

Nutritional value of six wild edible plants traditionally used as vegetables in Morocco

Ridwane Ghanimi^{1*}, Ahmed Ouhammou², Hakim Baazizi³, Khaoula Houguig¹ and Mohamed Cherkaoui¹

¹Laboratory of Pharmacology, Neurobiology, Anthrop Biology, Environment and, Behaviour, Department of Biology, Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakech, BP 2390, 40000, Morocco

²Laboratory of Microbial Biotechnologies, Agro Sciences, and Environment (BioMAGe), Regional Herbarium 'MARK', Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakech, BP 2390, 40000, Morocco

³National Marine Research Institute (INRH), Laboratory quality control, Agadir, Morocco

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ABSTRACT

Wild edible plants are used in various traditional dishes in rural areas. The present study aims to determine the nutritional value and chemical composition of six wild edible plants (*Nasturtium officinale*, *Malva sylvestris*, *Portulaca oleracea*, *Silene vulgaris*, *Scolymus hispanicus*, and *Emex spinosa*) commonly consumed in the Al-Haouz region of Morocco. Moisture, proteins, and ashes contents were analyzed according to the official Association of the Official Analytical Chemists Methods (AOAC) and fats content was determined by the Mojonnier method. The results revealed that these wild edible plants are rich sources of carbohydrates and proteins, while they had revealed low amounts of fats. The highest values of total carbohydrates, fat, and ash were found in *Emex spinosa*, *Malva sylvestris*, and *Silene vulgaris*. Finally, these wild edible plants seem to be important nutritional resources that should be valued to promote rural areas and conserve the gene pool that is threatened due to domestication.

Keywords: Dietary potential, Wild edible plants, Nutritional composition, Macronutrients; Morocco.

Introduction

Nutrition and biodiversity are two factors that can ensure food security and sustainable development (Erskine *et al.*, 2015). Therefore, integrating biodiversity into policies to reduce hunger and improve food security has the potential to generate wider benefits, including poverty reduction (Toledo and Burlingame, 2006). On the other hand, wild plants have played a crucial role in the human diet, and some communities still depend on these wild foods (Tbatou *et al.*, 2016). In Morocco, wild plants

are a seasonal food complement, and the most popular species are often traded in street markets (Bellakhdar, 1997).

World-wide food problems have challenged all organizations and researchers to investigate the possibility of using wild plant species as a supplementary source of carbohydrates, vitamins, fats, proteins, and minerals (Abubakar *et al.*, 2021). Moreover, the well-balanced diet has changed in recent years towards less red meat and more vegetable and fruit (Aberoumand and Deokule, 2009). Global dietary guidelines recommend increased consumption

of fruits and vegetables to mitigate the threat of diet-related diseases, including metabolic disorders, cancer, and cardiovascular diseases (Stratton *et al.*, 2021).

Therefore, the promotion of these plants will ensure important nutritional sources while respecting biodiversity. This work aimed to determine the energy value and chemical composition including carbohydrates, proteins, moisture, lipids, and total ash content of six wild edible plants used as vegetables in traditional Moroccan dishes.

Materials and Methods

Samples preparation

Six different wild edible plants (*Nasturtium officinale*, *Malva sylvestris*, *Portulaca oleracea*, *Silene vulgaris*, *Scolymus hispanicus*, and *Emex spinosa*) were collected during 2020. The botanical identification was done by Professor Ahmed Ouhammou in the regional herbarium "MARK" of the FSSM-Marrakech, University Cadi Ayyad (Morocco). The selected species were known for their use as wild vegetables in the Al-Haouz region, Morocco. These wild edible plants were collected at the mature stage of their phenology where the stems and leaves are well grown but still tender. The samples were rinsed under the running water and the inedible parts were eliminated. The edible parts were dried under shade and then powdered in a blender for further study.

Water content

The Moisture was determined by drying 4-5 g of samples in the drying oven at 100 °C until a constant weight was obtained (Nielsen, 2003).

Proteins content

Total protein content was determined by the Kjeldahl method (European Commission regulation N° 152, 2009). The sample (1g) was digested by 25ml of concentrated sulfuric acid in the presence of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ as catalyst (1g). The acid solution was then alkalinized by 100 ml of sodium hydroxide 40%. The ammonia was distilled off and collected in 25ml of sulfuric acid (0.25 mol/l), the excess of which was titrated by a standard solution of sodium hydroxide (1mol/l). The total proteins content was calculated by multiplying nitrogen quantity by the conversion factor (6.25).

Total fats content

The total fat content was determined by the Soxhlet method. A quantity of 2 g of the dried samples was dissolved in 250 ml of petroleum ether. The solvent was removed by a rotary evaporator, then the extracted fats were dried at 100 °C and cooled in a desiccator before being weighed (Nielsen, 2003).

Ash content

The sample (5 g) was placed in an ash crucible that was previously heated to 550 °C, cooled down, and tared. The crucible was then heated on the hot plate until the substance was carbonized and then placed in the calibrated muffle-furnace set at 550 °C. After 3 hours, the crucible was placed in a desiccator, cooled, and then reweighed (European Commission regulation N° 152, 2009).

Total carbohydrates

The total carbohydrates content was calculated according to Ouzouni *et al.* (2009) by the following formula: (% total carbohydrates = 100 - % moisture - % protein - % ash - % fat).

Total energy

Total energy was calculated according to the following equation (Barros *et al.*, 2010):

$$\text{Energy (kcal)} = 4 \times (\text{g protein} + \text{g carbohydrate}) + 9 \times (\text{g lipid}).$$

Results and Discussion

The proteins content

Table 1 shows the energy and nutritional value of six wild edible plants that are used as vegetables in the Al-Haouz region. *Silene vulgaris*, *Malva sylvestris* and *Emex spinosa* showed the highest protein con-

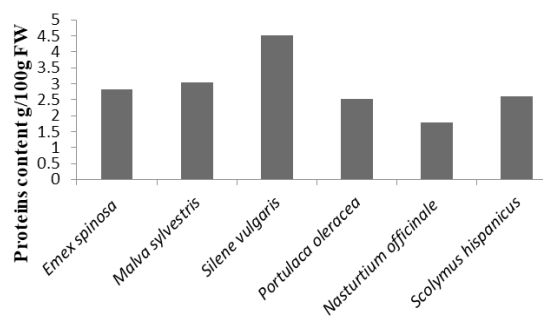


Fig. 1. Proteins content of the six wild edibles plants

tents with 4.53 g/100g FW, 3.05 g/100g FW, and 2.83 g/100g FW, respectively (Fig. 1).

The high protein content in *Silene vulgaris* compared to other plants has been reported by several authors (García-Herrera *et al.*, 2020; Thakur *et al.*, 2021). This high protein content of *Silene vulgaris* would allow this species to be a good complement to the human diet (Thakur *et al.*, 2021). In addition, it is known that diets rich in plant proteins have advantages over animal proteins as in the case of chronic renal failure where plant proteins do not accelerate the progression of the disease and would also allow a reduction in weight without risk among obese patients (Bernstein *et al.*, 2007).

Lipid and carbohydrate content

The highest lipid and carbohydrate levels were observed in *Emex spinosa* (0.48 g/100g FW lipid and 11.06 g/100g FW carbohydrate), *Malva sylvestris* (0.48 g/100g FW lipid and 10.63 g/100g FW carbohydrate), and *Silene vulgaris* (0.40 g/100g FW lipid and 10.22 g/100g FW carbohydrate), respectively.

Emex spinosa is used as a wild vegetable in the Al-Haouz region and other Moroccan regions. The carbohydrate and lipid content obtained from this

species was very high compared to other studies such as the one conducted by Tbatou *et al.*, 2018 in the El-Jadida region (0.13 g/100g FW for fats and 5.25 g/100g FW for carbohydrates).

The ash content

The highest ash contents were observed in *Malva sylvestris* (2.76 g/100g FW), 2.29 g/100g FW in *Emex spinosa*, and 2.10 g/100g FW in *Silene vulgaris*. The ash content of *Malva sylvestris* reported by Barros *et al.* (2010) was 13.53g/100g of Dry Weight, while that reported by Tabaraki *et al.*, (2012) was 14.85 g/100g of DW. However, these values are lower than those obtained in our study (16.32g/100g of DW = 2.76 g/100g of FW).

The water content

The three species; *Nasturtium officinale*, *Portulaca oleracea*, and *Scolymus hispanicus* revealed the highest moisture content with 92.33%, 90.09%, and 88.58%, respectively. Also, *Nasturtium officinale* among all the plants studied revealed the lowest content of protein (1.79 g/100g FW), lipids (0.16 g/100g FW), carbohydrates (4.62 g/100g FW), and ash (1.1 g/100g FW). Moreover, the *Nasturtium officinale*, is

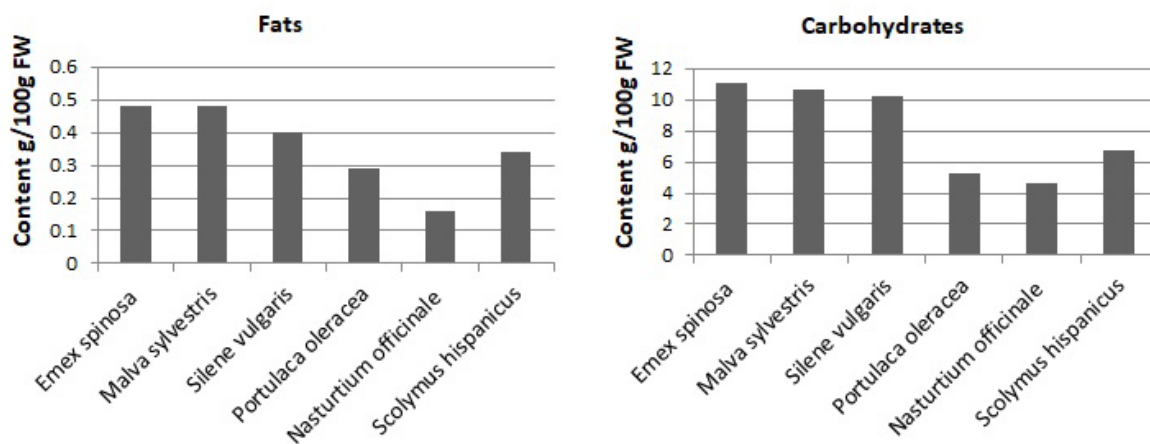


Fig. 2. Fats and carbohydrates content of the six wild edibles plants

Table 1. The nutritional value (g/100 g fresh weight (FW) and energetic value (kcal/100 g FW).

Species	Proteins	Fats	Carbohydrates	Ashes	% Moisture	Energy
<i>Emexspinosa</i>	2.83	0.48	11.06	2.29	83.33	59.93
<i>Malva sylvestris</i>	3.05	0.48	10.63	2.76	83.09	59.00
<i>Nasturtium officinale</i>	1.79	0.16	4.62	1.10	92.33	27.10
<i>Portulaca oleracea</i>	2.51	0.29	5.32	1.79	90.09	33.93
<i>Scolymus hispanicus</i>	2.60	0.34	6.76	1.72	88.58	40.50
<i>Silene vulgaris</i>	4.53	0.40	10.22	2.10	82.76	62.57

known for its antioxidant power as well as high hypolipidemic activity (Bahramikia and Yazdanparast, 2010; Yazdanparast *et al.*, 2008). *Portulaca oleracea* also has a high water content which explains its high ash to dry matter ratio, which is in agreement with similar results on *Portulaca oleracea* that have been reported by several studies (Mohamed and Hussein, 1994; Teixeira and Carvalho, 2009).

The energy value

Regarding the energetic value, the highest result was observed among *Silene vulgaris* with 62.57 kcal per 100 g of fresh matter, while *Nasturtium officinale* showed the lowest energetic value (27.10 kcal/100 g FW) due to its high water content compared to the other studied species.

Conclusion

The wild edible plants studied were found to be an excellent source of macronutrients. The highest values of total carbohydrates, fat, and ash were found in *Emex spinosa*, *Malva sylvestris*, and *Silene vulgaris*. The two species *Nasturtium officinale* (92.3376 g/100g of FW) *Portulaca oleracea* (90.0976 g/100g of FW) revealed the highest water content. On the other hand, *Silene vulgaris* revealed the highest protein content (4.53 g/100 g body weight) and the highest energy value (62.57 kcal/100 g body weight). Regarding the ash content, *Malva sylvestris*, *Emex spinosa* and *Silene vulgaris* were the richest species with 2.76 g/100 g FW, 2.29 g/100 g FW, and 2.10 g/100 g FW, respectively. Therefore, these wild edible species should be promoted to conserve the biodiversity and the wild genes that are threatened due to domestication.

Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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