Evaluation of Phytochemical, proximate analysis, mineral composition and polyphenolic contents of aqueous extract of (Ephedra (Alata) leaves

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Abstract

This study was conducted to determine the mineral, phytochemical constituents and nutritive worth of (leaf Ephedra )which grows in AL – Salman desert, south of Iraq. The nutritional properties and elemental values of this (medicinal plant) were evaluated by leaves aqueous extract that showed high amounts of proteins 12% and carbohydrates 41%, with low amounts of fats. The Results of the phyto-composition in mg/100 g ((DW)) revealed variable contents of TPC, TFC and (TAC )in Ephedra extract leaves obtaining a yield of (48.15±0.6,33.3±0.1,8.8±0.5) respectively. The mineral investigation indicated that this plant leaf has relatively high mineral content like (Cu, K, Ca, Zn, Fe, Mn,) and Mg. Therefore, the present results of phytochemistry, minerals and nutritional content in this promising herb plant promote the leaf’s use as nutrition materials or as pharmaceutical supplements and for clinical treatments.

Keywords: Ephedra Alata; polyphenolics, proximate, medicinal plants, nutritive elements.

1. Introduction

Herbal medication is becoming increasingly the most magnificent tendency towards the discovery of new medicines, bio-sourced materials and provided nutritional purposes to humanity for a long time. Around 4 billion population presently utilize the herbal cure for the amazing nature of some health complications according to the World Health Organization (WHO). These plants contain a broad variety of drug with potential against microbial oxidants, tumors or cancer, hypolipidemia, heart dysfunction, central nervous system, respiratory, immune system, anti-inflammatory, and many other chronic diseases [1]. One of these interesting medicinal plants is (Ephedra alata Decne )which is commonly a part of the (Ephedraceae) family. It is a kind of Ephedra that grew mainly in desert extreme climate conditions . The genus (Ephedra )is instigated approximately( 40 species )present in large hot desert environments [2]. (Ephedra ) kinds species have commonly for a long time in folk Chinese medicine herb for its therapeutic use(for at least 5000 years) beside treatments in the medicine of today.

Figure 1: Ephedra alata in Salman in Muthanna, Iraq during autumn

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Secondary metabolites extracted from Ephedra species are represented by alkaloids (ephedrine pseudoephedrine, or, norephedrine, methylephedrine, methylepseudoephedrine), which act and influence the sympathetic nervous system as a sympathomimetic medicinal drug to treat coughs and flu [3]. Nowadays, polyphenols content and antioxidant activity of Ephedra alata Decne have been considered in the phytochemistry and bioactivity due to their antibacterial activity antifungal and primarily antioxidant activity [4]. The aim of this research was directed towards the determination of the phytochemicals components, nutritional value, mineral contents present in Ephedra alata Decne leaves which were harvested from the desert of Salman (Figure 1&2). The results of this research declared that leaves plant extract could be used for its health benefit.

2. Materials & Methods

2.1 Collection of herbal plant material

Parts of the herbal plant Ephedra alata Decne collected from the Al-Salman desert which is located in Al-Muthanna governorate, Iraq 200 km (124 miles) south of Samawah, from May to September (2019) and authenticated in our university. Leaves were dried, ground into powder, stored in amber bottles and kept in a dark dry place for analysis.

2.2 Preparation of leaves extract

The extraction was carried out as follows, Plant material powdered (20±3, gm) were extracted with 200 mL of water for 24 h. Then filtered by using Whatman filter paper. The (w/w) extract yields were recorded as (10.5%) percentage. The dried extracts which prepared used for chemical and nutritive analysis values of this herb plant.

2.3 Chemicals used

Folin Ciocalteu reagent, methanol, sodium acetate, gallic acid, tannic acid, quercitin, and AlCl3 were procured from Merck. Potassium acetate, ammonium hydroxide, acetic acid, sodium carbonate hydrochloric acid from ferric chloride. All chemicals employed were of standard analytical grade.

2.4 Phytochemical Analysis

2.4.1 Qualitative investigation

Qualitative tests were performed using standard known methods to evaluate the extinction of secondary metabolites like alkaloids, terpenoids, steroids, glycosides, and antioxidants compounds including phenols, flavonoids and condensed tannins [4-5].

2.4.2 Quantitative Analysis

2.4.1.1 Total Phenolic compounds ((TPC))

The concentration of total phenol compounds in the leaf powdered extract of Ephedra alata Decne was estimated using Folin-Ciocalteu reagent method. In brief, 1 mL leaves herb extract ((1 mg per mL−1)) was added to 2.5 mL of Folin–Ciocalteu reagent (10%w/w), then 2 mL of sodium carbonate 2% (Na2CO3) was added [6]. The absorbance was read at 760 nm and the amount of total phenolic compounds value calculated using gallic acid as a standard and expressed as mg/g gallic acid equivalent per 100 gm of the dry leaves herbal.

2.4.1.2. Total Flavonons Content ((TFC))

The total flavonoids content was calculated using quercetin, as a reference flavonoid compound[7]. 1 mL of the leaves herbal plant extract in methanol solvent ((200 µg/mL)) was mixed with 1 mL aluminium trichloride and a drop of acetic acid as added, after that diluted mixture with methanol up to 25 mL. The absorbance was read at 415 nm after 40 min incubation. The total flavonoid content was estimated using a standard curve of antioxidant compound quercetin (( with conc.12.5-100 µg/mL)) and expressed as mg of quercetin equivalent ((QE/mg of herbal leaf).

2.4.1.5 Alkaloids Determination

One mg of leaves plant extract was dissolved in solvent DMSO dimethyl sulphoxide and 1 mL with conc.2 N HCl was added and filtered by watt man filter paper. The solutions moved to a separating funnel with (5 mL) adding of the dye Bromocresol green solution and (5 mL) of phosphate buffer solution. The mixture was then shaken for a time thoroughly with (4 mL) of organic solvent chloroform and collected in a volumetric flask and diluted up to 10 mL volume with chloroform. The absorbances were read at 470 nm using an ultraviolet ((UV)) spectrophotometer. Finally, the total alkaloid conc. was calculated as mg of functional compound ephedrine equivalent ((AE)/g of each part extract [8].

2.5 Mineral Element content

Estimation of elements in powdered leaves was conducted by using a soft (NOVA 400 ) equipment atomic absorption spectrometer (Germany). By using wavelengths numbers and lamp kind for determine concentration of essential minerals as potassium ((K)), magnesium ((Mg)), zinc ((Zn)), calcium ((Ca)), copper ((Cu)) and iron ((Fe)). The results obtained for the concentration of (Mg, Ca, K, Zn, Cu) and Fe were expressed in (mg mineral/L extract) [9].

2.6 Proximate Analysis

The moisture content, ash, crude fiber, fat, protein and carbohydrate content was screened by the methods described by [10]. The carbohydrate is obtained by the difference between the total dry matter (( as 100% from total samples))
and the content of the percentage amount of crude soluble or insoluble fibre, protein, fat and ashes residue.

3. Results and Discussion

The results obtained through our study connected either proximate composition of the Ephedra leaves (Table 1) found that plant leaves parts have acceptable amounts of proteins, fats which makes this plant energy-rich source as it contains available carbohydrates, dietary soluble or insoluble fiber which improve human health by reducing cholesterol, triglycerides and can prevent tumors and cancer as well as GIT dysfunction [11]. The obtained results show that the herbal plant with limit water moisture content in leaves could inhibit bacterial, fungal, and ferment extension and recommend it as a significant demand for remedy storage [12]. The whole ash content is a test of the proximity of inorganic compounds in a drug from where the minerals could be obtained. Measuring the ash content of (Ephedra alata) is important because elements calculated in the material may use in pharmacy drugs [13]. Proteins are vital because they are required ingredients of the nutrition demanded by animals and humans. Moreover, their primary role in a diet is to provide enough quantities of needed amino acids. Furthermore, the presence of proteins may promote maturity, and tissue improvements, producing vital hormones and enzymes and may also serve as an alternative energy in starvation or malnutrition [14]. The value of fiber in the diet cannot be ignored since it reduces serum cholesterol levels, the danger of coronary heart attacks, hypertension, breast cancer, diabetes, obesity and other digestive complications [15]. Elevated crude fiber eating further raises the time of intestinal penetration and has prebiotic results.

Table 1: Nutritional parameters of Ephedra alata leaves (% dry matter)

<table>
<thead>
<tr>
<th>Composition</th>
<th>Leaves value%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiber</td>
<td>45.7 ±0.0003</td>
</tr>
<tr>
<td>Fat</td>
<td>0.2±0.0004</td>
</tr>
<tr>
<td>Moisture</td>
<td>8.8±0.007</td>
</tr>
<tr>
<td>Ash</td>
<td>15.7 ±0.0006</td>
</tr>
<tr>
<td>Protein</td>
<td>12.73% ±0.002</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>41.53 ±0.003</td>
</tr>
<tr>
<td>Energy</td>
<td>645.61 ±0.0001</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>2.037 ±0.0001</td>
</tr>
</tbody>
</table>

Table 2: Phytochemical screening of (aqueous extract) of Ephedra alata

<table>
<thead>
<tr>
<th>Phytochemical</th>
<th>Leaves.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saponin</td>
<td>+</td>
</tr>
<tr>
<td>Phenols</td>
<td>+</td>
</tr>
<tr>
<td>Tannin</td>
<td>+</td>
</tr>
<tr>
<td>Flavonoids</td>
<td>+</td>
</tr>
<tr>
<td>Reducing sugars</td>
<td>+</td>
</tr>
<tr>
<td>Anthraquioes</td>
<td>-</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>-</td>
</tr>
<tr>
<td>Steroids</td>
<td>-</td>
</tr>
<tr>
<td>Terpenoids</td>
<td>+</td>
</tr>
<tr>
<td>Alkaloids</td>
<td>+</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>+</td>
</tr>
</tbody>
</table>

Key: + = Present - = Not detected

Phytochemical analysis regarded the herbal plant (Ephedra) leaf has been confirmed to have a mixture of phytochemicals as sugars which have reduction action, glycosides, many phenolic compounds especially flavonoids and basic species alkaloids (Table 2).

The herb plant (Ephedra alata) is investigated for its high metabolites as alkaloid content, in this point alkaloids related the ephedrine compound ((E)) type[16]. The alkaloids content was found in the range of 8.8±0.5 mg/g in leaves. The presence of alkaloid commonly used in drug preparation may account for the medicinal use of the Ephedra leaves [17]. The presence of antioxidants like phenolic compounds found in the plants indicates that this medicine plant may act antimicrobs action. This result agrees with the document reported by [17]. The presence of flavonoids contents indicates that the Ephedra alata leaf may be an origin of antioxidants maintaining free-radical scavenging capacities [18]. Flavonoids in many studies show various pharmacological and care uses such as decreased inflammatory response consequences as anti-fungal, anti-
bacterial, antivirus and remove toxins effects [19]. Polyphenols and their antioxidant action is essentially due to their reoxid features and chemical composition which might perform a critical function in chelating transition metals and scavenging free radicals. They can donate electrons either singlet and triplets well as mineral attached molecules as chelators [20].

Table 3-TPC, TFC and TAC in Ephedra alata leaves

<table>
<thead>
<tr>
<th>Phytochemical constituent</th>
<th>TFC (mg GAE/gm weight)</th>
<th>Conc.(poly phenols) mg (mg/g dry weight)</th>
<th>TAC DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaves value</td>
<td>33.3±0.1</td>
<td>48.15±0.6</td>
<td>8.8±0.5</td>
</tr>
</tbody>
</table>

The essential mineral compositions of herb plant (Ephedra alata) leaves are represented below in Table 4. It involves the number of macro elements like (Zinc, Iron, Calcium, Magnesium and Potassium). Heavy metals like lead was not detected. [21] discussed and reported that zinc is important in synthesis and protein functions such as growth and division, defense system, and sex functions. Calcium is known to be greatly essential for blood clot bones to strengthen and act as a co-factor in some (enzyme as catalysis for enhancing reactions) [22]. In humans, magnesium metal is required by human and body cell fluid as it regulates and maintains osmotic fluid equilibrium [23]. Iron helps the redox reaction of macromolecules to prevent obesity which causes different diseases. It’s also greatly vital for (haemoglobin synthesis and formation) [23] and plays an important action in energy transfer inside or outside the plant and is also a critical start material of some enzymes and proteins. This confirms and aids the use of herb (Ephedra alata) in tradition and common medicine as a blood control because of its effect on blood clotting effect [24].

Acceptable and fixed amounts of mineral potassium (K) were recorded in the species leaves of Ephedra alata which are considered to be the main positive charge ions of Exo and endo-cellular liquid contents and help in keeping regulation within the body [25]. (Potassium) metal is very important and is greatly needed by a human in large quantities for correct and (plant growth and reproduction).

Table 4: Mineral contents of Ephedra alata leaves

<table>
<thead>
<tr>
<th>Mineral Element</th>
<th>concentration mg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>25.8</td>
</tr>
<tr>
<td>Magnesium</td>
<td>17.32</td>
</tr>
</tbody>
</table>

4. Conclusion

The results obtained indicate that ephedra leaves were rich in nutritional properties and contained good bioactive materials, hence they are suitable to be used in herbal preparation for medicinal purposes.

References


