# Effect of Pretreatments on Nutritional Quality of Minimally Processed Jackfruit Bulbs During Storage

**Ipsita Banerjee[1], Uma ghosh[2]**
[1, 2] Dept of Food Technology and Biochemical Engineering
[1, 2] Jadavpur University
Kolkata-700032

***Abstract-*** *Jackfruit (Artocarpus heterophyllus L.) is an important fruit that is generally consumed as a fresh fruit. A minimal process was carried out to investigate the effect of pre-treatments of fresh-cut jackfruit bulbs using additives such as ascorbic acid, citric acid, $CaCl_2$ and sodium benzoate in combination with mild acidified conditions for storage at low temperature. Pre-treated samples showed a restricted loss of around 25%, 17%, 58%, and 36% for total phenolics, antioxidants, vitamin C and total carotenoid respectively at the end of 21 days of storage. Among all pre-treatments the best result showed by sample pre-treated with ascorbic acid.*

***Keywords***- Fresh- cut jackfruit, pre-treatment, total phenolics, antioxidants, vitamin C, Carotenoid

## I. INTRODUCTION

Jackfruit (*Artocarpus heterophyllus* L.) is a fruit belongs to the family Moraceae and is grown in the tropical part of India. The fleshy, fibrous bulb of this fruit is rich in sugar, carotenoids, carbohydrates, minerals, carboxylic acids, dietary fibre, and vitamins such as vitamin C[1]. Carotenoid is responsible for the attractive yellow colour of the ripe bulbs[2]. The phytochemicals such as vitamin C, polyphenol, flavonoids of jackfruit shows health promoting effects. They act as natural antioxidants which inhibit oxidation-induced degenerative changes in cell. The fruit deteriorates rapidly upon ripening. So it is desirable that pre cut bulbs are processed and stored by an appropriate method. Pre-cutting of jackfruit bulbs increases oxidative stress and they tend to lose keeping quality, significant reduction of phytochemicals, such as phenolics, flavonoids, vitamin C, and carotenoids[3]. Introduction of additives during minimal processing has been reported, to minimise these deteriorative changes in fresh-cut fruits and vegetables[4]. Additives such as citric acid, ascorbic acid and calcium chloride, sodium benzoate at minimum level during minimal processing of pre cut bulbs have been found beneficial in minimizing the stress-induced metabolism, reduction of nutrient loss, reducing the browning reaction along with shelf-life extension[5]. Several studies have been conducted for various minimally processed produces such as apricot, apple, pear etc but very limited works were reported on post-harvest technology of jackfruit bulbs by minimal processing.

Therefore the objective of this work is to find out the effect of additives on nutritional quality of pre-cut jackfruit bulbs.

## II. MATERIALS AND METHODS

Ripe jackfruits were purchased from local market. After cutting the jackfruit yellowish bulbs were removed seeds were separated and used for further studies. Surface sanitized with 100 ppm chlorinated water[6]. Bulbs were cut in slices. Half of the fruits undergo a secondary phytosanitation wash in chilled chlorinated water (30 ppm) for 5 min. Then slice were separately dipped in solution containing $CaCl_2$ (0.05%, 1%, 2% w/v), sodium benzoate (0.01%, 0.02%, 0.05% w/v), Ascorbic acid (0.01%, 0.02%, 0.03% w/v) and Citric acid (0.5%, 1%, 1.5% w/v). Another part washed with water and used as untreated. Excess water drained of both pretreated and untreated samples. Then samples were packed in sealed polyethylene pouches and kept in low temperature for storage study.

**Total phenol content:**

Total phenolic content was determined by folin-ciocalteu method[7]at a wavelength of 765 nm using gallic acid standard and expressed as mg of gallic acid/g of fruit.

**Antioxidant content:**

Antioxidant content was determined by FRAP method and the value expressed as mg of ascorbic acid /g fruit[8].

**Vitamin C content:**

Ascorbic acid was determined by titrimetric method[9] and the value expressed as mg of ascorbic acid /100 g fruit.

**Total carotenoid:**

Carotenoid content was measured according to the process described by Saxena et al., 2009[6]. The absorbance was measured at 450nm. The value expressed as mg/100g.

$$\text{Total carotenoid (mg/100g)} = \frac{A(450) * \text{volume made up (ml)} * 1000}{2500 * \text{sample wg (g)}}$$

## III. RESULTS AND DISCUSSION

Generally jackfruit is available in market as separated bulb which is extremely susceptible to oxidative stress which results loss of important nutrients. Therefore some additives such as citric acid as anti respiratory agent, $Cacl_2$ as texturing substance, sodium benzoate as preservative and ascorbic acid as a supplement may be used to reduce the adverse excessive loss of nutrients due to pre-cutting process[10].

Table 1 Characteristics of jackfruit bulb

| Analysis | Jackfruit |
|---|---|
| TSS ($^0$B) | 22±0.36 |
| Moisture (%) | 72±0.60 |
| Total Phenol(mg/g) | 0.75±0.06 |
| Ascorbic acid (mg/100 g) | 8.32±0.93 |
| FRAP(mg/g) | 0.5±0.035 |
| Carotenoid (mg/100 g) | 1.336±0.21 |

**Total phenol content of jackfruit bulb during storage:**

It was observed from fig.1 that total phenol content decreases during storage in both pretreated and untreated samples. Pretreated samples showed lower loss of total phenol than untreated sample shows higher degree of degradation during storage. The pretreatments extended the shelf life and increased retention of total phenol by decreasing the oxidative stress[11]. Samples pretreated with ascorbic acid retained maximum amount of total phenol (0.557 mg/g) after 21 days of storage. Similar finding were observed by Saxena et al[6]. This was followed by citric acid 0.492 mg/g. The decrease in Total phenol during storage of fresh-cut jackfruit could be results of enzymatic degradation by peroxidase (POD) and PPO activities. Generally POD is responsible for oxidation of polyphenols[12]. POD can cause membrane damage and oxidative stress[13].Ascorbic acid and citric acid can restricted the action of polyphenoloxidase enzyme[14], they act as anti respiratory agent.

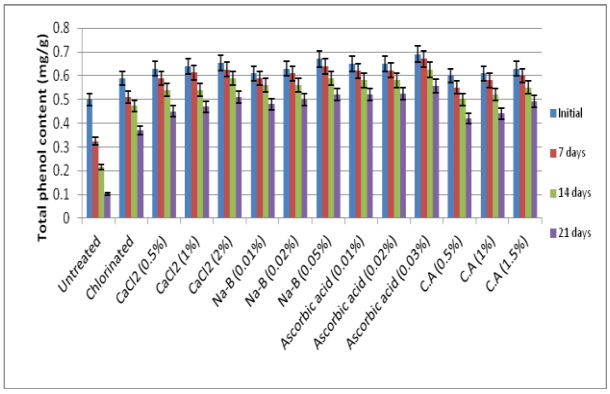


**Fig .1 Total phenol content of fresh cut jackfruit during storage**

**Antioxidant content of jackfruit bulb during storage:**

Fig.2 shows the degradation of antioxidant of pretreated and untreated samples. After 21 days of storage the untreated sample retained only 0.06 mg/g antioxidant. Whereas pretreated with ascorbic acid (conc 0.03%) contain 0.413 mg/g and citric acid 0.392 mg/ g which were followed by sodium benzoate and $Cacl_2$. Cutting of jackfruit bulb cause physiological stress that cause loss of phytochemical components which are responsible for antioxidant activity[15].Addition of ascorbic acid during pretreatment can retained maximum amount of antioxidant.

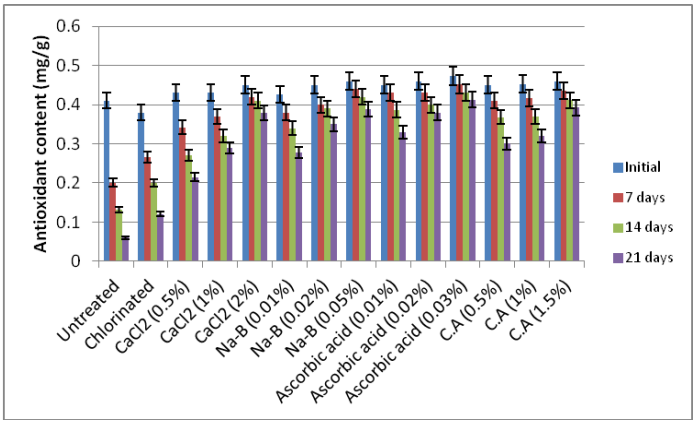


**Fig .2: antioxidant content of fresh cut jackfruit during storage**

**Vitamin C content of jackfruit bulb during storage:**

Vitamin C plays an important role as antioxidant. The oxidative stress introduce during fresh cut jackfruit cause degradation of vitamin C. Results shows that the addition of ascorbic acid during pretreatment retained maximum amount of vitamin C could be the result of vitamin C oxidation into dehydroascorbic acid. The untreated sample showed a rapid loss of vitamin C content during storage. Results were closely resembles with other research work[6, 14].

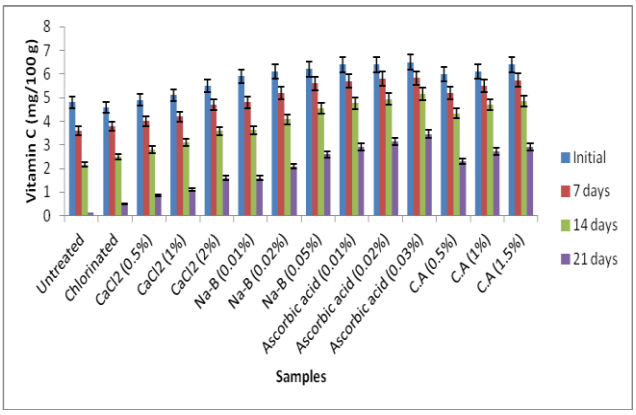


**Fig.3: Vitamin C content of fresh cut jackfruit during storage**

**Total carotenoid of jackfruit bulb during storage:**

Carotenoids are potential antioxidant but they are very susceptible to oxidative degradation. Study revealed from fig.4 that pretreated samples contain higher amount of carotenoid than untreated sample. Pretreatment with ascorbic acid could minimize the carotenoid loss by preventing carotenoid oxidation[16], which was followed by pretreated sample with calcium chloride ($CaCl_2$). That might be due to their role as radical scavenger and reducing agent in prevention of browning[17].Pretreated with ascorbic acid contain 1.28 mg/100g carotenoid at the initial stage and 0.85 mg/100 g after 21 days of storage.

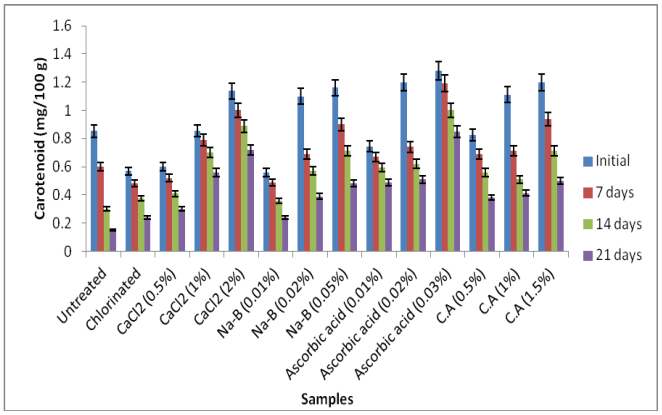


**Fig .4: Carotenoid content of fresh cut jackfruit during storage**

## IV. CONCLUSION

Pretreatment showed positive effect in pre cut fresh jackfruit during storage. Pretreatment can act as antirespiratory agents that minimize loss of nutrients such as vitamin C, polyphenols, and antioxidant, carotenoid. Among all pretreatments addition of ascorbic acid showed better results than others. Such assessment of polychemical status in processed foods, i.e., minimally-processed product, can help the modern health-conscious consumer.

## V. ACKNOWLEDGMENT

Authors greatly acknowledge University Grant Commission (UGC), New Delhi for their financial assistance.

## REFERENCES

[1] M. A. Rahman, N. Nahar, M. A. Jabbar, and M. Mosihuzzaman, "Variation of carbohydrate composition of two forms of fruit from jack tree (*Artocarpus heterophyllus* L.) with maturity and climatic conditions," in Food Chemistry, vol. 65,pp. 91–97, 1999.

[2] A. Saxena, A. S. Bawa, and P. S. Raju, "Optimization of a multitarget preservation technique for jackfruit (Artocarpus heterophyllus L.) bulbs", in Journal of Food Engineering, vol. 91, no 1, pp. 18–28 , 2009.

[3] P. A. Biacs, B. Czinkotai, and A. Hoschke, "Factors affecting stability of coloured substances in paprika powders", in Journal of Agriculture and Food Chemistry, vol. 40, pp. 363–367, 1992.

[4] P. S. Raju, and A. S. Bawa, "Food additives in fruit processing", in Y. H. Hui (Ed.), Handbook of fruits and fruit processing, Oxford: Blackwell Publishing, pp. 145–170, 2006.

[5] R.C. Soliva-Fortuny, M.N. Grigelmo, J. Hernando, M.A. Lluch, O. Martin-Belloso, "Effect of minimal processing on the textural properties of fresh-cut pears", in Journal of Science of Food and Agriculture, vol. 82, pp. 1682–1688, 2002.

[6] Alok Saxena, A.S. Bawa, P.S. Raju, "Phytochemical changes in fresh-cut jackfruit (*Artocarpus heterophyllus* L.) bulbs during modified atmosphere storage", in Food Chemistry, vol. 115, 1443–1449, 2009.

[7] V. L. Singleton and J. A. Rossi, "Colorimetry of total phenolics with phosphomolybdic -phosphotungestic acid reagents", in Am J Enol Viticult.vol. 16, pp. 144-153, 1965 .

[8] I.F. Benzie, J.J. Strain, "The ferric reducing ability of plasma (FRAP) as a measure of "antioxidant power": The FRAP assay", in Anal Biochem, vol. 239, no. 1, pp.70-76, 1996.

[9] S. Rangana, "Handbook of analysis and quality control for fruit and vegetable products", 2nd ed, pp. 105-106, 1986.

[10] A. Lopez-Malo, E. Palou, J. Welti, P.Corte, A. Argaiz, "Shelf stable high moisture papaya minimally processed by combined methods" in Food Research International, vol.27, pp.543–553, 1994.

[11] A. Saxena, A. S. Bawa, and P. S. Raju, "Use of modified atmosphere packaging to extend shelf-life of minimally processed jackfruit (Arotocarpus heterophyllus L.) bulbs", in Journal of Food Engineering", vol.87, no.4, pp.455–466, 2008.

[12] D. S. Robinson, "Peroxidases and catalases in foods", in D. S. Robinson, & N. A. M. Eskin (Eds.), Oxidative enzymes in foods, London New York: Elsevier Applied Science, pp. 1–45, 1991.

[13] G.Oms-Oliu, I. Odriozola-Serrano, R. Soliva-Fortuny, and O. Martin-Belloso, "The role of peroxidase on the antioxidant potential of fresh-cut 'Piel de Sapo' melon packaged under different modified atmospheres", in Food Chemistry, vol. 106, pp. 1085–1092, 2008.

[14] E. Cocci, P. Rocculi, S.Romani and M. Dalla Rosa, "Changes in nutritional properties of minimally processed apples during storage", in Postharvest Biology and Technology, vol.39, pp.265–271, 2006.

[15] M. M. Lana, and L. M. M. Tijskens, "Effect of cutting and maturity on antioxidant activity of fresh-cut tomatoes", in Food Chemistry, vol.97, pp.203–211, 2006.

[16] A. Z. Mercadante, and D. B. Rodriguez-Amaya, "Effects of ripening, cultivar differences, and processing on the carotenoid composition of mango" in Journal of Agriculture and Food Chemistry, vol.46, pp.128–130, 1998.

[17] P.Varela, A. Salvador, S.M. Fiszman, "The use of calcium chloride in minimally processed apples: a sensory approach", in European Food Research and Technology, vol. 224, pp. 461–467, 2007.