#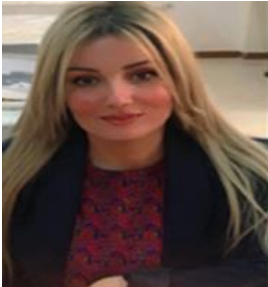 Ethnobotanical Study of Medicinal Plants Used in the Prevention and Treatment of COVID-19 Infection in the Tiaret Region (Algeria)

Soudani Leila [a], **Chafaa Meriem [b]**, **Benabdelkrim Souad [c]**, **Houcine Rekaia [d]**

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Abstract

The coronavirus disease has spread widely over the world with a high mortality rate. This spread has prompted people to look for other ways to treat or minimize the negative impact of this outbreak. During the pandemic, the Algerian population used medicinal plants for the prevention and treatment of COVID-19. The present work was carried out to identify the medicinal plants used during COVID-19 by the population of the Tiaret region (Algeria). An ethnobotanical survey was conducted to collect data on the medicinal plants used, including the socio-demographic parameters of the users and floral characteristics of the plants. Information was obtained from 428 participants, of which 67.05% were women, aged between 16 and 88 years old. Most plant users were between 41 and 64 years old. The majority of participants have a high level of education (55.14% university and 20.32% secondary). Quantitative indices, namely, Frequency of Citation (FC), Relative Frequency of Citation (RFC), and Family Importance Value (FIV) were used to analyze the data. 27 species of medicinal plants belonging to 15 botanical families were used during the COVID-19 pandemic in our region. The most used species were *Syzygium aromaticum*, *Zingiber officinale*, *Citrus limon,* and *Aloysia citriodora*. The most cited families were Myrtaceae (FIV =0.28), Zingeberaceae (FIV =0.21), Verbenaceae (FIV =0.19), Rutaceae (FIV =0.12), and Lamiaceae (FIV =0.05).

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Contents

1   Introduction

The world has been struggling to find medications to treat and prevent the new coronavirus disease (COVID-19) pandemic, which has caused global socioeconomic disturbances and an alarming number of deaths and health issues. Numerous combinations and tests have been conducted, but so far they have not yielded encouraging outcomes (Boulware et al., 2020; Keni et al., 2020; Mahammed et al., 2020; Rosa & Santos, 2020).

In the past, people have used medicinal plants to combat pandemics (Thomford et al., 2015), and it's possible that dependency on these plants has grown today due to the possibility of using them as a COVID-19 prevention measure (Taylor et al., 2020; Lim et al., 2021). In the absence of effective and specific pharmacological treatment against COVID-19, natural remedies are now being used by people all over the world to either prevent or treat COVID-19 infection, the prevalence of phytotherapy among Algerians is due to a number of factors, including the abundance of medicinal plants in the nation, the poor economic standing of the Algerian population, and the difficulty in accessing modern medicine (Hamdani & Houari, 2020; Brahmi et al., 2023).

In Algeria, on 30 April 2021, the Ministry of Health announced a total of 122,108 infections in the country territory since the first case was reported in 1 March 2020 and that 3,253 cases had died (INSP, Report N° 205 of 19 April 2021). As a consequence, the Algerian population has used medicinal plants for preventing or treating this COVID-19 infection (Hamdani & Houari, 2020; Brahmi et al., 2023; Salima et al., 2022). In this context, our study aims to realize an ethnobotanical survey to know and identify the different aromatic and medicinal plants used to prevent and treat COVID-19 during the pandemic by the population of the Tiaret region (Algeria).

2   Materials and Methods

Study area

Algeria's Tiaret Wilaya is situated in the country's highlands, in the west-central portion. Comprised of semi-arid regions in the South, high plateaus in the Center, and a mountainous region in the North. The Saharan atlas (Djebel Amour) in the south, the mounts of Frenda in the southwest, and the southern slope of the Tellian Atlas's Link (Ouarsenis) in the north serve as the wilaya's boundaries (Figure 1). The remainder of the wilaya is made up of high plains that are bordered to the south and north by the Sersou plateaus and the Chott Echergui basin. Its harsh winters with lots of snowfall and hot, dry summers define its climate (Mohammed & Benchaben, 2016; Leila et al., 2017).

The study area is characterized as one of the most cereal-producing wilayas due to its morphology and geographic location, which lend it an agro-pastoral flavor. This geographical position gives it a particular floristic and ecological originality and considerable biological wealth (Miara et al., 2014; Zemour et al., 2020). The total population of Tiaret is estimated at about 1,007.635 inhabitants. According to an epidemiological assessment published in 2017, this region had a high rate of deaths brought on by various illnesses, especially chronic respiratory disease. This may be caused by a number of things, including the region's unfortunate shortage of specialists, a lack of equipment, the people's poverty, and the difficulty in obtaining medications,

among other things, which have all contributed to a noticeable decline in the health of the local populace (Djahafi et al., 2021).
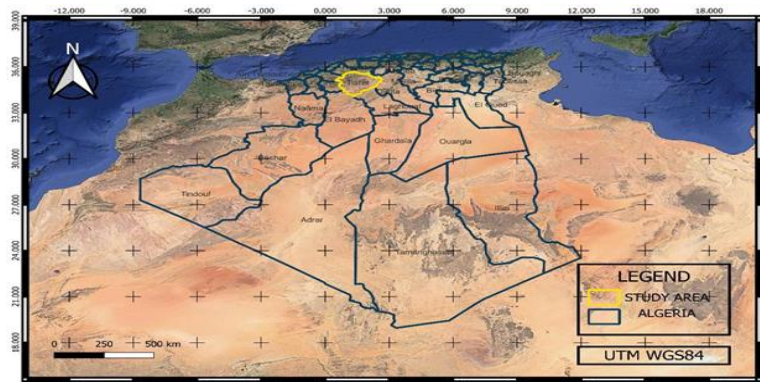

Figure 1. Geographical location of Tiaret region

Ethnobotanical survey and data collection

A questionnaire was used to gather information about the locals and the plants that are used in the Tiaret region to treat and prevent symptoms that are similar to those of the coronavirus (COVID-19). In this region, a survey of the local populace was carried out between May and September of 2021. The sanitary protocol was followed throughout this survey to minimize the risk of contamination. A total of 428 respondents took part in the survey. Data collected included age, gender, education level, family situation, socio-economic level, and locality (Giday et al., 2003; Manzaba & Rodríguez, 2021; Hidayat et al., 2022). The information on the medicinal plants used includes the name of the plants (both common and Latin names), the parts used, the state of the plant used, the preparation method, the mode of use, duration of the treatment, effectiveness of the plant and the origin of the information.

The scientific identification of plant species was confirmed by bibliographical references, in particular, the repertory of indigenous names of spontaneous plants and plants cultivated and used in North Africa (Trabut, 1935; Quézel & Santa, 1963). It was also verified in line with the International Index of Plant Names (http://www.ipni.org) and the Plant List database (http://www.theplantlist.org).

Data analysis

Excel software was used to process the data, and straightforward descriptive statistical techniques were used to process the results. Additionally, the Relative Frequency of Citation (RFC) and Family Importance Value (FIV) were used to analyze ethnobotanical data. The level of knowledge of the plants by the informants was assessed by the frequency of citation (FC). It is an excellent indicator to assess the reliability of the information obtained and the level of knowledge of plants within the population (Kouame et al., 2021). FC = The number of respondents who mentioned using a particular species.

The same author points out that credibility exists when the same plant, genus or family is mentioned at least twice to treat the same disease or condition. To ascertain whether informants agreed on the reported plants for the treatment of COVID-19 infection, the Relative Frequency of Citation (RFC) was assessed. The RFC value is calculated using the equation RFC = FC/N where (0<RFC<1) (Vitalini et al., 2013; Yaseen et al., 2015; Umeta Chali et al., 2021; Odebunmi et al., 2022). N = Total number of respondents who took part in a survey. Following Tardio & Pardo-de-Santayana (2008), frequency of citation (FC) and relative frequency of citation (RFC) calculations were made for all the species.

The significance of various families of medicinal plants is determined by the Family Importance Value (FIV). In order to calculate it, divide the total number of species in each family (Ns) by the percentage of informants who mention the family (FC family) (Brahmi et al., 2023).

$$FIV = FC\ family\ /\ Ns$$

3   Results and Discussions

3.1 Sociodemographic characteristics

Four hundred and twenty -eight persons were questioned with an assessment of demographic coal (Table 1). The age of participants varies between 16 and 88 years of age, most of them were women (67.05%). Nearly 43.45% of the respondents who had used medicinal plants were between 41 and 64 years old, followed by the 25-40 age groups (41.82%). As for the people belonging respectively to the age groups, less than 25 years and more than 65 years record a very low rate of 9.11% and 5.6%. The marital status of the respondents shows that 56.30% of the married people use medicinal plants in general.

58.87% of plant users are unemployed. About 55.14% of participants have a high level of education, followed by people with secondary education (20.32%). 62.85% of participants lived in urban areas. It is well recognized that differences in participant gender, age, and educational attainment have a significant impact on their knowledge (Brahmi et al., 2023).

Table 1
Socio-demographic features of the informants

Socio-demographic features	Category	Effective	Percentage (%)
Age	< 24	39	9,11
	25-40	179	41,82
	41-64	186	43,45
	> 65	24	5,6
Gender	Male	141	32.94
	Female	287	67.05
Family situation	Married	241	56.30
	Single	187	43.69
Social status	Employed	111	25.93
	Unemployed	252	58.87
	Other	65	15.18
Academic level	Illiterate	32	7.47
	Primary	29	6.73
	Average	44	10.28
	Secondary	87	20.32
	University	236	55.14
Habita	Urban	269	62.85
	Rural	159	37.14

Since ancient times, the Algerian people have employed medicinal plants for therapeutic purposes (Miara et al., 2014). According to earlier research, it also employed these plants for the prevention and treatment of COVID-19 (Hamdani & Houari, 2020; Brahmi et al., 2023; Salima et al., 2022). According to our research, persons between the ages of 24 and 64 are the most frequent users of medicinal plants during pandemics. The group of those over the age of 64 has the lowest rate, nonetheless. Similar results have been found in the Helali et al. (2020); Akbulut (2021); Kouame et al. (2021), studies.

In our region, it is mainly women who use plants in the prevention or treatment of COVID-19. These results are similar to those obtained by Khadka et al. (2021); Brahmi et al. (2023); Odebunmi et al. (2022). They are contrary to ethnobotanical studies in which men are the most use plants in coronavirus treatment (Akbulut, 2021; Chebaïbi et al., 2022; Kouame et al., 2021). The majority of female participants show that women in the study area are better knowledgeable about medicinal plants than their male counterparts. Additionally, married people use more plants than single people do. Therefore, they have distinct responsibilities for providing ancestor health care, particularly as parents. This is consistent with Kadri et al.

(2019), findings, which revealed that 88% of the traditional plant usage in Algerian's department of Adrar is held by married people.

The majority of participants have a university level, and a sizable majority of those who have completed secondary education also utilize plants for therapeutic purposes. These results are similar to Khadka et al. (2021); Brahmi et al. (2023); Chebaïbi et al. (2022); Kouame et al. (2021), researches. Additionally, the use of plants is influenced by socioeconomic factors and low income; the majority of participants who used plants in treatment were unemployed (Kabbaj et al., 2012; Eddouks et al., 2017; Samouh et al., 2019). The inhabitants surveyed in the Tiaret region revealed that 62.85% of them reside in urban areas against 37.14% who live in rural regions. Unlike Chebaïbi et al. (2022), an ethnobotanical study, discovered that plants are frequently used in rural regions. This can be accounted for by the fact that most COVID-19 virus infections reside in densely populated (urban) areas.

3.2 Ethnobotanical data
3.2.1 Plants used

A total of 27 plants belonging to 15 botanical families were recorded to treat or prevent COVID-19. The most represented families, in terms of the number of species, were Lamiaceae (8 species) and Astéraceae (5 species) (Table 2). Similar findings were recorded by Akbulut (2021); Khadka et al. (2021); Brahmi et al. (2023); Chebaïbi et al. (2022); Odebunmi et al. (2022), who found that Lamiaceae was the most common family to avoid COVID-19 infection.

Table 2
Medicinal plants used for the prevention and treatment of COVID-19 infection in the Tiaret region

Family (APG III)	Botanical name	Common name	Vernacular name	Part used	FC	RFC	FIV
Amaryllidaceae	*Allium sativum* L.	Garlic	Thoum	Bulbs	11	0,025	0,018
	Allium cepa L.	Onion	Bssal	Bulbs	5	0,011	
Anacardiaceae	*Pistacia lentiscus* L.	Lentiscus	Dharw	Leaves and fruits	10	0,023	0,023
Apiaceae	*Pimpinella anisum* L.	Green anise	Habetlhlawa	Fruits	12	0,028	0,028
Araliaceae	*Panax ginseng*	Korean ginseng	Djensin	Rhizomes	1	0,002	0,023
	Anacyclus pyrethrum L.	The Africanpyrethrum	Tegountos	Rhizomes	2	0,004	
	Artemisia campestris L.	Field wormwood	Tegouft	Leaves and flowers	3	0,007	
Astéraceae	*Artemisia herba-alba*	White wormwood	Chih	Aerial parts	31	0,072	0,018
	Saussurea costus	Indian costus	Kist hendi	Rhizomes	1	0,002	
	Matricaria chamomilla L.	Chamomile	Babounej	Inflorescence	4	0,009	
Fabaceae	*Trigonella foenum-graecum* L.	Fenugreek	Helba	Seeds	2	0,004	0,0046
Illiciaceae	*Illicium verum*	Chinese star anise	Nedjmet lard	Fruits	17	0,039	0,039
	Lavandula stoechas L.	Lavender	Khuzama	Leaves and flowers	1	0,002	
	Rosmarinus officinalis L.	Rosemary	Iklil El Djabal	Leaves	16	0,037	
	Melissa officinalis L.	Lemonbalm	Temrsat	Leaves	4	0,009	
	Mentha pulegium L.	Penny royal	Flio	Leaves	9	0,021	
Lamiaceae	*Mentha spicata* L.	Spearmint	Naanaa	Leaves	61	0,142	0,054
	Thymus serpyllum L.	Grey thyme	Zaâter el bari	Leaves	23	0,053	
	Thymus vulgaris L.	Thyme	Zaatar	Leaves	66	0,154	
	Salvia officinalis L.	Sage	Meramiya	Leaves	7	0,016	

Lauraceae	*Cinnamomun verum*	Cinnamon	Karfa	Barks	12	0,028	0,028
Myrtaceae	*Eucalyptus globules*	Eucalyptus	Kalitouss	Leaves	42	0,098	
	Syzigium aromaticum L.	Clove	Kronfol	Flowerbuds	203	0,474	0,286
Oleaceae	*Olea europaea* L.	Olive	Zitoune	Fruits and Leaves	6	0,014	0,014
Ranunculaceae	*Nigella sativa* L.	Black cumin	Sanouj	Seeds	5	0,011	0,011
Rutaceae	*Citrus x limon*	Lemon	Lim	Fruits	103	0,24	0,122
	Citrus sinensis	Orange	Tchina	Fruits	2	0,004	
Verbenaceae	*Aloysia citriodora*	Verbena	Tizana	Leaves	84	0,196	0,196
Zingiberaceae	*Alpinia officinarum*	Lessergalangal	Khoundjlan	Rhizomes	4	0,009	
	Zingiber officinalis	Ginger	Zanjabil	Rhizomes	182	0,425	0,217

In the study, the Relative Frequency of Citation (RFC) values ranged from 0.002 to 0.47. The highest RFC was found for *Syzygium aromaticum* (0.47). Other taxa with high RFC values included *Zingiber officinalis* (0.42), *Citrus limon* (0.24), and *Aloysia citriodora* (0.19). *Zingiber officinale* has been cited in several studies, from the use of medicinal plants for the prevention and treatment of coronavirus (Hamdani & Houari, 2020; Widoyo et al., 2022; Akbulut, 2021; Umeta Chali et al., 2021; Khadka et al., 2021; Brahmi et al., 2023; Chebaïbi et al., 2022; Salima et al., 2022; Odebunmi et al., 2022). It is one of the plants that can be used worldwide as food, a spice, and medication (Ali et al., 2008; Osmanlioğlu-Dağ & UZ, 2018). It has been used in the treatment of numerous illnesses, including colds, rheumatism, nerve diseases, gingivitis, toothaches, asthma, paralysis, constipation, diabetes, cough, menstrual cramps, cancer, and colds, especially in traditional medicine in India, China, and Tibet (Shukla & Singh, 2007).

It has been demonstrated that ginger extract, which contains active substances like ginrol and shogavel, has a higher potential for viral inhibition than the antiviral drugs chloroquine and hydroxychloroquine, which are used to treat COVID-19. In another study on the substance 6-ginrol, it was discovered that this substance has a high propensity to bind the virus-infected cell proteins, including RNA polymerase, and that doing so stops the virus from replicating. Therefore, it is viewed as a COVID-19 drug candidate in the theory of density function (Rathinavel et al., 2020; Srivastava et al., 2020).
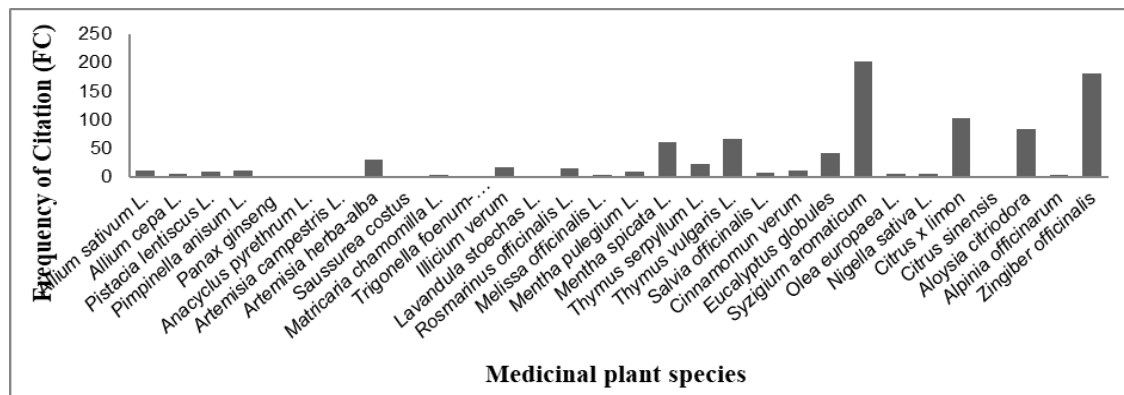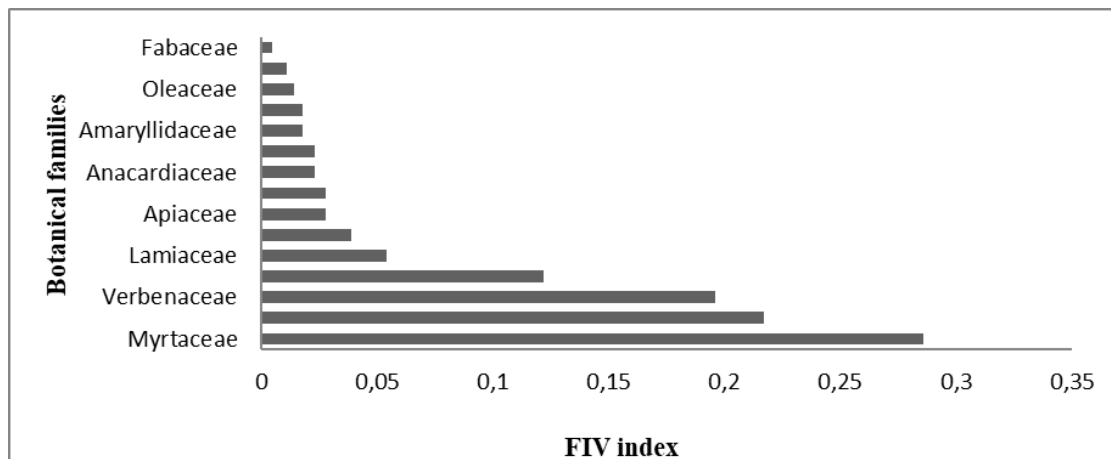

Figure 2. Frequency of Citation of medicinal plants used in the prevention and treatment of COVID-19 infection by the population of Tiaret region

The data of Figure 2, shows the most lyconsumed plant during the pandemic according to their frequency (FC), are cloves (*Syzygium aromaticum*), ginger (*Zingiber officinalis)*, lemon (*Citrus limon*), and verbena (*Aloysia citriodora)*. Vroh (2020), states that some species such as *Zingiber officinale, Citrus limon* and *Ocimum gratissimum* have already been reported to be involved in the treatment of the main symptoms of COVID-19 such as cough, fatigue and fever. A study by Briguiche & Zidane (2019), also showed that *Piper nigrum*, *Citrus limon* and *Zingiber officinale* are used to treat respiratory diseases such as flu and colds.

Hamdani & Houari (2020), report the extensive use of the *Syzygiuma romaticum, Thymus vulgaris, Zingiberis officinalis, Artemisia herba-alba, Eucalyptus globulus* and *Mentha spicata* species during the pandemic. Helali et al. (2020), identified 57 species belonging to 25 families, the main ones being *Eucalyptus globulus, Syzigiuma romaticum, Thymus* vulgaris, *Aloysia citriodora, Mentha spicata* and Citrus lemon and others not mentioned in our surveys such as *Boswellia sacra* and *Peganum harmala*, used by the Algerian population during the COVID-19 pandemic.

Figure 3. Family Importance Value (FIV) of medicinal plants used in the prevention and treatment of COVID-19 infection by the population of Tiaret region

According to Figure 3, the FIV shows that the 5 highly cited families were Myrtaceae (FIV= 0.28), Zingeberaceae (FIV =0.21), Verbenaceae (FIV =0.19), Rutaceae (FIV =0.12), and Lamiaceae (FIV =0.05); this indicates that they are largely responsible for preventing and treating COVID-19 infection. The same results are obtained by Brahmi et al. (2023). These families are renowned for their abundance in a wide range of bioactive components, and many anti-infectious chemicals. Numerous researches have demonstrated that the plants mentioned in this survey have considerable antiviral effects in both clinical and experimental settings (Andrade et al., 2018; Bahramsoltani et al., 2018; Ez zoubi et al., 2020; Klimek-Szczykutowicz et al., 2020; Zhukovets and Özcan, 2020; Chandorkar et al., 2021; Salima et al., 2022).

3.2.2 Plants part used

Participants in the study area reported that a variety of plant parts, including the leaves, the flower, the fruits, the rhizomes, the bulb, and the seeds, had been used to treat COVID-19. However, the plant's leaves were the most part frequently used (Figure 4).
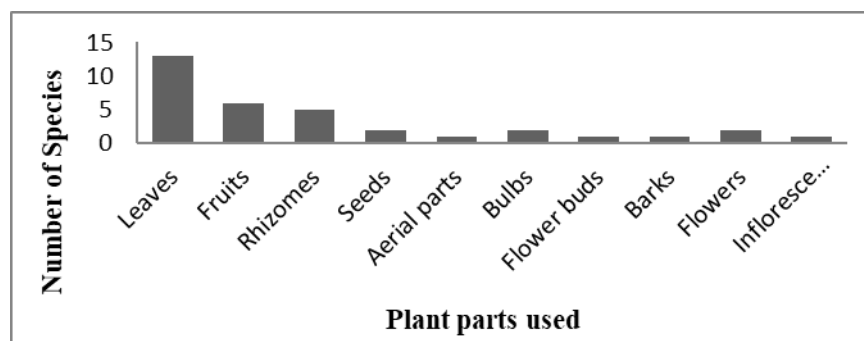

Figure 4. Plant parts used in the prevention and treatment of COVID-19 infection by the population of Tiaret region

Additionally, according to a number of earlier studies (Moore et al., 2020; Helali et al., 2020; Vroh, 2020; Widoyo et al., 2022; Akbulut, 2021; Khadka et al., 2021; Brahmi et al., 2023; Chebaïbi et al., 2022; Odebunmi et al., 2022), leaves were used more frequently than other plant components in the conventional treatment of the Coronavirus. The fact that leaves are widely used for making herbal medicines is probably due to their relative abundance, accessibility, and simplicity of gathering (Helali et al., 2020; Chebaïbi et al., 2022). Additionally, the development of bioactive compounds with medicinal qualities may have been aided by the considerably increased photosynthetic and metabolic activity present in the aerial sections of most plants, notably leaves (Ahmad et al., 2014; Helali et al., 2020).

3.2.3 Mode of use of plants
3.2.3.1 Phytoterapy reasons and effectiveness of herbal medicine

The most compelling reason is the effectiveness of herbal medicine, 44% of the study population uses herbal medicines to prevent and treat COVID-19 (Figure 5). Respondents stated that the use of herbal medicine is due to its low cost and that the plants are natural and do not contain chemicals. 8% of the informants reveal that traditional medicine is better than modern medicine. All patients mentioned that herbal medicines have an improving effect on health (71%) and healing (26%) (Figure 6).
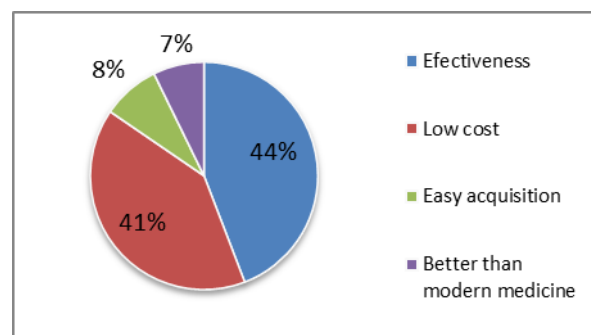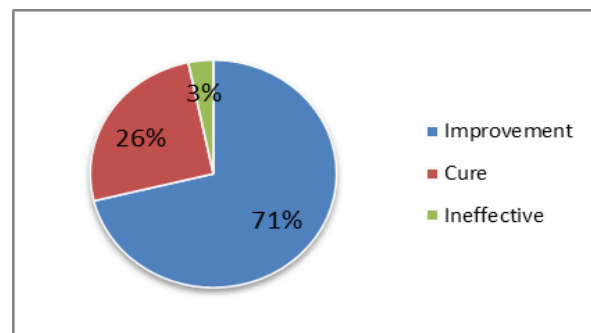

Figure 5. Phytoterapy reasons

Figure 6. Effectiveness of herbal medicine

Our results are in agreement with those reported by Hamdani & Houari (2020), in the North of Algeria, who found that 91.2% of people believed in the effectiveness of herbal medicine to treat COVID-19, and 60% of respondents indicated that medicinal plants improve the health of patients and can be used as a preventive treatment against COVID-19. Brahmi et al. (2023), report that patients favor the use of plants for their effectiveness, ease of acquisition, and low cost compared to drug treatments.

The prevalence of phytotherapy among Moroccans can be attributed to a number of factors, including the country's abundance of medicinal plants, the population's economic situation, the prevalence of illiteracy, and the lack of access to modern medicine (Chebaibi et al., 2022). Numerous investigations have been conducted to identify a natural cure for this virus (Hamdani & Houari, 2020; Khadidja & Sarah, 2021; Sehailia & Chemat, 2021). Salhi et al. (2010), state that phytotherapy is based on natural remedies, which are well-accepted by

the organism and have fewer side effects than chemical medicines. According to a survey, some traditionally eaten plant species can increase immunity. Consequently, might aid in preventing COVID-19's clinical manifestation (Yang et al., 2020).

3.2.3.2 Origin of the information of the plants used

The social environment and general culture represent the main sources of information on the use of medicinal plants with a rate of 50% and 46% respectively (Figure 7). This indicates that the environment plays a fundamental role in the transmission of knowledge about traditional herbal medicine.
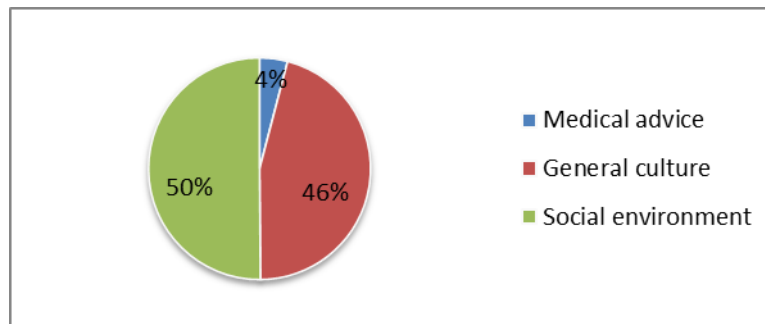

Figure 7. Origin of the information of the plants used

Slimani et al. (2016), confirmed that the population relies on parental experience in using medicinal plants as remedies for specific diseases. This reflects the relative modes of transmission of practices from one generation to the next, which remains highly valued by the population. Kouame et al. (2021), states that the main source of information on medicinal plants involved in the treatment and prevention of Coronavirus disease is the Internet (47.36%). This is reflected in the higher level of education of the respondents. The species cited by these people generally fit into the so-called "grandmother's recipes" that are recurrent on social networks.

According to Hseini & Kahouadji (2007), the transmission of know-how by the elderly has been interrupted by the development of modern medicine and is currently retained by very few people (Benkhnigue et al., 2010). Therefore, ethnobotanical studies on medicinal plants in different locations should be conducted to safeguard the knowledge acquired by the indigenous population (Hseini & Kahouadji, 2007). This traditional knowledge needs to be translated into scientific knowledge in order to value, preserve and use it rationally (Daoudi et al., 2016; Salima et al., 2022).

3.2.3.3 COVID-19 symptoms

People were affected differently by COVID-19 (Figure 8), the most frequent symptoms are: fever (33%), and cough (32%), other less frequent symptoms were observed among respondents such as: aches and pains (11%), respiratory problems (9%) and diarrhea (5%). While 10% of informants had other symptoms such as chills, sneezing, nasal congestion, dry and sore throat, loss of taste, and asthenia.
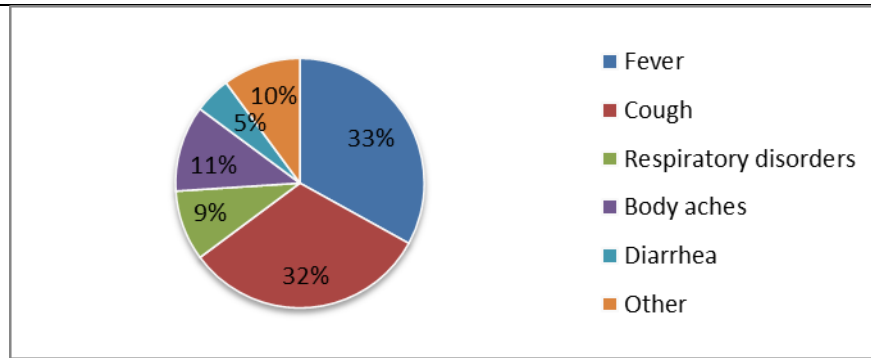
Figure 8. COVID-19 symptoms

All symptoms observed in the respondents were observed worldwide. COVID-19 causes pneumonia, which is characterized by flu-like symptoms such as fever, cough, fatigue, and severe acute respiratory distress. In some cases, it causes death in affected individuals (Helali et al., 2020; Rosa & Santos, 2020 Sun et al., 2020; Akbulut & Gencer-Bingol, 2021; Kouame et al., 2021; Odebunmi et al., 2022). In sub-Saharan Africa, the most frequent symptoms are: fatigue, cough, and fever (Vroh, 2020). Other symptoms were observed by COVID-19 patients such as: myalgia, sputum production, and headache (Umeta Chali et al., 2021).

According to Mahammed et al. (2020), the second phase of COVID-19 disease is characterized by tissue destruction brought on by heightened inflammation and occurs in 15-20% of cases, possibly in patients who are deteriorating between days 7 and 10.

3.2.3.4 Mode of administration

Most of the recipes prepared are used orally with a high percentage of 90% because it represents the simplest, most effective, and fastest mode of administration (Figure 9). This predominance can be explained by the fact that this method allows a better absorption of the the active principles of medicinal plants.
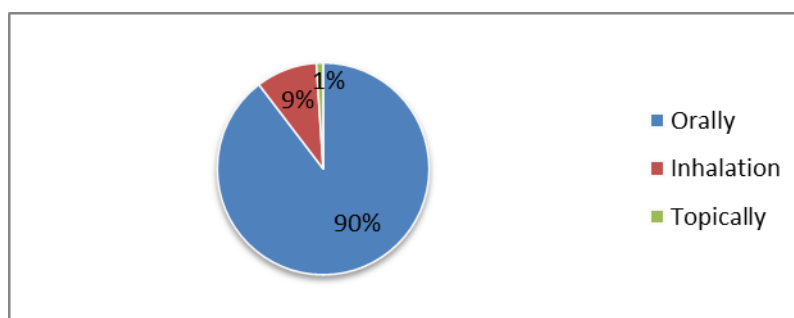

Figure 9. Mode of administration

Our results are similar to those found by Chaachouay et al. (2019), who reported that the oral mode of use is the most cited mode with a rate of 81.3%, Benkhaira et al. (2021), find that this mode of use is the most frequent (43.64%). Several researchers have confirmed the use of this mode of administration because it is the simplest and includes all plants prepared by: infusion, decoction, maceration, expression, raw, and cooked. (Boutabia et al., 2020; Hamdani & Houari, 2020; Helali et al., 2020; Kouame et al., 2021; Brahmi et al., 2023).

3.2.3.5. Condition of the medicinal plant used

The majority of plants are used in a dry state (73%), and 24% are used in a fresh state. Only 3% of plants can be used fresh or dry (Figure 10).
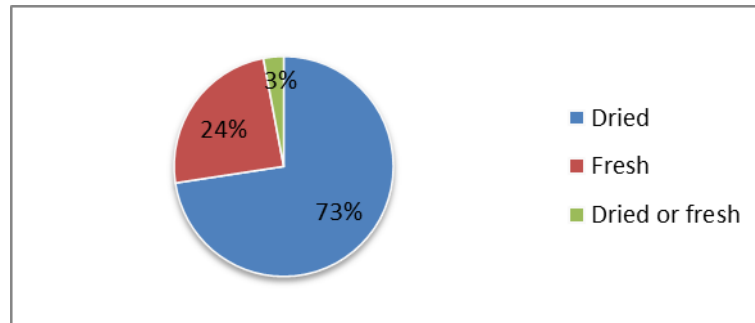
Figure 10. Condition of the medicinal plant used

It is clear that the use of dry plants is the mode most practiced by the population studied. The dry state of the powdered or extracted plants is the basis of herbal teas (Bradai et al., 2020). The study by Alalwan et al. (2019), showed that the use of fresh plants is the most used with a rate of 72% and this is due to the effectiveness of the active principle of plants compared to those used in a dry state.

3.2.3.6 Mode of preparation

Several preparation methods are used to facilitate the administration of the active ingredients of medicinal plants. Infusion is the most dominant method of preparation (45%), followed by decoction (35%), with the other methods of preparation being less frequent (Figure 11).
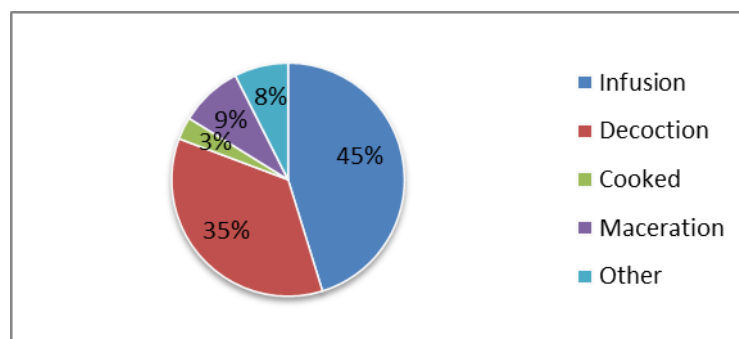

Figure 11. Mode of preparation

Our results are confirmed by (Suroowan & Mahomoodally, 2016; El Alami et al., 2020; Helali et al., 2020; Lawal et al., 2020; Ishtiaq et al., 2021; Brahmi et al., 2023). However, decoction was the most cited method by Khabache et al. (2012), with a rate of 65.6% followed by infusion (13.1%). These are the most frequently used modes because of the simplicity of the process (Lawal et al., 2020). When medicinal herbs are prepared via the decoction method, the body can be warmed and disinfected (Tahri et al., 2012) ,also this method allows to reduce the toxicity in the mixture with other plants used (Salima et al., 2022).

3.2.3.7 Duration of herbal treatment

The duration of treatment varies from person to person, Figure 12 shows that 39% of the surveyed society used herbal medicine at least once since the beginning of the pandemic, 21% once a week, 12% mentioned that they used herbal medicine every day, while 10% of the respondents used herbal medicine three times a week, and 18% reported random use of herbal medicine. These results are confirmed by Chebaibi et al. (2022), who found that 30.6% of the population used plants at least once since the beginning of the pandemic 23.1% once a week, 13.9% once a day and 9.3% every day during the epidemic.
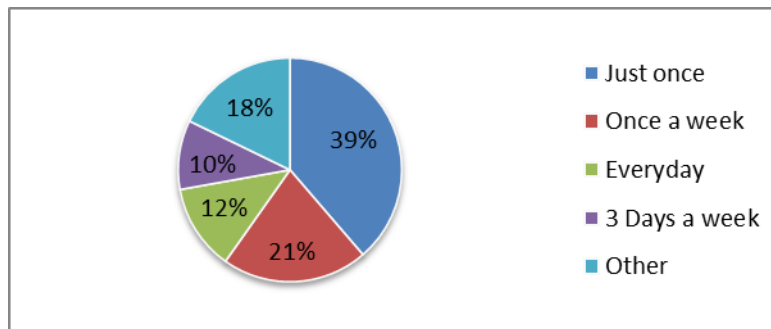

Figure 12. Duration of plant use by the population

4 Conclusion

This research has given us insight into the medicinal plants that the locals of the Tiaret region utilize to prevent or treat the main COVID-19 symptoms. This ethnobotanical survey indicated a high use of medicinal remedies in the study area and that the majority of the plants are used to prevent respiratory tract infections that have symptoms resembling COVID-19, 27 species of medicinal plants used have been recorded; Syzygium aromaticum, Zingiber officinalis, Citrus limon and Aloysia citriodora are the species most frequently cited by respondents. These species are renowned for their abundance in different secondary metabolites, some of which have antibacterial or even antiviral properties.

A number of socioeconomic and demographic factors were linked to the use of medicinal plants. Additionally, the source of medicinal plants varied in accordance with the respondents' sociodemographic factors. This study suggests that further research be done on the medicinal plants used during COVID-19. Research in phytochemistry and pharmacology should be conducted earlier to test the safety and clinical value of the main raw and bioactive components derived from these plants. It is advised that people stay up to date with news about the COVID-19 pandemic from reliable sources.
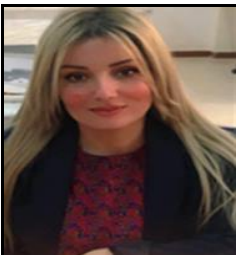
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