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TRADITIONAL FOOD AND MEDICINAL USES OF LEAFY VEGETABLES IN NORTH MACEDONIA

SUMMARY

This ethnobotanical study explores the traditional knowledge and use of leafy vegetables in North Macedonia, focusing on both culinary and medicinal aspects. In 2024, structured interviews were conducted with 67 respondents from five regions of the country, gathering information on the use of twenty-one species from ten botanical families. The majority of the species belong to the families Apiaceae and Asteraceae. All respondents reported consuming leafy vegetables, with most of them also using wild species. The most frequently cited plant was spinach (*Spinacia oleracea*), with a citation frequency index of 0.58. These plants are most frequently prepared in the form of salads, soups, stews, teas, juices, smoothies, and pies, or used as spices. Apart from their dietary roles, these plants are traditionally used to support various health functions, including those of the cardiovascular, gastrointestinal, immune, urinary, and respiratory systems. Certain species are also associated with benefits such as detoxification, the treatment of anemia and diabetes, weight management, improved bone health, and anticancer effects. Despite their significance, ethnobotanical research on leafy vegetables in North Macedonia remains scarce, highlighting the need for more in-depth studies. Continued research is crucial to safeguard this traditional knowledge and to better understand the broader cultural, ecological, and health-related values of these plants.

Keywords: ethnobotany; leafy vegetables; North Macedonia; traditional knowledge; medicinal plants

INTRODUCTION

Vegetables are the consumable portions of plants, including leaves, stems, roots, flowers, seeds, fruits, bulbs and tubers and fungi, which can be eaten

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entirely or in sections, either fresh or prepared as a component of a main course (Nnamani *et al.*, 2010). However, when the edible portion of a vegetable primarily consists of leaves, it is classified as a leafy vegetable. They are also known as potherbs, greens, vegetable greens, leafy greens, or salad greens (Vainio-Mattila, 2000; Filipović *et al.*, 2025). Leafy vegetables are consumed primarily for their dietary benefits, but they are also used in treating various health conditions. Leafy greens are highly versatile, hardy, and capable of withstanding harsh climates. They grow naturally in the wild, and most do not require formal cultivation, as they are easily found in open fields (Raghuvanshi *et al.*, 2001).

Leafy vegetables offer strong nutritional and medicinal benefits and can help meet dietary needs. According to Randhawa *et al.* (2015), the minimal calorie content of leafy greens makes them perfect for weight control. Additionally, leafy greens contain essential nutrients, abundant in dietary fiber, low in fats, and rich in folate, vitamin C, vitamin K, magnesium, and potassium. They are also a valuable source of phytochemicals such as β-carotene and flavonoids. According to Oluwole *et al.* (2021), the bioactive substances found in leafy greens possess antioxidant, anti-inflammatory, and various other physiological properties.

Ethnobotanical research serves as a crucial connection between flora and human societies within a particular ecosystem. It explores how people utilize plants for their well-being, whether as food or folk remedies. The Balkan region heavily depends on wild plant species, demonstrating a strong reliance on natural resources. Ethnobotanical investigations in the Balkans are highly significant due to the area's vast biodiversity, cultural richness, and longstanding tradition of plant-based knowledge, as well as their role in fostering rural development and eco-tourism (Pieroni *et al.*, 2013).

Wild leafy vegetables have been documented as part of the diet in coastal, rural, and remote mountainous communities in Bosnia (Redžić, 2006; Redžić, 2007; Redžić, 2010; Lakić *et al.*, 2022), Bulgaria (Nedelcheva, 2013), Greece (Kostakis and Lazaridis, 2019), Albania (Pieroni, 2008; Pieroni, 2010; Pieroni *et al.*, 2014a; Pieroni *et al.*, 2014b), Croatia (Łuczaj *et al.*, 2013a; Łuczaj *et al.*, 2013b; Dolina and Łuczaj, 2014), and Turkey (Dogan *et al.*, 2004; Kargioglu *et al.*, 2008; Sarper *et al.*, 2009; Simsek *et al.*, 2012; Dogan, 2012; Dogan *et al.*, 2013; Dogan *et al.*, 2015).

The number of ethnobotanical studies in North Macedonia is very limited (Pieroni *et al.*, 2013; Rexhepi *et al.*, 2013; Miskoska-Milevska *et al.*, 2020; Josimovska and Miskoska-Milevska, 2025; Miskoska-Milevska *et al.*, 2025; 2026). Research on leafy plants in North Macedonia highlights their historical and cultural importance. Traditionally, rural communities utilized a diverse array of leafy plants for culinary, medicinal, and spiritual purposes. Various ethnic groups in North Macedonia, including Macedonians, Albanians, Serbs and others have adapted plant usage to suit their cultural traditions and ecological surroundings (Rexhepi, 2018; Rexhepi and Bajrami, 2021).

The objective of this study was to compile and analyse the key culinary and medicinal aspects of certain leafy vegetables used in North Macedonia.

MATERIAL AND METHODS

This ethnobotanical survey was conducted across the territory of North Macedonia, located in the central region of the Balkan Peninsula. The country experiences a transitional climate between Mediterranean and continental influences, characterized by hot, dry summers and cold, wet winters.

Traditional knowledge about leafy vegetables was obtained through an ethnobotanical field survey conducted in 2024, involving direct structured interviews with randomly selected 67 respondents from five regions of North Macedonia: Skopje, Northeastern, Vardar, Pelagonia, and Southwestern. Face-to-face interviews were used to gather information on the practical use and knowledge of leafy vegetables among respondents of different age groups. Respondents shared their knowledge and experiences regarding the use of wild and cultivated leafy vegetables as food and folk remedies. This study presents the scientific and folk names of leafy vegetables, along with their culinary and medicinal applications.

Taxonomic identification of plants is based on standard references for the Macedonian flora (Micevski, 1985-2005). Species taxonomy and nomenclature follow the World Flora Online (https://www.worldfloraonline.org).

A total of twenty-one plant species were documented in this study: *Allium ursinum* L., *Angelica sylvestris* L., *Anethum graveolens* L., *Apium graveolens*. L., *Petroselinum crispum* (Mill.) Fuss., *Calendula arvensis* L., *Cichorium intybus* L., *Lactuca sativa* L., *Taraxacum officinale* F.H. Wigg., *Brassica oleracea* var. *viridis* L., *Brassica oleracea* var. *sabauda* L., *Eruca vesicaria* subsp. *sativa* (Mill.) Hegi., *Beta vulgaris* subsp. *cicla* (L.) Schübl. and G. Martens), *Chenopodium album* L., *Spinacia oleracea* L., *Ocimum basilicum* L., *Malva sylvestris* L., *Rumex patientia* L., *Rumex acetosa* L., *Portulaca oleracea* L., and *Urtica dioica* L. The Relative Frequency of Citation (RFC) index was calculated for each mentioned plant species. The RFC was determined using the formula: RFC=FC/N, where FC is number of respondents who mentioned the use of the species and N is total number of respondents in the survey (Sansanelli *et al.* 2017). The RFC value ranges from zero (when nobody referred to a plant as useful) to one (when all respondents referred to a plant as useful).

Descriptive statistics, including frequencies and percentages, were used to summarize the data obtained through a Microsoft Excel spreadsheet, which was also used for drawing graph. Further analysis was carried out to compare the field data with existing ethnobotanical literature (Pulliah, 2002; Guarrera, 2003; Leporatti and Ivancheva 2003; Brussell, 2004; Ishtiaq *et al.*, 2007; Jana and Shekhawat, 2010; Malik *et al.* 2011; Rexhepi *et al.*, 2013, Dogan *et al.*, 2013; Street *et al.*, 2013; Nedelcheva, 2013; Łuczaj *et al.* 2013b, Ouhaddou *et al.*, 2014; Dogan *et al.*, 2015; Vasas *et al.*, 2015; Saidi *et al.*, 2015; Fortini *et al.*, 2016; Mueen Ahmed and Parasuraman, 2016; Rexhepi, 2018; Bhat *et al.*, 2020;

Miskoska-Milevska *et al*., 2020; Oladimeji and Kumar, 2023; Mehraj and Alam, 2024; Miskoska-Milevska *et al*., 2025).

RESULTS AND DISCUSSION

Socio-demographic characteristics of participants

In the research, a total of 67 respondents were interviewed. Of these, 40.3% were above 50 years of age, 31.3% were in the 36-50 age group, and 28.4% were in the 18-35 age group. The largest percentage of the surveyed individuals (68.7%) were female (Table 1). The majority of respondents were Macedonian (83.6%), followed by Albanian (7.4%), Serbian (3%), Turkish (3%), and Roma (3%). Regarding geographical distribution, 70% of the respondents were from the Skopje region, 15% from the Northeastern region, 7.5% from the Vardar region, 6% from the Pelagonia region, and 1.5% from the Southwestern region. In terms of education, most respondents had secondary-school education (59.7%), 23.9% had a university degree, 13.4% had primary-school education, and 3% had other forms of education.

Table 1. Age distribution of the respondents interviewed

Age	Male	Female	Total number	Percentage
18-35	4	15	19	28.4%
36-50	7	14	21	31.3%
Above 50	10	17	27	40.3%
Total	21	46	67	100%

In this survey, all respondents answered that they practice consuming leafy vegetables. A smaller percentage of the interviewees (41.8%) practice growing leafy vegetables, while a larger percentage (58.2%) do not. Half of the respondents collect wild leafy vegetables, while the other half do not practice this. The majority of the interviewees (89.6%) consume wild leafy vegetables. The main sources of information about the use of leafy vegetables were the Internet (40.7%), literature (37.4%) and older people (21.9%).

Diversity of leafy vegetables

According to the results presented in Figure 1, twenty-one species from ten botanical families were identified as leafy vegetables. The majority of the species belong to the families Apiaceae (4), Asteraceae (4), Brassicaceae (3), and Chenopodiaceae (3).

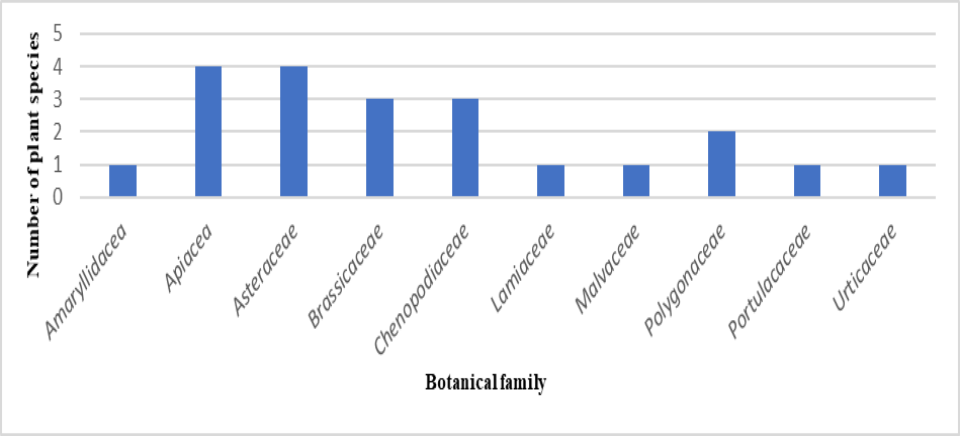

Figure 1. Number of plant species in different families

In the study, *Spinacia oleracea* exhibited the highest relative citation frequency index (0.58), followed by *Petroselinum crispum* (0.52) and *Beta vulgaris* ssp. *cicla* (0.42), (Table 2).

Table 2. List of leafy vegetables used in North Macedonia

No.	Botanical family	Botanical name	Macedonian folk name	Cultivated/ wild	Culinary use	Medicinal use	RFC
1.	Amaryllidaceae (previously in Alliaceae)	*Allium ursinum* L.	Divorast echki luk, mechkin luk, shumski luk, sremush	Wild	As additive to -salads, -stews, -soups, -juices	Improves the functioning of the heart, gallbladder and liver.	0.06
2.	Apiaceae	*Angelica sylvestris* L.	Anglica	Wild	-In salads, -In soups, -In stews	Improves food digestion and appetite.	0.01
3.	Apiaceae	*Anethum graveolens* L.	Kopar	Cultivated	-As spice in salads, tarator, pickled cucumber, soups, fish dishes, vegetable dishes, and sauces	-Improves digestion, -Prevents bloating, -Helps fight infections, -Has a nephroprotective effect.	0.09

4.	Apiaceae	*Apium graveolens* L.	Celer, Gereviz	Cultivated	-As spice (in stews, salads and soup), -In juices, -In teas, -In smoothies	-Improves heart and lung function, -Helps with asthma, -Reduces stomach acid, -Speeds up metabolism and promotes weight loss, -As a diuretic.	0.31
5.	Apiaceae	*Petroselinum crispum* (Mill.) Fuss.	Magdonos	Cultivated	-As spice in salads, soups, stews, -In smoothies, -In juices, -In teas	-As a diuretic, -For urinary infections, -Improves kidney function, -Supports detoxification, -For reducing high blood pressure, -Promotes weight loss, -Relieves pain (headaches, menstrual cramps), -Helps fight cancer.	0.52
6.	Asteraceae	*Calendula arvensis* L.	Polski neven	Wild	-Salads, -Teas	-Used for cleaning and rinsing wounds, burns, and chronic ulcers, -For treating liver diseases.	0.01
7.	Asteraceae	*Cichorium intybus* L.	Cikorija	Wild	-Salads, -Coffee substitute -Tea	-Foods suitable for diabetics -For diarrhea.	0.01
8.	Asteraceae	*Lactuca sativa* L.	Salata	Cultivated	-Salads	-Strengthens immunity, Improves heart function, -Stimulates metabolism, -Helps eliminate toxins.	0.22

9.	Asteraceae	*Taraxacum officinale* F.H. Wigg.	Gluvarche, Obicno gluvarche	Wild	-Salads, -Teas, -Syrups, -Juices, -Smoothies -Honey	-Young leaves are used: to regulate blood pressure, a cure for infections, to treat gallbladder and liver problems, to treat bone pain, for rheumatism, -For diabetics it is recommended to chew 5-10 hollow stems, -The root is used as a cure for cancer.	0.15
10.	Brassicaceae	*Brassica oleracea* var. *viridis* L. (syn. *Brassica oleracea* var. *acephala* DC.)	Lisnata zelka	Cultivated	-Salads	To improve the immune system.	0.01
11.	Brassicaceae	*Brassica oleracea* var. *sabauda* L.	Kelj	Cultivated	-Salads, -Soups, -Stews, -Smoothies	/	0.01
12.	Brassicaceae	*Eruca vesicaria* subsp. *sativa* (Mill.) Hegi. (syn. *Eruca sativa* Mill.)	Rukola	Cultivated	-Salads, -Smoothies, -Addition to sandwiches soups, risotto and butter.	-In the treatment of ulcers, -For the treatment of diabetes, -For breast cancer, -For cardiovascular disease, -For regulating digestion, -For detoxification, -For weight loss, -Against viruses and colds, -For healthy bones.	0.28

13.	Chenopodiaceae	*Beta vulgaris* ssp. *cicla* (L.) Schübl. & G. Martens)	Blitva, Mangolda	Cultivated	-Salads, -Soups, -Stews, -Pies, -Sarma, -Spice, -Smoothies.	-For anemia, -For better heart function, -For better immunity, -Helps with weight loss, -For stabilizing blood sugar, -Against cancer.	0.42
14.	Chenopodiaceae	*Chenopodium album* L.	Loboda, Bela samonikata loboda, Guskina noga	Wild	-Pies, -Salads, -Soups, -Stews	-As a diuretic -For anemia.	0.07
15.	Chenopodiaceae	*Spinacia oleracea* L.	Spanak	Cultivated	-Pies, -Stews, -Side dish, -Salads, -Soups, -Smoothies	-For anemia, -Prevention of cancer -Prevention of hepatic diseases.	0.58
16.	Lamiaceae	*Ocimum basilicum* L.	Bosilel	Cultivated	-Salads, -Stews, -Spices, -Pasta additive, -Teas	-Prevention of cancer -Prevents cold symptoms, -Treats cough, sinus, bronchitis and asthma -Has positive effects on mental problems, -Improves stomach and kidney function.	0.18
17.	Malvaceae	*Malva sylvestris* L.	Crn slez	Wild	-Salads, -Stews, -Syrups, -Soups, -Teas	-Treats gastrointestinal problems, -Treats urological problems, -Treats respiratory problems -For cold.	0.04

18.	Polygonaceae	*Rumex patientia* L.	Shtavej, Zelje	Cultivated/ Wild	-Salads, -Stews, -Pies, -Sarma, -Teas, -Soups - Smoothies	-As a diuretic -For anemia, -For better digestion.	0.31
19.	Polygonaceae	*Rumex acetosa* L.	Kiselec, Kiselica, Obichen shtavej	Wild	-Salads, -Soups, - Smoothies	-For diarrhea, -In the treatment of gallstones, -For rashes, -For digestive problems.	0.07
20.	Portulacaceae	*Portulaca oleracea* L.	Tuchnica	Wild	-Salads	Antiscurvy remedy.	0.01
21.	Urticaceae	*Urtica dioica* L	Kopriva	Wild	-Soups, -Pies, -Stews, -Salads, -Puree, - Smoothies -Juices, -Teas, - Syrups	-For anemia, -Improves circulation, -Has an anti-inflammatory effect, -Treats respiratory diseases, -Treats liver diseases.	

Leafy greens are rich in polyphenols and antioxidants, giving them distinctive therapeutic properties. They also exhibit antimicrobial effects and can be incorporated into various food products to prolong shelf life (Randhawa *et al.*, 2015). Research in the northeastern area of North Macedonia highlights several edible and medicinal plants, such as leafy vegetables, used in local dishes or as part of herbal treatments for their nutritional and therapeutic values. Well-known plants studied include *Urtica dioica, Cichorium intybus, Chenopodium* spp., and *Rumex* spp., recognized for their combined use as food and herbal remedies (Rexhepi, 2018). Respondents in our study also referred to these plants.

Traditional culinary use of leafy vegetables

Based on the results of our research, the leaves of *Allium ursinum* are consumed as an additive in salads, stews, soups, and juices. Nedelcheva (2013) documented the use of *Allium ursinum* consumed raw, in salads, and as a pickle. According to Sobolewska *et al.* (2015), these leaves are incorporated into pesto, soups, risotto, ravioli, and used as a spice to flavor hard cheeses. A previous study (Miskoska-Milevska *et al.*, 2025) documented that this plant is used in the preparation of herbal tea.

According to our research, *Angelica sylvestris* is used in salads, soups and stews. An Angelica jam was traditionally prepared using the stems of *Angelica sylvestris* (Koç Alibaşoğlu *et al*., 2024).

As shown by the results of our study, fresh and dried leaves of *Anethum graveolens* are used as spice in salads, tarator, pickled cucumber, soups, fish dishes, vegetable dishes, and sauces. Similar uses of *Anethum graveolens* to flavor and season various foods are mentioned in the research of Blank and Grosch (1991), and Huopalahti and Linko (1983). Used both raw in salads and as a flavor enhancer in soups and stocks, celery is a versatile ingredient (Malhotra, 2012). Also, in our research, the application of Apium graveolens as a spice in stews, soups, and salads, as well as in juices, teas, and smoothies, was mentioned. The essential oil of *Petroselinum crispum* finds application in the food, pharmaceutical, personal care, and chemical industries (Marín *et al.*, 2016). Based on the outcomes of our research, *Petroselinum crispum* is used as a spice in salads, soups, and stews, as well as in smoothies, juices, and teas, while *Calendula arvensis* is used in salads and teas.

The ancient Egyptians cultivated *Cichorium intybus* as a coffee alternative, edible crop, and herbal remedy (Street *et al.*, 2013). In our research, respondents reported using *Cichorium intybus* as a coffee substitute and in salads. The young leaves of *Taraxacum officinale* are used as food in salads, beverages, and vegetable dishes, owing to their nutritional benefits, including high levels of minerals, fiber, vitamins, and essential fatty acids (Escudero *et al*., 2003). Based on the outcomes of our research, *Taraxacum officinale* is used in the preparation of salads, teas, syrup, juices, smoothies, and honey.

As noted by Šamec *et al.* (2018), the leaves of *Brassica oleracea* var. viridis are commonly eaten raw in salads and juices, and prepared in a range of soups, omelets, and stir-fries. In accordance with the results of our study, *Brassica oleracea* var. *viridis*, *Lactuca sativa*, and *Portulaca oleracea* are consumed primarily in salads. According to Masoodi *et al.* (2011), *Portulaca oleracea* has been consumed in salads and utilized as a medicinal herb for centuries. Łuczaj *et al.* (2013b) found that young leaves of *Portulaca oleracea* are used for boiled salad. *Portulaca oleracea* is consumed as a salad, either fresh or mixed with yogurt and garlic, as well as cooked with onion (Dogan *et al.*, 2013). Also, in our research, *Brassica oleracea* var. sabauda is consumed in salads, soups, stews, and smoothies.

Beta vulgaris ssp. *cicla* is a perpetually available and affordable provider of essential compounds (Ninfali and Angelino, 2013). According to our research, the leaves of *Beta vulgaris* ssp. cicla are used as food in salads, soups, stews, pies, sarma, smoothies, and as a spice.

Species of *Chenopodium*, *Malva*, *Rumex*, and *Urtica*, are commonly eaten as leafy vegetables in Turkey (Dogan *et al.*, 2015). In Italy, *Chenopodium album* is traditionally eaten boiled or featured in salads, soups, and stews (Bianco *et al*., 1996; Nedelcheva, 2013). Numerous studies highlight that *Chenopodium album* is an essential food source, packed with nutrients and antioxidants (Afolayan and

Jimoh, 2009; Hussain *et al.*, 2009). According to the data from our research, *Chenopodium album* and *Spinacia oleracea* are consumed in pies, salads, soups, and stews.

As noted by Ishtiaq *et al.* (2007), *Malva sylvestris* can be made into soup, but it is most commonly used in salads. As shown by the results of our study, *Malva sylvestris* is consumed in salads, stews, soups, teas, and syrup. The leaves of *Rumex acetosa* are utilized in sauces, soups, and for making sarma (Dogan *et al.*, 2015). According to Nedelcheva (2013), *Rumex acetosa* was consumed raw, in salads, and mashed, whereas *Rumex patientia* was used raw, in salads, pies, and soups. *Rumex acetosa* seeds have been traditionally utilized for making flour (Miskoska-Milevska *et al.*, 2025). In our study, respondents reported using *Rumex acetosa* in salads, soups, and smoothies, while *Rumex patientia* is used in stews, pies, sarma, salads, soups, teas, and smoothies. *Urtica dioica* is a valuable source of vitamin A, C, iron, manganese, potassium, and calcium, and is commonly used to prepare herbal teas, soups, as a filling in burek dough, and in other recipes (Singh and Sengar, 2021). In light of the results from our study, *Urtica dioica* is consumed in soups, pies, stews, salads, puree, smoothies, juices, teas, and syrups. Also, Nedelcheva (2013) mentioned the consumption of *Urtica dioica* raw, in salads, soups, pies, dried, and mashed. According to Miskoska-Milevska *et al.* (2020), the dried leaves of *Urtica dioica* are used as a spice (Figure 2).

According to our research, *Eruca vesicaria* subsp. *sativa* has culinary applications in salads and smoothies, as well as being an addition to sandwiches, soups, risottos, and butter. *Ocimum basilicum* is consumed in salads, stews, teas, as a spice, and as a pasta additive.

Traditional medicinal use of leafy vegetables

The favorable nutritional profile of leafy vegetables is beneficial in reducing the risk of cardiovascular diseases and cancer (Randhawa *et al.*, 2015; Rakašćan *et al.*, 2021; Vasileva *et al.*, 2023; Popović *et al.*, 2012; Popović, 2025). Based on the findings of our research, eight plants have been used as a treatment for addressing cardiovascular issues in traditional medicine (*Allium ursinum*, *Apium graveolens*, *Petroselinum crispum*, *Lactuca sativa*, *Taraxacum officinale*, *Eruca vesicaria* subsp. *sativa*, *Beta vulgaris* ssp. *cicla*, and *Urtica dioica*). This effect is in line with the research of Sobolewska *et al.* (2015), Kooti *et al.* (2014), Agyare *et al.* (2017), and Ninfali and Angelino (2013). According to Rexhepi *et al.* (2013), *Allium ursinum* has a positive effect on the cardiovascular system by improving blood flow. The significant potential of *Allium ursinum* in preventing and treating cardiovascular diseases has been demonstrated through both in vitro and in vivo studies (Sobolewska *et al.*, 2015; Simić *et al.*, 2025). *Lactuca sativa* has been applied in traditional medicine for a range of uses, including enhancing circulatory system health (Oladimeji and Kumar, 2023). It is also thought that the leaves of *Taraxacum officinale* may benefit the cardiovascular system owing to their elevated potassium levels (Gonzalez-Castejo *et al.*, 2012; Gallahera *et al.*,

2006). According to Singh and Sengar (2021), the rich combination of vitamin C and iron in stinging nettle makes it excellent for boosting red blood cell production, which in turn enhances blood circulation (Figure 2).

In this research, six plants are mentioned that possess anticancer activates (*Petroselinum crispum, Taraxacum officinale, Eruca vesicaria* subsp. *sativa, Beta vulgaris* ssp. *cicla, Spinacia oleracea, Ocimum basilicum*). The anticancer effect is due to the chemical composition and it is in keeping with the research of Fernandes *et al.* (2020), Di Napoli and Zucchetti (2021), Garg and Sharma (2014), Ninfali and Angelino (2013), Maeda *et al.* (2008), and Bhat *et al.* (2020). According to Maeda *et al.* (2008), *Spinacia oleracea* may assist in cancer prevention and serve as a functional food with anticancer properties. Due to its chemical composition, *Eruca vesicaria* subsp. *sativa* exhibits inhibitory effects on melanoma and tumors (Garg and Sharma, 2014).

Figure 2. Collection and sale of *Urtica dioica* (Photograph by E. Miskoska-Milevska)

Green leafy vegetables are also important for individuals with type 2 diabetes due to their high fiber and magnesium content, as well as their low glycemic index (Randhawa *et al.*, 2015). Inulin from *Cichorium intybus* roots is considered a functional food ingredient that promotes better health and reduces the risk of many diseases (Kaur and Gupta, 2002). As indicated by our research findings, four plants are identified as suitable for diabetics: *Cichorium intybus*, *Taraxacum officinale*, *Beta vulgaris* ssp. *cicla*, and *Eruca vesicaria* subsp. *sativa*. This is in accordance with the research of Pushparaj *et al.* (2007), Hardeep and Pandey (2013), Di Napoli and Zucchetti (2021), Ninfali and Angelino (2013), and El-Missiry and El-Gindy (2000) and Trifunović *et al.*, (2015).

Portulaca oleracea is utilized as a remedy for scurvy (Bosi *et al.*, 2009).

Also, in our research, it was found that *Portulaca oleracea* has the same use. The study highlighted the use of *Calendula arvensis* in wound healing and

the treatment of burns. Through maceration, the leaves of *Calendula arvensis* were employed to treat internal ulcers, warts, and skin lesions (Saidi *et al.*, 2015). Fortini *et al.* (2016) discovered that *Calendula arvensis*, whether macerated or in ointment form, is used to treat burns and sunburn. In an ethnobotanical study in Greece, Brussell (2004) reported that the flowers, stems, and leaves of *Calendula arvensis* are applied to reduce swelling, treat acne, and alleviate diaper rash. According to Garg and Sharma (2014), *Eruca vesicaria* subsp. *sativa* exhibits antiulcer activity, which correlates with the findings of our research.

The analgesic effects of *Petroselinum crispum* are attributed to the active components in parsley leaves (Fernandes *et al.*, 2020). Additionally, the use of *Petroselinum crispum* in pain relief is highlighted in our ethnobotanical research.

The results obtained from our research showed that 14 plants have a positive effect on gastrointestinal system (*Allium ursinum, Angelica sylvestris, Anethum graveolens, Apium graveolens, Calendula arvensis, Cichorium intybus, Taraxacum officinale, Eruca vesicaria subsp. sativa, Ocimum basilicum, Spinacia oleracea, Malva sylvestris, Rumex patientia, Rumex acetosa* and *Urtica dioica*). Al-Howiriny *et al.* (2010) found that *Apium graveolens* extract significantly protects the gastric mucosa and reduces basal gastric secretion in rats, likely due to its antioxidant properties. Korkmaz *et al.* (2016) reported that the flower of *Calendula arvensis* was utilized due to its liver-protective properties. Hepatoprotective activities of *Taraxacum officinale* was reported by Di Napoli and Zucchetti (2021). According to Bhat *et al.* (2020), *Ocimum basilicum* is used in the treatment of gastrointestinal disorders. The leaves of *Rumex acetosa* are used to treat constipation and diarrhea (Dogan *et al.*, 2015; Miskoska-Milevska *et al.*, 2025). The leaves of *Urtica dioica* are utilized for treating liver disorders (Singh and Sengar, 2021). *Anethum graveolens* is used to relieve colic pain in babies and flatulence in young children (Pulliah, 2002). *Eruca vesicaria* subsp. *sativa* has applications in traditional medicine for its therapeutic properties as a digestive aid (Sharma *et al.*, 2012). *Spinacia oleracea* is used in the prevention of hepatic diseases (Jain and Singhai, 2012; Maximas *et al.*, 2014) and nervous disorders (Das and Guhta, 2008). *Malva sylvestris* has been used as a gentle laxative and a detoxifying liver tonic (Guarrera, 2003; Ishtiaq *et al.*, 2007). In European herbal traditions, *Allium ursinum* has been valued for its digestive benefits, antimicrobial properties, detoxifying effects, and its role in cardiovascular disease prevention (Treben, 1992; Macků and Krejča 1989; Leporatti and Ivancheva 2003; Miskoska-Milevska *et al.*, 2025). *Angelica sylvestris* has traditionally been used for its anti-inflammatory, diuretic, expectorant, and diaphoretic properties. It has served as a remedy for colds, influenza, hepatitis, arthritis, indigestion, coughs, chronic bronchitis, pleurisy, typhoid, headaches, flatulence, fever, colic, motion sickness, rheumatism, bacterial and fungal infections, as well as disorders of the urinary system (Sarker and Nahar, 2004).

According to the research *Angelica sylvestris* has a positive effect on appetite. According to Chiocchio *et al.*, (2024), the boiled flowers of *Angelica sylvestris* have traditionally been used to treat baldness.

According to Vasas *et al.* (2015), *Rumex acetosa* is used for treating skin and gallbladder disorders, which aligns with our findings.

As per the research, four plants show an influence on weight loss (Ap*ium graveolens, Petroselinum crispum, Beta vulgaris* ssp. *cicla*, and *Eruca vesicaria* subsp. *sativa*). According to Ahmad *et al.* (1998), *Apium graveolens* seed stimulates perspiration which may help with weight loss, especially in cases of water retention. *Beta vulgaris* ssp. *cicla* is widely consumed in the modern diet and serves as a significant source of biologically active compounds, including plant pigments, polyphenolic compounds, and essential elements with protective and immune-enhancing properties (Ivanovic *et al.* 2019). The anti-obesity effects of *Eruca vesicaria* subsp. *sativa* were mentioned by Markou *et al*. (2024).

The study found that five plants are used in the treatment of anemia (*Beta* vulgaris ssp. *cicla, Chenopodium album, Spinacia oleracea, Rumex patientia,* and *Urtica dioica*). Mehra *et al.* (2014) reported that *Chenopodium album* is traditionally used in the treatment of anemia. *Urtica dioica* has a long-standing tradition of use in folk medicine for treating anemia (Mueen Ahmed and Parasuraman, 2016; Miskoska-Milevska *et al.*, 2025). *Beta vulgaris* ssp. *cicla* leaves have the highest content of fiber, sodium, magnesium, flavonoids, and vitamin C, while stems are high in potassium (Gamba *et al.*, 2021). *Spinacia oleracea* has beneficial effects on anemia and constipation due to its content of saponins, dietary fiber, ferric salts, and folic acid (Luka *et al.*, 2014).

In keeping with the research, four plants (*Anethum graveolens*, *Petroselinum crispum, Ocimum basilicum,* and *Malva sylvestris*) were mentioned as suitable for the treatment of the urinary system. According to Jana and Shekhawat, (2010), *Anethum graveolens* is incorporated into more than 56 Ayurvedic treatments. Based on our research findings, nephroprotective effects are characteristic of *Anethum graveolens,* aligning with the findings of Srivastava *et al.* (2018). Our research agrees that *Petroselinum crispum* is used for urinary infections and improving kidney function, which aligns with the findings of Blumenthal *et al.* (2000). According to Bhat *et al.* (2020), *Ocimum basilicum* is effective in the management of renal/urinary conditions. *Malva sylvestris* leaves and roots are used to treat urinary disorders (Ouhaddou *et al*., 2014).

In line with the research, diuretic features were mentioned for four plants: *Apium graveolens, Petroselinum crispum, Chenopodium album* and *Rumex patientia*. According to Belanger (1998) and Al-Howiriny *et al.* (2010), *Apium graveolens* demonstrates a protective effect on the gastric mucosa and exhibits a diuretic effect. Due to the active components present in parsley leaves, *Petroselinum crispum* possesses many important pharmacological activities, such as diuretic, antispasmodic, hepatoprotective, anti-inflammatory, antidiabetic, analgesic, antianemic, antihyperlipidemic, antitumor, anticoagulant, antihypertensive, and immunosuppressive effects (Fernandes *et al.*, 2020).

According to Das and Borthakur (2022), *Chenopodium album* has traditionally been used as a diuretic. In this research, *Lactuca sativa* was mentioned as a plant that stimulates metabolism. According to Kim *et al.* (2016), the bioactive compounds in *Lactuca sativa* are responsible for its anti-diabetic, anti-inflammatory, and cholesterol-lowering activities.

Due to the phytochemicals found in its flower, leaf, stem, and roots, *Taraxacum officinale* is rich in medicinal properties. The most commonly discussed activities in the scientific literature are its antioxidant, hepatoprotective, and anticancer effects (Di Napoli and Zucchetti, 2021). In agreement with our research, *Taraxacum officinale* is suitable for the treatment of rheumatism.

According to our research, four plants (*Apium graveolens, Ocimum basilicum, Malva sylvestris* and *Urtica dioica*) are used in the treatment of respiratory problems. Stinging nettle has been linked to treating various respiratory ailments, such as hay fever, asthma, and seasonal allergies (Singh and Sengar, 2021). *Apium graveolens* has various applications in traditional medicine, including the treatment of bronchial diseases and asthma (Mehraj and Alam, 2024). As stated by Bhat *et al.* (2020), *Ocimum basilicum* is incorporated in the treatment of respiratory ailments. The leaves and roots of *Malva sylvestris* are utilized in treating respiratory ailments (Ouhaddou *et al.*, 2014).

Seven plants (*Anethum graveolens, Lactuca sativa, Taraxacum officinale, Eruca vesicaria* subsp. *sativa, Brassica oleracea* var. *viridis*, *Beta vulgaris* ssp. *cicla*, and *Urtica dioica*,) were mentioned as suitable for improving the immune system. *Lactuca sativa* is known for its significant vitamin C content, which supports the prevention of infections (Anasuya *et al.*, 2024). Immunoprotective characteristic of *Taraxacum officinale* was reported in scientific literature (Kim *et al.*, 1998; Lee *et al*., 2012; Sang *et al*., 2019; Tan *et al*., 2017). As reported by Dogan *et al.* (2015), *Urtica* spp. is utilized for its anti-inflammatory and diuretic effects. Based on Ninfali and Angelino (2013), the healing properties of *Beta vulgaris* ssp. *cicla* contribute to enhancing immunological responses. Additionally, *Anethum graveolens* plays a significant role in immunity maintenance (Meena *et al*., 2019). Sinapic acid and its derivatives are essential in the immune defense against infection (Nićiforović and Abramovič, 2014). *Eruca vesicaria* subsp. *sativa* shows antimicrobial activity (Garg and Sharma, 2014).

Based on the findings of our research, *Petroselinum crispum, Lactuca sativa,* and *Eruca vesicaria* subsp. *sativa* are used in detoxification. *Lactuca sativa* is applied in Unani medicine as a blood detoxifier (Oladimeji and Kumar, 2023).

As shown by the results of our study, *Taraxacum officinale*, and *Eruca vesicaria* subsp. *sativa* are used because of their benefits on bone health. Malik *et al.* (2011) report that a mixture of boiled leaves of *Taraxacum officinale*, salt, and turmeric is typically used to heal bone fractures.

According to Bhat *et al.*, (2020), *Ocimum basilicum* is used in the treatment of mental health issues, which aligns with our research.

CONCLUSIONS

Based on the findings of our study, twenty-one species from ten plant families were recognized as leafy vegetables. The greater part of the species is classified within the Apiaceae (4) and Asteraceae (4) families. *Spinacia oleracea* recorded the greatest relative citation frequency index (0.58), followed by *Petroselinum crispum* (0.52) and *Beta vulgaris* ssp. *cicla* (0.42). The plant species listed in this study are used not only as food but also for traditional medicinal purposes in the treatment of various health problems. Only for *Brassica oleracea* var. *sabauda* was no medicinal use documented. The intuitive use of these species for treating health problems is further supported by scientific research. However, studies focusing on traditional knowledge related to leafy vegetables in the Republic of North Macedonia remain limited, and more comprehensive investigations are required from social, dietary, and ecological perspectives. To protect the knowledge related to leafy greens and their application in human life, it is crucial to continue conducting similar ethnobotanical research.

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