BIOCHEMICAL STUDIES ON PHENOLIC COMPOUNDS OF BROCCOLI AND SWEET FENNEL VARIETIES

By

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B.Sc. Agric. Sci. (Biochemistry), Fac. Agric., Zagazig Univ., 1994
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APPROVAL SHEET

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SUPERVISION SHEET

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ABSTRACT

A field experiment was carried out to study the effect of organic and bioorganic fertilizers on growth parameters yield and the quality of two broccoli cultivars (*Calabrese* and *Southern star*) and two sweet fennel cultivars (*Dolce* and *Zefa fino*). Bio-organic fertilizer gave better results for all vegetative growth parameters for *Southern Star* and *Zefa fino* cultivars. Total phenolics (TPC), total flavonoids (TFC), total glucosinolates (TGs) and vitamin C (Vit C) were almost higher in *Calabrese* and *Dolce* cultivars as a result of organic fertilizer application. The antioxidant activities of both plants were evaluated and *Calabrese* and *Dolce* cultivars showed the highest $DPPH^{\cdot}$ scavenging activity expressed as IC_{50}. In addition, *Calabrese* and *Dolce* cultivars showed the highest chelating power activities when organic fertilizer was applied.

The HPLC analysis of methanolic extracts of broccoli and sweet fennel showed the presence of many phenolics and flavonoids in variable levels. Gallic acid, chlorogenic acid, 3,5-dimethoxybenzyl, *P*-cumaric, quercetin, kampferol and eugenol were found as the most abundant consistuents in broccobi. While, the highest content of phenolic compounds content of sweet fennel were Pinostrobin, Pyrogallic acid, Chlorogenic acid, Protocatechuic acid, Salicylic acid and Rutin. Other compounds showed different concentrations depend on the cultivar and the type of fertilization treatment.

The hepatoprotective effect of methanolic extracts of broccoli and sweet fennel cultivars in a dose 100 and 200 mg/kg BW compared with silymarin as a reference agent at the same doses were evaluated against CCl_4-induced liver injury. Methanolic extracts of broccoli and sweet fennel were restorated and reversed the liver injury (CCl_4-induced hepatotoxicity) in rats.

The results indicated that there is a good margin for enhancing antioxidant compounds of broccoli and sweet fennel for economic production by using organic fertilization. The study indicated the potential application of broccoli and sweet fennel as potent natural sources of antioxidants and hepatoprotective agents.

Key words: Broccoli, sweet fennel, antioxidant activity, organic fertilizer, bio-organic fertilizer, phenolics, HPLC and hepatoprotective effect

DEDICATION

I dedicate this work to whom my heart felt thanks; to soul of my parents, my wife, my daughters, my brothers and my sister for their patience, help and for all the support they lovely offered along the period until now.

Also, I dedicate this work for my spiritual mother in my work and my life Dr. Zeinab Hanem Abd El-Rahman Salama.

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In recent years, increasing attention has been paid to the role of diet in human health. This is mainly attributed to the health promoting effect of fruit and vegetables. Several epidemiological studies have indicated that a high intake of fruits and vegetables is associated with a reduced risk of a number of chronic diseases, such as cancer and heart diseases (Law and Morris, 1998; Gosslau and Chen, 2004).

These protective effects are generally attributed to the presence of bioactive compounds such as phenolics, flavonoids, glucosinolates, vitamin C and minerals which possess antioxidants activity. Many of these compounds have bioactive mechanisms for scavenging reactive oxygen species (ROS) and reducing cell proliferation in cancer cell (Kris-Etherton *et al*., 2002). Vegetables belonging to cruciferous family (broccoli, cauliflower, cabbage and turnip) have high antioxidant activity.

Broccoli has been a favorite test vegetable for several researchers due to its potential antioxidant properties (Zhang and Hamauzu, 2004; Piao *et al*., 2005). It is considered a significant source for phenolics such as sinapic acid and caffiec acid derivatives and flavonoids (Vallejo *et al*., 2003a). Broccoli also is considered a significant source of sulforaphane glucosinolates, a phytochemical that is believed to have strong anticarcinogenic properties (Beecher, 1994).

Sweet fennel (*Foeniculum vulgare*) belongs to family *Apiaceae* (*Umbelliferae*), which well known as annual vegetable,