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Comparison in Levels of Minerals and Phenolic Compounds in *Origanum* and *Menthe* Plants From Northeast of Libya

Ahlam K. Alaila*

Botany Department, Faculty of Science, Omar AL-Mukhtar University, Libya

***Corresponding author:** Ahlam K. Alaila
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Abstract **Original Research Article**

The medicinal plants (*Origanum* and *menthe*) were subjected to mineral analysis; appraise the antioxidant properties and the total phenolic contents. Couple plants were collected from AL-Gabal AL-Akhder region (Libya) during summer (2016). Results were showed that mineral content found to vary variable. Appreciable amounts of calcium (Ca), potassium (K), sodium (Na), and phosphor (P) were found in both plants. The high concentration of K (667 ppm), Na (1.143) and P (4.14) were found in dry leaves of *Origanum*. While lowest contents Ca (17.39 ppm) was found in dry leaves of *Origanum.* However, the highest content of Ca was recorded in leaves of *Mentha* (60.87 ppm). The results showed that highest contents of total phenolic compounds recorded in leaves comparing with stems in same plant. Total antioxidant activity values were fluctuated couple plants. The values high in both leaves and stems in *origanum* plant comparison to *menthe* plant.
Keywords: *Origanum*, *menthe*, Minerals, antioxidant and phenolic compound.

INTRODUCTION

Increasing demand on each biological process and health foods with higher nutraceutical, pharmaceutical, biological process and purposeful properties are studied extensively. Many wild healthful plants are currently recognized. Within the past, healthful plants are used with multi-functional properties as well as medical usage, practical food and nutraceutical food parts. Health effects of medicinal plants have been associated with its consumption of active compounds such as volatile oils, peptides and phenolic compounds that lead to decrease risk of cardiovascular disease, antiviral activity, antibacterial activity, antifungal activity, laxative effect and anti-inflammatory [1].

There are about 1,825 vascular plant species in Libya, 134 of which are endemic. About 450 species are reported to have medicinal value [2]. Some important plant families are Apiaceae, Asteraceae, Lamiaceae, Poaceae, Fabaceae,and Brassicaceae. Medicinal plants are distributed all over the country especially in the Al-Jabal Al-Akhdar, Ghadames, Gharian, Awbari and Tarhona regions [3].

Mentha piperita L. (Family: Lamiaceae), commonly known as peppermint, is an important medicinal herb worldwide. “Medicinal plant of the year 2004”; oldest known medicinal plant species in Eastern and Western traditions although first described by Carolus Linnacus. It is used as flavoring agent, in cosmetics preparations, and as pharmaceutical products amongst others. The trace elements present in Menthae may play a direct or indirect role in their biological activities: anti-inflammatory, antioxidant, antimicrobial, antifungal. Studies show antioxidant and antimicrobial properties of the Menthae leaves that are locally available [4]**.** Some investigators found that its antifungal activity is comparable to that of synthetic fungicides. As a significant trace element, iron is necessary for all living organisms and essential element in cell metabolism (involved in photosynthesis, respiratory, etc.). Since elements can pass through different membranes, essential elements enter the cells and organs of the human body, which lead to favorable or unfavorable processes. Therefore, increasing focus on the importance of dietary minerals in disease prevention justifies the need for more serious studies on the mineral content of plants [5].

Oregano (Origanum vulgare) is an important culinary and medicinal plant. Six subspecies of Origanum vulgare are known (*vulgare, hirtum, gracile, glandulosum, virens* and *viridulum*). Most of the commercial oregano comes from wild plant populations growing in Turkey and Greece [6]. Oregano has traditionally been used to treat upper respiratory tract disorders, coughs, fever, digestive disorders, dysmenorrhea, rheumatic pain and urinary disorders [7]. Another study, anti-hyperglycaemic and cytotoxic activities were reported [8]. In the food industry, oregano is not only used as a flavouring agent, but also as a preservative, due to significant antimicrobial effects and good antioxidative activity [9]. The U.S. Food and Drug Administration (FDA) recognize *Origanum vulgare* as generally safe for human consumption without limitations on intake, granting the plant a GRAS (generally recognised as safe) status [10]. The secondary metabolite profile of *Origanum vulgare* has been widely investigated The secondary metabolite profile of Origanum vulgare has been widely investigated and the main components are volatile oils, flavonoids, phenolic acids, anthocyanins, tannins and triterpenic acids [11]. The sensory qualities and many of the medicinal properties of oregano are attributed to the volatile oil, highly variable in composition as a function of genotype, developmental stage, environment and even agricultural practice [11]. Carvacrol (associated with a sharp, pungent flavour) and thymol (potent antibacterial) are important chemicals in Greek oregano (ssp. *hirtum*), a typical East Mediterranean taxon [12]. On the contrary, the volatile oil of wild oregano (ssp. *vulgare*) growing in Eastern European countries like Romania mainly contains sabinen, β-caryophyllen, D-germacrene and trans-β-ocymene, while carvacrol and thymol are absent [13]**.** Flavonoids (quercetin, apigenin, kaempferol derivatives) and phenolic acids (rosmarinic, ferulic, p-coumaric, caffeic) confer a potent antioxidant capacity to oregano [14]. While the organic constituents of the plant were intensely studied, including the geographical variability, there is scant knowledge about the minerals contained by oregano. Some references on the calcium and magnesium content [15], the composition of a new variety [16] and studies on the growth response of oregano to metal and salt induced stress are available [17]. The present study was designed to determine some minerals and phenolic compound in dry steam and leaves in couple species *Mentha*, and *Origanum* which growing and used in many purpose in Al-Gabal Al–Kadar Region.

MATERIALS AND METHODS

Plant materials (*Mentha*, and *Origanum*) were collected twice from different locations in Libya at Al-Gabal Al–Kadar Region during summer 2016. Both plants were identified in Botany department at Omar Al-Mokhtar University according on Angiosperm Phylogany Group [18]. Scientific name, common name and their parts that used were shown in (Table 1).

The Minerals analysis

The mineral content of the samples including Na, K, Ca and P, were determined. Soluble Na, K and Ca contents were determined with a Flame Photometer (EEL Flame Photometer) according to the method described by **[**19] Total phosphor was determined Spectrophoto-metrically using the procedure of [20]. After digestion with H_2SO_4 and $HClO_4$ acid [21] and determined using Spectrophotometer (Milton Roy Perkin Elmer 3300) according to the method described by [22]**.**

Samples preparation

The leaves and steams were separated from each plant and washed several times with distilling water then dried in dark place and sorted**.**

Determination of total phenols by Folin Ciacalteu

One gram of powder was defatted with petroleum ether. The defatted powder was then extracted sequentially by stirring with 10 ml methanol twice, then with 10 ml 1% hydrochloric acid: methanol (v/v). The three combined extracts were evaporated under vacuum and the residue was dissolved in 10 ml methanol. Aliquots of the extracts were taken in a 10 ml flask and made up to a volume of 3 ml with distilled water. Then 0.5 ml folin ciocalteu reagent (1:1 with water) and 2 ml Na CO_3 (20%) were added. The solutions were warmed for 1 minute, cooled and the absorbance measured at 650 nm against the reagent used as a blank. A standard calibration plot was generated at 650 nm using known concentrations of tannic acid from 4 to 20 µg/ml as shown in Figure 1.

Determination of Antioxidant power by Prussian Blue Method

Half ml of the extracted solution was diluted with 3 ml distilled water, 3 ml 0.008 M $K3Fe(CN)_6$ added, followed by 3 ml 0.1 M HCl and 1 ml 1% FeCl. The blue color is allowed to develop for measured at 720 nm against the blank. Construct a calibration curve within 1-10 µg/ml tannic acids as shown in Figure 2.

Statistical analysis

Where applicable, statistical analysis was carried out in Minitab software; statistical significance was assessed using ANOVA analysis with Tukey multiple comparison test.

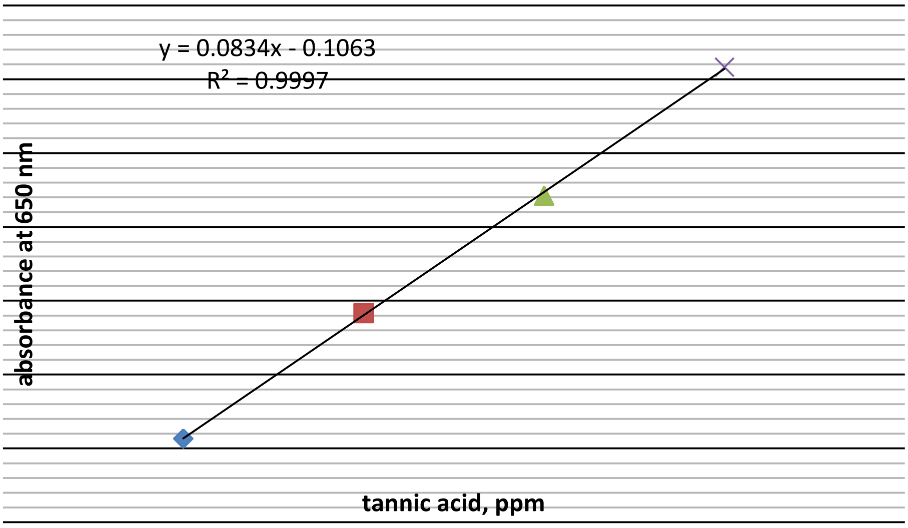

Fig-1: Calibration curve of total phenols using Folin Ciacalteu method

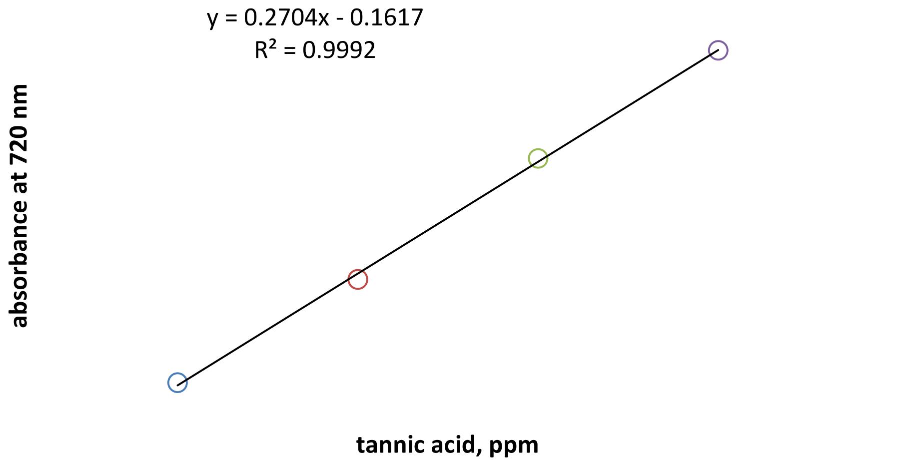

Fig-2: Calibration curve of tannic acid using Prussian blue method

RESULTS

The mineral element constituents of the studied herbal plants are shown in Table 2. The results showed that that the highest contents of K were recorded in leaves of *Mentha* and *Origanum* (333 and 667ppm) respectively comparing with other elements. The Ca was found with higher concentration in leaves of *mentha* (60.87 ppm). The concentration of P was found in the *Mentha*. The Na was found in higher concentration in leaves of *Origanum* (1.413 ppm). While the Ca in *Mentha* was found in high concentration (60.87 ppm) comparison to the *Origanum* (17.39 ppm). The total phenolic compounds content (mg/ml) of the leaves and the stems of couple herbal plants: in the dry leaves 171.4012 and 179.3228 mean time in the stems were 157.6554 and 174.7349 in *Mentha* and *Origanum* respectively (Table 3). The total antioxidant content (mg/ml) of the dry leaves and the stems of couple herbal plants were determined, in *Mentha* were 116.4222 and 130.3074 in dry leaves and stems respectively (Table 3). The total antioxidant content (mg/ml) of the dry leaves (38.8074) and in the dry stems (49.922) in *Origanum* (Table 3).

Table-1: Scientific and synonyms names with family of couple plants from Libya

Plant scientific name	Family name	Synonyms name	Part used
Origanum majorana	Lamiaceae	Bardigusha	leaves and steams
Mentha piperita	Lamiaceae	Nahnah	leaves and steams

Table-2: Mineral element contents of *Mentha* and *Organum* (ppm) (Mean ±SEM)

Mineral contents	*Mentha*	*Origanum*
Na	0.003±0.0006	1.413±0.1
Ca	60.87±0.67	17.39±0.3
K	333±2.08	667±2.7
P	4.14±0.4	6.511±0.02

Table-3: Level of anti-oxidant and phenol compound in *Menth* and *origanum* at leaves and stems for each plant (mean ± SEM)

Parameters	*Mentha*		*Origanum*	
	Leaves	Steam	Leaves	Steam
Anti-oxidant	116.4^{b}± 0.54	130.3^{a}±0.62	38.8^{c}±0.44	49.9^{a}±0.5
Phenol compound	171.42^{a}±0.4	157.66^{b}±0.7	179.32^{a}±0.4	174.73^{b}±1.4

Data are expressed as mean ± SE of each plant. Within each row, means with different superscript (a, b, c or d) were significantly different at $p<0.05$. Where means superscripts with the same letters mean that there is no significant difference ($p>0.05$).

Discussion

Mint tea is widely used as herbal tea; therefore, mineral content of its herbs can meet daily elemental mineral demand of human body when consumed as herbal tea. Minerals are most important in the diet, even though they comprise only 4–6% of the human body [23]. Their excess or deficiency in organs and tissues leads to diseases. It is very important to know the possible influence of metals on pharmacological properties of herbal infusions [24]. Geographical origin of plants belonging to the same species can result in different concentrations of elements and their bioavailability, depending on environmental pollution and soil topographies [24]. Minerals play vital and important role in our body; sodium and potassium normalize acid base balance and osmotic pressure of body fluid [25]. Calcium, a macro-mineral, is vital for bones and teeth health. It is needed for cardiac muscles and nerve impulses, blood and milk clotting [26]. Herbal medicine development research is in progress throughout the world, so the present current report will be helpful for the isolation and production of new drugs, medicine and health care product. At the end, it can be concluded that the active minerals component found in the *Mentha piperita* would definitely find place to cure minerals deficiency. Finally, this aromatic plant should be further studied extensively for exploration of its ability to cure different ailments.

On the other side the phosphors are important for building the ATP &ADP molecules of energy and PO 5^{-3} ions which they are activate most of compounds during the biochemical reactions in Glycolysis cycle. Most of plants containing minerals (Na, K and P) but in different contents. In this study the contents of potassium are higher than those reported in [27] study. The sodium and potassium are very important to balance of osmotic pressure of human body and they are have many function.

The concentration of the phenolic compounds in the study plants ranged from 157.6554 to 157.83 mg GAE g-.Was the highest value in the *origanum* and *Mentha*. This is quite consistent with [28]. Our results showed that, the increase in total phenolic compounds contents was higher in leaves compared to stems in plants in this study (in Libya) as *origanum* and *Mentha*, It is extremely important to point out that there is the phenols are very important plant constituents because of their scavenging ability on free radicals due to their hydroxyl groups [29]. In this study the total antioxidant values of *mentha* samples were higher than those of *origanum* samples. This is not accordance with [28]. The antioxidant capacity of plant extract may be due to the hydrogen donating ability of phenols and flavonoids which may be present in it. Antioxidant activity of the plant extract is often associated with the phenolic compounds present in them. Plant phenols constitute the major group of compounds that act as primary antioxidant [29].

Conclusions

The selected plants contain high levels of K. The *Mentha* and *Origanum* studied spices are important sources of potent phenolic compounds. The spices exhibited strong antioxidant capacity in vitro and they may be potential sources of natural antioxidants.

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