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SHORT COMMUNICATION

Phytochemical components, total phenol and mineral contents and antioxidant activity of six major medicinal plants from Rayen, Iran

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ABSTRACT
The aim of this work was to evaluate the phytochemical components, minerals, the antioxidant activity and total phenol contents of the essential oil from aerial parts of six major medicinal plants in Rayen, Iran. The plants included Ranunculus arvensis, Teucrium polium, Dracocephalum polychaetum, Kelussia odoratissima, Artemisia sieberi and Thymus kotschyanus. Total phenol content ranged from 0.03 to 0.158 mg/mL. A. sieberi showed the highest radical scavenging ability (IC50 = 94 μg/mL). The amount of minerals ranged as follows: P (0.23–29%), K (1.08–4.76%), Ca (0.78–2.35%), Mg (0.24–0.94%), Cu (8.3–15 mg/kg), Cd (0.7–1.1 mg/kg), Pb (2–11.7 mg/kg) and Fe (250–1280 mg/kg). A total of 79 compounds were identified across all plants. The main components studied in the plants were l-perillaldehyde, biosol, carvacrol, 1,8-cineol, terpinyl acetate and 1,2,3,6,7,7 a-hexahydro-5 h-inden 5-one.

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1. Introduction

Plants are being used as valuable sources of medicine for illness prevention and maintenance of human health. Iran has a long medical tradition and traditional learning of plant remedies (Ghorbani 2005). Traditional medicine is the primary mode of healthcare for most of the population of south of Kerman, Iran (Sadat-Hosseini et al. 2017). Hezar Mountain in Rayen has rich medicinal plant diversity (Rajaei & Mohamadi 2012). ‘Hezar’ means 1000. The mountain has taken its name from the 1000 medicinal plants growing on it. The most widely available medicinal plants in Rayen are Lamiaceae, Asteraceae, Fabaceae, Apiaceae, Rosaceae and Brassicaceae. They are utilised to treat ailments such as digestive disorders of the gastrointestinal tract, renal and genital disorders, respiratory tract system disorders, and heart-blood circulatory system disorders (Rajaei & Mohamadi 2012). Additional they have antioxidant, antibacterial, antimicrobial and antifungal activity (Maissa & Walid 2015; Purnavab et al. 2015; Delogu et al. 2016; Raziq et al. 2016; Vitali et al. 2016).

The interest in chemical composition of medicinal herb products is growing because of the ongoing developments in nutrition and in biochemical surveying and mineral prospecting (Başgel & Erdemoğlu 2006).

Six major medicinal plants in Rayen Iran, are Ranunculus arvensis, Teucrium polium, Dracocephalum polychaetum, Kelussia odoratissima, Artemisia sieberi and Thymus kotschyanus, among which D. polychaetum and K. odoratissima are endemic to Iran (Mehrabani et al. 2005; Omidbaigi et al. 2008).

There is no study on the essential oil compositions and mineral content of these plants in the area. The aims of the present study were to assess the essential oil, total phenol and minerals content, chemical composition and antioxidant activity of six major medicinal plants from Rayen, Iran.

2. Result and discussion

In the present study, two of the six medicinal plants are endemic to Iran: D. polychaetum and K. odoratissima (Table S1). The highest essential oil yield was obtained in T. polium (1.8%), followed by T. kotschyanus (0.34%), K. odoratissima (0.29%), D. polychaetum (0.19%), A. sieberi (0.16%) and R. arvensis (0.12%; Figure S1). Cimanga et al. (2002) studied the variation in essential oil of 15 medicinal plants, the essential oil content ranged from 0.13 to 1.87%. This variation in essential oil yield from medicinal plants could be due to many factors such as climate, plant age, time of harvest and extraction method.

Among the six plants, high total phenol was observed in A. Sieberi (0.158 mg/mL) and T. Kotschyanus (0.138 mg/mL) (Figure S1). The aerial parts extracts of the plants demonstrated the dose-dependent scavenging activity (Figure S2). The IC50 values varied from 94 to 312 μg/mL (Table S2). According to IC50 values, the rank order was as follows: D. Polychaetum > T. Polium > K.Odoratissima > R. arvensis > T. Kotschyanus > A. Sieberi. A. Sieberi showed the highest radical scavenging ability (IC50 = 94 μg/mL). Nugroho et al. (2016) reported that concentration of phenolic compounds in Asteraceae family is higher than some other family. The results of our study confirm their claim. Moreover, correlation coefficient was calculated in order to find a relationship between antioxidant activity and total phenol content. The result of this analysis showed a high positive correlation between them (r = 0.76).

K has the highest concentration in comparison with the other minerals (Table S3). The highest amount of Pd (11.7 ± 0.68 mg/kg), Cd (1.1 ± 0.11 mg/kg) and K (4.76 ± 0.23%) were...
in *R. arvensis*, *D. Polychaetum* and *K. Odoratissima*, respectively. *T. Kotschyanus* had the highest concentration of Fe (1280 ± 50 mg/kg) and Cu (15 ± 0.49 mg/kg). The concentrations of P in the plants were close to each other. Two plants had the highest concentration of Ca (*K. Odoratissima* and *A. Sieberi*) and Mg (*T. Kotschyanus* and *A. Sieberi*). These elements are important in the diet, however, they exist in human body with low percentage (4–6%). Nowadays, the use of dietary minerals is increasing in order to prevent some diseases (Aouinti et al. 2014). The permitted limit of concentration for Pd Acceptable Daily Intake (ADI) in medicinal plants is 10 mg/kg (WHO 1992). All plants in our study except *R. arvensis*, had Pd concentration below than the permissible limit concentration.

According to the results of GCMS analyses, 79 compounds were identified in the essential oil of the plants (Table S2). The main compounds were as follows; in *R. arvensis* were guaiol (8.81%), caryophyllene oxide (7.1%), spathulenol (6.73) and camphor (6.2%), in *T. polium* were 1,2,3,6,7,7a-hexahydro-5 h-inden 5-one (25.8%), terpinyl acetate (19.6%), (E,E)-1,3,5-Undecatriene (8.97%) and beta.-phellandrene (6.62%), in *D. polychaetum* were l-perillaldehyde (54%), (4-Isopropenyl-1-cyclohexen-1-yl)methyl acetate (8.24%), d-limonene (4.9%) and biosol (4.6%), in *K. odoratissima* were 1,8-cineol (14.1%), carvacrol (9.02%), pulegone (8.59) and biosol (6.58%), in *A. sieberi* were carvacrol (53.4%), biosol (21.2%) and m-cymene (5.29%) and in *T. kotschyanus* were carvacrol (31%), biosol (21.7%), m-cymene (6.41) and (z)-7-Hexadecenal (4.19%). Some components were found only in one plant such as β-phellandrene, alpha.-pinene, nonanal, chrysanthone, alpha.-campholenal and cyclooctanone. However, some of them were found in all plants like linalool, alpha-terpineol, p-cymen-8-ol, pulegone and carvacrol.

In order to evaluate the relationship among the plants, cluster analysis was used. In the present study two clusters were derived first, from phytochemical data (Figure S3A) and second, from minerals data (Figure S3B). In both clusters, the highest similarity among the plants was between *A. sieberi* and *T. kotschyanus*. These two plants were rich in carvacrol, biosol and m-cymene components and had the highest total phenol content and antioxidant activity.

In the root of both dendrogram three species including *T. kotschyanus*, *T. polium* and *D. polychaetum* are close to each other. The three species are from Lamiaceae family. In order to compare the extent of agreement between information obtained from phytochemical and minerals data, a Euclidean distance matrix was constructed for each assay and compared using the Mantel test. The moderate *r* value was observed between phytochemical and minerals data (*r* = 0.43).

### 3. Conclusion

Today, there is a significant increase of resistance in different microbial strains and cells against available therapeutic compounds. Therefore, there is an urgent need for novel compounds as well as exploration in medicinal plants germplasm. In the present study some characters of six major medicinal plants from Rayen were investigated. The results showed that all characters including essential oil content, total phenol content, antioxidant activity, minerals content and phytochemical components were different in the plants. The main components in the studied plants were l-perillaldehyde (1 plant), biosol (3 plants), carvacrol (3 plants), 1,8-cineol (1 plant), terpinyl acetate (1 plant) and 1,2,3,6,7,7a-hexahydro-5 h-inden 5-one (1 plant). The results showed that *A. sieberi* and *T. kotschyanus* had the highest
antioxidant activity, may be that is due to the high concentration of biosol, carvacrol and m-cymene components. Also, the results showed a moderate relationship between mineral contents and phytochemical components.

4. Experimental

Please refer to the supplementary material.

Disclosure statement

No potential conflict of interest was reported by the authors.

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References


