Radical Scavenging Activity in Fruit Extracts

Piyawan Surinrut, Supannee Kaewsutthi and Ranee Surakarnkul
Department of Biochemistry
Faculty of Pharmaceutical Sciences
Chulalongkorn University
Bangkok 10330
Thailand

†Ramkhamhaeng University

Keywords: antioxidant, free radicals, DPPH

Abstract
Phytochemicals in plants, vegetables and fruits have been reported to prevent oxidative stress related diseases, such as cancer, cardiovascular disease, cataracts, brain and immune-system dysfunction and inflammation. Many plant phenolic flavonoids have been shown to have antioxidant activity. In our study, the polyphenolic content and the radical scavenging activity of a number of Thai fruit extracts were determined by Folin-Ciocalt eu reagent and scavenging of DPPH (2,2-diphenyl-1-picrylhydrazyl) radical respectively. We found that grape skins, mulberries, mango, carambola, guava and lichee possess strong activity to scavenge the DPPH radical (IC50 from 1.10 to 9.60 mg/ml). Moderate antioxidant activity was found in mangosteen, orange, pomelo, grapes and papaya (IC50 from 11.18 to 32.80 mg/ml). Low antioxidant activity (IC50 from 50.62 to 110.46 mg/ml) was found in orange juice, grape, rose apple and jackfruit.

INTRODUCTION
Active oxygen and related species: superoxide anion (O2−), hydroxyl radical (OH·), nitric oxide (NO), hydrogen peroxide (H2O2), lipid radical (L·), lipid peroxy radical (LO2·) and lipid alkoxyl radical (LO·) play a vital role in biological processes of energy production, phagocytosis and signal transduction (Borek, 1997). There is increasing evidence to show that active oxygen species may also play a causative role in various diseases such as atherosclerosis, ischemia reperfusion injury, inflammation, carcinogenesis, cataracts, brain dysfunction, immune-system decline, cardiovascular disease, and rheumatoid arthritis (Ames et al., 1993; Halliwell et al., 1994). Endogenous antioxidant enzymes, catalase, superoxide dismutase and glutathione peroxidase defend against oxidative damage caused by active oxygen and related radicals. In addition to the enzymatic antioxidant defenses, nutritional antioxidants in the diets may have protective effects to prevent oxidative stress related diseases (Ames et al., 1993). Low dietary intake of fruits and vegetables doubles the risk of most types of cancer as compared to high intake (Stahelin et al., 1991) and also markedly increases the risk of heart disease and cataracts (Hertog et al., 1993).

In our study, we determined the radical scavenging activity of 12 Thai fruits. These fruits are Vitis vinifera (grape), Morus alba (mulberry), Mangifera indica (mango), Averrhoa carambola (carambola), Psidium guajava (guava), Litchi chinensis (lichee), Garcinia mangostana (mangosteen), Citrus aurantium (orange), Citrus maxima (pomelo), Carica papaya (papaya), Eugenia javanica (rose apple), and Artocarpus heterophylla (jackfruit).

MATERIALS AND METHODS
Fresh fruits were obtained from local supermarkets. After the fruits were cleaned with tap water and air dried, the edible portion was weighed, chopped, and homogenized. The homogenate was then extracted with appropriate solvents (Singh et al., 2002). The suspension was separated by centrifugation at 7,000 rpm for 10 min. The supernatant was
used for the quantitative determination of the polyphenolic content by Folin-Ciocalteu method (Kahkonen et al., 1999) and for DPPH radical scavenging activity (Abe et al., 1998).

Supernatant of the fruit extract (0.25 ml) was mixed with 15 ml of distilled water, 1.25 ml of Folin-Ciocalteu reagent (Merck) and 3.75 ml of Na2CO3 (200 g/l). The mixture was measured at 765 nm after 1 hour at 20°C. Gallic acid was used as a standard and the total phenolics were expressed as GAE (gallic acid equivalents) in milligrams per gram wet weight of fruits.

The free radical scavenging activity of the fruit extract was analyzed by using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay. Briefly, dilutions of fruit extract (2 ml) were mixed with a 0.5 mM DPPH (1 ml) and distilled water (2 ml). After standing at room temperature for 30 min, the absorbance at 517 nm was measured. The percentage of DPPH scavenging activity is expressed by \[1 – (\text{test sample absorbance/control absorbance})\] x 100. The quality of the radical scavenging property of the fruits was determined by calculating the IC50. The IC50 value is the concentration of each fruit extract required to scavenge the DPPH radical to 50% of the control.

RESULTS AND DISCUSSION

The total polyphenolic content in fruits varied widely and ranged from 6.0 ± 0.21 to 236.4 ± 16.58 mg GAE/g wet weight. High levels (>50 mg/g GAE) were found in grape skins, mulberries, carambola, and orange. Moderate levels (20-50 mg/g GAE) were found in guava, lichee, mango, mangosteen, pamel, and orange juice. Low levels (<20 mg/ g GAE) were found in jackfruit, papaya, grapes, and rose apple.

The ability of fruit extracts to scavenge the DPPH radical measured as IC50 varied significantly from 1.10 to 110.46 mg/ml. Grape skins, mulberries, mango, carambola, guava, and lichee showed high antioxidant activity with their IC50 from 1.10 to 9.60 mg/ml. Fruits with moderate antioxidant activity (IC50 from 11.18-32.80 mg/ml) were found in mangosteen, orange, pomelo, grapes, and papaya. Low levels of antioxidant activity (IC50 from 50.62-110.46 mg/ml) were found in orange juice, grape, rose apple, and jackfruit (Fig. 1).

Our data suggests an inverse correlation between the amount of polyphenolic and the value of IC50. This implies that polyphenolic compounds in fruits might contribute to their radical scavenging activity.

CONCLUSIONS

Our observation demonstrates that several Thai fruits such as mulberries, carambola and guava are good sources of dietary antioxidants as determined by the chemical DPPH radical scavenging assay. However, the ability of these fruits to protect cell components from oxidative damage remains to be investigated.

ACKNOWLEDGEMENTS

We would like to thank the Ministry of University Affairs, Bangkok, Thailand for granting this research project and to Mr. W. Kaewruang, Sericultural Research Institute, Department of Agriculture, Ministry of Agriculture and Cooperative, Bangkok, Thailand for assistance in collection of mulberries.

Literature Cited


**Figures**

Fig. 1. Radical scavenging activity in fruits.