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Antioxidants in two varieties of Guava and Papaya fruits from Agasteeswaram Taluk, Kanyakumari District: a Comparative Study

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ABSTRACT

This study was conducted to compare the total polyphenolic content (TPC) and total flavonoid content (TFC) in two varieties of Guava and Papaya fruits from Agasteeswaram taluk in Kanyakumari District. Red and white flesh varieties of Guava, red and yellow flesh varieties of Papaya fruits were selected for investigation. The total poly phenol (TPC) content was determined by Folin-Ciocalteu's method while total flavanoid content (TFC) was estimated by aluminium trichloride colorimetric method. It was observed that the concentration of total polyphenol in guava fruit was three times greater than papaya fruit. The total flavonoid content in guava fruits was three times higher than the amount of the total flavonoids in papaya fruits. As the TPC and TFC are proportional to the antioxidant activity, it is observed that the antioxidant activity due to TPC lie in the order: white guava (3.355 µg/ml) > red guava (3.255 µg/ml) > red papaya (1.32 µg/ml) > yellow papaya (1.143 µg/ml) and the antioxidant activity due to TFC lie in the order: red guava (1.991 µg/ml) > white guava (1.663 µg/ml) > yellow papaya (0.795 µg/ml) > red papaya (0.584 µ g/ml).

Keywords: *poly phenol, Flavonoid, Guava, Papaya, antioxidant activity*

INTRODUCTION

An antioxidant is a molecule that inhibits the oxidation of other molecules. Oxidation is a chemical reaction that transfers electrons or hydrogen from a substance to an oxidizing agent. Oxidation reactions can produce free radicals. In turn, these radicals can start chain reactions. When the chain reaction occurs in a cell, it can cause damage or death to the cells. Antioxidants terminate these chain reactions by removing free radical intermediates and inhibit other oxidation reactions. They do this by being oxidized themselves, so antioxidants are often reducing agents such as thiols, ascorbic acid or polyphenols. These are found in various plant products including fruits, leaves, seeds, oils and juices[10, 24]. Many researchers around the world have been studying antioxidant activity in various foods, especially in grains, vegetables and fruits[25, 11]. Fruits are more interesting because they are rich in antioxidants and can be consumed on various occasions as fresh, dried, juice and other processed fruits. Total phenolics, flavonoids and flavanols of natural products and related to these compounds' antioxidant activity have a health protective effect[1, 23, 14, 27].

Guava (*Psidium guajava* L.), is grown commercially and in many home gardens in Kanyakumari District. The fruits vary in size, shape and flavour depending on the variety. On average, the fruit contains 74–87% moisture, 13–26% dry matter including 0.5–1% ash, 0.4–0.7% fat and 0.8–1.5% protein.[5] Guava, as in many other fruits and vegetables, is also rich in antioxidants that help to reduce the incidence of degenerative diseases such as arthritis, arteriosclerosis, cancer, heart disease, inflammation and brain dysfunction. In addition, antioxidants were reported to retard ageing[6, 7, 9] besides preventing or delaying oxidative damage of lipids, proteins and nucleic acids caused by reactive oxygen species.

Among the most abundant antioxidants in fruits are polyphenols and ascorbic acid. In the case of guava, free elagic acid and glycosides of myricetin and apigenin are found to be present[12]. The total polyphenol content include simple polyphenols, catechins, anthocyanins, glycosides of flavones, flavonols, isoflavones and flavanones, their aglycons, anthraquinones, chalcones and theaflavins. Phenolic compounds such as myricetin and apigenin,[18] ellagic acid and anthocyanins[19] are also at high levels in guava fruits. Ascorbic acid and phenolics are the major contributors to antioxidant activity in guava fruit[13].

Carica papaya (C. papaya) belongs to the family of *Caricaceae* and many species of *Caricaceae* have been used as medication against a variety of diseases [17]. Papaya fruits contain components that can increase the total antioxidant power in blood and reduce the liquid peroxidation level. These components include α-tocopherol, ascorbic acid, beta carotene, flavonoids, vitamin B_1 and niacin. It has been showed that phenolic compounds are the major bioactive phytochemicals related with human health benefits[3]. Many authors have reported a direct relationship between total phenolic content and antioxidant activity in numerous fruits and vegetables[28]. In view of the fact that several food components, i.e. carotenoids, vitamin C, vitamin E, phenolic compounds and their interactions contribute to the overall antioxidant activity of foods, it is difficult to measure total antioxidant activity on the basis of individual active components[21].

The purpose of the present study is to compare the total polyphenolic content (TPC) and total flavonoid content (TFC) in two varieties of Guava and Papya fruits from Agasteeswaram taluk in Kanyakumari District, as these are proved to have antioxidant properties.

MATERIALS AND METHODS

Sample preparation

The two varieties (red flesh and white flesh) of guava and two varieties (yellow flesh and red flesh) of Papaya were collected from the home gardens of Konam village. Konam is a village in Agasteeswaram Taluk, about five kilometers away from Nagercoil town in Kanyakumari District of south India. The Kanyakumari district lies at geographical co-ordinates between 77º 15’ and 77º 36’ east and 8º 03’ and 8º 35’ north. The respective fruit juices were extracted from the homogenized flesh of the fruits of each variety. The juice was separated from the pulp of each variety by pressing it several times and centrifuging. Fresh juices were analyzed for the total polyphnolic content and total flavonoids.

Estimation of total polyphenols

Quercetin, gallic acid and Folin-Ciocalteu reagent used were purchased from Sigma Aldrich Ltd. All other chemicals such as sodium carbonate, methanol, potassium acetate and aluminum chloride used were of analytical grade. Polyphenols in fruit juices were estimated on following the procedure of McDonald *et al*. [16]. Exactly 0.5 ml of the fruit juice was added to 4 ml sodium carbonate (1M) and 5 ml Folin-Ciocalteu reagent (1:10 dilution with distilled water). The solution was allowed to stand for 15 minutes and absorbance was measured at 750 nm using Double Beam Spectrophotometer 2203. A calibration plot was drawn using the values obtained in the following concentrations of gallic acid 125-830 µg/ml.

Estimation of total flavonoids

The total flavonoids in fruit juices were estimated by aluminum chloride colorimeteric method on following the procedure of Chang *et al*.[4]. Exactly 0.5 ml of the fruit juice was added to 4.3 ml methanol. To the above solution 0.1 ml of 10% $AlCl_3$ and 0.1 ml of 1 M potassium acetate were added. Absorbance at 428 nm was measured using Double Beam Spectrophotometer 2203 after allowing standing for 30 minutes. A calibration plot was drawn using the values obtained in various concentrations of quercetin 20-200 µg/ml.

RESULTS AND DISCUSSION

The food components like carotenoids, vitamin C, vitamin E, flavonoids, polyphenolic compounds and their interactions contribute to the overall antioxidant activity of foods. Therefore the total antioxidant activity is difficult to measure based on individual active component[15].

The factors such as fruit maturity, agro climate and post- harvest storage conditions are known to affect the content of polyphenols in fruits[2]. The determination of total phenolic compounds was included in this study because strong correlations between total phenolic ompounds and antioxidant activity in various kinds of fruits were found in previous studies[8, 22]. The constituents having the antioxidant activity such as the total polyphenolic content (TPC) and the total flavonoids of two varieties of papaya and guava were studied by estimating them. The amount of polyphenols and falvonoids were proportional to their antioxidant activity.

Total polyphenols in guava and papaya fruits

The observations obtained from absorbance 125-830 nm against concentrations of standard quercetin (polyphenols) and data are presented in table 1. The concentration of total polyphenols in guava and papaya fruit juice was determined from their absorption at 750 nm using spectrophotometer and the values are shown in Table 2. The concentration of total polyphenols in red guava (red flesh) was 3.255µg/ml and white guava (white flesh) 3.355 µg/ml. Aysun Ozkan *et al.* reported that there was a significant correlation between antioxidant capacity and total phenolics indicating that phenolics contributed to the antioxidant activity[2]. On comparing the total polyphenols in two varieties of guava indicated that the guava with white flesh contained slightly higher amount of total polyphenols than the guava with red flesh. This is in agreement with the findings of Thipong *et al.* (2005) that the antioxidant activity was greater in guava with white flesh than the red flesh variety[26].

The measured concentration of total polyphenols in red papaya was 1.32µg/ml and yellow papaya 1.143 µg/ml. On comparing the total polyphenols in two varieties of papaya showed that the papaya with red flesh contained higher amount of total polyphenols than the papaya with yellow flesh. On comparing the total polyphenols in two varieties of papaya showed that the antioxidant property in terms of total polyphenols in red papaya was higher than the yellow papaya. Therefore, the antioxidant activity due to total polyphenols was three times greater in guava than in papaya fruits.

Total flavonoids in guava and papaya fruits

The observations obtained from absorbance 20-200nm against concentrations of standard gallic acid ranging from 0. 044 µg/ml to 0.599 µg/ml and data are presented in table 3. The total flavonoids in two varieties of guava fruit juices and two varieties of papaya fruit juices were estimated from their absorption at 428 nm. The observed values are presented in table 4. The estimation of total flavonoids present in papaya and guava fruit juices from their absorption at 428nm showed that the highest concentration was found in guava with red flesh (1.991µg/ml) and the lowest concentration in papaya with red flesh (0.584µg/ml) Table 4.On comparing the total flavonoids in two varieties of guava, the guava with red flesh contained higher amount of flavonoids (1.991 µg/ml) than the guava with white flesh (1.663µg/ml). Therefore the antioxidant property of red guava was higher than the white guava since the antioxidant property is directly proportional to the concentration of total flavonoids. The concentration of total flavonoids in red papaya was 0.584 µg/ml and yellow papaya 0.795 µg/ml. On comparing the total flavonoids concentration in two varieties of papaya, the papaya with yellow flesh contained higher amount of total flavonoids (0.795 µg/ml) than the papaya with red flesh (0.584 µg/ml). It can be concluded that antioxidant property of yellow papaya was higher than the red papaya. On comparing the total flavonoids in selected guava and papaya fruits showed that the guava fruits contained higher concentration than papaya fruits. This observation is in agreement with the the observation made by Oruma *et al.*[20]. who studied the antioxidant activity and total phenolic compounds in various fruits and found out that the papaya fruit showed the lowest antioxidant activity and guava exhibited high levels of antioxidant activity.

Table 1: Absorbance of Quercetin (Standard) for different concentrations

Absorbance(nm)	Concentration (µg/ml)
125	1.174
200	1.181
250	1.438
333	1.684
555	1.974
625	2.874
830	2.926

Table 2: Concentration of total polyphenol in guava and papaya fruits

Sample	Absorbance (nm)	Concentration (µg/ml)
Red guava	913.5	3.255
White guava	949.85	3.355
Red papaya	211.99	1.320
Yellow papaya	250.51	1.143

Table 3: Absorbance of gallic acid (standard) for different concentrations

Absorbance(nm)	Concentration (µg/ml)
20	0.044
22	0.034
25	0.095
28.5	0.069
30	0.126
40	0.195
50	0.243
66	0.235
100	0.418
200	0.599

Table 4: Concentration of the total flavonoids in guava and papaya fruits

Sample	Absorbance (nm)	Concentration (µg/ml)
Red guava	637.05	1.991
White guava	531.76	1.663
Red papaya	180.50	0.584
Yellow papaya	258.99	0.795

CONCLUSION

In the present study, it is observed that the antioxidant activity due to total polyphenols lie in the order white guava 3.355µg/ml) > red guava (3.255 µg/ml) > red papaya (1.32 µg/ml) > yellow papaya (1.143 µg/ml). The antioxidant activity due to total flavonoids lie in the order: red guava (1.991µg/ml) > white guava (1.663 µg/ml) > yellow papaya (0.795 µg/ml) > red papaya (0.584 µg/ml).

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