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Original Research Article

Nutrient composition of six wild edible Mediterranean Asteraceae plants of dietary interest

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ABSTRACT

Interest in wild leafy vegetables has significantly increased in Europe, and elsewhere, because they provide high nutrient levels and potential health benefits. Some Asteraceae species are widely cultivated, and many non-cultivated species are also traditionally eaten as green vegetables; however, the information on their nutrient composition is scarce. This study presents useful data (proteins, fat, available carbohydrates, soluble/insoluble fibre and mineral content) of interest for furthering the knowledge of the nutritional value of six wild Asteraceae species traditionally consumed in many areas in Mediterranean countries. These rarely studied species are *Taraxacum obovatum* (Willd.) DC, *Chondrilla juncea* L., *Sonchus oleraceus* L., *Cichorium intybus* L., *Scolymus hispanicus* L. and *Silybum marianum* (L.) Gaertn. From the results obtained, these species are notable for their high fibre content (2.3–13.4 g/100 g), K (375–1772 mg/100 g) and Ca (16–472 mg/100 g), compared to most conventional vegetables. *C. juncea* can contribute to fibre and micronutrient intakes, particularly Mn (with values of up to 50% of daily Recommended Dietary Allowances for adults). These new findings suggest that these plants can be considered as valuable food resources in the traditional Mediterranean diet, allowing their incorporation into food nutrient databases.

1. Introduction

The consumption of wild greens has traditionally played an important role in complementing staple agricultural foods in many countries, and their contribution to the Mediterranean diet is well documented (Hadjichambis et al., 2008; Leonti et al., 2006; Tardío, 2010). Several studies reveal the important role played by unconventional species, as excellent sources of macro- and micronutrients in contributing to human dietary requirements (Flyman and Afolayan, 2006; Grivetti and Ogle, 2000; Ogle, 2001; Tardío et al., 2011). Moreover, green leafy vegetables may have a role as functional foods, as they contain physiologically active food components and provide health benefits beyond basic nutrition, showing potential biological activity of interest for the prevention of several chronic diseases (Guil-Guerrero et al., 1998a,b, 1999; Trichopoulou et al., 2001; Salvatore et al., 2005; Flyman and Afolayan, 2006). Therefore, the revalorisation of these traditionally consumed wild species is an important strategy to improve the diversity of available foods, which today is receiving the focus of renewed attention.

The Asteraceae are one of the largest plant families, with more than 1600 genera and about 23,000 species, most of them occurring in temperate regions (Jeffrey, 2007). These plants are generally herbaceous and less frequently shrubs or sub-shrubs (Punt and Hoen, 2009). Human consumption of wild edible members of the Asteraceae family has been widespread, e.g. of 719 Asteraceae species in the Iberian flora, 65 species have been used as wild vegetables in Spain. A regression analysis showed that the number of edible species used is much higher than predicted by the number of species in this family (Tardío, 2010). This preference for Asteraceae vegetables is certainly due to their agreeable sensory properties, leading nowadays to the cultivation of many species of this family for human consumption (Guil-Guerrero et al., 1998a).

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There are various ethnobotanical references from Spain (Tardío et al., 2006), and other countries (Hadjichambis et al., 2008; Leonti et al., 2006) that confirm that the leaves of many Asteraceae are traditionally consumed – either raw or cooked – in the regions where they grow. Some of them suggest that they may provide a significant input of biologically active compounds in the diet (Leonti et al., 2006). However, these wild plants have been little studied as foods, and are not included in food composition databases due to the scarcity of data on their composition in the scientific literature.

Some previous works (Sánchez-Mata et al., 2012) showed that *Taraxacum obovatum* (Willd.) DC, *Chondrilla juncea* L. and *Cichorium intybus* L. contain 10–20 mg/100 g of vitamin C and <100 mg/100 g of oxalic acid (which is an abundant antinutrient in many leafy vegetables, decreasing Ca bioavailability). *T. obovatum* is notable for its very low oxalic acid content (3–20 mg/100 g), while *Silybum marianum* (L.) Gaertn and *Scolymus hispanicus* L. have low amounts of vitamin C and high concentrations of oxalic acid (100–1000 mg/100 g); however, oxalic acid content is greatly reduced if they are consumed cooked (García-Herrera et al., 2012). In another study, *Ci. intybus* and *Sonchus oleraceus* L. were shown to contain higher amounts of tocopherols (2.98 and 2.22 mg/100 g respectively) than other wild vegetables, with α-tocopherol as the main vitamer (Morales et al., 2012a,b).

Apart from these studies focusing on bioactive compounds, there are very few data available on the nutritional composition of some of the most widely-used wild edible Asteraceae species. Various wild species of the genus *Sonchus* have been studied by Guil-Guerrero et al. (1998a), and cultivated and wild *Ci. intybus* leaves, by Maynard and Hochmuth (2007) and Jan et al. (2011), respectively. To the authors' knowledge, none of the other species presented here have been previously studied from a nutritional point of view.

As providing information about uncultivated plants that may be suitable for further development has been previously recognised as a current need for food composition research (Greenfield and Southgate, 2003), the primary aim of this research was the nutritional characterisation of some Asteraceae wild vegetables traditionally consumed in the Mediterranean area, in order to provide data that may be incorporated into food nutrient databases, and foster renewed interest in their use.

2. Materials and methods

2.1. Plant samples

Six species belonging to the Asteraceae family, *T. obovatum*, *C. juncea*, *So. oleraceus*, *Ci. intybus*, *Sc. hispanicus* and *S. marianum*, were selected for analysis (Fig. 1), based on the high number of use reports in the Iberian Peninsula (Tardío et al., 2006).

In order to obtain representative data, four different batches for each one of the six studied species were collected, from two different sites (sites 1 and 2) and during two different years (2007 and 2008). Thus, a total number of 24 independent batches samples were analysed (6 species × 2 sites × 2 years). They were gathered in spring (mid-March to late May), and the descriptions of the gathering sites for each species are presented in Table 1.

Each batch constituted an independent sample, consisting of at least 500 g of edible portion of the plants, i.e. basal leaves, young leaves and stems, or mid-ribs of basal leaves, depending on the species (see Table 1), taken from more than 25 randomly chosen individual plants, all with a healthy external appearance. They were collected at the optimum time for harvesting, when the edible parts were large enough but still tender. As traditionally consumed, the leaves of *Sc. hispanicus* and *S. marianum* were peeled, the mesophylls were discarded, and only the mid-ribs of these thistles were taken for analysis. After gathering and preparation, each sample was packed in plastic bags and transported to the laboratory in a cold system within one day. The procedure of preparation of samples was in agreement with the recommendations given in Greenfield and Southgate (2003) for leafy vegetables and vegetable inflorescences: the edible parts of the vegetables were chopped and homogenised, and portions were taken for different analysis. To facilitate handling and preservation, they were immediately freeze-dried and preserved at −20 °C in a dark, dry ambience.

Fig. 1. Plant samples studied: (a) *Taraxacum obovatum*; (b) *Chondrilla juncea*; (c) *Sonchus oleraceus*; (d) *Cichorium intybus*; (e) *Scolymus hispanicus*; and (f) *Silybum marianum*.

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