



Where medicinal plants are enjoyed as a tea: Ethnobotany of herbal teas in the coastal region of Syria

Naji Sulaiman¹ · Andrea Pieroni^{1,2} · Renata Sōukand³ · Zbynek Polesny⁴

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Abstract

Herbal medicine is vital for the medical care of millions of people around the globe. The area between Mesopotamia and the Mediterranean is an ancient and rich region with folk medicinal knowledge accumulated over thousands of years. However, there is a gap in studies documenting this knowledge. The study focuses on documenting the diversity of medicinal plant species used as an infusion tea. We aim to identify the medicinal plant species used for herbal tea preparation and examine the relationship between medicinal and recreational uses of herbal teas in the study area. Semi-structured interviews were conducted with 91 informants between February 2018 and May 2020 in 32 villages in the coastal region of Syria. We documented 56 medicinal plant species used as tea. We received 477 use reports, which were categorised into ten ailment categories. Digestive and respiratory system disorders were the main ailments treated with herbal teas. Recreational use was significantly intersected with the medicinal uses for digestive disorders. The study highlights the most culturally salient species, which may have promising economic and medicinal values (e.g., *Micromeria myrtifolia* and *Teucrium procerum*). Future laboratory studies are needed to examine the biological activity of the little-known species in our inventory.

✉ Naji Sulaiman
n.sulaiman@unisg.it

¹ University of Gastronomic Sciences, Piazza Vittorio Emanuele II 9, 12042 Pollenzo, Italy

² Department of Medical Analysis, Tishk International University, Erbil 44001, Iraq

³ Department of Environmental Sciences, Informatics, and Statistics, Ca' Foscari University of Venice, Venice, Italy

⁴ Department of Crop Sciences and Agroforestry, Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague, Kamýcká 129, 16500 Prague-Suchdol, Czech Republic

somniferum L., most of which are still in use today for the treatment of ailments ranging from coughs and colds to parasitic infections and inflammation. Egyptian pharmaceutical record is the “Ebers Papyrus”, dating from 1,500 BC. This document some 700 drugs (mostly of plant origin) and includes formulas, such as gargles, snuffs, poultices, infusions, pills, and ointments, made with beer, milk, wine, and honey as vehicles (Cragg and Newman 2001). Since then, until modern history, medicinal plants were used by various well-known Middle Eastern scholars such as Avicenna (*Ibn-e-Sinā*), and *Ibn alBitar*, a botanist and pharmacist who lived in Damascus in the thirteenth century and published Food and Drinks, which is considered the most prestigious book in the Arabian pharmacopoeia (Saad and Said 2011). The Eastern region of the Mediterranean has been distinguished throughout generations with a rich inventory of natural medicinal herbs used by local herbalists; 700 plant species in the Middle East were noted for their use as medicinal herbs or as botanical pesticides. Recent ethnopharmacological surveys revealed that only around 200 to 250 plant species are still in use in Arab traditional medicine to treat various diseases (Said et al. 2002).

The medicinal and aromatic plants are mainly collected by the rural communities to prepare traditional medicines (Sincich 2002). These plants can also be found in the markets of large cities. Many of these medicinal plants are prepared in the mode of tea (Obón et al. 2014; Sulaiman et al. 2021). Herbal teas are called “*Zhourat*” in Syria and many other countries in the Levant. This drink is also often consumed in cafes in major cities in Syria, Lebanon and adjacent countries (Carmona et al. 2005). This herbal tea blends wildflowers, herbs, leaves, and fruits. These are selected from over 70 species known for their treatment properties (Obón et al. 2014).

Despite the previously stated richness of traditional medicine and its associated knowledge in the region, there are only a few ethnobotanical studies documenting and analysing this knowledge. Alachkar et al. (2011) documented folk medicine in Aleppo, Northern Syria. Carmona et al. (2005) and Obón et al. (2021, 2014) studied the herbal teas used in Damascus, Beirut, and the diaspora in France. Khatib et al. 2021 studied ethnomedicine in two cities in central Syria. Sulaiman et al. (2021) studied the use of yerba maté (and the additive herbs) among Syrian residents and diaspora. However, to our knowledge, there has been no previous study on medical plants and herbal teas in the Mediterranean region of Syria. Hence, the general focus of our research is to investigate herbal teas and their medical uses in the coastal area of Syria. We mainly aim to:

- (1). Identify the medicinal plant species used (pure or in mixtures) for herbal tea preparation and highlight the culturally essential plant species.
- (2). Examine the relationship between medicinal and recreational perceptions of herbal teas in the study area.

Methods

Study area

The study was conducted in the coastal region of Syria (Fig. 1). The area is located in the north-western part of the country, including the provinces of Latakia and Tartus, bordered by the Mediterranean Sea from the west, Turkey in the north, Lebanese in the south, and Syrian provinces of Hama, Idlib, and Homs in the east. The area includes coastal plains

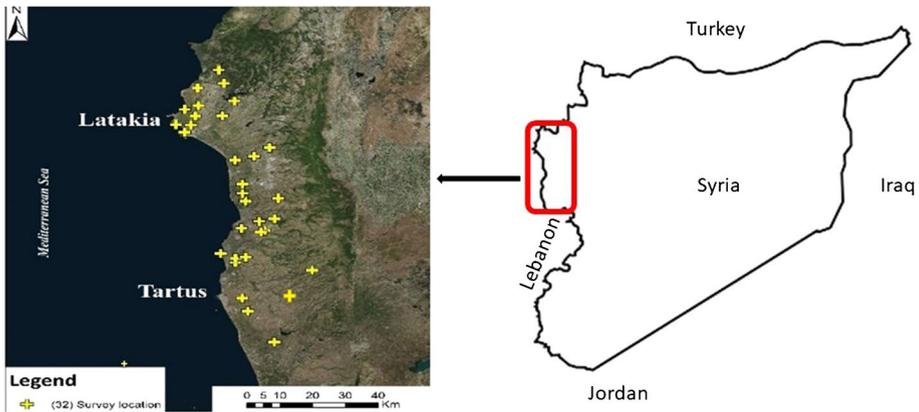


Fig. 1 Study area map within the map of Syria; yellow points refer to the locations of informants (the map was adapted from ArcGIS software)

and mountains up to 1,524 m above sea level. The climate in the study area is Mediterranean, with a perception varying from 800 to 1,300 mm (Abou Zakhem and Hafez 2007). Evergreen forests cover the wild habitats in the coastal mountains. The agricultural practices in the coastal plains are represented by smallholding fields of citrus and greenhouse vegetable production, while olives, apples, cherries, almonds, and tobacco dominate mountainous areas (FAO/WFP 2013).

The region was home to ancient civilisations such as the Phoenicians. Phoenicians were centred in several cities in the area, such as Amrit and Arwad near the current city of Tartous, and Ugarit (in which the first written alphabet in human history was developed and standardised) near the current Latakia (Markoe 2000; Cross 1967). The region is considered diverse in ethnicities and religions, with Alawites constituting the majority, alongside Sunni, Ismaili, Murshidis, Greeks, Armenians, Turkmans, Maronites, and several Orthodox and Catholic Christian subgroups. While most of these groups, except Sunni Muslims, are considered minorities at the national level in Syria, they form the demographic majority in the coastal region (Bengio and Ben-Dor 1999).

The coastal region is under governmental control, and compared to other regions of Syria, the area has been relatively safe during the Syrian conflict and has hosted hundreds of thousands of displaced people from different parts of the country. However, rural areas of Latakia in the northeastern part of the region were war-battle areas throughout the 13-year-old conflict. The lack of young men is easily observable, as most have been requested to join the mobilisation in the Syrian army or migrated as a result. Despite the study area not being significantly affected by military operations like other regions in Syria, the community suffers from the war's side effects, such as food shortage, economic sanctions, declining health care services, and frequent blackouts (World Food Programme 2020).

Data collection and data analysis

The fieldwork was conducted between February 2018 and May 2020. Study participants were selected using snowball and convenient sampling methods in 32 locations along the study area (Fig. 1; Dolores and Tongco 2007). These locations shown as yellow crosses

in Fig. 1 are primarily villages and small towns in rural areas of Latakia and Tartus provinces. We targeted informants who represent most of the ethnic/religious/cultural spectrum by targeting various villages that are known for hosting the previously mentioned groups. Semi-structured interviews were applied with 91 informants, with an almost equal representation between women (47 participants) and men (44 participants). The study participants ranged between 22 and 97 years old, with the majority being older than 50. The study participants were not traditional healers or biomedical professionals, but rather laypeople with deep practical knowledge of local plant use, typically passed down orally through generations. Approximately 80% of the informants had completed high school, and over half held a bachelor's degree. Seven informants had completed only primary education. Most participants were employed in government jobs, which typically provide modest incomes insufficient for full livelihood support. Consequently, many rely on small-scale agriculture (e.g., olives, greenhouse vegetables, tobacco) for subsistence and supplemental income, producing goods for both household use and sale in local markets. The participants were asked to list all medicinal plants used in tea preparation (infusion, decoction). Information was collected on plant vernacular names, plant part(s) used, medicinal uses, plant source (wild, home gardens, local markets), and other uses. We also investigated whether the plant species is used solely or mixed with other herbs. The Code of Ethics of the International Society of Ethnobiology (ISE 2008) was followed, and verbal consent was always obtained before the interview. Interviews were conducted in the Arabic language. Voucher specimens of most taxa were collected, taxonomically identified, and subsequently deposited in the Herbarium of the American University of Beirut (BEI). The non-collected taxa were either commonly well-known or unavailable in the study area (usually bought from local markets). When the plant sample was unavailable, identification was made based on a detailed description of the plant, its habitat, the species' local name(s), and checking the sold plant part in regional markets (e.g., the bark of *Cinnamomum verum* J.Presl). All the reported taxa were identified down to the species level except for one plant identified down to the genus level. All the reported taxa were identified down to the species level except for one plant identified down to the genus level. We followed World Flora Online with the botanical nomenclature (World Flora Online 2024).

Medical citations obtained from informants were converted into Use Reports (UR) (Chellappandian et al. 2012). A UR was defined as one independent mention of a plant species used to treat an ailment category by an individual informant. If the same informant cited the same species for several conditions within the same ailment category, this was counted as a single UR to avoid inflating species importance (Amiguet et al. 2005). This approach avoids over-representation of commonly used species. Ailments were classified into nine categories based on Cook's data collection and classification standards in Economic Botany (Cook 1995), a widely accepted framework in ethnobotanical research. Although we considered the International Classification of Primary Care (ICPC) (WICC 2020), Cook's system was retained for consistency with previous ethnobotanical literature and for its specificity to traditional and folk uses of medicinal plants. Additionally, a tenth category labelled "recreational" was added to account for non-therapeutic uses such as herbal teas consumed for taste or general wellbeing. We followed the term "recreational tea" proposed by Sökand et al. (2013) to describe those herbal beverages prepared as infusions and that are consumed in a food context for their general social and/or recreational value or for their general attributions of being "healthy" drinks. To determine the most cited species in our survey, we calculated the frequency of citation, which was defined by Tardío and Pardo-de-Santayana (2008): the sum of the number of informants that mention a plant species as useful. The most commonly used species were defined as those cited by

at least ten informants; however, some of these species were reported by more than half of the study participants. This criterion ensured that the highlighted species were culturally salient across a wide portion of the community. Visual analysis was conducted using the ethnobotany package of R (Tardio and Pardo-de-Santayana 2008; Whitney 2019). We used the tools in RAWGraphs software (Mauri et al. 2017) to illustrate the association between recreational use and other medicinal uses. We conducted quantitative analysis between men and women using the Botanical Ethnoknowledge Index (Sulaiman 2025), a recently developed index for cross-cultural analysis in ethnobotany. The BEI formula is as follows:

$$BEI = [(ms/Sg) + (mc/N)] * Sg/St$$

where BEI: Botanical Ethnoknowledge Index. ms: mean number of species reported per participant in a particular group. Sg: total number of species reported by all participants in a particular group. mc: mean number of citations per species in a particular group. N: number of participants in the particular group. St: total number of species reported by all compared groups in the study.

In order to compare the non-equal-sized groups of men (44 participants) and women (47 participants), we apply the following correcting factor formula:

$$F = Nmean / (Nmean + \sqrt{Nmin})$$

F	correcting factor
N mean	mean number of participants among all compared groups
\sqrt{Nmin}	square root of the number of participants in the smallest group

Qualitative analysis was applied by comparing our results and previously published ethnobotanical studies on medicinal plants and herbal teas from the Eastern Mediterranean region, neighbouring countries, and worldwide (e.g., Alachkar et al. 2011; Baydoun et al. 2017; Carmona et al. 2005; Obón et al. 2021, 2014; Güzel et al. 2015; Karousou & Deirmentzoglou 2011; Khatib et al. 2021; Sulaiman et al. 2021). Comparisons focused on used species, preparation methods, and medicinal use, allowing us to identify convergences, divergences, and culturally unique uses of herbal teas in relation to regional patterns.

Results and discussion

Diversity of medicinal plants used in herbal tea preparation in coastal Syria

The present study documented 56 plant taxa prepared as tea for medical purposes. All the reported taxa were identified down to the species level except for one plant identified down to the genus level. The reported taxa belong to 55 plant genera and 24 botanical families. The most represented families were Lamiaceae (11 species), Apiaceae (seven species), Fabaceae (six species), and Rosaceae (four species). The dominant life form of the reported species was herb (72%), while shrubs and trees were significantly less represented (14% each). Herbal teas are called “*Zhourat*” in the local Arabic dialect, which means “plant flowers”; however, flowers were not the dominant part used for preparing herbal teas; leaves (including the young shots) were used in 25 plant species, followed by

flowers (14 species), and seeds (8 species); while bark, rhizomes, and fruits were marginally reported. The sources of plant material of the reported species were diverse; more than half of the reported species were collected from the wild (29 species), while 15 species were bought from the local markets, and 12 plant species were cultivated in the home gardens. The strong presence of the wild as a plant source corresponds with a previous study in the region that shows the deep local ethnobotanical knowledge of wild plants (Sulaiman et al. 2022, 2023a).

On the other hand, the species sold in local markets (27%) are used mainly by those living in urban areas where access to the wild or home gardens is impossible. However, some species sold in local markets are not local, such as yerba maté (*Ilex paraguariensis* A.St.-Hil.), imported from South America (Sulaiman et al. 2021). Compared to other studies in Syria and neighbouring countries, medical plant diversity in the study area is high, considering that the study focuses solely on plants prepared as tea (Obón et al. 2014; Carmona et al. 2005). We found 29 species in our survey reported in a previous study in Aleppo in northern Syria (Alachkar et al. 2011). On the other hand, 25 of our reported species are used as an infusion in Hama and Homs in central Syria (Khatib et al. 2021).

However, some of our documented species, such as *Anemone coronaria* L., *Gnaphalium sanguineum* L., *Melilotus officinalis* (L.) Pall., and *Spergularia rubra* (L.) J.Presl & C.Presl, have not been previously reported by any of the studies in Syria. On the other hand, the species *Ceratonia siliqua* L. and *Ruta chalepensis* L. were not previously reported in Syria but were reported in the Antakya region in Southern Turkey (Güzel et al. 2015). This can be attributed to the geographical and sociocultural closeness between the Antakya region in Turkey and the coastal region in Syria, as they are mostly dominated by the same cultural-religious group (Alawites) and used to be one society before Turkey annexed the region in 1934. Notably, our study reported a species (*Teucrium procerum* Boiss. & Blanche; Fig. 2) that has not previously been mentioned in any study published in the Web



Fig. 2 Dried aerial part of *Micromeria myrtifolia* (on the left) and *Teucrium procerum* (on the right)

of Science or Scopus-indexed journals. However, some other *Teucrium* species have shown anti-inflammatory and anti-nociceptive effects (Fattollah Gol et al. 2024). Many of our documented taxa (e.g., *Viola*, *Urtica*, *Mentha*), are also used as medicinal herbal teas in neighbouring countries such as the Kurds in Iraq and Iran (Sulaiman et al. 2024a). Moreover, specific genera reported in our study, like *Origanum*, *Thymus*, and *Teucrium*, are commonly used across various populations in the Balkan region, and this may be attributed to a certain amount of historical and cultural relatedness between the two regions (Alrhoun et al. 2024).

Most of the reported species were prepared either fresh or dried. Drying was mainly done in the shade, either spread over a dish or tied in bouquets (Fig. 2). While fresh plants were used when cultivated in home gardens (e.g., *Rosmarinus officinalis* L.), drying was followed to preserve mainly the wild species available only for a limited period of the year. All the reported species were consumed as hot tea (Table 1).

Ailment categories treated with herbal tea

We received 477 use reports belonging to nine ailment categories and the recreational category (Table 2). Recreational tea is a technical term for an infusion made of leaves or flowers of taxa other than *C. sinensis* (Sōukand et al. 2013). Digestive system disorders, which include reports for treating stomachache and constipation, were the most reported category in terms of the number of used species. On the other hand, recreational (pleasure feeling while having the tea) was the most reported category in some use reports. Table 2 shows that most use reports were under the recreational, digestive, and respiratory categories. The primary use of herbal teas to treat digestive and respiratory-related health complaints was previously reported in many studies (e.g., Horackova et al. 2023; Sulaiman et al. 2024b). Tables 1 and 2 show an absolute informant agreement on the medical use of particular species. For instance, all informants agreed on using *Crataegus* sp. pl. for regulating blood pressure; similarly, all study participants reported using *Origanum syriacum* to treat all respiratory infection symptoms. This could be interpreted by the rooted common folk knowledge related to these species. Those species were highly reported in previous studies in the region (Sulaiman et al. 2023b, 2022; Alachkar et al. 2011; Obón et al. 2014; Baydoun et al. 2017).

The most culturally important species used in herbal tea preparation

Our results demonstrate that some species have a high citation ratio, which may be due to their cultural and/or medical importance. Figure 3 shows the species that were quoted by at least ten informants. Two of these species (*I. paraguariensis* and *M. myrtifolia*) were cited by more than 71% of our study participants. Although *I. paraguariensis* is not locally cultivated, it is considered one of the most preferred drinks in the country, as Syria is the world's second-largest importer of yerba maté (OEC 2018). The unique presence of yerba maté in the Syrian beverage culture started at the beginning of the twentieth century when Syrian migrants returning from South America brought the beverage (Sulaiman et al. 2021). Figure 3 illustrates that *I. paraguariensis* is largely used for recreational and marginally for medicinal purposes.

On the other hand, all other species are either harvested from the wild (e.g. *M. myrtifolia*), cultivated in home gardens (e.g. *A. citriodora*), bought from local markets (e.g. *M.*

Table 1 Plant species used in herbal tea preparation for medicinal and recreational purposes in the coastal region of Syria

Scientific name; family name; (Voucher code)	Local name(s)	Part used	Medicinal use, use reports	Mode of preparation and consumption	Frequency of citation
<i>Aloysia citriodora</i> Palau; Verbenaceae; (Sulaiman 66)	Malliseh	Leaves	Stomach ache (7), recreational (7), headache (2), kidney stones (1), calming (1)	Infusion; added to yerba maté tea (<i>Ilex paraguariensis</i> A.St.-Hil.)	10
<i>Athaea officinalis</i> L.; Malvaceae	Khetmiah	Flowers	Heartburn (1), stomach ache (1), cold (1), urinary infections (1)	Infusion; added to yerba maté	3
<i>Ammi majus</i> L.; Apiaceae	Khelleh	Seeds	Kidney stones (4)	Decoction; added to yerba maté	4
<i>Anemone coronaria</i> L.; Ranunculaceae; (Sulaiman 1)	Shaqaq Alnoa'man	Flowers and leaves	Severe cough (3)	Added to yerba maté	3
<i>Asparagus acutifolius</i> L.; Asparagaceae; (Sulaiman 30)	Halyoun	Leaves	Kidney stones (1)	Infusion; added to yerba maté	1
<i>Camellia sinensis</i> (L.) Kuntze; Theaceae	Chai Akhdar	Young shoots	Recreational (5), slimming (3), Headache (1), stomach ache (1)	Infusion	5
<i>Carum carvi</i> L.; Apiaceae	Kerrawiah	Seeds	Stomach ache (1)	Decoction	1
<i>Cerantia siliqua</i> L.; Fabaceae; (Sulaiman 2)	Kharnoub	Dried pods	Asthma (1), cough (1)	Decoction; steam for inhale	2
<i>Cichorium intybus</i> L.; Asteraceae; (Sulaiman 43)	Hendbeh	Flowers	For general immunity (3)	Added to yerba maté	3
<i>Cinnamomum verum</i> J.Presl; Lauraceae	Kerfah	Bark	Indigestion (1), recreational (1)	Added to tea (<i>Camellia sinensis</i>)	2
<i>Cortandrum sativum</i> L.; Apiaceae	Kezbarah	Leaves	Stomach ache (1)	Infusion	1
<i>Crataegus monogyna</i> Jacq. and possibly <i>C. azarolus</i> L.; Rosaceae; (Sulaiman 5; Sulaiman 64)	Za'arour	Flowers and young leaves	Regulating blood pressure and heartbeat (20), diabetes (1), diuretic (1)	Infusion; added to yerba maté	20
<i>Cuminum cyminum</i> L.; Apiaceae	Kammoun	Seeds	Stomach ache (6), recreational (3), headache (1), Slimming (1)	Decoction, commonly drank with lemon	7
<i>Cymbopogon citratus</i> (DC.) Stapf; Poaceae	Mallesah Kesbiah	Leaves	Stomach ache (1)	Added to yerba maté	1

Table 1 (continued)

Scientific name; family name; (Voucher code)	Local name(s)	Part used	Medicinal use, use reports	Mode of preparation and consumption	Frequency of citation
<i>Elaeagnus angustifolia</i> L.; Elaeagnaceae	Zaizafoun	Flowers	Cold and flu (3)	Added to yerba maté	3
<i>Elettaria cardamomum</i> (L.) Maton; Zingiberaceae	Hal	Seeds	Stomach ache (1)	Added to coffee	1
<i>Eriobotrya japonica</i> (Thunb.) Lindl.; Rosaceae	Ekkdnia	Flowers	Cough (4), kidney stones (1)	Added to yerba maté	5
<i>Eucalyptus globulus</i> Labill.; Myrtaceae; (Sulaiman 21)	Keena	Leaves	Inflammation of respiratory tracts and asthma (1)	Steam for inhale	1
<i>Foeniculum vulgare</i> Mill.; Apiaceae; (Sulaiman 37)	Shamra	Seeds	Respiratory infections (7), Recreational (3), Stomach ache (2)	Decoction; added to yerba maté	12
<i>Gnaphalium sanguineum</i> L.; Asteraceae; (Sulaiman 50)	Parseiah/Ejr alhajal	Leaves and flowers	Diuretic (3)	Added to yerba maté	3
<i>Glycyrrhiza glabra</i> L.; Fabaceae	Araksous	Roots	Heartburn (1)	Decoction	1
<i>Hibiscus sabdariffa</i> L.; Malvaceae	Karkadiyah	Flowers	Blood pressure regulation (2), stomach ache (1)	Infusion	2
<i>Hordeum vulgare</i> L.; Poaceae	Sha'er	Seeds	Kidney stones (1)	Decoction	1
<i>Ilex paraguariensis</i> A.St.-Hil.; Aquifoliaceae	Matte	Leaves	Recreational (67), diuretic (3), for digestion (2), improve concentration (1), headache (1), hydration (1), slimming (1)	Infusion; used as a basis of herbal mixtures	67
<i>Laurus nobilis</i> L.; Lauraceae; (Sulaiman 33)	Ghar	Leaves	Indigestion (2), recreational (1)	Infusion; added to yerba maté	3
<i>Lavandula angustifolia</i> Mill.; Lamiaceae	Alkhozama	Leaves	Stomach ache (1)	Added to yerba maté	1
<i>Linum usitatissimum</i> L.; Linaceae	Kettan	Seeds	Urinary infections (1)	Decoction	1
<i>Malva sylvestris</i> L.; Malvaceae; (Sulaiman 23)	Khebbazeh	Flowers	Cough and hoarseness (1)	Added to yerba maté	1

Table 1 (continued)

Scientific name; family name; (Voucher code)	Local name(s)	Part used	Medicinal use, use reports	Mode of preparation and consumption	Frequency of citation
<i>Matricaria chamomilla</i> L.; Asteraceae	Babounej	Flowers	Stomach ache (11), cold and flu (9), recreational (4), tooth and gums pain (2), calming (1) Helps digestion (2)	Infusion; added to yerba maté	17
<i>Melilotus officinalis</i> (L.) Pall.; Fabaceae; (Sulaiman 47)	Handkouq	Flowers		Added to yerba maté	2
<i>Mentha</i> sp. pl.; Lamiaceae (Sulaiman 63)	Na' na'	Aerial part	Stomach ache (10), recreational (6), nausea (2), throat pain (2), headache (2), calming (2)	Infusion; added to yerba maté; used as a basis of herbal mixtures	15
<i>Micromeria myrtifolia</i> Boiss. & Hohen.; Lamiaceae; (Sulaiman 29)	Zoufa	Aerial part	Recreational (45), to treat all symptoms of cold and flu including cough and hoarseness (12), stomach ache (4), expectorant (3), asthma (2), tonsillitis (1), calming (1)	Infusion; added to yerba maté; used as a basis of herbal mixtures	65
<i>Myrtus communis</i> L.; Myrtaceae; (Sulaiman 7)	Rayhan/Hinblas	Leaves	Heartburn (1), head ache (1)	Added to yerba maté	2
<i>Ocimum basilicum</i> L.; Lamiaceae; (Sulaiman 65)	Habak	Leaves	Recreational (1)	Added to yerba maté	1
<i>Olea europaea</i> L.; Oleaceae; (Sulaiman 26)	Zaitoun	Leaves	Diabetes (2), regulation of blood pressure (1)	Added to yerba maté	2
<i>Origanum majorana</i> L.; Lamiaceae (Sulaiman 49)	Martakoush	Leaves	Recreational (1), menstruation pain (1), calming (1)	Added to yerba maté	3
<i>Origanum syriacum</i> L.; Lamiaceae; (Sulaiman 24)	Zauba'	Leaves	To treat all respiratory infection symptoms, including pharyngitis, cough, expectorant and throat pain (20), stomach ache (3), lowering blood pressure (1), calming (1), slimming (1)	Infusion; added to yerba maté	20
<i>Petroselinum crispum</i> (Mill.) Fuss; Apiaceae; (Sulaiman 67)	Bakdounes	Leaves	Respiratory infections (1), Stomach ache (1), kidney stones (1)	Infusion; added to yerba maté	3

Table 1 (continued)

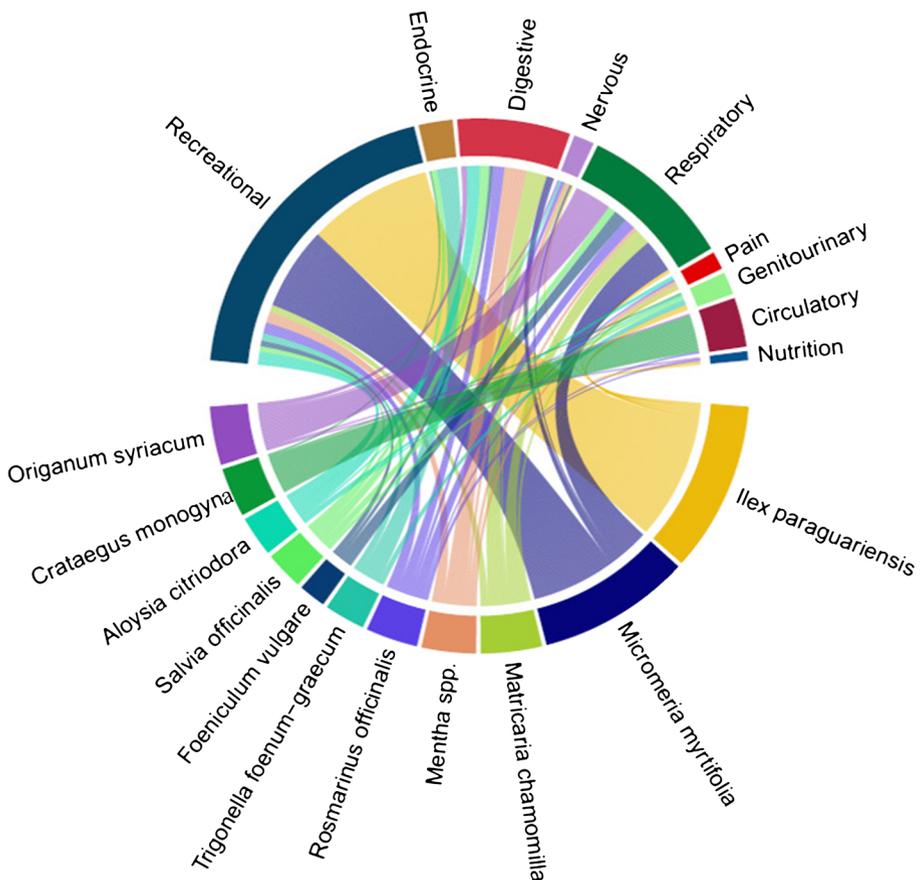
Scientific name; family name; (Voucher code)	Local name(s)	Part used	Medicinal use, use reports	Mode of preparation and consumption	Frequency of citation
<i>Pimpinella anisum</i> L.; Apiaceae	Yansoun	Seeds	Stomach ache (4), alarming and hypnotic (4), recreational (3), stomach ache (1), cough (1), stimulate milk production in women who just gave birth (1)	Infusion; a key-cultural species used to flavour the popular local liquor <i>Arak</i>	8
<i>Quercus infectoria</i> G.Olivier; Fagaceae (Sulaiman 61)	Ballout	Bark and fruits	For immunity as anti-infections (2)	Decoction	2
<i>Raphanus raphanistrum</i> L.; Brassicaceae	Fejel	Leaves	Kidney stones (1)	Infusion	1
<i>Rosa damascena</i> Herrm.; Rosaceae	Wardeh shamiah	Flowers	Constipation (1)	Added to yerba maté	1
<i>Rosmarinus officinalis</i> L.; Lamiaceae; (Sulaiman 22)	Ekleel aljabal	Leaves	To treat symptoms of cold and flu (6), stomach ache (6), recreational (6), headache (1), blood pressure (1), memory enhancing (1), calming (1), slimming (1)	Infusion; added to yerba maté	16
<i>Ruta chalepensis</i> L.; Rutaceae; (Sulaiman 53)	Shozab	Leaves and young shoots	For general immunity (2)	Added to yerba maté	2
<i>Salvia officinalis</i> L.; Lamiaceae; (Sulaiman 54)	Maryamiah	Leaves	To treat respiratory infections, including cough and tonsillitis (4), Stomach ache (4), diabetes (2), infertility (1), estrogen regulation (1), diarrhoea (1), urinary infections (1)	Infusion; added to yerba maté	11
<i>Sarcopoterium spinosum</i> (L.) Spach; Rosaceae; (Sulaiman 42)	Bellan	Fruits	For heart diseases (2)	Added to yerba maté	2
<i>Senna alexandrina</i> Mill.; Fabaceae	Senamki	Leaves	Constipation (1)	Added to yerba maté	1
<i>Spegularia rubra</i> (L.) J.Presl & C.Presl; Caryophyllaceae	Na'emah	Aerial part	Kidney stones (3)	Added to yerba maté	3

Table 1 (continued)

Scientific name; family name; (Voucher code)	Local name(s)	Part used	Medicinal use, use reports	Mode of preparation and consumption	Frequency of citation
<i>Teucrium procerum</i> Boiss. & Blanche; Lamiaceae; (Sulaiman 58)	Kentariah	Aerial part	Stomach ache with nausea (9), diabetes (2)	Added to yerba mate and rarely consumed pure due to its bitterness	9
<i>Thymus vulgaris</i> L.; Lamiaceae; (Sulaiman 25)	Zaatar barri	Leaves and flowers	To treat respiratory infections, including cough and throat pain, and serves as an expectorant (5), gallbladder inflammation (2)	Infusion; added to yerba maté	6
<i>Trifolium pratense</i> L.; Fabaceae; (Sulaiman 35)	Neffleh	Flowers	For immunity against anti-bacterial (2)	Added to yerba maté	2
<i>Trigonella foenum-graecum</i> L.; Fabaceae; (Sulaiman 41)	Helbeh	Pods and leaves	Stimulate milk production in women who just gave birth (10), recreational (4), kidney stones (3), diabetes (1)	Added to yerba maté	17
<i>Urtica dioica</i> L.; Urticaceae	Qerras	Young shoots	Kidney stones (3), prostatitis (2), anemia (2)	Added to yerba maté	5
<i>Viola papilionacea</i> Pursh; Violaceae; (Sulaiman 55)	Banfsaj	Flowers	Cold and flu (1), regulating blood pressure (1)	Added to yerba maté	2
<i>Zingiber officinale</i> Roscoe; Zingiberaceae	Zangabeel	Rhizome	Stomach ache with nausea (1), throat pain (1), slimming (1)	Added to yerba maté	3
<i>Ziziphora</i> sp.; Lamiaceae	Qernaieh	Flowers	For general immunity (2)	Added to yerba maté	2

Table 2 Ailment categories based on the respondents' reports

Ailment category	Number of reported species	Number of use reports	Most reported species for the relevant category
Recreational	18	163	<i>Ilex paraguariensis</i> , <i>Micromeria myrtifolia</i>
Digestive System Disorders	30	95	<i>Mentha</i> sp. pl., <i>Matricaria chamomilla</i>
Respiratory system disorders	19	88	<i>Origanum syriacum</i> , <i>Micromeria myrtifolia</i>
Genitourinary system disorders	17	36	<i>Urtica dioica</i>
Circulatory System Disorders	8	30	<i>Crataegus</i> sp. pl
Endocrine System Disorders	6	20	<i>Trigonella foenum-graecum</i>
Nervous System Disorders	9	14	<i>Pimpinella anisum</i>
Pain	7	11	<i>Aloysia citriodora</i>
Immune System Disorders	5	11	<i>Cichorium intybus</i>
Nutritional Disorders	6	9	<i>Camellia sinensis</i>

**Fig. 3** The most reported species and their associated use category (arc size aligns with the frequency of reports)

chamomilla), or available in all previous sources (e.g. *O. syriacum*). Our study participants reported that *M. myrtifolia* was, historically, the main tea that used to be drunk daily in the region before the mass arrival of typical black tea (*Camellia sinensis*) in the early twentieth century. “When I was a kid, we used to collect Zoufa (*M. myrtifolia*) and drink it; it was the only available tea we had, while people with a good economic situation were able to drink yerba maté, which was relatively new in the region at that time”, a 74-year-old participant stated.

The correlation arcs in Fig. 3 show the high agreement ratio between the study participants on the use of some of the highly quoted species such as *I. paraguariensis* (recreational) and *M. myrtifolia* (recreational and respiratory), *C. monogyna* (circulatory), and *O. syriacum* (respiratory). On the other hand, we can observe the diversity of use in some species, such as *R. officinalis* and *S. officinalis*. The Figure also shows that *O. syriacum* is the only species among the top-quoted plants that did not receive any report for the recreational category. Study participants described that this species is largely used either as food to prepare the cultural dish “Zaatar” or as a tea to treat respiratory infections.

Herbal tea mixtures

Besides the individual use of plant species documented in Table 1, some of our study participants reported using plant mixtures in herbal tea preparation. We received 49 reports on mixing two (or more) plant species in herbal teas. We observed that a few main species, such as *I. paraguariensis*, *M. myrtifolia*, and *Mentha* sp. pl. are used in more considerable amounts as a mixture basis. The purpose of these mixtures was either to enhance the medicinal effect (e.g., *I. paraguariensis* and *G. purpureum* as diuretic), to improve the taste when one species does not have a pleasant taste (*I. paraguariensis* and *T. procerum* for stomachache), or for both reasons. The taste of these three species (*I. paraguariensis*, *M. myrtifolia*, and *Mentha* sp. pl.) was described as “pleasant” by most of the study participants, which may explain why they are used as a basis for the tea mixtures. On the other hand, the bitterness of *T. procerum* was often described as the bitterness of *Citrullus colocynthis* (L.) Schrad., which is used as a reference for the bitterness in Arabic. “Kentariah (*T. procerum*) is very bitter; I can not accept it pure; I mix it with yerba maté when I have stomach ache; the hot sweetened tea of yerba maté makes Kentariah acceptable”, an informant reported.

Herbal tea mixtures seem to be shared in Syria and the Middle East, as was previously reported by some studies (Carmona et al. 2005; Serhan et al. 2024; Obón et al. 2021). However, a notable difference can be observed when comparing the used plants in these mixtures. Figure 4 shows the overlapping plant genera used in our study (only those used in herbal mixtures) and another study conducted on herbal mixtures in Damascus (Carmona et al. 2005). The significant difference may be attributed to the differences in flora and potentially beverage culture between Damascus and the coastal region of Syria. For instance, we can notice the presence of *Rosa* sp. pl. in Damascian herbal tea mixtures, which is considered one of the cultural key species in Rural Damascus (Shohayeb et al. 2014), while *Origanum* is a unique species largely used in coastal Syria (Sulaiman et al. 2022).

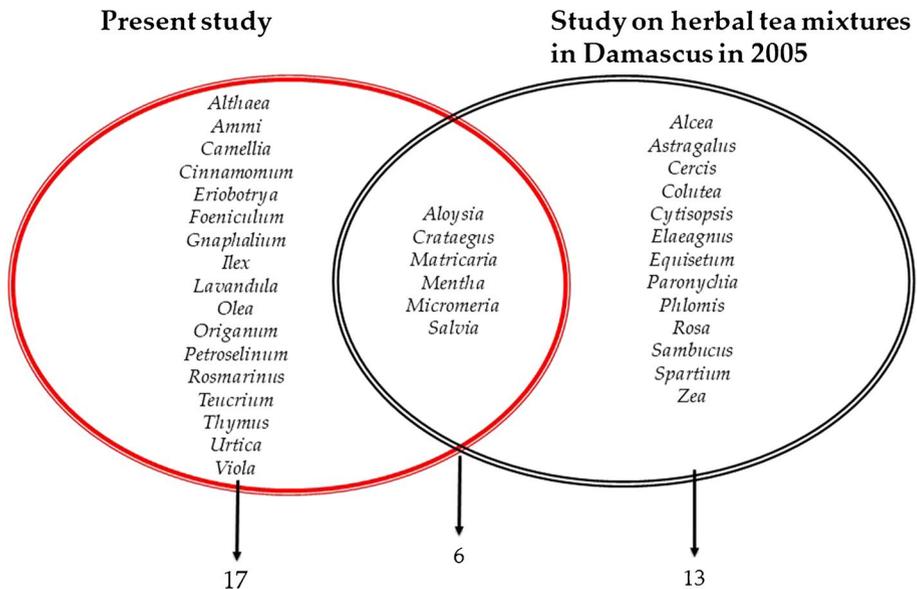


Fig. 4 Reported plant genera used in herbal tea mixtures in our study and a previous study in Damascus (Carmona et al. 2005)

Cross-gender comparison

Out of the 56 plant species reported in our study, 46 species were reported by women, while men reported 41 species. However, the number of reported species is not solely an absolute indication of the ethnobotanical knowledge of both genders. Therefore, we calculate the Botanical Ethnoknowledge Index (Sulaiman 2025), which employs several critical factors when assessing ethnobotanical knowledge.

$$BEI_{women} = [(ms/Sg) + (mc/N)]^* Sg/St^*$$

$$F = [(4.106/46 + (4.196/47))]^* 46/56 * 0.873 = 0.128$$

$$BEI_{Men} = [(ms/Sg) + (mc/N)]^* Sg/St^*$$

$$F = [(3.409/41 + (3.659/44))]^* 41/56 * 0.873 = 0.106$$

The index results provide robust evidence that female participants in our study possess greater knowledge of, and more frequent use of, herbal teas compared to male participants. This difference may be explained by cultural factors, as women in the local community traditionally bear greater responsibility for household management and child-rearing, including oversight of food and health. Such roles may motivate women to acquire and maintain extensive local knowledge regarding the medicinal uses of plant species. This interpretation is further supported by participants' anecdotal accounts, some of whom nostalgically recalled their grandmothers preparing herbal teas during their childhood.

Recreational vs. medicinal: a method to “enjoy” the medicine?

Our results show that 72% of the use reports were under the recreational, digestive, and respiratory categories. This may refer to the fact that study participants use herbal teas to mainly treat common non-serious illnesses such as flu and cough (respiratory), stomachache (digestive), and, at the same time, to enjoy beverages with a pleasant taste. We observed the strong intersection between recreational and medical use with specific species such as *Micromeria myrtifolia* Boiss. & Hohen. and *Ilex paraguariensis* (Fig. 3). Our results demonstrate that recreational use was significantly associated with the use to treat particular ailment categories. Figure 5 illustrates that recreational use was primarily related to digestive medicinal use and, to a slightly lower degree, to nervous, respiratory and pain disorders. Study participants generally understood that “hot tea” would help treat many digestive and respiratory illnesses besides being a preventative agent for many health disturbances.

On the other hand, we observed a significant intersection of recreational use with nervous and pain-related uses, which may be interpreted by the pleasant and relaxing feeling reported by Obón et al. (2021, 2014). The blurry border between the recreational and medicinal use of herbal teas was prominent in *I. paraguariensis*, mainly used for recreational purposes and in treating a wide variety of illnesses (e.g., as a diuretic, improving concentration, and counteracting headaches) by very few people. This phenomenon was also recorded by a previous study on using yerba maté (*I. paraguariensis*) among Syrian residents and diaspora

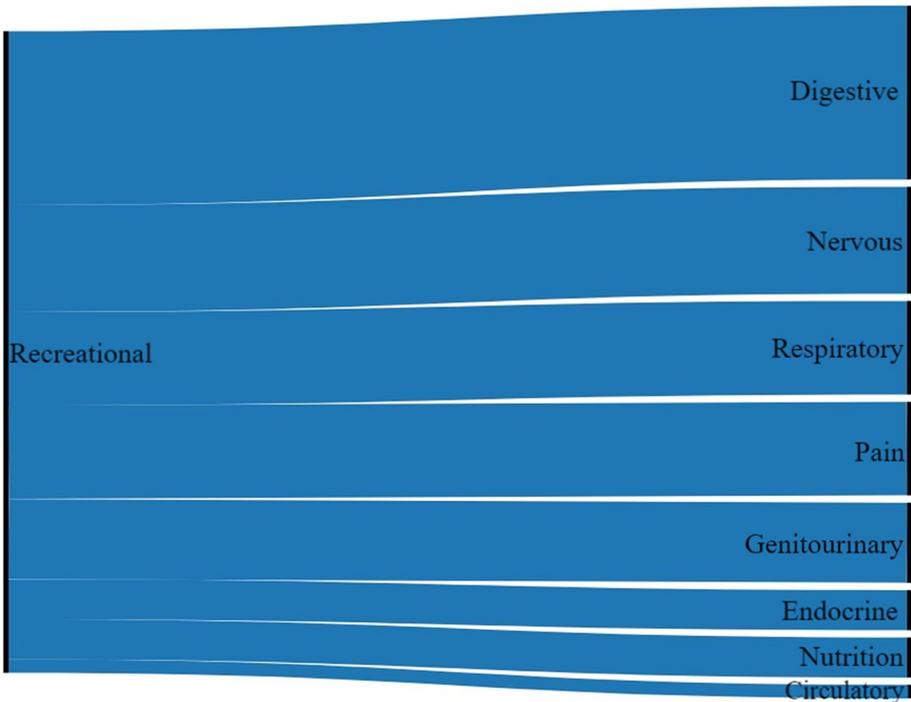


Fig. 5 The intersection between the recreational use of herbal teas and other ailment categories among our study participants (line length on the right axis refers to the intersection level)

(Sulaiman et al. 2021). Similarly, Sõukand and Kalle (2013) reported a grey area between herbal teas' recreational and medicinal uses. McKay and Blumberg (2006) highlight that recreational/medicinal species provide sensory pleasures that promote relaxation and social interaction. The drinking of dual-purpose beverages could reflect an ancient utilisation of local herbs or a more recent phenomenon since the time tea/infusions were encouraged as an alternative to coffee after the dissolution of the Ottoman Empire (at the start of the twentieth century) for which pleasure and wellness did and do not mutually contradict.

Participants' statements show a pattern in which their needs and preferences determine the purpose of herbal tea use. For instance, the same tea can be used for recreation on some days and for health reasons on others, but more precisely, by increasing its dose and frequency. A 46 year-old participant explained the dual uses of *Aloysia citriodora*, which was introduced with yerba maté by Syrian migrants returning from South America at the beginning of the twentieth century.

Conclusion

Our study documented 56 medicinal plant species used (pure or in mixtures) as infusion tea, among which species (e.g., *Teucrium procerum*) have been poorly assessed in laboratory studies. We received 477 use reports, categorized into ten categories (nine ailment categories and one recreational category). Herbal tea mixtures were mainly used to enhance the medicinal effect and/or improve the taste. The digestive and respiratory system disorders were the main ailments treated with herbal teas. Recreational use was strongly intersected with digestive medicinal use and, to a slightly lower degree, with nervous, respiratory and pain disorders. Our study demonstrates the blurry border between recreational use and medicinal use of herbal teas in the study area. The study highlights the most culturally salient species, which may have promising economic and medicinal values (e.g., *Micromeria myrtifolia* and *Teucrium procerum*). Future laboratory studies are needed to examine the biological activity of the little-known species in our inventory.

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Author contributions Study design: N.S. and Z.P.; conceptualization: N.S., A.P., R.S. and Z.P.; methodology, investigation, data analysis, visualization, and writing-original draft: N.S.; writing-review and editing: N.S., A.P., R.S. and Z.P. All authors have read and agreed to the published version of the manuscript.

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Data Availability The data that support the findings of this study are presented in the article. Further inquiries can be directed to the corresponding author.

Declarations

Ethical approval Informed consent was obtained prior to the interviews. The Code of Ethics of the International Society of Ethnobiology was followed. The data that support the findings of this study are presented in the article.

Conflicts of interest The authors declare no conflict of interest.

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