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# Chemical composition, total phenolic, flavonoids content, and antioxidant activity of *Nigella Damascena*

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**Abstract:** This research aimed to study the chemical composition, with an emphasis on the content of mineral salts, polyphenols and flavonoids from seeds of the of *N. Damascena* (ND) plant. Antioxidant activity was also found highest with 75% methanolic extracts. ND being a good source of antioxidants might be recommended against the treatment of various human ailments

## • Introduction

*Nigella Damascena* (Figure 1) is part of the spontaneous flora of the Mediterranean regions, North Africa and Asia. In Romania, it grows either spontaneously as a weed in sowing fields or on sunny hills, or it is cultivated as an ornamental plant, especially in the south of the country. The plant grows up to 60 cm high, has a simple or branched stem, hairy, with upward growth. The leaves are alternate, divided, with lacinate elements, narrow, linear and long. The flowers are solitary, having white petals with a blue-green tip and they bloom in May-August. The fruits are follicles, forming capsules with 5 spiny elements at the top, which house numerous triangular, black and wrinkled seeds. It is widely cultivated and used, both for its healing properties and in culinary art for over 2000 years. *Nigella Damascena* seeds have no aroma, but when they are ground or chewed, they develop a smell similar to that of oregano. The taste is bitter, hot and a little smoky. They can be used whole or ground. In our country, the most well-known use is in flavoring Telemea cheese.



Figure 1: *Nigella Damascena* Flowers, Seeds

## • Material and method

The fatty acid content (as methyl esters) of the seeds oil was determined by GC- MS; analysis.

The mineral compounds in examined plant materials were analyzed by AAS method using an Analytik Jena novAA 350i apparatus.

Total phenolic content was assessed by Folin-Ciocalteu method;

The content of flavonoids was measured spectrophotometrically by using the  $AlCl_3$  assay.

Free radical scavenging activity of the extracts was evaluated by DPPH assay.

## • Results and discussions

The radical scavenging activity, using a DPPH generated radical, is presented in Table 3. It was observed that 75% methanolic extract exhibited the highest radical scavenging activity ( $93.19 \pm 1.76\%$ ), followed by 60% ethanolic ( $82.04 \pm 1.55\%$ ), 80% methanolic ( $81.96 \pm 1.78\%$ ), 100% methanolic ( $77.30 \pm 1.95\%$ ), 75% ethanolic ( $77.22 \pm 1.46\%$ ), aqueous ( $73.49 \pm 1.38\%$ ), and 20% methanolic ( $70.57 \pm 1.11$ ) extract. 20% ethanolic extract showed the weakest activity ( $65.35 \pm 1.75\%$ ).

Table 3: Antioxidant activity of NS seed extracts

Solvents	DPPH free radical scavenging activity (%)
100% Aqueous	73.49 ± 1.38c
20% ethanol (20:80 v/v ethanol-water)	65.35 ± 1.75a
60% ethanol (60:40 v/v ethanol-water)	82.04 ± 1.55e
75% ethanol (75:25 v/v ethanol-water)	77.22 ± 1.46d
100% ethanol (100:00 v/v ethanol-water)	69.38 ± 1.96
20% methanol (20:80 v/v methanol-water)	70.57 ± 1.11b
60% methanol (60:40 v/v methanol-water)	86.16 ± 1.76f
75% methanol (75:25 v/v methanol-water)	93.19 ± 1.78e
100% methanol (100:00 v/v methanol-water)	77.30 ± 1.95d

## • Results and discussions

Mineral analysis of the ND seeds sample is presented in Table 1. In this study, the sample contained  $89.15 \pm 0.42$ ,  $62.45 \pm 0.12$ ,  $58.17 \pm 1.1$ ,  $9.5 \pm 0.02$ ,  $10.5 \pm 0.06$  and  $2.88 \pm 0.05$ ,  $586.37 \pm 10.06$  and  $432 \pm 9.19$  mg per 100 g of magnesium, iron, chromium, copper, zinc, manganese, calcium and phosphorus, respectively.

Table 1: Mineral content of ND seeds

Mineral contents	mg/100 g
Calcium	586.37 ± 10.06
Chromium	58.17 ± 1.1
Copper	10.5 ± 0.06
Iron	62.45 ± 0.12
Magnesium	89.15 ± 0.42
Manganese	2.88 ± 0.05
Phosphorus	432 ± 9.19
Zinc	6.6 ± 0.03

The values depicted are Mean ± SD where n=5.

Table 2 shows the total phenolic content of ND seeds in different solvents (aqueous, ethanolic and methanolic) at different concentrations (20%, 60%, 75%, and 100%). The TPC of NS seeds extract is ranging from  $15.95 \pm 1.09$  mg GAE/g to  $398.12 \pm 9.22$  mg GAE/g. The range of total flavonoid content (TFC) in extracts is from  $106.10 \pm 0.1$  mg RU/g to  $118.39 \pm 0.05$  mg RU/g. 75% methanolic extract showed the highest TFC.

Table 2: Total polyphenol and total flavonoids content of ND seed extracts in different solvents

Solvents	TPC (mg GAE/g)	TFC (mg RU/g)
100% Aqueous	15.95 ± 1.09c	106.17 ± 0.1b
20% ethanol (20:80 v/v ethanol-water)	77.31 ± 1.08a	109.17 ± 0.01b
60% ethanol (60:40 v/v ethanol-water)	198.36 ± 2.46d	110.23 ± 0.03cd
75% ethanol (75:25 v/v ethanol-water)	155.26 ± 3.35c	114.19 ± 0.01b
100% ethanol (100:00 v/v ethanol-water)	110.52 ± 2.27b	106.25 ± 0.02a
20% methanol (20:80 v/v methanol-water)	213.18 ± 5.08b	111.18 ± 0.02b
60% methanol (60:40 v/v methanol-water)	229.99 ± 4.16e	117.39 ± 0.02e
75% methanol (75:25 v/v methanol-water)	398.12 ± 9.22d	118.06 ± 0.01d
100% methanol (100:00 v/v methanol-water)	176.92 ± 1.09c	113.2 ± 0.02bc

## • Conclusions

From the findings of *in vitro* antioxidant study, it was concluded that 75% methanolic extract showed the best solvent for the extraction of TPC, TFC, and antioxidant activity of ND seeds. The correlation results suggested that the antioxidant activities of NS seeds are may be due to the presence of polyphenol and flavonoid contents. However, future studies are needed to identify the polyphenolic and flavonoid contents that are correlated with the antioxidant activity of ND seeds.

The experimental data obtained from this study suggest that *N. Damascena* can be considered a source of minerals and natural antioxidants for food and therapeutic applications.