Comparative nutritional quality evaluation of different cultivars of papaya

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ABSTRACT

Two cultivars of papaya fruits i.e. seeded and seedless were analyzed for their physico-chemical and nutritional constituents. The parameters studied were weight, length, colour, peel percentage, proximate composition, sugars, pH, acidity energy value and vitamin C content. Results of study revealed the cultivar differences were there in the physico-chemical and nutritional constituents of papaya fruit cultivars. The physical characteristics viz; length, weight, diameter, and peel percentage was higher in the seeded variety. Whereas, edible portion, crude protein, ash, crude fat and crude fiber, TSS, acidity, energy, β-carotene, total sugars and ascorbic acid were higher in the seedless papaya except moisture which was in higher amount in seeded cultivar of papaya. High amounts of the edible portion, low content of peel and seeds indicates enormous potential of seedless papaya fruit for the commercial exploitation.

Key words: Edible portion, Peel percentage, Proximate composition, pH, Seeded papaya, Seedless papaya, TSS, Vitamin C, β-carotene.

INTRODUCTION

India is the second most important fruit producing country in the world. India produced 82.631 million tonnes of fruit in 2014-15 while China topped the list with 154.364 million tonnes (Anonymous 2016). About 10.4 per cent of all the fruits and 40 per cent of the tropical fruits of the world are produced in India. Fruit production has increased steadily mainly as a result of supply of chain policy incentives (Vennila, 2007). Nature has been abundantly generous to Himachal Pradesh in endowing it with conditions conducive for growing of large variety of fruits that is why it is known as fruit bowl of India. Papaya is one of the important fruit crop of Himachal Pradesh, mainly produced in lower hills. 212 hectare area is under cultivation of papaya with the total production of 1106 metric tonnes (Anonymous, 2016).

Papaya (Carica papaya), popularly known as wonder fruit of tropics, belongs to family caricaceae (Aruna et al., 1998). Papayas are the fourth most traded tropical fruit following bananas, mangoes, and pineapples. Approximately 75 percent of the world’s papayas are produced in only ten countries. India leads the world in papaya production followed by Brazil, Indonesia, Nigeria, and Mexico. Papaya tree is a large, quick growing, soft stemmed plant. The fruits can be harvested with in a year (Chauhan and Chatterjee, 2005). According to NHB (2014), papaya production in India was 5639 thousand tons from 133 thousand hectares of land with an average yield of 42.3 ton/ha. Papaya is a very wholesome fruit ranks second only to mango as a source of beta carotene. It is a good source of natural sugars, vitamin C and also contains fair amounts of calcium and phosphorus (Saravanan et al., 2004). It is low in calories and has got medicinal value. It has been used as a laxative since ancient times. It is used for the treatment of various digestive disorders, diabetes mellitus and is also effective in lowering blood cholesterol level (Cherian and Cheriyan, 2003). Although work has been done on the proximate composition of papaya fruit but much work has not been done on the comparative nutritional quality evaluation of seeded and seed less cultivars of papaya; So the present study was planned to study the physicochemical composition of papaya.

MATERIALS AND METHODS

The ripe and ripe papaya fruits of two varieties i.e. seeded and seedless were procured from the local market of Palampur and were sorted for the uniformity in colour, shape and size. The healthy and disease free fruits were selected for the study. The selected fruits were washed with distilled water to remove dust and adhering particles from the surface of the fruits and then the fruits were taken for the various analysis. Colour of the fruits was assessed by visual perception. The length and diameter of fruits were observed with the help of Vernier caliper, whereas weight was recorded in an electronic weighing balance. Fruits were cut, peeled and seeds were separated. The peel percentage was calculated taking the weight of the peel from the total weight of the fruit. Edible portion was determined by detecting the weight of the peel from the fruit weight.

The fruits were also analyzed for the proximate composition according to standard methods (AOAC, 1990), sugars, acidity, ascorbic acid (Ranganna, 1995), β carotene
(Roy, 1973) energy (O’shea and Maguire, 1962), TSS by the hand refractometer and pH by using a pH meter. The mineral elements i.e. sodium and potassium were assessed by the atomic absorption spectrophotometer whereas phosphorus was assessed by the method of Chen et al. 1956, iron by the method suggested by Piper (1950) and calcium by the method of Vogel (1962).

Data was analyzed statistically for ANOVA under CRBD using computer software.

RESULTS AND DISCUSSION

Data in Table 1 shows the results pertaining to various physical parameters and proximate constituents of the papaya fruit. The colour of unripe fruit of both cultivars was green which changed to orangish yellow with maturity. No variation in the colour among the two varieties was observed. The values for the length of the ripe fruits were 22.67 cm and 21.43 cm, respectively in the seeded and seedless variety of papaya. Similar results have also been reported by Khedar et al. (1980). A significantly (p<0.05) higher weight (813.33 g) was observed in case of the fruits of seeded variety as compared to the fruits of seedless variety in which the weight was 738.33 g. The values for the diameter were 38.47 cm in the seeded variety and 36.50 cm in the seedless variety. These findings are in conformity with the findings of the Khedar et al. (1980). The higher diameter of the fruits of the seeded variety might have been due to the varietal differences only. The edible portion of both the varieties was 77.96 and 85.76 per cent, respectively. This might be due to the reason that the seedless fruit has no seeds and also due to varietal differences. As is evident from the data that the peel percentage was 22.14 and 14.24 per cent in the seeded and seedless fruits respectively.

Table 1 represents the proximate composition of the papaya fruit of the seeded and seedless varieties. The moisture content of the fruit was 92.69 and 90.89 per cent. This might have been due to the increase in the sugar content and TSS of the fruits which bounded the free water of the fruits and hence reduced the moisture content. Chauhan and Chatterjee (2005) reported 88.50 per cent moisture in the ripe papaya fruits.

The crude protein was 0.71 and 0.76 per cent, in the seeded and seedless varieties of papaya. Selvaraj and Pal (1982) observed similar observations in case of papaya fruit.

The crude fat content of the seeded and seedless variety of papaya was 0.12, 0.13 per cent, respectively. This might have been due to the varietal differences. The maturity of the fruits affected the fat content significantly. Chauhan and Chatterjee, (2005) reported 0.14 per cent fat in the papaya fruit.

The ash content of the fruits was 0.45, 0.47 per cent in the seeded and seedless papaya respectively. Chauhan and Chatterjee (2005) assessed 0.48 per cent ash in the papaya fruit which are in conformation with the results of the present investigation.

Data pertaining to the crude fibre shows that the lowest (1.03%) fibre content was observed in the seeded variety of the papaya, whereas the highest (1.19%) was recorded in the seedless papaya. These findings are in agreement with the findings of Srivastava (2003). While comparing the fibre content of both the varieties, the seedless variety has slightly higher fibre content than the seedless variety, which might be due to the varietal differences and agroclimatic conditions.

The results presented in the Table 2 show a significant variation in the TSS, pH, ascorbic acid, reducing, non reducing total sugars, energy and β carotene content of the fruit. The TSS of the papaya fruit was maximum 12.07 °B in the seeded variety followed by 11.80 °B in the seedless variety. These results are at par with the findings of the Chauhan and Chatterjee (2005).

Highest pH (5.65) was there in the fruits of the seeded variety. The fruits of the seedless variety had pH5.35. Chauhan and Chatterjee (2005) reported pH5.93, which was slightly higher than the present results.

A look at the data reveals that the acidity of the fruits was 0.27 and 0.28 per cent in the seeded and seedless variety of papaya, respectively. The results of the present investigation are in conformation to the results of Selvaraj and Pal (1982) who reported a gradual decline in the acidity of the papaya fruit with increase in the maturity.
Table 2: Chemical composition of papaya fruit

| Attribute                  | Seeded papaya | Seedless papaya | CD(Pd<0.05) |
|----------------------------|---------------|-----------------|-------------|
| TSS (°B)                   | 11.80         | 12.07           | 0.12        |
| pH                         | 5.65          | 5.35            | 0.06        |
| Ascorbic acid (mg/100g)    | 54.83         | 55.84           | 0.03        |
| Acidity (%)                | 0.27          | 0.28            | 0.04        |
| Non Reducing sugars (%)    | 2.12          | 1.97            | 0.03        |
| Reducing sugars (%)        | 8.31          | 8.94            | 0.03        |
| Total sugars (%)           | 10.43         | 10.91           | 0.03        |
| β-carotene (µg/100g)       | 1.06          | 1.07            | 0.01        |
| Calcium (mg/100g)          | 16.59         | 16.63           | NS          |
| Phosphorus (mg/100g)       | 12.57         | 12.61           | NS          |
| Sodium (mg/100g)           | 5.52          | 5.58            | NS          |
| Potassium (mg/100g)        | 68.41         | 68.47           | NS          |
| Iron (mg/100g)             | 0.48          | 0.50            | NS          |

The non-reducing sugars in case of the ripe papaya were 2.12 and 1.97 per cent, respectively. Similar observations have also been reported by Selvaraj and Pal (1982).

In between the two varieties the higher amount of the reducing sugars (8.94 %) were there in the seedless variety as compared to the seeded variety of the papaya (8.31 %). However, Singh and Rao (2005) reported 9.10 per cent reducing sugars in the shrink wrapped papaya fruits stored at 27-32 °C after ripening of the fruits.

The highest value 10.91 per cent for the total sugars was observed in the seedless variety of papaya, which was closely followed by 10.43 per cent, in the seeded papaya fruits. The findings of the present investigation are at par with those reported by Singh and Rao (2005).

The energy content of the ripe fruits was 24.00 and 30.00 Kcal/100g, respectively in the seeded and seedless variety. A slightly higher β-carotene content (1.07 mg/100g) was observed in the seedless variety fruits as compared to the seeded variety (1.06 mg/100g). Gopalan et al. in 2000 reported similar observation in the papaya fruit.

The maximum ascorbic acid content i.e. 55.84 mg/100g was there in the seedless papaya fruits followed by 54.83 mg/100g in the seeded papaya. The findings of the present investigation are at par with Wall (2006) and Ghanta (1994). Data presented in Table 2 shows the mineral content of the papaya fruit. The calcium content of the seed and seedless varieties was 16.59 and 16.63 mg/100g, respectively. These findings are in conformation with those reported by Gopalan et al. (2000).

A slightly higher phosphorus 12.61 mg/100 g was observed in the seedless papaya as compared to 12.57 mg/100g in the seeded papaya. Similar trend has also been observed by Srivastava (1998) and Gopalan et al. (2000). The sodium content of the fruits was 5.52 and 5.58 mg/100g in the seeded and seedless papaya which is in conformation with the results of the Gopalan et al. (2000).

The values for potassium were 68.41 and 68.47 mg/100g in the fruits of the seeded and seedless varieties. The findings of the present investigation were at par with those reported by Srivastava and Kumar (2003) and Gopalan et al. (2000).

The iron content of the fruits was 0.48 and 0.50 mg/100g in the seeded and seedless variety. Srivastava and Kumar (2003) and Gopalan et al. (2000) reported similar observations in the papaya fruit.

From the outcomes of the present investigation it can be concluded that papaya is not only a table fruit in our country but it has a great potential for the processing industry because it possesses high proportion of edible part with the lower content of peel and seeds and is also rich in TSS, vitamins, sugars, acidity, pH, mineral elements with a good sweet taste and appearance.

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