and vegetables i.e. Pineapple and cabbage were carried out. The selected fruit and vegetables for microbial analysis were brought to the laboratory under aseptic conditions and analyzed for Total Plate Count (TPC)



Fig. 1. Ready-to-eat fresh-cut produce on display on a market stand (Pineapple and Cabbage shreds)

and yeasts and moulds.

Preparation of the sample and media used for analysis

- 1 gm or 1 ml of the sample was weighed under aseptic conditions.
- Homogenized with 9 ml of distilled water by using mortar and pestle.
- Serially diluted to 5 dilutions under aseptic conditions.

Media preparation

Media varied with the micro organisms need for the growth. The corresponding media, incubation temperature and incubation time required for development of each micro organisms individually in the food samples are given in the following table

Statistical Analysis

The results obtained during the analysis were subjected to statistical analysis by taking mean, standard deviation, f-value, and p-value. Statistical analysis is necessary to know the significant difference.

RESULTS AND DISCUSSION

Market survey

Various markets including supermarkets in Tirupathi were visited to know the availability of minimally processed foods. The following observations were made during the survey time. The minimally processed foods available in Tirupathi are presented in Table 2. By the survey it was observed that only small quantities of minimally processed fruits and vegetables are available. The varieties of minimally processed fruits and vegetables available in super market are enlisted in the Table 2.

Consumer Survey

In the present study consumer survey was carried out to know the consumption pattern of minimally processed fruits and vegetables by the consumers in local areas of Tirupathi. The following observations were made during the survey.

- 1) It was observed that the consumption of minimally processed cabbage, cauliflower and sprouted seeds was high.
- 2) A minimally processed mixed vegetable packet i.e. commonly called as "palav cut" was largely consumed by consumers, as it is convenient to use in curries and palavs etc.

Table 1. Particular media used for various organisms

Organism	Media used	Incubation temperature °C	Incubation time
Total plate count	Standard plate count agar	37°C	24hrs
yeasts and moulds	Potato dextrose agar medium	37°C	48-72 hrs

3) From the survey it was observed that consumers mostly prepare fresh cut raw fruits and vegetables more than canned fruits and vegetables.

Physico-chemical Parameters of Minimally Processed Fruits and Vegetables

Various Physico-chemical parameters like moisture, pH, acidity were analyzed for minimally processed

Table 2. Minimally processed foods available in Tirupati

S. No.	Minimally Processed Foods	Super Market	Vegetable Market	Fruit Market
1	Vegetables			
	Cabbage	√	×	×
	Baby corn	√	×	×
	Corn	√	√	×
	Carrot	√	×	×
	Brocoli	√	×	×
	Cauliflower	√	×	×
	Beans	√	×	×
	Peas	√	√	×
	Beetroot	√	×	×
2	Fruits			
	Pineapple	√	×	√
	Grapes	√	×	√
	Pomegranate	√	×	×
	Mixed fruit (Orange, Apple)	√	×	×
	Papaya	√	×	√
	Water melon	√	×	×
3	Sprouts			
	Green gram	√	√	×
	Cow pea	√	√	×
	Groundnut	√	√	×
4	Others			
	Green leafy vegetables		×	×
	Mushrooms	√	√	×
	Salads	√	×	×

fruits and vegetables, i.e. pineapple and cabbage. The results obtained for various physicochemical parameters of minimally processed fruits and vegetables are enlisted below.

Moisture content of minimally processed fruits and vegetables during storage periods

The data in Table 3 show that the mean values of moisture content of minimally processed pineapple and cabbage during different storage periods . The moisture content of minimally processed pineapple at 0, 3rd, 5th days were 85.87±0.06, 85.36±0.40 , 84.57±0.28 respectively. The mean values of moisture content of minimally processed cabbage at 0, 3rd, 5th day was 91.12±0.06, 90.32±0.06, 89.36±0.19 respectively. The F values is 15.675 for pineapple and 145.103 for cabbage. A significant difference was observed in the moisture content of pineapple and cabbage during storage. The results showed that the moisture content of minimally processed pine apple and cabbage was decreased during storage periods. It might be due to loss of water content or due to collapse of injured cells at the cut surface, loss of water content during preparation of fresh cut fruits.

pH of minimally processed fruits and vegetables during storage periods

The data in the Table 4 shows that the mean values of pH of minimally processed pineapple and cabbage during different storage periods. The mean values of pH of minimally processed pineapple at 0, 3rd, 5th days were 3.48±0.03, 3.20±0.00, 3.00±0.000 respectively. The mean values of pH of minimally processed cabbage at 0, 3rd, 5th day was 6.73±0.21, 6.00±0.00, 5.70±0.00 respectively. The F values are 637 for pineapple and 58.692 for cabbage. A significant difference was observed in the pH of pineapple and cabbage during storage. The results

Table 3. Moisture content of minimally processed pine apple and cabbage during different storage periods

Minimally processed fruits and vegetable	Mean ± SD			FValue	Sig
	0 Day	3 rd Day	5 th Day		
Pine apple	85.87±0.06	85.36±0.40	84.57±0.28	15.675	0.004*
Cabbage	91.12±0.06	90.32±0.06	89.36±0.19	145.103	0.000*

Note: P value < 0.05 significant at 0.05% level

*Significant at 0.05% level

showed that the pH value of minimally processed pineapple and cabbage was decreased during storage periods. It might be due to storage temperatures, method of packaging of minimally processed food (i.e., modified atmospheric packaging, vacuum packaging), amount of acid content in fruits and vegetables and amount of CO₂ content.

Acidity of minimally processed fruits and vegetables during storage periods

The data in the Table 5 shows that the mean values of acidity of minimally processed pineapple and cabbage during different storage periods. The mean values of acidity of minimally processed pineapple at 0, 3rd, 5th days were 0.13±0.01, 0.10±0.00, 0.08±0.00 respectively. The mean values of acidity of minimally processed cabbage at 0, 3rd, 5th day was 1.10±0.01, 1.02±0.01, 0.99±0.01 respectively. The F value is 196.000 for pineapple and 145.500 for cabbage. A significant difference was observed in the pH of pineapple and cabbage during storage. The results showed that the acidity of minimally processed pineapple and cabbage was decreased during storage periods.

Microbial Quality of Minimally Processed Fruits and Vegetables

In the present study, the microbiological quality of minimally processed fruits and vegetables, i.e. cabbage and pineapple were analyzed and the Tpc and yeasts / molds content present in the samples were analyzed and observed during storage periods.

The data in the Table 6 shows that the mean values of Total Plate Count of minimally processed

pineapple and cabbage during different storage periods. The mean values of TPC of minimally processed pineapple at 0, 3rd, 5th days were 5626.67 ± 88.08, 200090.00 ± 52.92, 5883333.33 ± 104083.30 respectively. The mean values of TPC of minimally processed cabbage at 0, 3rd, 5th day was 3153.67 ± 288.96, 198666.67 ± 1154.70, 5300000 ± 264575.13 respectively. The F values are 9260.000 for pineapple and 1160.077 for cabbage. A significant difference was observed in the total plate count of minimally processed pineapple and cabbage during storage. The results in the table show that Total Plate count of minimally processed pineapple was increased during storage periods. The reasons for increase of in Total Plate Count content was might be due to Inadequate employee hygiene during processing operations, Higher susceptibility to microbial spoilage, Increased respiration rate and ethylene production, which is stimulated by wounding of the tissues in fact, the processes operations (i.e cutting, splicing etc) form lesions in the tissues that determine enzymatic browning, texture decay, rapid microbial growth, thus reducing the shelf life and Coarse and abrasion peelings increase the microbial content over that of hand peeling.

Yeasts/molds of minimally processed fruits and vegetables during storage periods

The yeasts and molds count of minimally processed pineapple and cabbage during storage period is presented in Table 7.

The data in the Table 7 shows that the mean values of yeasts / molds of minimally processed pineapple and cabbage during different storage periods. The mean values of yeasts / molds of minimally processed pineapple at 0, 3rd, 5th days

Table 4. pH of minimally processed pineapple and cabbage during different storage periods

Minimally processed fruits and vegetable	Mean ± SD			F Value	Sig
	0 Day	3 rd Day	5 th Day		
Pine apple	3.48±0.03	3.20±0.00	3.00±0.00	637	0.000*
cabbage	6.73±0.21	6.00±0.00	5.70±0.00	58.692	0.000*

Note: P value < 0.05 significant at 0.05% level; *Significant at 0.05% level

Table 5. Acidity of minimally processed pineapple and cabbage during different storage periods

Minimally processed fruits and vegetable	Mean ± SD			F Value	Sig
	0 Day	3 rd Day	5 th Day		
Pine apple	0.13±0.01	0.10±0.00	0.08±0.00	196	0.000*
cabbage	1.10±0.01	1.02±0.01	0.99±0.01	145.50	0.000*

Note: P value < 0.05 significant at 0.05% level; *Significant at 0.05% level



Fig. 2. TPC Count at 0 and 5th day of cabbage



Fig. 3. TPC Count at 0 and 5th day of Pineapple

were 786.67 ± 5.77 , 8433.33 ± 57.54 , 84000.00 ± 1000.00 respectively. The mean values of yeasts / molds of minimally processed cabbage at 0, 3rd, 5th day was 700 ± 0.00 , 7525.00 ± 114.56 , 7525.00 ± 114.56 , respectively. The F values is 18975.991 for pineapple and 8386.003 for cabbage. A significant difference was observed in the Yeast / molds of pineapple and cabbage during storage. The results in the Table 8 show that yeasts/molds count of minimally processed pine apple was increased during storage periods. The reasons for increase of yeasts/molds content might be due to Inadequate

employee hygiene during processing operations. Higher susceptibility to microbial spoilage, Increased respiration rate and ethylene production, which is stimulated by wounding of the tissues in fact, the processes operations (i.e cutting, splicing etc) form lesions in the tissues that determine enzymatic browning, texture decay, rapid microbial growth, thus reducing the shelf life, Molds and yeasts may be introduced during growing season from the environment or from handling fruit, Potential preharvest sources like soil, faces, irrigation water, insects are potential sources of contamination.

SUMMARY AND CONCLUSION

Minimal processing gives additional value to fresh-cut fruit in terms of convenience and time saving, although several handles are encounter due to the difficulty in preserving their freshness during prolonged periods. These products, in fact, are characterized by a shorter shelf life than their whole counter parts, because of higher susceptibility to microbial spoilage, increased respiration rate and ethylene production, which is stimulated by wounding of the tissue, in fact, the process operations (i.e., cutting, splicing etc.) form lesions in the tissue that determine enzymatic browning, texture decay, rapid microbial growth, weight losses and undesirable volatile production, thus reducing the shelf life.

Hence the present study is carried out to analyze the physiochemical and microbial parameters of minimally processed fruits and vegetables, available in local markets of Tirupati. Market Survey and consumer survey was carried out to known the

Table 6. Total plate count (cfu/g) of minimally processed pineapple and cabbage.

Minimally processed fruits and vegetables	Mean +- SD			F Value	Sig
	0	3 rd Day	5 th Day		
Pine apple	5626.67±88.08	200090.00±52.92	5883333.33±104083.30	9260	0.000*
Cabbage	3153.67±288.96	198666.67±1154.70	5300000±264575.13	1160.077	0.000*

Note: P value < 0.05 significant at 0.05% level; *Significant at 0.05% level

Table 7. Yeast / Molds (cfu/g) of minimally processed pineapple and cabbage

Minimally processed fruits and vegetables	Mean ± SD			F Value	Sig
	0	3 rd Day	5 th Day		
Pine apple	786.67±5.77	8433.33±57.54	84000.00±1000.00	18975.991	0.000*
cabbage	700±0.00	7525.00±114.56	57000.00±1000.00	8386.003	0.000*

Note: P value < 0.05 significant at 0.05% level; *Significant at 0.05% level

maximum availability and consumption of minimally processed fruits and vegetables in local areas of Tirupati. The physio-chemical parameter includes moisture, pH, acidity of cabbage and pineapple were analyzed. The microbial parameters i.e., TPC (Total Plate Count) and yeast/moulds count was analyzed for minimally processed fruits and vegetables, i.e., pineapple and cabbage respectively from the market survey it was observed that, only small quantities of minimally processed fruits and vegetables are available which includes minimally processed cabbage, pineapple, cauliflower, sprouted seeds, mixed vegetables. Consumer Survey was carried out to know the maximum consumption and the most frequently consumed fruits and vegetables in local areas of Tirupati was observed that the consumption of sprouted seeds and individually processed cabbage and cauliflowers was high. In the physiochemical parameters, the moisture content of minimally processed pineapple and cabbage was decreased during different storage periods. The pH and acidity was decreased during different storage periods. The microbial parameters, i.e., TPC and yeasts/moulds content was increased both for pineapple and cabbage during different storage periods.

Due to the increasing demand for convenience foods from consumers, the market share of pre-packaged fresh cut fruits and vegetables and sprouts on supermarket shelves was increased dramatically in the last several years. Plant products such as fresh cut vegetables, generally have an image as healthy foods and form an important part of a healthy nutritious diet. However the occurrence of several large scale out breaks of food borne illness affecting thousands of consumer has highlighted the potential risks associated with these products. The results obtained have demonstrated that the microbiological quality of fresh cut fruits and vegetables, sprouts, sold in Tirupati is poor. Hence to ensure the safety of these products in to the future, it is critical that food safety control measures are effectively implemented.

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