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Original article

Determination of Carbohydrate, Total Antioxidant, and Mineral Concentrations of *Linaria triphlla* (L) (Om lawlad), *Malva parviflora* Linn L. (Khabiza), and *Myrtus communis* L. (Birsim) Plants

Khadijah Al-Awjali[1], Mona Khanfar[2], Farag El-Mokasabi[3], Zuhir Akrim[4], Hamad Hasan[5]

[1]*Botany Department, Faculty of Science, Derna University, Libya*
[2]*Chemistry Department, Faculty of Science (Al-Quba), Derna University, Libya*
[3]*Botany Department, Faculty of Science, Benghazi University, Libya*
[4]*Pharmacology and Toxicology Department, Faculty of Pharmacy, Omar Al-Muhtar University, Libya*
[5]*Chemistry Department, Faculty of Science, Omar Al-Mukhtar University, Libya*
Corresponding email. hamad.dr@omu.edu.ly

Abstract
This study investigated the biochemical composition of three plant species growing in northeastern regions of Libya: *Linaria triphlla* (Om lawlad), *Malva parviflora* (Khabiza), and *Myrtus communis* (Birsim). Leaves and stems were analyzed to determine antioxidant capacity, total phenol content, carbohydrate levels, and mineral concentrations (sodium, potassium, calcium). Spectrophotometry was used to estimate antioxidants, phenols, and carbohydrates, while flame photometry measured mineral content. Results revealed notable variations between leaves and stems. Total phenol content fluctuated between 194.61–295.45 ppm in leaves and 283.449–313.770 ppm in stems, indicating higher phenolic concentrations in stems. Antioxidant values showed minimal variation, ranging from 9.703–9.96 ppm in leaves and 10.198–10.528 ppm in stems. Carbohydrate levels were generally low, with values between 0.016–0.134 ppm in leaves and 0.155–0.419 ppm in stems. Mineral analysis demonstrated greater differences. Sodium concentrations ranged from 0.625–1.208 ppm in leaves and 1.88–16.88 ppm in stems, showing a marked increase in stems. Potassium levels were consistently higher in stems compared to leaves, while calcium concentrations were relatively small in leaves (0.12–0.68 ppm) but higher in stems (0.375–1.541 ppm). Overall, the study highlights those stems of the selected plants generally contain higher levels of phenols, minerals, and carbohydrates compared to leaves, while antioxidant capacity remains relatively stable across plant parts. These findings provide insight into the nutritional and biochemical properties of native Libyan plants, emphasizing their potential value in food science, pharmacology, and traditional medicine.
Keywords. Carbohydrate, Antioxidant, Phenols, Minerals, Plants, Libya.

Introduction

Around the world, the use of medicinal plants has taken center stage in health systems. This entails using medicinal plants not only to treat illnesses but also as a possible resource for preserving health and well-being. Due to its greater cultural acceptability, greater compatibility and flexibility with the human body, and less adverse effects, herbal medicine is used for primary healthcare in many nations, accounting for two-thirds of the global population. Based on documents, Plant extracts are found in the majority of medications. Some have bioactive compounds or active chemicals derived from plants. Despite recent advancements in science and technology, some of the claims and beliefs of indigenous people are irreplaceable. Recent research has led to the discovery of plant-derived drugs through the study of curative, therapeutic, traditional cures, and particularly the folk knowledge of indigenous people [1]. Aspirin, atropine, artimesinin, colchicine, digoxin, ephedrine, morphine, physostigmine, pilocarpine, quinine, quinidine, reserpine, taxol, tubocurarine, vincristine, and vinblastine are a few medications that are thought to be derived from plants. Examining the traits and functions of phytochemicals in some of the medical plants that are frequently utilized in Libya will be important since the significance of medicinal plants cannot be understated. Due to their potential to benefit humanity and society in many ways, particularly in the fields of health and pharmaceuticals, medicinal plants are receiving more attention than ever.

Because of its ethnochemical properties, plant parts including leaves, roots, and bark are employed for medicinal purposes and also act as precursors for the manufacture of beneficial pharmaceuticals. nature's medical significance [2]. The bioactive phytochemical components of these plants that have physiological effects on humans may be the source of their therapeutic potential. Due to their versatility, substances originating from plants have recently attracted a lot of attention. Phytochemicals are compounds found in plants that increase their global utility [3]. As a result, numerous investigations were conducted to predict a wide range of chemicals [4–38]. In addition, the amounts of metals and minerals were examined using various techniques in various samples [38–75]. The purpose of this study is to quantify some of the chemical components (antioxidants, total phenols, and carbohydrates) in a few chosen plants. utilizing the phytochemicals found in stems and leaves. To quantify the amounts of the minerals Na, K, and Ca in the leaves and stems of plants growing in the Al-Gabal Al-Ahder districts of Libya, namely Linaria triphlla (L) (Om lawlad), Malva parviflora Linn L. (Khabiza), and Myrtus communis L. (Birsim). in Libya's Al-Gabal Al-Ahder districts.

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Methods
Sampling
The leaves and stems of Linaria triphlla (L) (Om lawlad), Malva parviflora Linn L. (Khabiza), and Myrtus communis L. (Birsim) plants were chosen for this study. Samples were gathered from various locations, such as the Wadi Derna valley and Karsah in the West, Al-Dhahr Al-Ahmar in the South, and the Mediterranean coast in the North. The study area is situated on the second terrace of El-Jabal El-Akhdar Mountain, which is situated in the Derna region of northeastern Libya. The city is divided into two sections by the Wadi, which runs between longitudes 33°00' and 32°30'N and 22°30' and 22°45'E. The Wadi is situated between 40 and 300 meters above sea level. With a mean temperature of roughly 20 oC, the study area's climate is similar to that of El-Jabal El-Akhdar. Rainfall often falls between 200 and 300 mm (Figure 1). Al-Dhahr Al-Ahmar in the south, the Mediterranean coast in the north, and Karsah in the west. The study area is situated on the second terrace of El-Jabal El-Akhdar Mountain, which is part of Wadi Derna in the Derna region of northeastern Libya. The Wadi separates the city into two halves between longitudes 33°00' and 32°30'N and 22°30' and 22°45'E. The Wadi is situated between 40 and 300 meters above sea level. With a mean temperature of roughly 20 ^{o}C, the study area's climate is similar to that of El-Jabal El-Akhdar. Rainfall often falls between 200 and 300 mm (Figure 1).

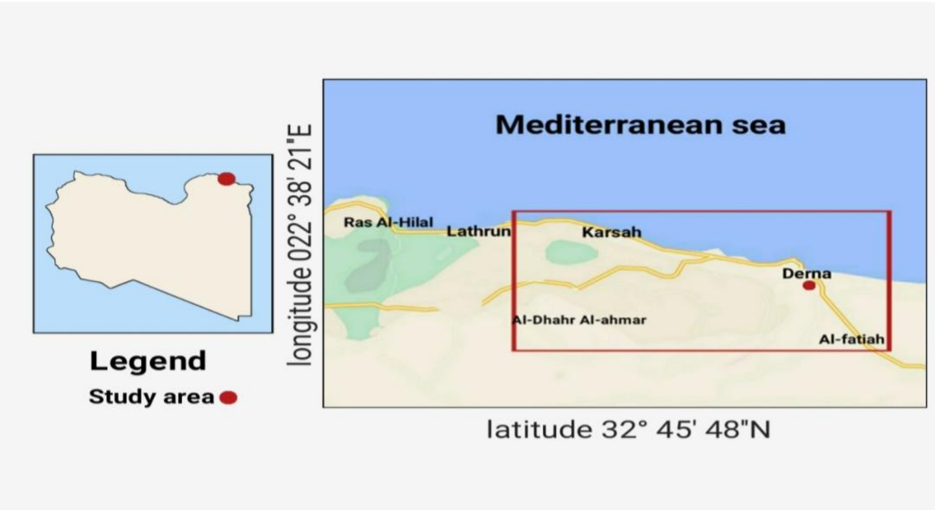

Figure 1. The studied area

Sample extraction
10 grams of each dried sample were taken and transferred to the beaker containing 100 ml of distilled water, and the mixture was mixed. Then the extraction was carried out by the evaporator system at 75 ^{0}C. After two hours, the mixture was filtered, and the filtrate was used to determine the phytochemical screening [6-10].

Determination of Phenol Compounds by Folin Ciacalteu Method
This experiment was carried out to determine Phenolic compounds, where the amount of total phenolic in the Extracts was determined by (the Folin-Ciocalteu) reagent according to the method of Slinkard and Singleton (10) using gallic acid as a standard. Samples (two replicates of the sample) were introduced into test cuvets, then 1.0 ml of Folin-Ciocalteu reagent and 0.8 ml of Na_2CO_3 (7.5%) were added. The absorbance of all samples was measured at 765 nm using the Shimadzu UV – Vis spectrophotometer after incubating at 30 °C for 1.5 h. Results were expressed as ppm of fresh weight.

Determination of antioxidant capacity by the Prussian blue method
One gram of the powdered sample was defatted with petroleum ether. The defatted powder was then extracted sequentially by stirring with 10 ml of methanol twice, then extracted again 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 of methanol. Half ml of the solution was diluted with 3 mL of distilled water, 3 ml (0.008 M) of $K_3Fe(CN)_6$was added,3 ml 0.1M HCl, and 1 ml 1% $FeCl_3$. The blue color is allowed to develop for 5 minutes, and the absorbance is measured at 720 nm at the central lab of the Faculty of Science, Omar Al-Mukhtar University.

Determination of Carbohydrates
To estimate total carbohydrates, a known weight of 0.2 g of the dried sample was ground, then 5 ml of sulphuric acid was added. After completing the samples, the samples were cooled at room temperature, then a small quantity of Barium carbonate (Ba_2CO_3) was added, and the mixture was heated again. After cooling,

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the samples were filtered. One ml of solution was taken, then one ml of 5% phenol was added. The total carbohydrate was determined by the method carried out in a previous study. Where the absorbance was measured at a wavelength of 490 nm [8-10].

Determination of Minerals

The sodium and potassium, calcium contents were measured by a Flame Photometer (JENWAY Flame Photometer) according to the method described by some studies [60-70]. In the central lab of the Faculty of Science, Omar Al-Mukhtar University.

Results

Total Phenols, Antioxidant, and Carbohydrate Contents

In this study, the concentrations of total phenols showed an increase in their values in stems of the studied plants compared with the leaves. The higher content (313.70 ppm), on the other hand, the lower content (194.61 ppm) was observed in the stems of *Myrtus communis L. Sp. Pl* plant. Generally, the contents of total phenols fluctuated as follows (from 194.61to 295.45 ppm) and from 283.449 – 313.770 ppm) of leaves and stems, respectively, (Table 3). The antioxidant values ranged from 9.703 – 9.96 ppm in leaves and from 10.198 -10.528 ppm in stems. No wide variations were observed in the antioxidant contents of the studied plants. The carbohydrate contents did not show high values or high variations between leaves and stems of the studied plants. Where their values ranged between 0.016 and 0.134 ppm in leaves, and from 0.155 to 0.419 ppm for stems (Table 1).

Table 1. The contents (ppm) of Phenols Antioxidant and Carbohydrate in the studied samples

Scientific Name	**Total Phenols**		**Antioxidant**		**Carbohydrate**	
Compounds	Leaves	Stems	Leaves	Stems	Leaves	Stems
Linaria Triphlla (L) Mill Gard Dict	221.12	295.818	9.870	10.198	0.118	0.419
Malva Parviflora Linn. Demonstr. Pl	194.61	283.449	9.703	10.204	0.134	0.156
Myrtus Communis L. Sp. Pl.	295.45	313.770	9.96	10.528	0.016	0.155

Minerals

The results of this study recorded the presence of sodium, potassium and calcium in leaves and stems of the studied plants, the contents of sodium were ranged as following: (0.625 -1.208 ppm) and(1.88 -16.88 ppm) in leaves and stems, respectively, the results indicated that there as increase the sodium contents (16.8 ppm) in *Malva parviflora Linn. Demonstr.Pl* comparing with the other studied plants, especially in stems, the concentrations of potassium showed higher levels compared with sodium and calcium, also, there are high concentrations in *Malva parviflora Linn. Demonstr.Pl* plant compared with the other studied plants. The results showed an increase in the potassium concentrations in stems compared with leaf samples. Generally, the concentrations of potassium fluctuated in the ranges of 3.96 – 28.36 ppm in leaves and from 54.76 – 84.36 ppm in stems. The results also showed small amounts of calcium in leaves compared with stems, there is a relative increase of Calcium (1.541 ppm) in *Malva parviflora Linn. Demonstr.Pl* plant comparing with the other studied plants, (Table 2).

Table 2. The contents (ppm) of minerals (Na, K, and Ca) in the studied samples

Scientific Name	**Sodium**		**Potassium**		**Calcium**	
Compounds	Leaves	Stems	Leaves	Stems	Leaves	Stems
Linaria Triphlla (L) Mill Gard Dict	1.208	7.28	19.76	65.16	0.28	0.375
Malva Parviflora Linn. Demonstr. Pl	1.208	16.88	28.36	84.36	0.68	1.541
Myrtus Communis L. Sp. Pl.	0.625	1.88	3.96	45.76	0.12	0.708

Discussion

According to the study's findings, the plant being studied has tiny levels of carbohydrates, antioxidants, and total phenols. The existence of various phenol or flavonoid molecules, among others, is what primarily determines the antioxidant activity. The majority of plants that are categorized as medicinal typically contain several natural product chemicals that give them their effectiveness as antioxidants. Additionally, the antioxidant is linked to the presence of phenols in plants. An accurate equipment, such as GC-Mass or HPLC, which are used to identify the kinds and amounts of natural products or organic compounds, is required for the assessment of the types of phenols or flavonoids. The presence of carbohydrates indicates that the majority of the plant's secondary metabolites originate from various compounds, such as phenolic acids, tannins, terpenes, and carbohydrates; the slight variations in their contents are primarily caused by the physiological characteristics of each plant tissue [30–35].

The presence of sodium, potassium, and calcium minerals in leaves and stems was also noted in this study. The slight variations in these minerals' contents in the leaves and stems were also linked to the unique structure of each tissue. Additionally, the environmental conditions surrounding the plant sampling had a

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major impact on the mineral contents in samples, including the types of soils, water, and the geochemical makeup of the plants growing [73–85]. The type of chemical analysis also has an impact on the amounts of minerals or metals in samples. A variety of instruments, such as atomic absorption, spectrophotometer, flam photometer, ionic coupling plasma, X-ray Florence, and others, can be used to estimate the metals in various samples, such as soil, water, plants, and others [86–95]. Some studies have also used the metals in other applications, such as antibacterial agents [96–103].

Conclusion

According to the results obtained in this study, the selected plants contain different natural compounds such as sterols, flavonoids, phenols, Alkaloids, Tannins, Anthraquinones, and saponins. Also, there are variations in their contents in leaves and stems. Small amounts of calcium were recorded compared with potassium and sodium. The results also showed that the studied plants contained different amounts of antioxidants and total phenols in both leaves and stems.

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Conflict

The authors state that no conflict in the results recorded in this study with other studies.

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