



Recovery of bioactive compounds from germinated lentils (*Lens culinaris* L.): effect of different extractions on their antioxidant properties.

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Abstract

Germination is considered to be an efficient method to modify the biological properties of different types of grain. Thus, the aim of this work was to analyse the effects of different extractions using distilled water and ethanol (99.5%) on the recovery of bioactive compounds from germinated lentils and on their antioxidant properties. The antioxidant properties were evaluated using the DPPH-radical scavenging (DPPH), reducing power assay (RPA) and ABTS-radical scavenging (ABTS) methods. The bioactive substances determined included the contents of total phenolic compounds, flavonoids and condensed tannins.

Key words:

Germination, Lentil, Antioxidant activity.

Introduction

Legumes are grains rich in proteins, carbohydrates, fibers and vitamins, besides containing substances with antioxidant properties, such as phenolic compounds and peptides, in which interest is increasing due to their ability to decrease the adverse effects of free radicals. In order to modify the biological and nutritional properties of grains, germination has been used as a process that enhances the digestibility of the nutrients in the organism, reduces the content of antinutritional compounds and increases the biological properties of the grain. Thus, the aim of this study was to evaluate the antioxidant properties and the phenolic compounds content of germinated lentil extracts obtained by aqueous and ethanolic extraction.

Results and Discussion

The results for the antioxidant activities in the different concentrations using aqueous and ethanolic extractions are shown in Tables 1 and 2, respectively. Pearson's Correlation Analysis was applied and a positive correlation was observed between the antioxidant activities and the sample concentrations.

Table 1: Antioxidant activities of the aqueous extracts obtained from germinated lentils

[mg/mL] ¹	DPPH (%)	[mg/mL] ¹	RPA (abs) ²	[mg/mL] ¹	ABTS (%)
1.00	11.51 ^c	9.0	0.20 ^c	1.25	24.55 ^d
1.25	18.62 ^{b,c}	11.5	0.24 ^b	1.50	27.57 ^c
1.50	25.92 ^{a,b}	13.0	0.28 ^a	2.00	37.97 ^b
1.75	29.73 ^a	15.0	0.30 ^a	2.50	49.70 ^a

¹[mg/mL] = sample concentration; ²abs = absorbance.

Table 2: Antioxidant activities of the ethanolic extracts obtained from germinated lentils

[mg/mL] ¹	DPPH (%)	[mg/mL] ¹	RPA (abs) ²	[mg/mL] ¹	ABTS (%)
20	17.36 ^e	50	0.11 ^d	2.0	13.66 ^c
25	21.40 ^{d,e}	75	0.13 ^c	2.5	16.87 ^b
35	25.49 ^{c,d}	90	0.15 ^b	3.0	17.22 ^b
50	29.14 ^c	100	0.16 ^a	5.0	26.28 ^a

¹[mg/mL] = sample concentration; ²abs = absorbance.

Pearson's Correlation Analysis indicated a positive and significant correlation (p -value < 0.05) between the antioxidant activities and the sample concentrations. The solvent used in the extraction of the bioactive compounds had a crucial role in the recovery of the bioactive compounds and antioxidant properties of each extract. Aqueous extraction was considered to be more adequate than ethanolic extraction. The values were expressed in mg of gallic acid or catechin equivalents per gram of sample. The maximum values obtained for DPPH-radical scavenging were 29.73% at 1.75 mg/mL and 29.14% at 50 mg/mL for the aqueous and ethanolic extracts, respectively. ABTS-radical scavenging reached maximum values of 49.70% at 2.5 mg/mL and 26.28% at 5 mg/mL for the aqueous and ethanolic extracts, respectively. Increases in the absorbance in the reducing power assay (RPA) indicate increases in antioxidant activity, and the highest values were detected at 15 and 100 mg/mL for the aqueous and ethanolic extracts, respectively (Tables 1 and 2). With the exception of the flavonoids, extraction using distilled water was more efficient in the recovery of the bioactive compounds (Table 3).

Table 3: Bioactive compounds obtained from germinated lentils by aqueous and ethanolic extraction

Extraction	Total Phenolics (GAE/g) ¹	Flavonoids (CE/g) ²	Condensed Tannins (CE/g) ²
Aqueous	5.49	0.44	2.23
Ethanolic	0.35	0.62	0.14

¹GAE = gallic acid equivalents; ²CE = catechin equivalents.

Conclusions

The results obtained in this study showed that aqueous extraction allowed for a greater recovery of the phenolic compounds from germinated lentils, which was positively correlated with their antioxidant properties. Although, the ethanolic extracts showed similar antioxidant activities as compared to the aqueous extracts, the sample concentration required to reach the same order of biological activity was considerably higher.