

ETHNOBOTANICAL STUDY ON TRADED MEDICINAL PLANTS AND HERBAL MARKET ANALYSES IN GAZIANTEP/TURKEY

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Abstract. Herbal markets are the meeting point of the local people and allow quick information exchange about medicinal plants. In this study, it is aimed both to investigate the traditional uses of medicinal plants traded in Gaziantep herbal markets and to make a detailed evaluation of the selected herbal markets. Data about herbal markets and medicinal plants were collected through semi-structured and open-ended questionnaires from herbalists and customers. Ethnobotanical data were analysed using indices such as; Frequency of Citation (FC), Cultural Importance Index (CI), Relative Frequency of Citation (RFC), and species Use Value (UV). Totally, 58 species (belonging 30 families) out of which 10 imported were surveyed from 14 selected herbal markets to be used as traditional medicines. *Mentha x piperita* (147), *Thymus* sp. (141), and *Tilia platyphyllos* (132) were determined to have the highest FC values. According to the results of the study, the density of customers in herbal markets, the variety and quality of products sold, and the number of herbal markets has increased in recent years. It has been determined that the average operating age of the herbal market is 34.7 years, the average number of employees is 2.6, and the average annual turnover of the markets is 166,772,888TL (US\$42,762,279, currency in 2017).

Keywords: traditional knowledge, market characteristics, FC, CI, Turkey

Introduction

Although molecular biology and computerized drug design are developing rapidly, medicinal plants continue to play a dominant role in the healthcare system for approximately 80 percent of the world's population is living in developing countries. At the same time, in developed countries, which make up the remaining 20 percent of the population, natural products and medicines derived from herbs are an important part of health systems (Bussmann, 2002). Realizing that natural compounds cannot be replaced by synthetic products, the treatment with medicinal plants, which lost interest in the past due to synthetic drugs, has become more common in recent years. Among the reasons of the increasing demand for medicinal plants are people's dissatisfaction with their medical treatments, their desire to add quality to living standards by reducing the side effects of the drugs they use, and cultural heritage (Prance, 1991). According to WHO (2013), herbal medicines and traditional therapies are the main sources of health care system and are sometimes the only sources of care for millions of people.

Today, the concentration of people in city centers and the decrease in access to plants have led to an increase in the demand for herbal markets. Herbal markets not only facilitate people's access to medicinal and aromatic plants, but also contribute to the transfer of cultural heritage and traditional knowledge about plants to future generations

(Ji et al., 2020). In recent years, many research has been done documenting traditional knowledge in herbal markets (Bussmann et al., 2016; Carvalho et al., 2018; Jin et al., 2018; Franco et al., 2020; Nanogulyan et al., 2020; Palabaş-Uzun and Koca, 2020; Ötnü and Akan, 2020; Łuczaj et al., 2021). Research conducted in herbal markets provides a fast and effective communication with people who sell and use plants. At the same time, these markets are meeting point and allow rapid information exchange on the names of the plant materials sold, their ethnobotanical characteristics, uses and benefits (Łuczaj et al., 2021).

Gaziantep, whose history dates back to 5600 BC, has also been the center of various civilizations. The first humans lived in caves were found in Dülük (Doliche), 12 km north of the city center. The historical ruins of many ancient settlements from the Hellenistic, Roman and Byzantine periods have survived to the present day in Gaziantep. It is possible to encounter traces of all these civilizations in the cultural life of the city. The role of Turkmen tribes is more dominant in today's traditional life of the city, which has lived through the Turkish-Islamic and Ottoman periods (Yüksel, 2007; Şahin, 2011; Gürsel, 2015).

The city, whose commercial volume and popularity increased with the GAP (Southeastern Anatolian project), actually had a strategic importance before the project due to its geographical location. Gaziantep is located on the historical "Silk Road" connecting the Near East, the Middle East and the Far East. In addition, being at an important crossroad connecting the western region of the country with neighboring countries in the east and southeast, has increased its geographical importance of the province since the past. While this historical caravan route connecting Asia to Europe formed the basis of the city's productivity and commercial capability, it also formed the foundations of the city's cultural richness (Yüksel, 2007; Külek, 2010). The cultural richness of the city is also reflected in its gastronomy and Gaziantep cuisine has been added to the Creative Cities Network list by UNESCO in 2015 and has taken its deserved place among the world cuisines (Uçuk and Kayran, 2020). The characteristic feature of Gaziantep cuisine comes from the different spices used in the dishes. The most important secret of tastes, liked by almost everyone comes from the high aroma and taste of herbal and animal products grown in the region under natural conditions.

To date, no studies have been conducted to evaluate the herbal markets, which have an important role in Gaziantep's cultural life. With this study, it is aimed both to make a detailed evaluation of the herbal markets of the province and to determine the relative importance of the medicinal plants traded. For this purpose, we tried to determine the plant species that are frequently used in the treatment of diseases and to perform analysis of the documented data using quantitative ethnobotanical indices. In addition, this study reveals the sales volume of herbal markets and their quantitative and qualitative change in the last five years.

Materials and methods

Location of the study site

Gaziantep province, located on Turkey's Syrian border, is between 37031' North latitude and 38001' East longitude at the intersection of the Mediterranean and Southeastern Anatolia regions (*Figure 1*). A large part of the province located in the west of the Southeastern Anatolia region. Gaziantep city center is built on the Gaziantep

Plateau, which is considered higher than its surroundings, and its altitude is 850 m on average (Çakır, 2009).



Figure 1. Geographical location of the study area

Gaziantep province, which hosts approximately 2264 taxa belonging to 115 family, is located in the Mediterranean phytogeographical region (MAF, 2021). Steppe vegetation is common throughout the study area. In addition, forest vegetation mostly formed by oak communities, and maquis vegetation, are also observed (Çakır, 2009). In Gaziantep, an area of 370,736 hectares is agricultural land. Of these areas, 195,110 hectares are fruit lands and 7,277 hectares are vegetables. The largest area in orchard lands belongs to pistachio (*Pistacia vera* L.) plantations (127,087 ha) and 31% of Turkey's pistachio production is provided by Gaziantep.

Gaziantep is the most populous city of the Southeastern Anatolia region. Gaziantep population is 2,101,157 according to 2020 data and 50.49% of the population is men and 49.51% is women (TUIK, 2020). The majority of the population of Gaziantep consists of the Turkish (75%), followed by the Kurdish minority (20%), and a small minority (5%) of Arabs and Circassians (Güllü, 2009; URL-1, 2022).

Ethnobotanical data collection

Herbal markets have been important components of trade life since ancient times in the province of Gaziantep, which is on the Silk Road. The culture of the grand bazaar, where many herbal markets and spice sellers trade together, still continues in the province. In the present study, ethnobotanical data were collected through face-to-face interviews during the herbal market visits held at regular intervals between 2016 and 2017. In total,

14 herbal market vendors and 160 customers were interviewed in Gaziantep. The interviewees were selected only from those who wanted to participate in the survey, and no distinction was made between the interviewees.

Questionnaires; designed to collect detailed data about each taxa, such as its uses, vernacular name, parts used and preparation methods. Data were obtained by semi-structured questionnaires and open-ended interviews. The questionnaire consisted of two parts (*Appendix I*), with the first part including demographic information about the informants (*Table 1*). One of the herbalists we interviewed was female and thirteen were male. Six herbalists were between the ages of 18-35, five were between 36 and 50 years old, and three were over 51. Four herbalists were primary school graduates, seven were secondary school graduates and three were university graduates. Out of the 160 customers interviewed, 89 were male and 71 were female. 46 of these customers were aged between 18 and 35; 60 were aged between 36 and 50, and 54 were aged 51 years or older. Seventy-two customers graduated from primary school, 49 from secondary school, and 39 from university. The second part of the questionnaire mostly consisted of questions measuring the professional knowledge of the herbalists, such as: how do they buy their products; what are the top-selling plant taxa, where or from whom they buy the products they sell; how often do they buy medicinal plants; how do they get information about plants; and are they aware of the laws regarding the collection, processing and sale of plants; what is the most important criteria that customers pay attention when purchasing medicinal plants. We also asked about the changes they have observed in the medicinal plant market in the last 5 years. For customers, the second part consisted of information about the name of the plant, plant part used, the method of use, and the list of diseases being treated (*Appendix II*).

Table 1. Demographic profile of informants

| Variables | Category | Herbalist | Customer | Total Number of Informants | Percentage |
|------------------|-----------|-----------|----------|----------------------------|------------|
| Age | 18-35 | 6 | 46 | 52 | 29.9 |
| | 36-50 | 5 | 60 | 65 | 37.3 |
| | above 51 | 3 | 54 | 57 | 32.8 |
| Gender | Male | 13 | 89 | 102 | 58.6 |
| | Female | 1 | 71 | 72 | 41.4 |
| Education | Primary | 4 | 72 | 76 | 43.7 |
| | Secondary | 7 | 49 | 56 | 32.2 |
| | Higher | 3 | 39 | 42 | 24.1 |

Samples were taken from the plant materials, reported by the informants, and their identifications were made in the Herbarium KASOF (Kahramanmaraş Sütçü İmam University, Faculty of Forestry Herbarium). Plant parts have been stored in Herbarium KASOF. Since the samples stored in the herbarium were just dried plant parts (not a complete sample), the herbarium number could not be given. The study examines, not all products sold in herbal markets, only medicinal plants whose use is mentioned by informants. Herbal products such as resins, oils, and juices were not included in this study.

Ethnobotanical data analyses

The collected data from the field studies were entered into Microsoft Excel© spreadsheets. For analysis of data; Frequency of Citation (FC), Cultural Importance (CI), Relative Frequency of Citation (RFC), and species Use Value (UV) were calculated.

Frequency of citation (FC)

FC allows to assess the relative cultural importance of a species or group of species (Heinrich et al., 2009). In order to determine the FC value, which is defined as an absolute number, herbalist and local people were asked the medicinal uses of plants. In this study, two types of FC values were determined: FC and FC_{event}. FC is obtained by reporting the number of participants citing a plant species for different diseases. Therefore, it ranges from 0 (if none of the informants used this plant species) to 160 (if all used this plant species in different uses). FC_{event} explains the number of participants using a species for a particular disease and FC_{event} refers to the citation frequency for only one disease (Mehrnia et al., 2021).

Cultural importance index (CI)

Cultural Importance Index (CI) was calculated according to following equation (Eq.1) for each taxon (Tardio and Pardo-de-Santayana, 2008):

$$CI = \sum_{U=U1}^{UNC} \sum_{i=i1}^{iN} \frac{UR_{Ui}}{N} \quad (\text{Eq.1})$$

where, U = use category; N = the number of participants in the survey, NC = total number of different use categories; i varying from only one use to the total number of uses; UR = total number of use reports.

Relative frequency of citation (RFC)

The RFC was calculated using the Eq.2 according to Vitalini et al. (2013):

$$RFC = \frac{FC}{N} \quad (0 < RFC < 1) \quad (\text{Eq.2})$$

where “FC” is the number of informants mentioning the use of the species and “N” is the total number of informants in the survey.

Use value (UV)

The number of the use-reports for each taxon was used for the calculation of the use value. It was calculated by the Eq.3 given below (Trotter and Logan, 1986):

$$UV = \frac{U}{n} \quad (\text{Eq.3})$$

where “U” is the number of uses mentioned by each informant for a given taxa and “n” is the number of informants who cited the plant species.

Results

Herbal market characteristics and traditional knowledge

We asked herbalists the changes they have observed in herbal markets in the last five years. Accordingly, 43% of herbalists said that the number of customers increased, 71% said that the quality and standardization of the products increased, 71% said that the number of products demanded by customers increased, 79% said that the price of the products increased; and 64% stated that the number of herbal markets in the market has increased (Table 2). According to Table 2, herbalists did not mention a significant improvement (50%) regarding the inspections in the production and sale of products.

Table 2. Changes observed in the medicinal plant market in the last five years

| | Increase | | Decrease | | Steady | |
|--|------------------|-----------|------------------|-----------|------------------|-----------|
| | Herbalist Number | Ratio (%) | Herbalist Number | Ratio (%) | Herbalist Number | Ratio (%) |
| Number of customers | 6 | 43 | 4 | 29 | 4 | 29 |
| Quality and standardization of the products | 10 | 71 | 0 | 0 | 4 | 29 |
| Product variety | 10 | 71 | 0 | 0 | 4 | 29 |
| Product price | 11 | 79 | 0 | 0 | 3 | 21 |
| Inspections | 7 | 50 | 0 | 0 | 7 | 50 |
| Number of herbal markets | 9 | 64 | 2 | 14 | 3 | 22 |

During the herbal market visits, we observed that many of the products sold do not have a collection and expiration date, that the products were not properly stored, and that some products were too old to be beneficial for health. Increasing the inspections of the provincial health directorates in order to eliminate such deficiencies will contribute to the development and amelioration of the herbal markets. In addition, it is thought that herbalists gave subjective answers to some of the questions we asked, such as the number of customers, due to their professional concerns.

Traditional knowledge about processing of medicinal plants is learned from vendors' masters/teachers or parents (Ji et al., 2020). When we asked the herbalists how they get the information about medicinal plants, seven of them said that they learned it from their master and seven herbalists said that they were self-taught. None of the herbalists have a university degree or any certificate related to their profession. When customers come to herbalists, they sometimes come to buy a plant and sometimes to find healing for their diseases. For this reason, herbalists who will suggest a treatment about plants must have a certain level of knowledge. When we examined the frequency of herbalists who buy medicinal plants, they reported that they buy medicinal plants once a week (43%), once a month (36%), every three months (14%), and once a year (7%).

Herbal markets in Gaziantep have been popular places since the past due to the history and rich cuisine of the province. Many of the herbalists we wanted to interview for the survey did not want to participate in due to financial concerns. Some herbalists who accepted the interview did not want to give information about their income. According to interviews, it has been determined that the average operating age of the herbal market is 34.7 years, the average number of employees is 2.6, and the average annual turnover of the markets is 166,772,888TL (US\$42,762,279, currency in 2017). The annual average

turnover of the herbal markets is calculated according to the average of nine responding herbalists. Five of the herbalists did not answer this question, and there is a wide variation in the income of the respondents. In addition, according to the statements of eleven herbalists, their monthly income varies between 800TL (US\$205) and 10,000TL (US\$2,564), and their average income has been determined as 2,745TL (US\$704). In 2017, the per capita monthly income in Turkey was US\$883 (TUIK, 2018). Ten of the herbalists stated that they do not have any other source of income. A significant difference was also observed between the monthly incomes of the herbalists who participated in the interview. The location of the herbal market could be important in its income. Gaziantep is a city of gastronomy and museums and hosts an increasing number of tourists every year. Since most of the tourists visit historical spice shops and herbal markets, the sales rates of herbalists situated in near touristic bazaars is much higher than others.

The vast majority of herbalists participated in the survey stated that they bought the products from vendors and in processed form. Only one herbalist stated that he collected the products from nature, and one herbalist stated that he bought them as unprocessed. Also, majority of herbalists (57%) stated that they were not aware of the laws regarding the collecting, processing and selling of plants. When we examined the storage methods of medicinal plants sold by herbalists, it was determined that they mostly prefer to store them in gunny bags (40%) followed by storing it in paper boxes (27%), plastic boxes (15%), plastic bags (12%) and finally in glass jars (6%), respectively. We also asked about the most important criteria that customers pay attention to when purchasing medicinal plants. Herbalist indicated that quality (31%), price (31%), expiry date (19%) and trademark (11%) are the most important criteria respectively. During the field survey, we observed that the products were exhibited open to all kinds of contamination and some of them did not have an expiry date on storage bags. Failure to paying attention to the storage and hygiene conditions of the products also threatens public health. It is necessary to increase the frequency of inspections and herbalists should be trained about these improper practices.

Medicinal plant diversity, plant parts and their preparations

We identified 58 medicinal plant taxa belonging to 30 families as a result of our interviews with herbalists and customers from 14 herbal markets in the Gaziantep city. We were able to identify 56 plant samples in species level and 2 samples in genus level. The plant family with the most taxa represented was *Lamiaceae* (11 taxa). *Asteraceae* was the second most common plant family with six taxa while *Rosaceae* was the third rank with five taxa. Other frequently used families include *Malvaceae* (4 taxa); *Apiaceae* and *Fabaceae* (3 taxa); and *Cupressaceae*, *Anacardiaceae*, *Lauraceae*, *Zingiberaceae* (2 taxa) (Figure 2). The following families have only one taxon: *Equisetaceae*, *Aquifoliaceae*, *Caryophyllaceae*, *Ericaceae*, *Hypericaceae*, *Juglandaceae*, *Myrtaceae*, *Nitrariaceae*, *Oleaceae*, *Orchidaceae*, *Papaveraceae*, *Piperaceae*, *Ranunculaceae*, *Santalaceae*, *Solanaceae*, *Theaceae*, *Urticaceae*, and *Zygophyllaceae*.

Customers reported the use of 85 plant parts from 58 taxa and the leaves were the most frequently cited plant parts. The parts cited by customers were; leaves (27%), followed by fruits and flowers (each of 14%), seeds (13%), shoots (12%), roots (8%), aerial parts (4%), bark, cones and rhizomes (each of 2%), and tuber (1%), respectively (Figure 3).

The annual average weight for the 10 top-selling taxa by 14 herbalists were as follows: Mint (*Mentha x piperita* L.) 878 kg, Licorice (*Glycyrrhiza glabra* L.) 579 kg, Ginger (*Zingiber officinale* Roscoe) 301 kg, Thyme (*Thymus* sp.) 274 kg, Carob (*Ceratonia*

siliqua L.) 222 kg, Senna (*Senna alexandrina* Mill.) 216 kg, Linden (*Tilia platyphyllos* Scop.) 214 kg, Sage (*Salvia officinalis* L.) 120 kg, Common Nettle (*Urtica dioica* L.) 98 kg and Chamomile (*Matricaria chamomilla* L.) 68 kg. Also, herbalists stated that the preferred medicinal plants differ according to the seasons; Licorice in summer, Linden in autumn and winter, and Green Tea (*Camellia sinensis* (L.) Kuntze) in spring were the top-selling taxa.

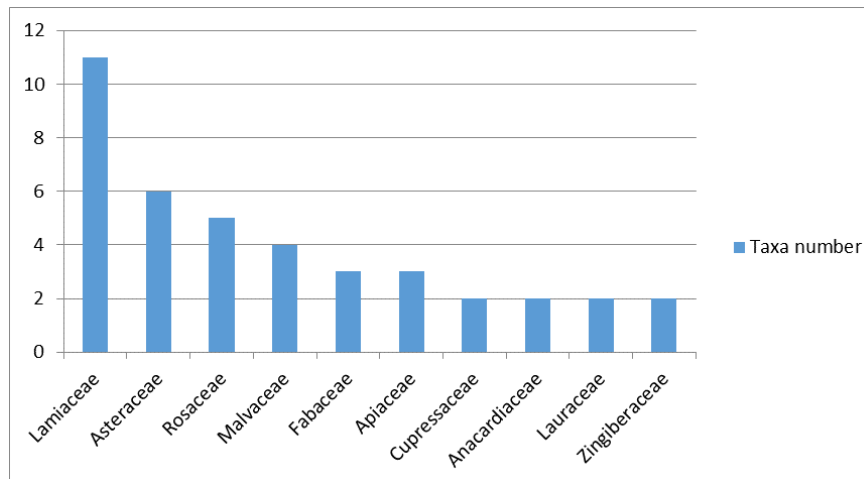


Figure 2. Richest plant families with their number of taxa

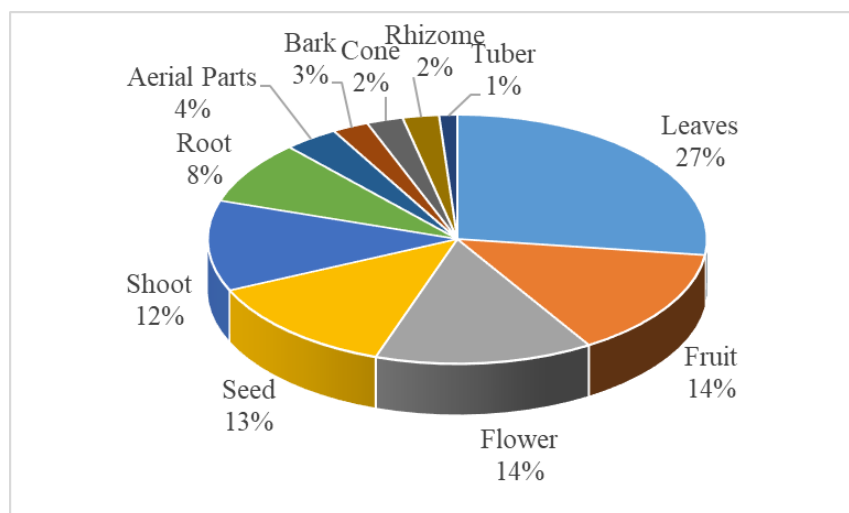


Figure 3. The percentage of plant parts used

When the preparation methods were examined, it was determined that the infusion, decoction and powder were the three most commonly used preparation methods. Paste method was used 3 times, oil, bath and raw methods were used 2 times; molasses, smoke, vinegar and marmalade methods were reported only once by customers (Figure 4). Totally, 11 different preparation methods were reported by customers.

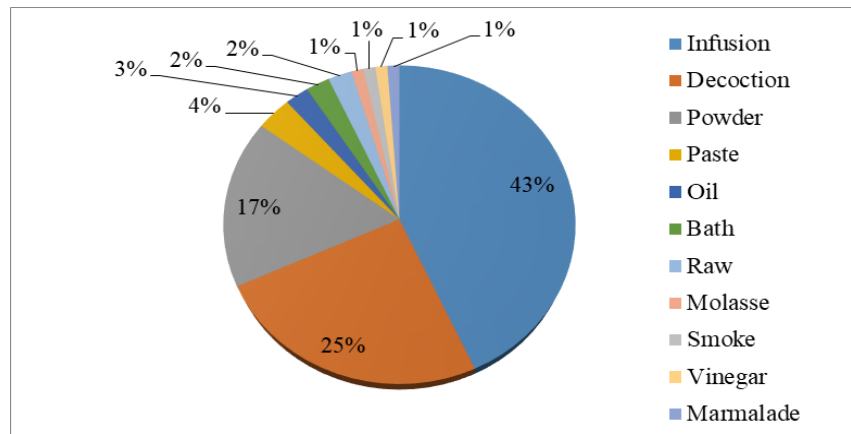


Figure 4. The percentage of plant parts used

Salient ailments and indices

The "Anatolian people" living in Anatolia since the Paleolithic Age (50.000-7.000 BC) have constantly benefited from the plants around them (Baytop, 2021). Over time some plants have developed a single medicinal use, whereas some other plants have versatile uses. In the current study, it was determined that 58 plants were used for medicinal purposes and 9 of them showed high versatility in their uses (see bolded taxa in Table 3). Plant species with more than 6 use reports include *Urtica dioica*, *Curcuma longa* L., *Achillea arabica* Kotschy, *Mentha x piperita*, *Salvia officinalis*, *Thymus* sp., *Peganum harmala* L., *Nigella sativa* L. and *Prunus avium* L.

The plant species that are frequently used against various ailments in the region were determined with the FC value (Figure 5). Accordingly, *Mentha x piperita* (147), *Thymus* sp. (141), and *Tilia platyphyllos* (132) are the taxa with the highest FC value. Cultural importance index (CI) takes into account not only the prevalence of use (number of informants) for each species, but also its versatility, and it was obtained from the sum of the proportion of informants that mention each species use (Tardio and Pardo-de-Santayana, 2008). Ten plant taxa having the highest CI values are as follows: *Mentha x piperita* (1.43), *Thymus* sp. (0.98), *Salvia officinalis* (0.94), *Tilia platyphyllos* (0.91), *Urtica dioica* (0.72), *Zingiber officinale* (0.72), *Thymbra spicata* L. (0.67), *Orchis* spp. (0.67), *Glycyrrhiza glabra* (0.65), *Rosa canina* L. (0.65).

The RFC can give an indication of the medicinal plants best known or long used by the local people and can represent a source of reliability (Appiah et al., 2017). In this study RFC values ranged from 0.92 to 0.04. *Mentha x piperita* has the highest RFC value and *Thymus* sp. (0.88), *Tilia platyphyllos* (0.83), *Salvia officinalis* (0.68) are the other taxa having high RFC values.

The Use Value (UV) index measures the relative importance of species, and UV is important in assessing which herbs are considered most useful for a given group of people and in identifying potential uses of a plant (Zenderland et al., 2019). The UVs of the taxa ranged from 0.03 to 0.86. The taxa having the highest UVs were *Prunus avium* (0.86) followed by *Achillea arabica* (0.55), *Curcuma longa* (0.54), *Papaver rhoeas* L. (0.50). The lowest UVs were recorded for *Tilia platyphyllos* (0.03) and *Glycyrrhiza glabra* (0.03). *Prunus avium* is reported by 7 informants for 6 different pharmacological properties. The UVs of *Tilia platyphyllos* and *Glycyrrhiza glabra* were relatively low because many informants use these taxa often for a few ailments.

Table 3. Medicinal plants traded in Gaziantep herbal markets

| Botanical Names | Family | Vernacular/ English Names | Parts used | Preparation Form | Uses (FC _{event}) | FC | CI | RFC | UV |
|---|---------------|------------------------------------|-------------------------|-----------------------|---|----|------|------|------|
| <i>Equisetum arvense</i> L. | EQUISETACEAE | Boğumlu ot / Horsetail | Stem and Leaves | Infusion, Bath | Diuretic (3), carminative (6), astringent (4), regulates menses (2) | 11 | 0,10 | 0,07 | 0,36 |
| <i>Juniperus communis</i> L. | CUPRESSACEAE | Ardıç / Common juniper | Cones | Decoction, oil | Bronchitis (5), halitosis (2), hemorrhoids (7), liniment (3) | 13 | 0,10 | 0,08 | 0,31 |
| <i>Juniperus drupacea</i> Lab. | CUPRESSACEAE | Andız / Syrian juniper | Cones | Molasses, Infusion | Asthma (22), bronchitis (18), urinary burning (6), skin diseases (8) | 34 | 0,34 | 0,21 | 0,12 |
| <i>Pistacia terebinthus</i> L. | ANACARDIACEAE | Menengiç / Turpentine tree | Fruits, Roots | Powder; Decoction | Diuretic (7), intestinal disorders (15), skin diseases (3) | 24 | 0,37 | 0,15 | 0,21 |
| <i>Rhus coriaria</i> L. | ANACARDIACEAE | Sumak / Sumac | Leaves, Fruits | Powder; Decoction | Cold (6), diarrhea (18), astringent (12), stomach and intestinal disorders (22) | 17 | 0,15 | 0,11 | 0,18 |
| <i>Anethum graveolens</i> L. | APIACEAE | Dereotu / Dill | Aerial parts, Seeds | Infusion | Halitosis (18), galactagogues (56), appetiser (32), carminative (25) | 65 | 0,52 | 0,41 | 0,05 |
| <i>Cuminum cyminum</i> L. | APIACEAE | Kimyon / Cumin | Seeds | Powder | Carminative (9), galactagogues (12), digestive (6) | 87 | 0,63 | 0,54 | 0,25 |
| <i>Foeniculum vulgare</i> Mill. | APIACEAE | Rezene / Fennel | Roots, Leaves, Seeds | Decoction, Powder | Galactagogues (38), carminative (35), intestinal problems (22), kidney stones (8) | 12 | 0,18 | 0,08 | 0,06 |
| ⁶ <i>Ilex paraguariensis</i> A.St.-Hil. | AQUIFOLIACEAE | Mate / Yerba mate | Leaves | Infusion | Anti-fatigue (5), diabetes (3), lose weight and antiobesity (12) | 13 | 0,13 | 0,08 | 0,23 |
| <i>Achillea arabica</i> Kotschy | ASTERACEAE | Civan perçemi / Yarrow | Leaves, Flowers | Infusion | Menorrhagia (8), anemia (3), hemorrhoids (1), wounds (2), stomach and intestinal disorders (2) | 17 | 0,16 | 0,11 | 0,55 |
| <i>Artemisia absinthium</i> L. | ASTERACEAE | Pelin otuout / Absinth wormwood | Shoots and Leaves | Infusion | Abnormal menstrual cycle (9), diabetes (4), expel worms from digestive tract (2) | 11 | 0,10 | 0,07 | 0,27 |
| <i>Carthamus tinctorius</i> L. | ASTERACEAE | Aspir / Safflower | Seeds, Flowers | Infusion | Rheumatism (9), laxative (12) | 77 | 0,58 | 0,48 | 0,11 |

| Botanical Names | Family | Vernacular/ English Names | Parts used | Preparation Form | Uses (FC _{event}) | FC | CI | RFC | UV |
|--|-----------------|------------------------------------|------------------------------------|---------------------------|--|-----|------|------|------|
| <i>Helichrysum arenarium</i> L. | ASTERACEAE | Ölmez çiçek / Sandy everlasting | Flowers | Infusion | Abnormal menstrual cycle (8), diuretic (3), cholagogue (1) | 19 | 0,14 | 0,12 | 0,30 |
| <i>Matricaria chamomilla</i> L. | ASTERACEAE | Mayıs papatyası Chamomile | Flowers | Infusion, Powder, Bath | Insomnia (25), stress (43), sore throat (12), haircare (32) | 11 | 0,09 | 0,07 | 0,05 |
| <i>Silybum marianum</i> (L.) Gaertner | ASTERACEAE | Deve dikenini / Milk thistle | Shoots, Seeds | Infusion, Powder | Lung disease (11), kidney stones (8), urinary diseases (7) | 10 | 0,08 | 0,06 | 0,18 |
| <i>Saponaria officinalis</i> L. | CARYOPHYLLACEAE | Çöven / Soapwort | Leaves, Roots | Decoction | Expectorant (9), diuretic (4), sedative (2), depurative (8) | 16 | 0,11 | 0,10 | 0,25 |
| <i>Erica arborea</i> L. | ERICACEAE | Funda / Tree heath | Shoots, Leaves | Infusion | Urinary problems (12), respiratory disorders (8) | 15 | 0,13 | 0,09 | 0,20 |
| <i>Ceratonia siliqua</i> L. | FABACEAE | Keçiboynuzu / Carob tree | Leaves, Shoots, Bark, Fruits | Powder, Decoction | Anemia (32), sexual disorders (35), stomach and intestinal disorders (13) | 43 | 0,44 | 0,27 | 0,05 |
| <i>Glycyrrhiza glabra</i> L. | FABACEAE | Meyan / Liquorice | Roots | Decoction | Ulcer (75), laxative (17), stomach ache (55) | 90 | 0,65 | 0,56 | 0,03 |
| ^ε <i>Senna alexandrina</i> Mill. | FABACEAE | Sinameki / Senna | Leaves | Infusion | Purgative (38), lose weight (32) | 64 | 0,43 | 0,40 | 0,05 |
| <i>Hypericum perforatum</i> L. | HYPERICACEAE | Kantaron / St. John's wort | Flowers | Infusion, Oil | Fever (7), skin burns (18), nervous system disorders (16), anxiety (12), canker (7) | 21 | 0,37 | 0,13 | 0,24 |
| <i>Juglans regia</i> L. | JUGLANDACEAE | Ceviz / Walnut | Fruits, Leaves | Infusion | Antifungal (3), bronchitis (2), diabetes (6), cholesterol (12) | 14 | 0,15 | 0,09 | 0,29 |
| <i>Lavandula stoechas</i> L. | LAMIACEAE | Lavanta / Lavender | Flowers | Infusion | Nervous disorders (2), headache (5), stomach gas (3), stomach ache (1), irregular heart beat (9) | 141 | 0,98 | 0,88 | 0,38 |
| <i>Melissa officinalis</i> L. | LAMIACEAE | Oğul out / Lemon balm | Leaves | Infusion | Gas troubles (9), nervous disorders (12), sedative (11), insomnia (7) | 108 | 0,94 | 0,68 | 0,22 |
| <i>Mentha x piperita</i> L. | LAMIACEAE | Nane / Peppermint | Leaves | Infusion, Decoction | Stomach ache (82), cold (105), nausea (33), halitosis (22), fever (5), influenza (32) | 53 | 0,67 | 0,33 | 0,04 |
| <i>Ocimum basilicum</i> L. | LAMIACEAE | Reyhan / Basil | Leaves, Shoots | Infusion | Diabetes (5), cold (4), flu (3), indigestion (9) | 45 | 0,39 | 0,28 | 0,24 |

| Botanical Names | Family | Vernacular/ English Names | Parts used | Preparation Form | Uses (FC _{event}) | FC | CI | RFC | UV |
|--|-----------|---------------------------------|--------------------------|-----------------------------------|--|-----|------|------|------|
| <i>Rosmarinus officinalis</i> L. | LAMIACEAE | Biberiye / Rosemary | Leaves, Shoots | Infusion | Indigestion (5), diuretic (8), headache (2), nervous disorders (3) | 35 | 0,31 | 0,22 | 0,25 |
| <i>Salvia officinalis</i> L. | LAMIACEAE | Adaçayı / Sage | Leaves | Infusion | Antiseptic (22), indigestive (21), tooth (24) and throat inflammation (54), flu (65), fever (8) | 13 | 0,13 | 0,08 | 0,06 |
| <i>Sideritis congesta</i> L. | LAMIACEAE | Alanya Çayı / Mountain tea | Shoots | Decoction | Cold (23), appetiser (9), stomach gas (17) | 13 | 0,12 | 0,08 | 0,09 |
| <i>Teucrium polium</i> L. | LAMIACEAE | Peryavşan / Feltly germander | Aerial parts | Infusion | Appetiser (12), eczema (9), stomach ache (21), indigestive (7), galactagogues (12) | 16 | 0,11 | 0,10 | 0,11 |
| <i>Thymbra spicata</i> L. | LAMIACEAE | Zahter / Spiked Thyme | Shoots, Leaves | Infusion | Ulcer (18), expectorant (25), diabetes (23), colds (42) | 147 | 1,43 | 0,92 | 0,08 |
| <i>Thymus</i> sp. | LAMIACEAE | Kekik / Thyme | Leaves | Infusion | Stomach ache (33) and headache (13), indigestive (57), cough (72), bronchitis (35), diabetes (27) | 18 | 0,25 | 0,11 | 0,04 |
| <i>Vitex agnus-castus</i> L. | LAMIACEAE | Hayıt / Chaste tree | Leaves, Fruits, Seeds | Infusion, Powder | Regulates menses (11), diuretic (5), galactagogue (3) | 17 | 0,14 | 0,11 | 0,14 |
| ^ç <i>Cinnamomum</i> <i>zeylanicum</i> L. | LAURACEAE | Tarçın / Cinnamon | Bark | Powder, Infusion, Decoction | Gas troubles (12), digestive (15), controls blood glucose (17) | 64 | 0,44 | 0,40 | 0,06 |
| <i>Laurus nobilis</i> L. | LAURACEAE | Defne / Bay laurel | Leaves, Fruits | Decoction | Diuretic (5), digestive (18), colds (25), appetiser (22) | 22 | 0,28 | 0,14 | 0,23 |
| <i>Althaea officinalis</i> L. | MALVACEAE | Hatmi Çiçeği / Marsh mallow | Flowers | Infusion | Cough (10), expectorant (8), purgative (4) | 132 | 0,91 | 0,83 | 0,33 |
| ^ç <i>Hibiscus sabdariffa</i> L. | MALVACEAE | Hibiskus / Roselle | Flowers | Infusion | Controls blood pressure (5), diuretic (7), eczema (9), sedative (2) | 17 | 0,18 | 0,11 | 0,29 |
| <i>Malva sylvestris</i> L. | MALVACEAE | Ebegümeçi Common mallow | Flowers, Leaves | Infusion, Paste | Eczema (2), anti-inflammatory (4), treatment of abscess (8), laxative (9), hemorrhoids (5) | 12 | 0,18 | 0,08 | 0,23 |

| Botanical Names | Family | Vernacular/ English Names | Parts used | Preparation Form | Uses (FC _{event}) | FC | CI | RFC | UV |
|---|---------------|------------------------------|------------------------|---------------------------|---|----|------|------|------|
| <i>Tilia platyphyllos</i> Scop. | MALVACEAE | Ihlamur / Linden | Flowers, Leaves | Decoction | Cold (77), sore throat (29), sedative (33), insomnia (35) | 13 | 0,14 | 0,08 | 0,07 |
| ^ç <i>Syzygium aromaticum</i> (L.) Merr. & L.M.Perry | MYRTACEAE | Karanfil / Clove | Flower buds | Raw, Decoction | Antiseptic (9), halitosis (15), toothache (13), canker (7), nausea (6) | 22 | 0,31 | 0,14 | 0,27 |
| <i>Peganum harmala</i> L. | NITRARIACEAE | Üzerlik / Wild rue | Seeds, Roots | Infusion, Paste, Smoke | Hemorrhoids (7), eczema (4), stimulant (3), diuretic and urinary system disorders (6), fumigant (28) | 33 | 0,31 | 0,21 | 0,04 |
| <i>Olea europaea</i> L. | OLEACEAE | Zeytin / Olive | Leaves | Infusion | Diuretic (2), appetiser (6), diabetes (12), cholesterol (5) | 15 | 0,16 | 0,09 | 0,50 |
| <i>Orchis</i> spp. | ORCHIDACEAE | Salep / Sahlep | Tubers | Root powder, Infusion | Cold (27), expectorant (54), aphrodisiac (46) | 80 | 0,67 | 0,50 | 0,20 |
| <i>Papaver rhoeas</i> L. | PAPAVERACEAE | Gelincik / Poppy | Flowers | Infusion | Anti-fatigue (5), bronchitis (3), insomnia (6), sedative (5) | 8 | 0,12 | 0,05 | 0,18 |
| ^ç <i>Piper nigrum</i> L. | PIPERACEAE | Karabiber / Black pepper | Seeds | Decoction, Powder | Appetiser (7), stomach ache (8), indigestion (15), rheumatism (8) | 20 | 0,23 | 0,13 | 0,10 |
| <i>Nigella sativa</i> L. | RANUNCULACEAE | Çörekotu / Black cumin | Seeds | Decoction | Gastrointestinal disorders (27), asthma (5), diabetes (7), indigestion (10), rheumatism (3) | 33 | 0,32 | 0,21 | 0,29 |
| <i>Cerasus mahaleb</i> L. | ROSACEAE | Mahlep / Mahaleb | Seeds | Powder | Expectorant (8), asthma (12), aphrodisiac (14), diabetes (22) | 96 | 0,65 | 0,60 | 0,86 |
| <i>Crataegus orientalis</i> L. | ROSACEAE | Alıç / Hawthorn | Fruits, Leaves | Vinegar, Infusion | Controls blood pressure (15) and diabetes (5), arrhythmia (12), asthma (2), sedative (3) | 55 | 0,50 | 0,34 | 0,04 |
| <i>Prunus avium</i> L. | ROSACEAE | Kiraz / Cherry | Fruits, Fruit stalk | Infusion, Decoction | Cholesterol lowering (7), diuretic (8), purgative, antioxidant (5), bronchitis (3), lose weight (5) | 39 | 0,36 | 0,24 | 0,07 |
| <i>Rosa canina</i> L. | ROSACEAE | Kuşburnu / Rosehip | Fruits | Infusion, Marmalade | Cold (52), asthma (18), diabetes (27), anemia (25) | 17 | 0,23 | 0,11 | 0,27 |
| <i>Rubus sanctus</i> Schreb. | ROSACEAE | Böğürtlen / Blackberry | Fruits, Roots | Raw, Decoction | Cold (17), anemia (12), haemorrhoid (11), infertility (38) | 7 | 0,17 | 0,04 | 0,05 |

| Botanical Names | Family | Vernacular/ English Names | Parts used | Preparation Form | Uses (FC _{event}) | FC | CI | RFC | UV |
|--|----------------|---|---------------------------|-------------------------------|--|----|------|------|------|
| <i>Viscum album</i> L. | SANTALACEAE | Ökse otu, Gövelek out / Mistletoe | Leaves, Shoots, Fruits | Decoction, Infusion, Paste | Anti-allergic (6), purgative (4), control blood pressure (6), anticancer (12) | 15 | 0,19 | 0,09 | 0,24 |
| ^è <i>Capiscum annuum</i> L. | SOLANACEAE | Pul biber / Red Pepper | Fruit, Seeds | Powder | Cold (37), rheumatism (18), anticancer (26), analgesic (35) | 75 | 0,51 | 0,47 | 0,03 |
| ^è <i>Camellia sinensis</i> (L.) Kuntze | THEACEAE | Yeşilçay / Green tea | Leaves | Infusion | Diuretic (11), antioxidant (5), increases metabolism (16), lose weight (11) | 17 | 0,27 | 0,11 | 0,09 |
| <i>Urtica dioica</i> L. | URTICACEAE | Isırgan / Nettle | Aerial parts | Infusion, Decoction | Asthma (12), hair care (28), diuretic (16), astringent (14), anticancer (78), emmenagogue (8), aphrodisiac (5), purgative (12) | 87 | 0,72 | 0,54 | 0,23 |
| ^è <i>Curcuma longa</i> L. | ZINGIBERACEAE | Zerdeçal / Turmeric | Rhizomes | Decoction, Powder | Wound (3), stomach ache (2), digestive (4), cough (8), purgative (6), anemia (2), anticancer (10) | 13 | 0,22 | 0,08 | 0,05 |
| ^è <i>Zingiber officinale</i> Roscoe | ZINGIBERACEAE | Zencefil / Ginger | Rhizomes | Powder, Decoction | Carminative (31), cough (45), expectorant (25), digestive (13), control blood pressure (18) | 97 | 0,72 | 0,61 | 0,54 |
| <i>Tribulus terrestris</i> L. | ZYGOPHYLLACEAE | Deve Çökerten / Puncture Vine | Roots and Shoots | Decoction | Hemorrhoids (3), cough (2), aphrodisiac (3), diuretic (6) | 9 | 0,08 | 0,06 | 0,44 |

^è exotic plant taxa, not native for the Flora of Turkey

Abbreviations: **FC**: Frequency of citation; **CI**: Cultural importance index; **RFC**: Relative frequency of citation; **UV**: Use value

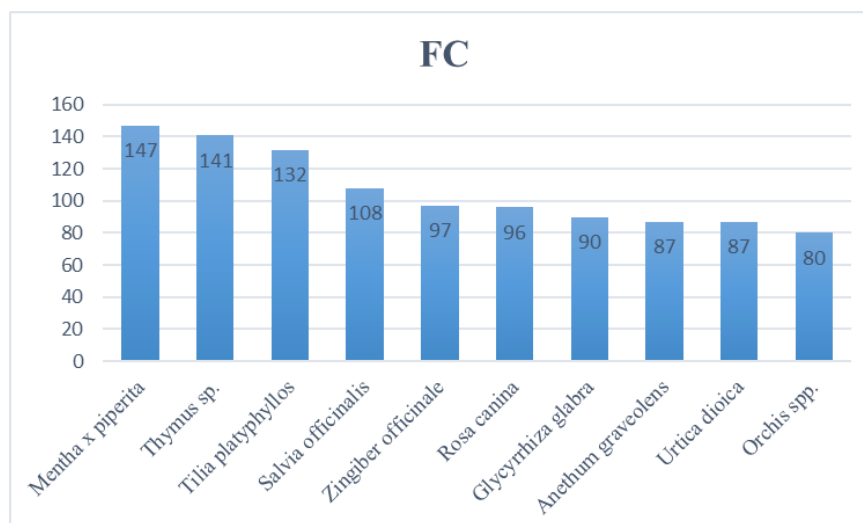


Figure 5. The percentage of plant parts used

Discussion

Herbal market characteristics and traditional knowledge

Although the international market for medicinal and aromatic plants and non-timber forest products interest by government, studies on the trade volumes of local herbal markets hardly exist (Bussmann et al., 2016). Increasing interest in medicinal plants day by day ensures that herbal markets become an important source of income for citizens (Wang et al., 2021). The results of the research also confirm the increase in the number of customers, product quality, annual income and the number of herbal markets in the marketplace. It is expected that these markets will grow even more in the near future with the diversification of health problem, human needs and increasing population.

It is estimated that at least 1000 of the native plant species in Turkey are used in various ways and approximately 400 of them are subject to trade (Acıbuca and Bostan Budak, 2018). Globally, approximately 2,500 medicinal plants are traded and worldwide market sales are estimated to reach US\$5 trillion by 2050 (Schippmann et al., 2002; Zahoor et al., 2021). As in the whole world, most of the medicinal plants in Turkey are collected from nature, and the number of those grown and traded is very low. However, with the increase in usage areas, the export amounts and trade volume of medicinal plants are increasing day by day. Turkey ranks as the first among exporting countries for products such as thyme, bay leaves and cumin. Today, although the cultivation area of medicinal and aromatic plant has increased by 40% compared to the 2000s, many plants have just been cultivated or studies are still continuing. Cultivation studies should be increased in order to respond to the increasing demand of medicinal plants (Temel et al., 2018). In addition, although some plants are cultivated, people do not want to use the grown ones because they believe that they do not have the same medicinal effect as the ones collected from nature. For this reason, when medicinal plants are cultivated, they should be cultured in places close to natural growing areas, and even in-situ studies should be emphasized. When collecting species from nature, quotas should be determined and excessive consumption should be prevented.

Medicinal plant use preferences

Medicinal plants may contribute to human health through their curative and therapeutic effects. In the present study the families with the highest number of taxa show similarities with other studies conducted in the nearby regions (Güneş et al., 2017; Özer and Türkmen, 2019; Palabaş Uzun and Koca, 2020; Ötnü and Akan, 2020) and even in the other parts of the world (Hanlidou et al., 2004; Ahmed, 2016; Petrakou et al., 2020; Shah et al., 2020). In general, *Lamiaceae* family taxa are widely used and traded as medicinal plants due to the high amounts of essential oils they contain.

The life forms of medicinal plants sold in Gaziantep herbal markets are similar to the other studies; mainly herbs (62.1%), followed by trees (19%), shrubs (17.2%) and a liana (1.7%) (Ahmed, 2016; Yeşil and İnal, 2019; Shah et al., 2020; Kızıllarslan Hançer et al., 2020). Of the identified taxa 48 (82.8%) are native to Turkey, and 10 (17.2%) are introduced. Unlike the studies conducted in different parts of the world (Hanlidou et al., 2004; Bussmann et al., 2016), the rate of native plants is generally higher. Hanlidou et al. (2004) reported that, while 56.4% of the plants sold in Thessaloniki/Greece plant markets are native species, 43.6% of plants are introduced. In his study conducted in Bolivia, Bussmann et al. (2016) revealed that 61.2% of the plants sold in the plant markets are native and 38.8% are introduced. Since Turkey is a rich country in terms of medicinal and aromatic plant species (Keykubat, 2016) and the people generally learn about the use of these plants from their parents, the sales rates of native and traditional species are higher in herbal markets.

In this study, leaves were the most frequently cited plant part by customers, as in many other studies conducted in different parts of the world (Ahmed, 2016; Petrakou et al., 2020; Zahoor et al., 2021). Conducted studies in different provinces of Turkey also found that leaves, flowers and fruits are the most commonly used plant parts (Akbulut, 2015; Kılıç et al., 2021). The most likely reasons for the frequent use of leaves are that they are easier to access than roots, seeds, flowers and fruits, and they are also active in the production of metabolites (Ghorbani, 2005; Giday et al., 2009), and that removing leaf does not harm plants as much as other plant parts. Although the top-selling plants are similar to the study conducted by Palabaş Uzun and Koca (2020) in Kahramanmaraş, the sales volumes in Gaziantep herbal markets are much higher in terms of quantity. In addition to the large population of the province, the high tourism potential has also an effect on in this.

The amount of use of medicinal plants varies according to the seasons and regions. Generally, taxa such as mint, thyme, sage and nettle have high usage amounts all over the world (Hanlidou et al., 2004; Ahmed, 2016; Nanagulyan et al., 2020; Petrakou et al., 2020; Łuczaj et al., 2021). While reaching similar results in the present study, also licorice is among the taxa with the highest usage amounts. Licorice, which is native in Southern Europe and Asia, has been used in Traditional Chinese Medicine for 1000 years (Jiang et al., 2020). It has also been determined by some other studies that licorice sherbet is consumed a lot in Turkey, especially in the southeastern provinces, during the summer months and during Ramadan, the holy month of Muslims (Palabaş Uzun and Koca, 2020; Ötnü and Akan, 2020). The thirst quenching and stomach-relieving effects of licorice are the reason why it is preferred among people in the region where the summers are very hot. In the region, licorice root is sold in herbal markets as plant material, and is also widely sold in herbal markets, bazaars and streets as sherbet. However, sales of linden increase in autumn and winter due to its sweat-inducing and relaxing effect against

feverish colds and infections. Likewise, green tea sales are increasing for weight loss by increasing metabolic activity in the spring.

When the usage methods are evaluated according to the plant parts, the “infusion” is preferred mostly for the softer plant parts such as leaves, flowers and fruits; “decoction” is preferred for harder plant parts such as roots, bark and shoots. The “powder” is mostly applied to the seeds of plants. In order to benefit from the bioactive compounds of the soft plant parts without crushing too much, they are thrown into boiling water and thus the degradation of phytochemical compounds is prevented. Harder plant parts, on the other hand, are boiled by throwing them into cold water, thus helping to release the bioactive substances (Petrakou et al., 2020).

Quantitative evaluation

To determine the best-known taxa, the frequency of use and the traditional uses of medicinal plants by the local people in Gaziantep herbal markets, some ethnobotanical indices were calculated. Among these indices, the RFC highlights the important taxa, used for many diseases, of the studied region. The fact that the species have high RFC values is very important as it may be an indication that the traditional knowledge about them will reach future generations. Similar to the results of our study, mint, thyme and sage generally have high citation reports, conducted studies in nearby regions (Nanagulyan et al., 2020; Petrakou et al., 2020; Shah et al., 2020).

Indices that record traditional knowledge by measuring current uses (active uses) of plants are noteworthy considerations. At the same time, the information gathered from semi-structured interviews in herbal markets offers a more in-depth analysis about the uses of plants compared to the information collected by the free list method in nature (Tardio and Pardo-de-Santayana, 2008). In the current study, the cultural significance index (CI), calculated according to the citation frequency, records the traditional knowledge and presents the most frequently used plants. Among the plant taxa having the highest CI values, the *Lamiaceae* family has the highest rate compared to other families. Most of the species belonging to the *Lamiaceae* family are aromatic and have essential oils (Lawrence, 1992). In addition, the species of the family are widely used as a spice, especially in the cuisine of Mediterranean countries (Khoury et al., 2016). Mint and thyme are among the most widely used spices in the rich cuisine culture of the region. In addition, they are the most frequently used taxa, especially in colds, stomach ailments, flu and bronchitis. For this reason, they have been the most cited plant taxa by the informant. In addition, most of the taxa with high CI value are among the most-selling taxa by the herbalist. However, *Orchis* spp. taxa draw attention in this list. Since these taxa have been over-harvested from nature for many years, both for food and therapeutic purposes, their populations have declined. Uncontrolled collection of taxa belonging to *Orchidaceae* family from nature is prohibited by the Ministry of Agriculture and Forestry. Today, many taxa belonging to this family are under threat. Salep powder obtained from the tubers of some genera of the *Orchidaceae* family is used by the local people as an aphrodisiac, cold and expectorant, especially in winter. Although the cultivation of some *Orchidaceae* taxa has been achieved in Turkey, it is not yet sufficient to meet the need. For this reason, it is important to increase and encourage the cultivation of the taxa in areas where suitable soil conditions.

Conclusions

Herbal markets are distinctive places for cultures and societies that serve to maintain and illuminate traditional plant uses from different regions and origins, representing the cultural or biological diversity of a particular region on a small scale. With this study, the evaluation of medicinal plants sold in Gaziantep herbal markets was made with the help of some ethnobotanical indices for the first time. In addition, analyze of the herbal market was revealed by evaluating the herbalists both in sales scale and product content and quality scale. In the study, 10 of the 58 medicinal plants sold in herbalists are imported, and some of them (*Zingiber officinale* and *Senna alexandrina*) are among the top-selling plants annually. On the other hand, native plants sold in herbal markets are mostly collected from nature. Among these plants, especially *Glycyrrhiza glabra*, *Ceratonia siliqua* and *Tilia platyphyllos* have very high sales volumes, so the balance of protection and use should be maintained and sales should be controlled.

According to our results the herbal market sector has improved in recent years in terms of customer density, product variety and quality sold, and the number of herbal markets. However, as a result of our observations, it has been determined that herbal markets still do not fully comply with the necessary hygiene and storage conditions. Also, during the field studies, it was observed that herbalists avoided answering some questions about their income due to their professional concerns. Elimination of such concerns will be possible by starting of some professional standards implementation. First of all, some basic training and certificates should be demanded to perform this profession. For herbalists, who are still doing this job, trainings should be organized to support their development, so that they can carry out their work in a well-equipped way and contribute to the transfer of traditional knowledge to future generations in a more accurate way.

As a result, observing the increasing demand for medicinal plants, following the growth of herbal markets and combining those with country's policies will also be a driving force for decision makers.

Conflict of Interests Statement. The authors hereby declare that they have no conflict of interests.

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APPENDIX

APPENDIX I (FOR HERBALIST)

First Part

1. Age of herbalist
2. Gender of herbalist
3. Education level of herbalist
4. How they obtained the knowledge of herbalism
5. Active years at herbal market, number of employees, number of products, annual turnover
6. Monthly earnings of herbalist

Second Part

7. How they buy their products?
8. What are the top-selling plant taxa?
9. Where or from whom they buy the products that they sell?
10. How often they buy medicinal plants?
11. How they get information about plants?
12. Are they aware of the laws regarding the collecting, processing and sale of plants?
13. What are the most important criteria that customers pay attention when purchasing medicinal plants?

APPENDIX II (FOR CUSTOMER)

Date: ----

Informants name:----

Age: ----

Education level:-----

1. Local name of plant: ----

2. Part of plant:----

3. Diseases being treated:----

5. How to use it (powder, pulp, tea, etc.) ---- Internal External