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P172. TRONCHUDA CABBAGE (*BRASSICA OLERACEA* L. VAR. *COSTATA* DC) SEEDS: PHENOLIC COMPOUNDS AND ANTIOXIDANT POTENTIAL

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Abstract

Tronchuda cabbage (*Brassica oleracea* L. var. *costata* DC) seeds were studied for their phenolic composition and antioxidant capacity. Thirteen compounds were characterized and quantified by reversed-phase HPLC-DAD-MS/MS-ESI and HPLC-DAD, respectively: two sinapoylgentiobiose isomers, three sinapoylglucose isomers, kaempferol-3-(sinapoyl)sophorotrioside-7-glucoside, sinapoylcholine, kaempferol-3,7-diglucoside-4'-(sinapoyl)glucoside, three disinapoylgentiobiose isomers, 1,2,2'-trisinapoylgentiobiose and 1,2-disinapoylglucose. The aqueous extract of tronchuda cabbage seeds was investigated for its capacity to act as a scavenger of DPPH radical and reactive oxygen species (superoxide and hydroxyl radicals and hypochlorous acid), exhibiting antioxidant capacity in a concentration dependent manner against all radicals.

Introduction

Brassicaceous plants represent one of the major vegetable crops grown worldwide, constituting an important part of a well balanced diet. *Brassica oleracea* is a native of the Mediterranean region and southwestern Europe, extending northward to southern England. Horticultural selection within the species has led to the development of a number of cultivars and, although essentially temperate, *Brassica oleracea* forms are today grown for food everywhere that plants can grow.

Tronchuda cabbage (*Brassica oleracea* L. var. *costata* DC) is especially popular in Portugal, having a determinant role in the Portuguese diet and agricultural systems. Several studies with other *Brassica* species reported the existence of phenolics in the seeds. These compounds have been considered as UV screens in young seedlings and have been associated with seedling vigour, height and weight. In this work, tronchuda cabbage seeds were studied for their phenolic composition and antioxidant capacity.

Materials and Methods

Extraction. 6.0 g of powdered tronchuda cabbage seeds were boiled for one hour in 600 mL of water and then filtered over a Büchner funnel. The resulting extract was lyophilized.

HPLC-DAD-MS/MS-ESI qualitative and HPLC-DAD quantitative analysis. The extract was analyzed as previously reported [1].

Antioxidant activity. DPPH, superoxide radical and hypochlorous acid scavenging activities, effect on xanthine oxidase activity and hydroxyl radical assay were performed according to described procedures [1].

Results and Discussion

Thirteen phenolic compounds were characterized and quantified by reversed-phase HPLC-DAD-MS/MS-ESI and HPLC-DAD, respectively: two sinapoylgentiobiose isomers, three sinapoylglucose isomers, kaempferol-3-(sinapoyl)sophorotrioside-7-glucoside, sinapoylcholine, kaempferol-3,7-diglucoside-4'-(sinapoyl)glucoside, three disinapoylgentiobiose isomers, 1,2,2'-trisinapoylgentiobiose and 1,2-disinapoylglucose (Fig. 1).

The seeds exhibited a high content of phenolic compounds (ca. 6.0 g/kg), being 1,2-disinapoylgentiobiose the compound present in highest amounts, representing ca. 17% of total phenolics, followed by kaempferol-3-(sinapoyl)sophorotrioside-7-glucoside and 1-sinapoylglucose, which corresponded to 15 and 12% of total compounds, respectively.

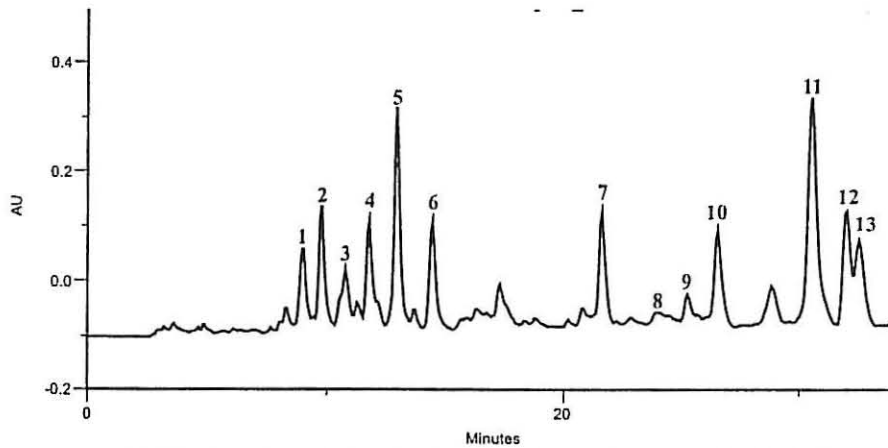


Fig. 1. HPLC-DAD phenolic profile of tronchuda cabbage seeds aqueous lyophilized extract. Detection at 330 nm. Peaks: (1) sinapoylgentiobiose; (2) 1-sinapoylglucose isomer; (3) sinapoylgentiobiose isomer; (4) 1-sinapoylglucose isomer; (5) 1-sinapoylglucose; (6) kaempferol-3-(sinapoyl)sophorotrioside-7-glucoside; (7) sinapoylcholine; (8) kaempferol-3,7-diglucoside-4'-(sinapoyl)glucoside; (9) 1,2-disinapoylgentiobiose isomer; (10) 1,2-disinapoylgentiobiose isomer; (11) 1,2-disinapoylgentiobiose; (12) 1,2,2'-trisinapoylgentiobiose; (13) 1,2-disinapoylglucose.

In the present study the lyophilized extract of tronchuda cabbage seeds displayed a strong concentration-dependent antioxidant potential against DPPH ($IC_{25} = 64 \mu\text{g/ml}$).

Seeds extract scavenged enzymatically-generated superoxide radical in a concentration dependent way, with an IC_{25} at $197 \mu\text{g/ml}$, and no effect was noticed on xanthine oxidase activity. The capacity of the extract to scavenge superoxide radical in a concentration-dependent manner was confirmed when this radical was generated by a chemical system, which indicated an IC_{25} at $118 \mu\text{g/ml}$.

The tronchuda cabbage seeds lyophilized extract also appeared to be a potent scavenger of hydroxyl radical generated by a Fenton system, in a concentration dependent manner ($IC_{25} = 4 \mu\text{g/ml}$). The extract showed to be an effective substitute of ascorbic acid for concentrations higher than $1.9 \mu\text{g/ml}$. Thus, it seems that, at the tested concentrations, tronchuda cabbage seeds have both anti-oxidant and pro-oxidant effects, with the first being more pronounced than the latter. The extract also displayed a concentration-dependent ability to chelate iron ions, with an IC_{10} at $12 \mu\text{g/ml}$.

Tronchuda cabbage seeds lyophilized extract exhibited a concentration-dependent protective activity against HOCl damage ($IC_{10} = 87 \mu\text{g/ml}$).

The protective effect observed in the antioxidant assays is not surprising once seeds often contain the highest concentration of lipids of any plant tissue, with high levels of polyunsaturated fatty acids. The occurrence of high amounts of phenolic compounds, particularly of hydroxycinnamic derivatives, in tronchuda cabbage seeds suggests that these compounds protect storage lipids from oxidation.

In conclusion, tronchuda cabbage seeds may constitute a good source of health promoting compounds. The high content of phenolic compounds may be important for the resistance of these seeds to downy mildew and insect pests, as they are known to exert a protective role against parasite attack.

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Reference

- [1] Ferreres *et al.* (2006) *Food Chem.* (in press).