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TOTAL PHENOLIC CONTENT AND ANTIOXIDANT ACTIVITY OF SYRUPS FROM PEONY (*PAEONIA PEREGRINA* MILL. VAR. ROMANICA) AND ROSE (*ROSA CENTIFOLIA*) PETALS

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Abstract: *Traditional medicine offers a wide range of plant based products with multiple claimed benefits in health preservation, as well as disease treatment and prevention. Although known for their therapeutic role in various health conditions, syrups prepared with flower petals have not been thoroughly studied. In this paper total phenolic content and antioxidant activity of peony (Paeonia peregrina Mill. var. romanica) and rose (Rosa centifolia) petal syrups were analyzed in order to confirm the beneficial effects on health that the consumption of syrups with high antioxidant content has. The ingredients used for syrup preparation were flower petals, water and acacia honey.The total phenolic content was determined using Folin-Ciocalteu method, while the antioxidant activity was evaluated by DPPH (1,1-diphenyl-2-picrylhydrazyl) method. Peony petal syrup had the highest phenolic content (642.03 mg GAE/g) and also a greater antioxidant activity (inhibition of 87.13%). DPPH radical scavenging activity measured for rose petal syrup (62.95%) reflected the influence of phenolic content (437.91 mg GAE/g) of the product on antioxidant activity. These results show that syrups from medicinal flower petals might be helpful in the treatment of common diseases and the prevention of oxidative stress related illnesses.*

Keywords: *rose, peony, antioxidants, DPPH, Folin-Ciocalteu*

1. Introduction

For thousands of years nature has been a source of numerous plants with health benefits and important role in the fight against frequent diseases. Plant composition and especially active compounds have been thoroughly investigated in order to validate their use.

Herbal medicine is the oldest from of healthcare known to mankind [1], also serving as base for the development of new antimicrobial drugs. The controversies and debates that surround commercially available drugs, as well as the high cost of medical treatment led patients and consumers toward alternative natural therapies involving medicinal plants.

As antioxidants have been reported to prevent oxidative damage caused by free radicals [2 -3], scientific developments in the antioxidant activity of phytochemicals from medicinal plants increased significantly.

Given the geographical position and favorable climate, Romania has a large medicinal flora comprising over 3600 species of spontaneous and cultivated plants. Peony (*Paeonia officinalis*) and rose (*Rosa centifolia*) are two flowering plants used as traditional remedies mostly for respiratory tract illnesses.

Species of Peonia genus are widely distributed in European, Mediterranean and Asia region and known for the ornamental and economic value of the entire plant as well as the medicinal properties of their

roots and petals [4]. The biological properties of peonies have been attributed to a group of monoterpenes with common cage-like pinane skeleton with hemiketal-acetal system, namely paeoniflorin and its derivatives [5-6]. More recent studies have reported considerable amounts of polyphenols (paeonol and gallic acid derivatives), monoterpenes and monoterpene glycosides, triterpenoids, and steroids as the main phytochemicals [7]. Peony seed oil is rich in α-linolenic acid [8], which has beneficial effects on human nutrition and health, and a great value on the Chinese market. Moreover, in peony pod were determined increased amounts of apigenin and luteolin, two flavonoids with antioxidant, anticancer, and anti-inflammatory effects [9]. Both compounds have manifested *in vitro* capacity to induced cell death in two aggressive human pancreatic cancer cell lines [10]. Furthermore, a large number of scientific observations suggest that luteolin could be a chemotherapeutic agent for other types of cancer.

Rosa centifolia, a specie native to Asia and Middle East belongs to the family Rosaceae [11]. This cultivar has medium sized colorful flowers that are rich in fragrance. Rose petals contain acids, essential oils, tellimagrandin I, rugosin B, carotenoids, anthocyanins and proanthocyanidins. The main constituent of the oil extracted from rose is geraniol, an alcohol with a rose-like odor that gives upon oxidation aldehyde citral, a compound also present in rose petals. Furthermore, the oil fraction of rose contains l-citronellol in a proportion of about 20% [12]. A small fraction of both citronellol and geraniol is combined in ester form. Other compounds found in rose are tannins, mineral salts, mallic acid and tartaric acid salts, pectin, riboflavin, vitamin C, sugars, and purgative glycosides (multiflorin A and B) [13]. Many chemical constituents of rose have proven antioxidant activity. Although the health benefits of rose and their mechanism have not been widely explored, the plant is used traditionally in the treatment of diabetes, conjunctivitis, and aroma therapy [14].

Most of the research on antioxidant activity and phenolic profile of peony and rose is conducted on extracts from different plant segments obtained through conventional or modern extraction techniques. The present study takes a more practical approach on the matter, using traditionally prepared syrups from peony and rose petals that are also commercially available. The advantages of syrups over petal extracts are the superior nutritional value, reduced toxicity, and improved digestibility. In the current case, the purpose of the study was to determine the total phenolic content and antioxidant activity of freshly prepared peony and rose petal syrups.

2. Matherials and methods

2.1. Plant material

To assure the preparation of high quality syrup, the plants were purchased from an organic farmer and were free of fertilizers and insecticides. Roses were from *Rosa centifolia* specie, while peonies originated from the Romanian cultivated specie *Paeonia peregrina* Mill. var. romanica. Petals were removed from the corolla, rinsed and then dried at 40 °C into an oven (to inactivate microbial cells but also avoid phytochemicals damage).

2.2. Syrup preparation

The syrup was prepared as follows: 1 g of peony or rose petals was added to a beaker containing 100 ml of water. After a slow stir, the beaker was placed over a heat source where the petal and water mix was allowed to simmer for about 15 minutes. The beaker was then removed from the heat

allowing the mix to cool. When the temperature of the mix decreased to 35 °C, 64% (w:w) acacia honey was added to petal infusion and mixed thoroughly. The beaker was covered again leaving the content to rest for about 10 hours. Finally, flower petals were removed using a filter and the syrup was refrigerated until its composition was analyzed.

2.3. Total phenolic content determination

The total phenolic content of the syrups was measured colorimetrically using the Folin-Ciocalteu method. 50 µl of syrup was transferred into a test tube and mixed thoroughly with 250 µl of Folin-Ciocalteu reagent. The content of the tube was shaken and then 500 µl of sodium carbonate (20%, w/v) was added and mixed again. The mixture was allowed to stand for 30 minutes prior to measuring the absorbance at 765 nm in a single beam UV-Vis-NIR spectrophotometer (Shimadzu Corporation, Japan).
Total phenolic content was expressed in mg gallic acid equivalents (GAE)/g. For gallic acid, absorbance is described by the following equation:

$$y = 0.0012x - 0.0345 \ (R^2 = 0.9997)$$

2.4. Antioxidant activity

The antioxidant activity of the syrups was measured using the DPPH (1,1-diphenyl-2-picrylhydrazyl) method. The DPPH radical-scavenging effect was evaluated through a procedure similar to those proposed by Mraicha et al. (2010) and Bouaziz et al. (2008) in previous studies [15,16]. The samples analyzed were prepared by mixing various concentration of syrup with ethanol solution, as follows: 1200 µl peony syrup and 1800 µl solvent, and 300 µl rose syrup in 2700 µl ethanol. The aliquots were added to 5 ml of a 0.004% (w/w) freshly prepared methanol solution of DPPH. After 30 minutes of incubation at room temperature, the absorbance was measured against a blank at 517 nm in a single beam UV-Vis-NIR spectrophotometer (Shimadzu Corporation, Japan). Free radicals inhibition (I%) was calculated using the equation:

$$I\% = [(A_{blank} - A_{sample})/A_{blank}] \times 100,$$

Where: A_{blank} – absorbance of the control reaction, containing all the reagents except the analyzed syrup
A_{sample} – absorbance of the analyzed syrup

3. Results and discussion

Two syrups with therapeutic benefits, respectively rose petal syrup and peony petal syrup, were analyzed to determine the total phenolic content and the antioxidant activity of the product. The results obtained for both parameters are presented in Table 1. The absorbance spectra for phenolic compounds and antioxidants are shown in Figures 1and 2.
As the results show, peony petal syrup had both the highest phenolic content and antioxidant activity. Total phenolic content of peony petal syrup was 642.03 mg GAE/g, while the concentration determined for rose petal syrup was 437.91 mg GAE/g. Very few studies were conducted on the antioxidants level of peony and rose petals, and no research was found on the phenolics and antioxidant activity of syrups prepared from petals. The phenolic content reported for polar extract obtained from roots of *Paeonia rockii* was 160.2 mg/g, and its soluble fraction had a total phenolic content of 256.0 mg/g [4]. For an extract from a mixture of *Astragalus membranaceus* and *Paeonia lactiflora* plant powder, the maximum phenolic content determined was 275.062 mg GAE/g [17]. In the case of rose, total phenolic content reported for fresh petals and essential oil extracted from rose exceeded the level measured in petal syrup.

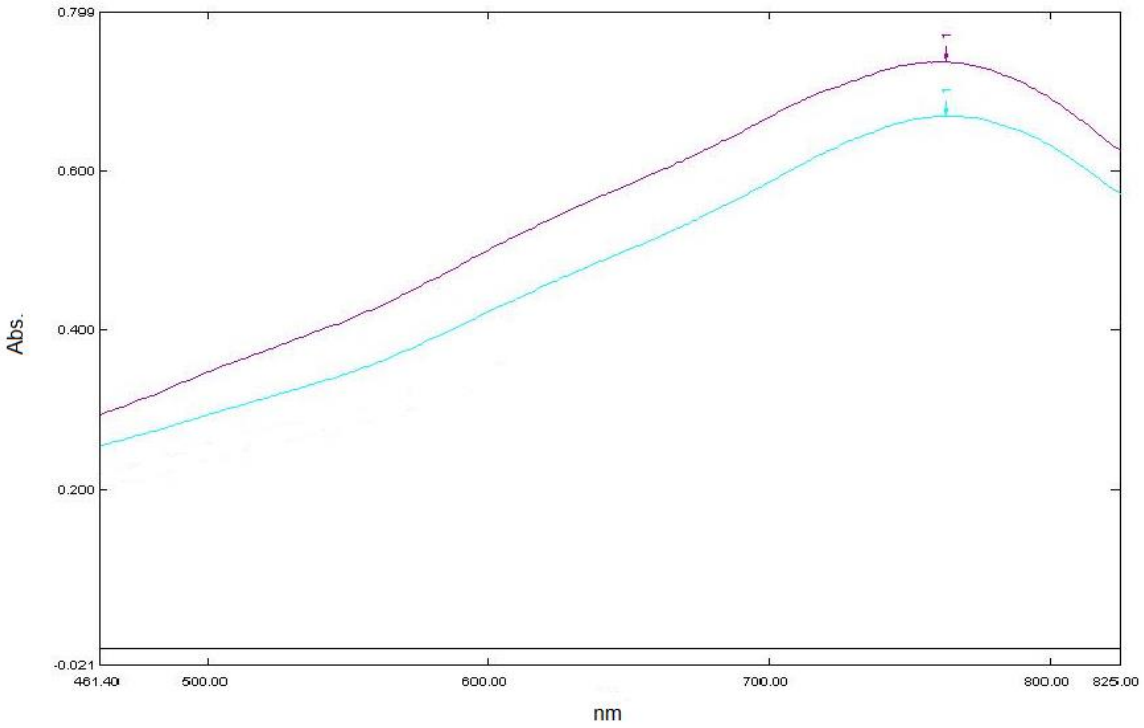

Fig.1 Absorbance spectra of phenolic compounds from peony petal syrup (—) and rose petal syrup (—)

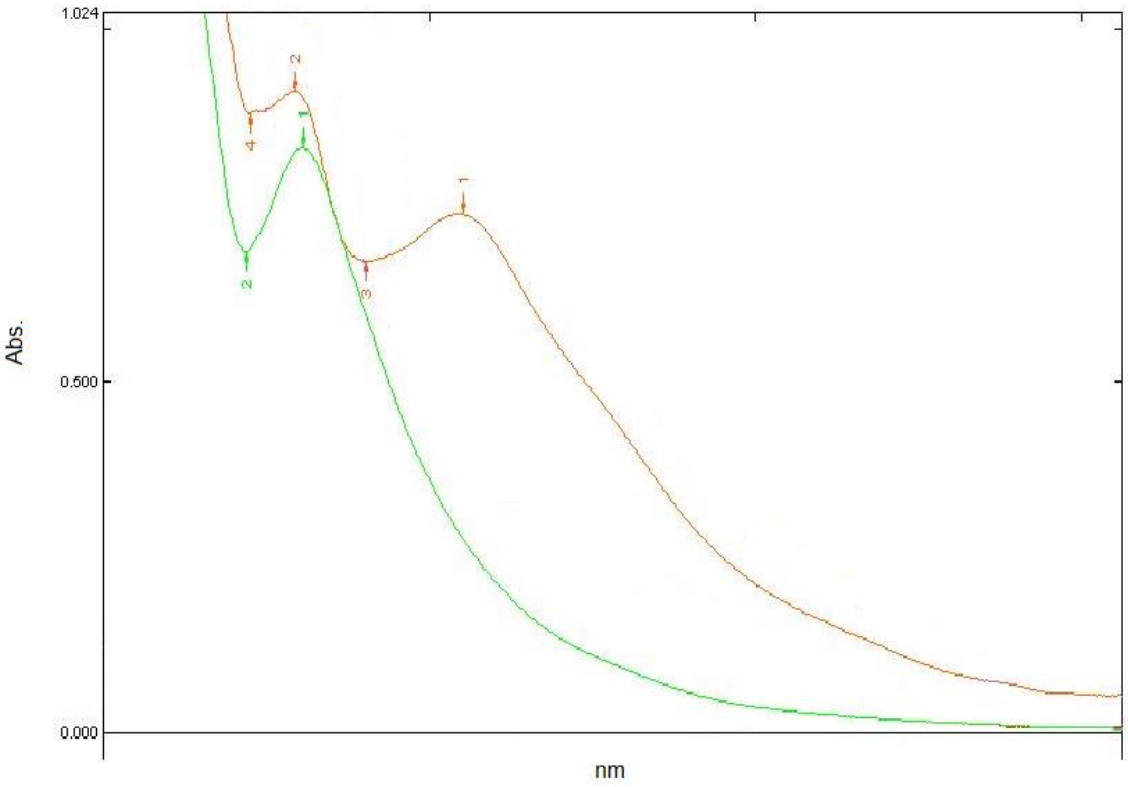

Fig.2 Absorbance spectra of antioxidants from peony petal syrup (—) and rose petal syrup (—)

Therefore, rose petals had a total phenolic content of 1,171.06 mg GAE/g [18], but this concentration was below the level determined in the essential oil from rose, namely 2,134.3 mg GAE/g [19].

Table 1

Total phenolic content and antioxidant activity of petal syrups

Sample	Total phenolic content (mg GAE/g)	Antioxidant activity (% inhibition)
Peony (Paeonia peregrina Mill. var. romanica) petal syrup	642.03	87.13
Rose (Rosa centifolia) petal syrup	437.91	62.95

It is well documented that phenolic compounds are the major bioactive components contributing to the antioxidant activity of many herbs. Moreover, the phenolic content was positively correlated with antioxidant capacity [20]. Given the high content of phenolics in peony and rose petal syrup, to further investigate its beneficial effects, the antioxidant activity of the products was analyzed. Phenolic compounds contribution to the antioxidant activity of the syrup was particularly highlighted in the case of peony petals, for which was determined an inhibition of 87.13%. Antioxidant activity of rose petal syrup (62.95% inhibition of reactive species) was comparable and slightly higher than DPPH radical scavenging activity reported for alcoholic extracts (70% ethanol) from rose petals (about 60% inhibition) [21].

4. Conclusion

This paper presents the results of a study on total phenolic content and antioxidant activity of two syrups used traditionally for therapeutic benefits. Syrups were prepared with *Rosa centifolia* and *Paeonia peregrina* Mill. var. romanica petals from a local organic culture.

The data obtained showed that peony plant syrup has a higher phenolic content than rose syrup, therefore exhibiting a greater antioxidant activity through the scavenging of free radicals. Taking note that peony petal syrup is less known among consumers and also rarely used, the study proves the importance of promoting its importance as a source of natural antioxidants, and pointing out the role of these compounds in health promotion and disease prevention.

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