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RESEARCH ARTICLE

Effect of Processing on Nutritional Composition and Physio-chemical Properties of Papaya

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Abstract

Fruits provide necessary nutrition supplements to our body, improve the body condition and provide perfect supplement for hormonal imbalance. Consumption of yellow-orange coloured fruits prevent vitamin A deficiency (VAD) related night blindness. 'Papaya' being a yellow-orange coloured fruit, has high amount of carotenoids and is considered to be a rich source of antioxidants. For increasing the availability of the fruits throughout the year, various processing techniques are being used over the past many years. Processing inactivates the enzymes, modifies the texture and preserves the color, flavour and nutritional value of the fruits. Blanching is one of the processing techniques generally used prior to freezing, canning or drying. The present study was an attempt to process papaya using blanching and microwave drying techniques and then analyse its nutritional composition and physio- chemical properties. The findings of nutritional composition revealed that the, moisture content of only microwave dried papaya and that of blanched + microwave dried papaya showed insignificant difference. Fibre, ash, calcium and â carotene nutrients content found to be significantly increased on blanching but Protein, fat, carbohydrate and vitamin C content, found to be reduced significantly on blanching. Further, physio-chemical properties findings revealed that blanching process gives insignificant difference on pH value. On the other hand, titrable acidity and bulk density found to be reduced significantly on blanching process. The results revealed that blanching helps in retention of nutrients and physio- chemical properties.

Keywords

Blanching, Carotenoids, Microwave Drying, Papaya, Physio-Chemical Properties

Introduction

Papaya (*Carica papaya* L.) is a member of the Caricceae family and is grown in every tropical and subtropical country. It is sweet and juicy, though with some muskiness and is spherical or pear shaped fruit that can be as long as 20 inches. The flesh of papaya is of rich orange color with either yellow or pink hues. The fruit contains papain, an enzyme that helps in digesting proteins. This enzyme is present in high concentration when the fruit is unripe. Papaya ranks highest, per serving, among fruits for its carotenoid content (Cho *et al*, 2004). It is a rich source of several antioxidants, such as carotenoids, vitamin C, flavonoids, B vitamins, folate, pantathonic acid, potassium and magnesium. Together, these nutrients promote the health of the cardiovascular system and also provide protection against colon cancer by clearing away the infection, pus and mucus. The fruit also helps in preventing constipation and aids in digestion. It is low in calories and high in nutritive value, hence it is an excellent food for those on a diet (Aravind *et al*, 2013). However, being highly perishable, 20-40 per cent of their total production goes waste from the time of harvesting till they reach the consumers. It is, therefore, necessary to make them available for consumption throughout the year in processed or preserved form and to save the sizeable amount of losses. Keeping this in view the present study has been undertaken, wherein; effect of processing on nutritional quality as well as on physio-chemical properties of papaya fruit was studied.

Material and Method

For the present study, variety of papaya - Red Lady, was procured from the International Horticulture Innovation and Training Centre, Durgapura, Jaipur, Rajasthan. After procurement, the fruit was washed, peeled cut into slices of 30mm width and then subjected to two sets of processing - one, where the fruit slices were blanched and then dried using microwave oven and second, where the fruit was only microwave dried, without being blanched.

Under the first set of processing, blanching of papaya slices was done by dipping them in a water bath at 90°C

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for 1 minute and then by dipping them in cold water (10-12°C) for 20 seconds (Yan *et al*, 2010). Thereafter, the blanched fruit slices were taken out and surface water on the slices was removed using a piece of clean cloth. After this the slices were grated using appropriate steel grater. It was observed that the blanching process improved the texture of the slices, which made the grating process easier. After grating, the fruit was dried in a microwave oven at 100°C temperature for about 1 hour and 40 minutes (Sagar and Suresh, 2010). For the other set of processing, the fruit was cleaned, peeled, grated and then finally dried in microwave oven for same time period and temperature as for the first set of process (Sagar and Suresh, 2010).

Nutritional Composition Analysis

The unprocessed and processed papaya nutritional composition were analysed by standardized biochemical for macro and micro nutrients. The analysis of macronutrients - moisture (g/100g), protein (g/100g), ash (g/100g), fiber (g/100g), fat (g/100g) and carbohydrate content (g/100g), was carried out using standard methods given by AOAC, 2005. Content of micronutrients, -carotene (UV spectrophotometer method) and calcium (Titration method) was analysed as per methods given by Raghuramunu, 2003 and vitamin C content by titration method (Sharma, 2007).

Analysis of Physio - Chemical Properties

The titrable acidity of the fruit was estimated by titrametric method (AOAC, 2005), pH was analysed using pH meter (AOAC, 2005) and bulk density by using formula of bulk density, i.e. weight of sample (g) / sample volume (cm^3) (Okaka and Potter, 1979).

Statistical Analysis

The nutrient data and physio-chemical properties of unprocessed and processed papaya fruit was analysed by applying various statistical tests, *viz*. Mean, Standard deviation and paired t- Test at 0.05 level (Gupta, 2008).

Results and Discussion

The results of nutritional composition analysis of processed papaya (blanched + microwave dried and only microwave dried) are presented in Table 1. The findings revealed moisture content of only microwave dried papaya (90.23±0.1 g/100g) and that of blanched + microwave dried papaya (90.64±0.03g/100g) to be almost same with insignificant difference ($p<0.05$) level. Researchers Adeniji and Tenkouano, 2008 too studied effect of processing on proximate composition of banana hybrid pulp and peel mixture; their results revealed blanching to cause no effect on moisture content of banana pulp which is in accordance to the present study. The protein content of papaya reduced (0.04±0.008g/100g) on processing (blanched + microwave dried papaya), which was found to be significant at 5% level of significance. Also, fat content (0.56±0.42g/100g) of microwave dried papaya reduced on processing (blanching + microwave drying) (0.34 ±0.13g/100g) and here also the difference was found to be significant. A study carried out by Akter *et al* , 2010, revealed that fat content of persimmons peel powder decreased in blanched peels in comparison to those that were only dried. Also, carbohydrate content (5.82 ±2.49g/100g) in papaya, which was only microwave dried, was found significantly higher in comparison to that which was blanched + microwave dried (2.47±0.94g/100g). Similar findings have been reported by Puupponen-Pimia *et al,* 2003, where due to blanching the amount of carbohydrate decreased in both fruits and vegetables. Akter *et al*, 2010 too reported carbohydrate content of persimmons peel powder to decrease due to blanching process. Contrary to this, ash content (5.42 ±0.8g/100g) to increase significantly ($p<0.05$) on processing (blanched + microwave dried) than that which was only microwave dried (0.45±0.14g/100g). Fiber content (2.03±0.97g/100g) too, was found to be high significantly in papaya that was blanched + microwave dried than the unprocessed fruit (only microwave dried) (0.45±0.18g/100g). Puupponen-Pimia *et al,* 2003 conducted a study on effect of blanching on the nutrient content of over 20 vegetables and found that blanching had either no effect, or in some cases slightly increased the available amounts of dietary fiber in vegetables.

Table 1. Effect of Processing on Nutritional Composition of Papaya

S.No.	Nutrients	Microwave dried papaya	Blanched + Microwave dried papaya
1.	Moisture (g/100g)	90.23±0.1	90.64±0.039
2.	Protein (g/100g)	0.05±0.01	0.04±0.0089 *
3.	Fat (g/100g)	0.56±0.42	0.34±0.13 *
4.	Ash(g/100g)	1.06±0.8	5.42±0.76 *
5.	Fiber(g/100g)	0.45± 0.18	2.03±0.97 *
6.	Carbohydrate(g/100g)	5.82±2.49	2.47±0.94 *
7.	Calcium (mg/100g)	15.96±0.28	16.40±0.80*
8.	β-carotene (µg/100g)	405±5.07	520±13.41 *
9.	Vitamin C (mg/100g)	11.05±0.39	10.59±0.27 *

Nutrient values are expressed as mean ± standard deviation. Values having stearic superscript within same row are significantly different ($p < 0.05$)

The micronutrients of the processed papaya when analyzed biochemically, revealed α - carotene (520

±13.41µg/100g) and calcium (16.40±0.80mg/100g), to be significantly higher in papaya which had undergone processing (blanched and microwave drying), and vitamin C (11.05±0.39mg/100g) content to be more in the fruit that was only microwave dried. All vitamins are either fat-soluble or water-soluble. Blanching helps to protect fat-soluble nutrients from breaking down, but in the process, some water-soluble nutrients are lost. Ascorbic acid (vitamin C) being particularly sensitive to thermal treatment, such as blanching, breakdown easily under exposure to heat (Rickman, 2007). This could be one of the reasons for reduced vitamin C content in the present study in papaya sample that had undergone blanching process. On the other hand, blanching seems to be helpful in retention of α-carotene in the fruit which is also in accordance to a study carried out by Negi and Ray, 2000. Their results showed blanching technique to retain more α-carotene content in leafy vegetables in comparison to non blanched leaves because of colour fixation and enzymes inactivation. Puupponen-Pimia *et al*, 2003 too found carotenoids to be resilient to blanching process. Another study conducted by Ndawula *et al*, (2004) showed higher retention of α σ-carotene in blanched cowpea leaves and mango fruit than in non blanched samples of theirs. Kyureghian *et al*, (2010) conduct a study on nutritional comparison of frozen and non frozen fruits and vegetables, revealed that calcium is not lost by leaching out due to water blanching because calcium is bound to the plant tissue and sometimes can even be taken up by fruits and vegetables during blanching by the hard water.

Table 2. Effect of Processing on Physio-chemical Properties of Papaya

S. No.	Physio-chemical Properties	Microwave dried papaya	Blanched + Microwave dried papaya
1.	pH	6.5±0.07	6.7±0.07
2.	Titrable acidity (%)	12.1 ±0.83	11.42 ±0.14*
3.	Bulk density(gcm^{-3})	0.87 ±0.03	0.76±0.008*

Nutrient values are expressed as mean ± standard deviation. Values having stearic superscript within same row are significantly different (P<0.05).

The estimation of physio-chemical properties of microwave dried + blanched and only microwave dried papaya fruit samples are shown in Table 2. The titrable acidity (11.42±0.14%) was found to have decreased significantly in processed (blanched + microwave dried) papaya samples than in that which was only microwave dried (12.1±0.83%). The pH value (6.7±0.07), on the other hand, did not differ significantly in processed (blanched + microwave dried) papaya and the unprocessed papaya sample (microwave dried papaya) (6.5±0.07). Rossi *et al*, 2003 had reported a non significant effect of blanching on pH value and titrable acidity in blue berry fruit samples. However, bulk density (0.87 ±0.03 gcm^{-3}) of microwave dried papaya sample was found to be significantly different than that which was blanched as well as microwave dried (0.76 ±0.008 gcm^{-3}). The value for the same was found to decrease on processing. In a study by Chethana *et al*, 2002 revealed little effect on bulk density of wheat and rice flours, on application of heat treatment.

Conclusion

Nutrient analysis of papaya fruit, pre (microwave drying) and post processing (blanching + microwave drying), revealed significant increase in the content of fibre, ash, calcium and â carotene nutrients on blanching. Protein, fat, carbohydrate and vitamin C content, on the other hand, reduced significantly post processing. Moisture, however, did not show much difference on blanching. Further, the physio-chemical properties of the fruit, on processing (blanching), revealed insignificant change with regard to pH value, whereas, the bulk density and titrable acidity reduced significantly on processing.

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