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NUTRITIVE VALUE AND CHEMICAL CONSTITUENTS OF *FORSSKAOLEA VIRIDIS* AERIAL PARTS

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ABSTRACT

In this study, the proximate analysis and primary phytochemical screening of the aerial parts of *Forsskaolea viridis* Ehrenb. ex Webb (Family: *Urticaceae*) has been done. Proximate analysis showed that the percentage of total ash was (16.77 ± 0.22), crude fibers (10.82 ± 0.41), total lipids (6.27 ± 0.07) and the chemical and physical properties of lipids were determined, total protein was (8.81± 0.45), total carbohydrates was (34.72± 0.41) and nutritive value of the plant determined. Phytochemical screening showed the presence of phenols, flavonoids, alkaloids, terpenoids, steroids, tannins, saponins, and sugars in the aerial parts of *F.viridis*.

KEYWORDS: *Forsskaolea viridis*, proximate analysis, crude fibers, total lipids, total ash, nutritive value and phytochemical screening.

INTRODUCTION

Family *Urticaceae* comprises 54 genera and more than 2000 species of herbs, shrubs, small trees, and a few vines.[1] *Forsskaolea* is a small genus in the nettle family, represented by 6 species, distributed in Canary Isles and southeast Spain eastwards to Pakistan, Africa, and Arabia to Western India.[2,3] The preliminary phytochemical screening of *Forsskaolea viridis* Ehrenb. ex Webb showed it contained carbohydrates, proteins, amino acids, alkaloids, flavonoids and tannins.[4]

The aim of this study is to investigate the proximate analysis and phytochemical investigations of *F. viridis* aerial parts, because of insufficient studies concerning of the proximate analysis and chemical contents on the plant.

MATERIALS AND METHODS

1. Collection of the Plant Sample

The fresh *Forsskaolea viridis* aerial parts were collected from Gebel Elba habitat during the period of investigation from southeast corner of Egypt in January 2016. They were washed, air-dried at lab. Temperature, then dried in an oven at 50°C till constant weight, and finally ground to fine powder. The plant specimens were identified and authenticated by Dr. Omran Ghaly, Desert Research Center. A voucher herbarium specimen was deposited in the herbarium of Desert Research Center (CAIH) with Code Number: CAIH-1000-R.

2. Methods Used for Proximate Analysis

The analysis was achieved using standard techniques provided by Association of Official Analytical Chemists.[5]

2.1.1. Moisture Content

The moisture content was determined by drying five gram fresh plant sample at 105°C in the oven up to constant weight.[5]

2.1.2. Ash Content

Total ash was determined by using a ceramic crucible. Three grams of the powdered sample were weighed and then dried at 100-105 ºC for 1 hr and ignited to constant weight in a muffle furnace at 600-625 ºC.[6]

2.1.3. Crude Protein

The total crude protein of the plant sample was assessed by determining total organic nitrogen using the method described in.[7,8] Total protein was calculated by multiplying the total nitrogen by the factor 6.25.[5]

2.1.4. Crude Lipid

The crude lipid content was determined by extracting the samples using petroleum ether (boiling point 40-60°C) in a Soxhlet apparatus for 6 hours then evaporating the solvent up to dryness using rotary evaporator.[5]

2.1.5. Crude Fiber

Crude fiber contents were determined by the method described in.[5]

2.1.6. Carbohydrate Contents

Total carbohydrate contents of the plant sample were obtained by subtracting the sum of ash, fats, proteins and fiber (in percentage) from 100[9] as stated below:

Carbohydrate (%) = 100- [moisture (%) + protein percentage (%) + lipid (%) + ash contents (%) + crude fibers (%)]. The investigation of total, soluble and insoluble carbohydrates were determined by the methods described in.[10]

3. Nutritive Values

The calculation of energy (kcal/100g dry weight) was carried out by multiplying the values obtained for protein, carbohydrates and fat by 4.00, 4.00 and 9.00, respectively, the results are expressed in kcal.[11] Whereas, the energy values of the sample was determined by using the following formula:

K calories /100 g = 9 [crude fats (%) + 4(carbohydrates (%) + proteins (%)]

4. Methods of Preliminary Phytochemical Screening

Preliminary Phytochemical Screening

Tests for volatile oils, carbohydrates and/or glycosides, resins, saponins, tannins, flavonids and/or phenolics, sterols, terpenes, alkaloids and cardic glycosides of *F.Viridis* aerial parts were carried out.

a. Steam Distillation of Volatile Oils

Fifty grams of fresh *F.viridis* aerial parts were subjected to steam distillation to extract volatile oils according to.[12]

b. Test for Carbohydrates and/or Glycosides

Molish's test carried for aerial parts of the plant for the presence of carbohydrates which described in.[13]

c. Test for Saponins

Haemolysis test was carried out for aerial parts of the plant to investigate the presence of saponins which described in.[14]

d. Test for Tannins

Ferric chloride and phenazone test**s** were carried out for aerial parts of the plant to investigate the presence of tannins which described in.[15]

e. Test for Flavonoids

Schinoda's test carried out for aerial parts of the plant to investigate the presence of flavonoids and/or phenolics which described in.[16]

f. Test for Sterols and Terpenes

A few mls of the 70 % alcoholic extracts of the plant aerial parts were evaporated till dryness. The residue was dissolved in 2ml chloroform and filtered. The filtrate was subjected to Libermann-Burchard's test which described in[17] and Salkwski Reaction's which described in.[18]

g. Test for Alkaloids

Mayer, Wagner and Dragendorrf tests were carried out for aerial parts of the plant to investigate the presence of alkaloids which described in.[19]

5. Methods of Total Active Materials

a. Estimation of Total Flavonoids Content (TFC)

The flavonoid content of *F. viridis* aerial parts determined spectrophotometrically and calculated as rutin equivalent according to.[20,21]

b. Estimation of Total Tannins

Condensed tannins were determined and expressed as mg (+)-catechin/g DW according to the method described in.[22]

c. Estimation of Total Saponins

The saponin content was calculated in percentage according to the methods described in.[23]

d. Estimation of Total Alkaloids (Gravimetric Method)

The total alkaloids was calculated in percent w/w according to the methods described in.[19]

e. Estimation of Total Phenolic Content (TPC)

The amount of total phenolic in plant extract was determined with Folin Ciocalteus reagent. Gallic acid was used as a standard and the total phenolics were expressed as µg/mg gallic acid equivalent (GAE) which described in.[24]

RESULTS AND DISCUSSIONS

The proximate analysis of *F. viridis* aerial parts were determined during the period of investigation (Jan 2016) and showed that, the percentage of water content of the fresh aerial parts was (22.61 ± 2.3)%. This percentage of water content of *F. viridis* aerial parts may be due to the presence of water sources in the winter, which lead to normal plant growth.[25]

The percentage of inorganic matter (ash) in *F. viridis* aerial parts during the period of investigation (2016) was (16.77 ± 0.22)%. Meanwhile, the percentage of organic matter was (83.23 ± 0.15) %. The rise in ash content is due to the increase of total ion accumulation as a result of increasing soil moisture stress and soil salinity, which agreed with the results obtained by.[26]

Also, the results showed that, the percentage of crude fibers of *F. viridis* aerial parts was (10.82 ± 0.41)% where dietary fibres play an important role in human health, which consists mainly of cellulose, hemicelluloses and lignin, which exert different physiological effects on human health.[27] Food fiber helps in absorption of trace elements in the gut and reduce absorption of cholesterol.[28]

The percentage of total carbohydrates of *F. viridis* aerial parts was determined which showed an increase in its

contents (34.72 ± 0.31%) while, the percentage of soluble and insoluble sugars were (33.08 ± 0.20) and (1.64± 0.20%) respectively. The obtained results are in harmony with those obtained by.[29] Such an increase in total carbohydrates under water conditions in flowering season is considered as an adaptive mechanism to water stress, since water tolerance can be partly attributed to soluble sugars accumulation.[30] As they are able to protect the structural integrity of membranes during dehydration.[31] Soluble sugars have a protective role for chloroplast from damage under water deficit conditions. Also, the increase in water content was found to be linked with an accumulation of soluble carbohydrates, which play an important role in increasing the osmoregulation.[32]

The percentage of total protein of *F.viridis* aerial parts was (8.81± 0.45)% respectively. The amount of total nitrogen and protein content was recorded in flowering season which may be due to the increase in metabolic rate of the studied plant as a result of high water resources of the soil.

Proximate Analysis

The results of proximate analysis of *F.viridis* aerial parts were recorded in table (1) which revealed the following data, total ash (16.77%), crude fiber (10.82%), crude fat (6.27%), crude protein (8.81%) and carbohydrate content (37.72%). Energy value was (230.55 K.cal./100g).

Table 1: Proximate analysis of *F.viridis* aerial parts.

Moisture g %	g/100 g dry weight					Energy value Kcal/100 g
	Ash	Crude fiber	Crude fat	Protein	Carbohydrates	
22.61	16.77	10.82	6.27	8.81	34.72	230.55

Proximate analysis of a food is the nutritional composition of that food and it is the estimation of nutritive value of human food in its chemical form.[33] The proximate analysis as shown in our results revealed that, *F.viridis* aerial parts contains high percentages of carbohydrates. This is beneficial, since carbohydrate constitutes a major class of naturally occurring organic compounds that are essential for the maintenance of plant and animal life and also provide raw materials for many industries.[34]

The relative high carbohydrate content can be used as energy source and also it is necessary in the digestion and assimilation of other foods.[35] Fat content is relatively high. It can be used for storage and transport forms of metabolic fuel. The protein content can contribute to the formation of hormones which controls a variety of body functions such as growth, repair and maintenance of body protein.[36] The results from the proximate analysis also showed that, *F.viridis* aerial parts was high in crude fiber content. At the same time, the results showed that, crude protein and ash are relatively high.

Nutritionally, this is of beneficial effect since it had been reported that, food fiber aids absorption of trace elements in the gut and reduce absorption of cholesterol.[28] The high content of ash is useful in assessing the quality of grading the plant and also gives an idea of the amount of minerals present in the plant sample.[36]

Chemical investigations

Phytochemical screening of 70% aqueous methanolic extract of *F.viridis* aerial parts showed the presence of various phtytoconstituents like alkaloids, glycosides and/or carbohydrates, cardiac glycosides, sterols and/or terpenes, tannins, saponins, flavonoids and phenolic compounds as shown in table (2).

Table 2: The preliminary phytochemical screening of *F.viridis* aerial parts.

Parameters	Results
Alkaloids	+ve
Glycosides and / or Carbohydrates	+ve
Cardiac Glycosides	+ve
Saponins	+ve
Sterols and / or terpenes	+ve
Tannins	+ve
Flavonoids and phenolics	+ve
Volatile oils	-ve

(+ve) = Positive results (-ve) = Negative results

The presence of secondary metabolites (alkaloids, saponins, tannins, flavonoids and phenolic compounds) lead the plant to be used for treatment of many diseases such as fever, cough, rheumatoid, cancer, headache ….. *etc*. where the plant secondary metabolies have potent antimicrobial, antioxidant, antitumor, antiviral activities.[37,38]

Table 3: Total active materials of *F.viridis* aerial parts.

Item	Results %
Total flavonoids (Rutin equivalent)	0.877 ± 0.2
Total phenolic acids (Gallic acid equivalent)	0.950 ± 0.5
Percentage of total tannins	0.623 ± 0.3
Percentage of total saponins	0.570 ± 0.4
Percentage of total alkaloids	0.426± 0.2

The high concentration of phenolic acids and flavonoids lead to increasing the ability of the plant to protect itself against insects, fungi, bacteria, and viruses because of their antioxidant activities.[39]

The literature collection, pertaining
to this investigation indicates that flavonoids and other plant phenolics are reported to have multiple biological activities in addition to their antioxidants or free radical terminators activity.[40]

Phenolic acids and flavonoids make the plant to have antimicrobial, antiviral, antioxidant and anti-inflammatory activities[41] and cytotoxicity against HEPG-2.[42] Anti-allergic, anti-inflammatory, anti-microbial, antiviral, they influence blood coagulation, anti-cancer activity and prevent heart attacks.[43,44]

Results of the present study showed that, the percentage of total phenolic acids and flavonoids were the highest concentration so the present study concerned to separate and identify the isolated phenolic acids and flavonoid compounds.

The flavonoids have been further adopted for a number of other uses by the plants and the animals that consume them. In plants, they appear to have diverse functions, including functioning as antioxidants, superoxide radical scavengers, chelators mediating mineral uptake, enzyme inhibitors and regulators, redox dispersal mechanisms by insects and animals. They also stated that, flavonoids biosynthesis might also be induced by exogenous stimuli, such as changes in light and temperature.[45]

CONCLUSION

The proximate analysis of *F.viridis* aerial parts showed that, the nutritive value of the plant was 230.55 Kcal/100g which considered an important as a nutritional source for animals and man which can provide them for sufficient energy which aid them to perform with vital operations and can affect by the formation of primary metabolites (vitamins, hormones, sugars …… *etc*). The phytochemical screening showed that, the plant aerial parts was rich of all types of secondary metabolites (flavonoids and/or phenolics, alkaloids, tannins and saponins). The findings showed that the total phenolic constituents of the plant aerial parts was high percentage which plays a vital role in treatment of many diseases.

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