

Antioxidant activity of Tomato skin, seeds and pulp

Tomato is a versatile vegetable that is consumed fresh as well as in the form of processed products. More recently, there has been renewed attention given to the antioxidant content of tomatoes because many epidemiological studies suggested that regular consumption of fruits and vegetables, including tomatoes, can play an important role in preventing cancer and cardiovascular problems. Approximately one-third of the total weight of tomatoes in the form of skin and seeds is discarded during processing of tomatoes into paste.

Researchers from New Zealand studied the major antioxidants and antioxidant activity in different fractions (skin, seeds and pulp) of three tomato cultivars ('Excell', 'Tradiro' and 'Flavourine') grown under hydroponic conditions in a commercial greenhouse in New Zealand. It was found that the skin fraction of all cultivars had significantly ($P < 0.05$) higher levels of total phenolics, total flavonoids,

lycopene, ascorbic acid and antioxidant activity compared to their pulp and seed fractions. The amount of antioxidants in each fraction was calculated on the basis of their actual fresh weights in whole tomato and it was found that the skin and seeds of the three cultivars on average contributed 53% to the total phenolics, 52% to the total flavonoids, 48% to the total lycopene, 43% to the total ascorbic acid and 52% to the total antioxidant activity present in tomatoes. These results show that removal of skin and seeds of tomato during home cooking and processing results in a significant loss of all the major antioxidants. Therefore, it is important to consume tomatoes along with their skin and seeds, in order to attain maximum health benefits.

This study suggests that the skin and seed fractions of tomato are a very rich source of antioxidant compounds and the incorporation of the skin and seeds fraction during home consumption or processing

could lead to about a 40-53% increase in the amount of all the major antioxidants in the final product. Therefore, removal of these fractions during home cooking or processing results in a loss of their potential health benefits. By adopting slight changes during processing, the antioxidant and nutrient composition of the final products can be increased, and a valuable reserve of antioxidants would be optimally utilized. The results of this study will also be of value in designing a unit on-site for the extraction of lycopene and other antioxidants from the tomato processing wastes. The skin and seed fractions of tomatoes could also be used as a value added ingredient in other food products. Along with a diet rich in other plant produce, tomatoes, and their skins and seeds, could play an important role in improving antioxidant intake in the human diet [Toor Ramandeep K and Savage Geoffrey P, Antioxidant activity in different fractions of tomatoes, *Food Res Int*, 2005, **38** (5), 487-494].

Textural change and antioxidant properties of Broccoli under different cooking treatments

Variation in cooking treatment can profoundly affect both the texture and the nutritional value of vegetables. Many studies have revealed that most vegetables precooked at a moderate temperature 50-80°C for a suitable period of time and subsequently cooked in boiling water showed greater firmness than those cooked directly without precooking. Broccoli (*Brassica oleracea* Linn. var. *italica* Plenck) was used as a testing material and sampled in four groups, including fresh, precooked (50°C, 10 min), cooked (boiling, 8 min), and precooked followed by cooking (precooked + cooked), to investigate the effect of the cooking treatment

on the textural change in the vegetable by Taiwan scientists. The antioxidant properties of the extracts from the four groups were also estimated and compared with those of α -tocopherol and butylated hydroxyanisole (BHA). The data indicated that, after cooking in boiling water for 8 min, the broccoli tissue had a 51% relative peak force of the fresh tissue, whereas the tissue, after precooking at 50°C for 10 min, and the tissue, after precooking + cooking, had relative peak forces of 172% and 119%, respectively, of the fresh tissue. These results revealed that cooked tissue with precooking softens more slowly than that without precooking. The extracts from the precooked, cooked, and

precooked + cooked broccoli exhibited high reducing powers. These extracts also exhibited high DPPH radical-scavenging activity, at 96.8, 97.3, 98.6 and 97.9%, respectively, for the fresh, precooked, cooked, and precooked + cooked samples, at a sample-to-solvent ratio of 20 mg/ml. This study indicated that a precooking and/or cooking treatment had no profound effect on the antioxidant properties of broccoli [Lin Chun-Hsien and Chang Chi-Yue, Textural change and antioxidant properties of broccoli under different cooking treatments, *Food Chem*, 2005, **90**(1-2), 9-15].

Developing crop coefficients for field-grown Tomato under drip irrigation with black plastic mulch

Vegetable production is mostly practiced by Jordanian farmers using plastic mulches and trickle irrigation systems. This practice is suitable and successful in Jordan, both in open fields or under green houses due to its benefits in conserving the scarce irrigation water resources. Effect of both mulching and localized irrigation on crop water use is an important area of study for successful irrigation management. Crop coefficients were, and still to be, a major topic of study for any researcher concerned in crop water requirements under different environments and agricultural practices.

A 2 years field study was conducted by researchers at Biosystems Engineering Department, Jordan University of Science and Technology, Jordan to develop crop coefficients for field-grown tomato (*Lycopersicon esculentum* Mill.), a major irrigated crop in the Jordan Valley, under drip irrigation system with black plastic

mulch. The area of the study field was 1.5ha surrounded by many similar tomato fields. Actual crop evapotranspiration (ET_c) was measured using eddy covariance technique which distinguishes this study from other previous studies conducted in the Jordan Valley that relied on the old indirect approach for ET_c estimation based on the soil water balance. Grass reference evapotranspiration (ET_0) was determined by using the FAO Penman-Monteith method utilizing the agrometeorological parameters measured at the study site. The crop coefficient (K_c) was determined as the ratio of ET_c to ET_0 . The tomato crop coefficients were determined following the FAO crop coefficient model. The average crop coefficient during the midseason growth stage ($K_{c_{mid}}$) was 0.82 which is far below the adjusted FAO crop coefficient of 1.19 by about 31%. Also, the late season crop coefficient ($K_{c_{end}}$) was much lower than the adjusted FAO crop coefficient

of 0.76 by about 40%. Moreover, the weighted average crop coefficient over the entire growing season ($K_{c_{GS}}$) was 0.69, which is about 36% lower than the FAO corresponding value. In fact, the low K_c values obtained reflect the effect of practicing both localized drip irrigation and plastic mulch covering. This study showed that there is a big difference between the reported FAO crop coefficients and the one measured in the field using a precise approach. These exact updated values of crop coefficients will enhance future estimation of crop water requirements and hence irrigation management of tomato crop which is the major irrigated crop in the Jordan Valley [Amayreh Jumah and Al-Abed Nassim, Developing crop coefficients for field-grown tomato (*Lycopersicon esculentum* Mill.) under drip irrigation with black plastic mulch, *Agric Water Manag*, 2005, 73 (3), 247-254].

Effect of freeze-chilling on the quality of cooked green beans and carrots

Ready-meals are items of convenience and life styles, and are consumed predominantly by one-person households, working couples, and increasingly by the elderly. Chilled ready-meals are perceived to be of better quality than frozen meals. One of the main problems with chilled ready-meals, however, is their relatively short shelf-life, and frozen ready-meals are bought more often due to their longer shelf-life. Freeze-chilling of food involves freezing and frozen storage followed by thawing and chilled storage.

The effect of freeze-chilling on the quality of cooked green beans and carrots

was examined by Redmond and others. They also studied the effect of long and short-term frozen storage prior to thawing. Three process treatments were used in the short-term trial; chill, freeze-chill and freeze. The products were tested for firmness, colour, centrifugal drip loss, total viable count (TVC) and taste panel acceptability. Results showed that freeze-chilling and freezing led to softer cooked carrots ($P < 0.001$) than chilling. However, freeze-chilling and freezing had no effect on the texture of cooked green beans ($P > 0.05$) but led to significantly higher drip losses than chilling ($P < 0.001$). Freeze-chilling and chilling led to paler green beans

but this was not reflected in the taste panel acceptability scores. No difference in TVC was found between any of the process treatments for cooked carrots or green beans. In general, frozen storage (-25°C) for up to 12 months had no effect on firmness, drip loss, colour, total viable count or sensory acceptability of freeze-chilled cooked carrots and green beans compared to freezing [Redmond GA, Gormley TR and Butler F, The effect of short- and long-term freeze-chilling on the quality of cooked green beans and carrots, *Innov Food Sci Emerg Technol*, 2004, 5 (1), 65-72].