

An Ethnobotanical Survey of COVID-19 Therapeutic Plants

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Abstract

After the emergence of COVID-19, the global usage of herbal medicine has expanded considerably. Exploring the scientific and clinical potential of medicinal plants, the World Health Organization (WHO) promotes projects to create COVID-19 medicines via traditional medicine. The purpose of our research was to compile a list of plants used in the outpatient treatment of COVID-19 by herbalists, including the plants, the sections utilized, and the method of preparation and administration. An ethnobotanical survey was done in order to determine the plants prescribed by herbalists to their COVID-19 patients/clients. In our investigation, we discovered 14 plant species, with *Eucalyptus globulus*, *Lavandula angustifolia*, *Artemisia herbacea alba*, *Syzygium aromaticum*, and *Thymus vulgaris* being the most often suggested.

Keywords: Phytotherapy, Medicinal Plants, COVID-19.

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Introduction

COVID-19 is an infectious viral illness caused by SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2), which was initially detected in December 2019 in Wuhan, China, and resulted in a global pandemic [1]. Numerous medicines have been tried to treat COVID-19, but there is little data to support their efficacy against COVID-19, therefore they remain contentious [2]. Medicinal plants have been used for a long time as an alternative source for the production of antiviral medications [3] and have played a crucial role in the treatment of several illnesses [4]. After the emergence of COVID-19, the global usage of

herbal medicine has expanded considerably. Exploring the scientific and clinical potential of medicinal plants, the World Health Organization (WHO) promotes projects to create COVID-19 medicines via traditional medicine [5]. In contemporary Moroccan culture, rural and urban groups continue to frequently practice traditional medicine at home. Over time, the information was transmitted from one generation to the next [6]. To cure or mitigate the effects of COVID 19, it is advisable to use a number of herbal treatments, either singly or in combination.

The purpose of our research was to compile a list of plants used in the outpatient treatment

of COVID-19 by herbalists, including the plants, the sections utilized, and the method of preparation and administration.

Materials and Methods

This research is descriptive, prospective, one-centered, qualitative, and quantitative. Between December 2021 and March 2022, an ethnobotanical survey was done in order to determine the plants prescribed by herbalists to their COVID-19 patients/clients. Using sheet quizzes, the study was conducted among herbalists in Rabat. All of the questioned herbalists were informed of the goal of this investigation. The research area was the Moroccan city of Rabat. The conversation with the herbalists was held in the local language, and it was followed by the purchase of some of the herbs used to cure COVID-19. Each interview lasted around twenty-five minutes. All types of herbalists were included in this research, regardless of age, amount of education, professional experience, lifestyle, or monthly income.

We used a questionnaire to obtain information from herbalists throughout our interviews. The surveys were conducted using semi-structured interviews. It was comprised of a series of questions separated into three sections.

The questions in the first part pertaining to the profile of herbalists cover major elements such as age, degree of education, years of experience in the field, and training in herbalism.

Herbalists were asked for the following information regarding plants used in the outpatient treatment of COVID-19: the common name, the method of administration (alone or in combination), the parts used, the method of preparation, the method of administration, the dose used, the dosage, the level of toxicity, and any side effects.

The third section focuses on the characteristics of clients according to

herbalists: age, gender, customer category (ill or their family), patient happiness, and their perspective on phytotherapy.

The data obtained on the survey sheets were recorded and stored in a Microsoft Excel database before being analysed using descriptive statistical techniques.

Results

Herbalist Profiles

Five of the 25 herbalists who took part in our study and are now in practise in Rabat refused to be interviewed for the article. The great majority of herbalists, who made up 85% of the total, ranged in age from 20 to 60 years old. Those herbalists who were under the age of 20 made up the minority, which was 5% of the total, and those who were above the age of 60 made up the remaining 10%. According to the interviews we conducted, 50% of the herbalists had finished their secondary education, 30% had done coursework at the university level, 15% had completed coursework at the primary level, and 5% had no formal education. According to the conclusions of this research on the experience of herbalists, 50% of them had more than ten years of professional experience, followed by 45% of them who had between one and ten years, and the last 5% of them had less than one year of experience. In terms of the herbalists' education, we found that 60% of them had learned herbalism from their ancestors and family members, 20% had learned it through formal instruction, 15% had learned it through the talent they possessed as creators, and 5% had learned it through other, unidentified means of education.

Plants listed during the survey for the care of COVID-19

The reported phytopharmacological data demonstrates the variety of therapeutic plants utilised in the several Rabat regions. We have discovered 14 plant species suggested for the

treatment of COVID-19 based on 20 interviews with herbalists. These herbalists

indicated that these plant species belong to distinct botanical families (Table 1).

Table 1: Plant distribution based on proportion of citations

Common Name	Vernacular Name	Scientific Name/ Species	Family	Parts Used	Percentage of Citations
Eucalyptus	Kalyptous	<i>Eucalyptus globulus</i>	Myrtaceae	Leaves	20%
Lavender	Lkhzama	<i>Lavandula angustifolia</i>	Lamiaceae	Aerial part	16,47%
white mugwort	Chih	<i>Artemisia herba alba</i>	Astraceae	Aerial part	16,47%
Clove	Qronfl	<i>Syzygium aromaticum</i>	Myrtaceae	Unopened flower buds	14,11%
Thyme	Zaâtar	<i>Thymus vulgaris</i>	Lamiaceae	Leaves	10,58
Pennyroyal mint	Mantha, Naânaâ	<i>Mentha pulegium</i>	Lamiaceae	Leaves	8,23%
Ginger	Skin jbir	<i>Zingiber officinale</i>	Zingiberaceae	Rhizome	3,52%
Rosemary	Azir	<i>Rosmarinus officinalis</i>	Lamiaceae	Leaves	2,35%
Olivier	Zitoune	<i>Olea europaea</i>	Oleaceae	Leaves	2,35%
Anserine	Mkhinza	<i>Chenopodium ambrosioides</i>	Amarantaceae	Aerial part	1,17%
Myrtle	Rayhan	<i>Myrtus communis</i>	Myrtaceae	Leaves	1,17%
Bay leaf - sauce	Warakate sidna moussa	<i>Laurus nobilis</i>	Lauraceae	Leaves	1,17%
Rhubarb	Hmida	<i>Rheum rhabarbarum</i>	Polygonaceae	Roots	1,17%
viola violets	Zahra banafsijia	<i>Viola odorata</i>	Purplish	Leaves	1,17%

Lamiaceae was the most mentioned botanical family at 28.57 percent, followed by Zingiberaceae at 21.47 percent. Each of the other families was represented by a single species, for a total of 7.14 %.

Most of the herbs that herbalists suggested for treating COVID-19 were *Eucalyptus globulus*, *Lavandula angustifolia*, *Artemisia herbacea alba*, *Syzygium aromaticum*, and *Thymus vulgaris*.

The leaves and stems were the most useful parts of the plant. Most plants are made into

medicines through infusions and decoctions. Most herbalists said that herbs should be mixed together to make medicines, but there were three situations where herbs like clove, eucalyptus, and ginger could be mixed and given on their own. The most common route of administration was inhalation, with the exception of ginger combined with lemon, which was suggested for oral consumption.

Only a few of the herbalists we interviewed used scales to determine the amount of herbs needed to make a dose, but this was the

exception rather than the rule. In almost all of the interviews we conducted, the herbalists we interviewed used their hands as a tool to determine how much to prepare for the treatment of COVID-19. A number of herbalists have recommended using 50 grammes of each herb that goes into making the preparation's mixture. For the treatment of COVID-19, the dosage that was recommended the most by herbalists was a daily dose until the patient was cured. This was followed by a weekly dose recommended by 35% of herbalists and a three-times-a-week dose recommended by 15% of herbalists. 100% of the herbalists who participated in this research said that the herbs they offer for COVID-19 therapy do not cause any toxicity effects or bad reactions.

Customer Characteristics

According to the herbalists who were questioned for this article, in terms of customer satisfaction, 85 % of customers were happy with the outcome of the herbs for healing COVID-19, whereas 15 % of customers were not satisfied with the result. Our research showed that the majority of customers (75%) were between the ages of 20 and 60 years old. This was followed by 15% of clients who were above the age of 60, while clients under the age of 20 comprised the minority with a ratio of 10%. Regarding the gender of the consumers, the herbalists said that around 65% of their clientele consisted of females, while the remaining 35% was comprised of males.

In this research, we asked the herbalists about their typical clientele to determine if sick people or their family members made up the majority of their customers. As a result, 60% of customers were relatives of the sick person, while 40% were the sick themselves.

Concerning the reasons for choosing plants over conventional medications, the majority of herbalists, 40%, listed reasons such as:

plants are natural without risk and side effects; conventional medicines did not work; plants are complementary to pharmaceuticals; 30% of them mentioned efficacy; and 15% each said the cheap cost is better than the drug.

Discussion

Herbalist and Consumer Profiles

Our project's primary objective is to compile a list of plants used in COVID-19 outpatient therapy. Using a questionnaire, the research was done among the population of herbalists in the city of Rabat. Our analysis found that 85 % of herbalists were between the ages of 20 and 60. This finding was consistent with research done in Marrakech, where herbalists aged 20–40 and 40–60 had the highest percentages (40.50% and 33%, respectively) [7]. This age group is the primary service age, engaged in all industries and particularly the business sector. Our research revealed a fall in the proportion of herbalists in the over-60 age group, presumably owing to a decline in herbalists' physical, mental, and social commitment to the field.

Due to their lack of herbalism expertise, herbalists under the age of 20 are the least represented age group in our findings (5%). The majority of herbalists acquired their craft orally from their parents. This group of young people is often involved in formal education at a young age and consequently has less time to learn herbalism. This is also connected with the level of education of herbalists, which shows that the majority of them have had formal training in areas that are not directly relevant to the practise of herbalism.

50% of herbalists had a secondary education, 30% had a university education, 15% had a primary education, and 5% had no formal education. This statistic contrasts with research done in the Fes Boulemane region of Morocco, where 40% of herbalists were

illiterate, 50 % had a basic education, and 10% had attained a secondary education [8].

Differences in social, educational, and cultural viewpoints between the city of Rabat and the countryside of Fes Boulemane might account for the paradox. Research conducted in Salé found that 53.3% of herbalists have a secondary education, 26.7% have a primary education, 3.3% have a university education, and 16.7% are illiterate [9].

The similarities may be explained by the fact that Rabat and Salé share a number of characteristics, such as a comparable standard of living, cultural practises, and educational policies. Concerning seniority in the practise of herbalism, the result indicated that 50% of the herbalists had more than 10 years of experience; this result correlates with the predominance (i.e., 85 percent) of herbalists within the age range of 20 to 60 years old.

This demonstrates the significance of our inquiry by explicating that experience and age are two significant correlated aspects impacting the ethno-pharmacological investigation, since skills and knowledge develop with age and the continued practise of traditional medicine [10]. 60% of herbalists in our survey are derived from herbalism, whereas only 20% have a certificate in herbalism. This statistic indicates that the majority of herbalists continue to practise without formal herbalism training.

According to this study, the majority of clients (65%) were women, with the dominant age group (75%) being between 20 and 60 years old). This dominance may be explained by the strong attachment that women have to tradition and culture in our society.

Plants Used in the Treatment of COVID-19 and Their Properties

According to our analysis, there are 14 species of suggested plants, with *Eucalyptus globulus* being the most popular with 18.28%, followed by *Lavandula angustifolia*, *Artemisia herba alba*, *Syzygium aromaticum*, and *Thymus vulgaris* with corresponding percentages of 15.05%, 15.05%, 12.90%, and 9.68%. With an average of 1.08%, *Myrtus communis*, *Chenopodium ambrosioides*, *Laurus nobilis*, *Viola violets*, and *Rheum rhobarbarum* are the species that herbalists in our research area recommend the least.

Research done in western Colombia, South America, found that *Zingiber officinale*, *Eucalyptus globulus*, *Citrus limon* (L) Osbeck, *Gliricidia sepium* (Jacq.), and *Matricaria recutita* L. are the plant species that are most often used to treat COVID-19 patients [11].

A second study done in the Peruvian province of Gusco found that *Eucalyptus globulus*, *Piper aduncum* L., *Zingiber officinale*, and *Matricaria recutita* L. were the herbs most often used to prevent COVID-19 and treat respiratory symptoms during the pandemic [12].

In a study conducted in Nepal, a total of 60 plant species were identified, with *Zingiber officinale* and *Curcuma angustifolia* being the most prevalent. There were a few species similar to those found in our study, including *Artemisia indica* Wild, *Salvia rosmarinus*, *Mentha piperita* L., and *Syzygium aromaticum* (L.) [13].

At the national level, a study conducted in herb markets in the prefecture of Salé revealed that herbalists frequently recommended the following plant species for the prevention and treatment of COVID-19: *Eucalyptus globulus* Labill., *Azadirachta indica* Juss. (Neem), *Ziziphus lotus* L. Lam. (Sedr), *Artemisia annua* L., *Rosmarinus officinalis* L., and *Thymus vulgaris* [9].

According to the data we collected, Eucalyptus was the most prevalent species during the COVID-19 epidemic. This may be owing to its capacity to survive and grow in harsh temperatures, which makes it readily accessible at all times. The majority of eucalyptus essential oils are extracted from the plant's leaves, with just a little bit extracted from other plant parts. Sesquiterpenoids, monoterpenoids, and phenylpropanoides are their chief bioactive constituents. 1,8-cineole is the primary medicinal component of eucalyptus oil [14]. According to research by Panikar *et al.* [15], the bioactive components of *Eucalyptus globulus* had the lowest binding energy on the replication-responsible protease (Mpro) of COVID-19. This suggests that eucalyptus has the capacity to suppress COVID-19.

Ginger (*Zingiber officinale*), a member of the Zingiberaceae family, is another species. It is used as a spice and in treatment due to the pharmacological effects of its chemical metabolites, including alkaloids, polyphenols, and terpenes [16]. The fact that Zingiber is often used to treat respiratory disorders such as pneumonia, asthma, and influenza may explain why herbalists prescribe it. Recent studies have shown that Zingiber rhizome extract has immunomodulatory and antiviral properties that alleviate COVID-19 symptoms [17].

The genus *Artemisia* (*Artemisia annua*) is a member of the Asteraceae family; it has more than 500 species mostly found in temperate regions. In the Chinese Pharmacopoeia, *Artemisia annua* (*L.*) is classified as a treatment for various fevers. Furthermore, *Artemisia* species are particularly rich in terpenoids, coumarins, flavonoids, and sterols [18]. *Artemisia annua* was historically used to treat respiratory infections and fevers, and current research has shown that artemisia phytochemicals are effective against malaria and other antiviral illnesses. Countries utilising artesunate-amodiaquine

or artesunate-mefloquine may have fewer COVID-19 instances and fatalities than those using artemether-lumefantrine, which may suggest that phytochemicals from *Artemisia annua* block COVID-19 3CLPRO or the primary protease (MPRO) [18]. *Artemisia annua* was one of the most often mentioned plants in our study, which may be attributed to its low toxicity, as determinedly highlighted by Randjlovi *et al.* [19].

Rosemary is one of the herbs most often referenced by herbalists (*Rosmarinus officinalis*). The latter is a member of the Lamiaceae family, which is native to the Mediterranean area but is grown worldwide. It is a perennial, evergreen plant that emits strong scents. *Rosmarinus officinalis* has been extensively used in cooking and in the food business as a natural preservative, as well as being cultivated as a decorative plant. Several phytochemicals having pharmacological activity are present in the extracts. The most often mentioned acids include rosmarinic acid, caffeic acid, camphor, carnosic acid, ursolic acid, chlorogenic acid, betulinic acid, and monomeric acid [20]. Rosemary is one of the most significant sources of naturally occurring bioactive substances; it has essential pharmacological activity, including antibacterial, antioxidant, and other qualities [21]. Rosemary's anti-inflammatory properties significantly reduce the intensity of COVID-19's effects on the patient's body.

Myrtaceae family member Clove (*Syzygium aromaticum*), one of the oldest and most valuable aromatic spices, is a fascinating plant. 70% to 85% of clove essential oil consists of phenylpropanoides-type eugenol, thymol, cinnamaldehyde, and carvacrol. Cloves' anti-inflammatory, analgesic, and antipyretic properties are often crucial since COVID-19 patients experience inflammation, pain, and fever. This proves that herbalists were right to suggest cloves as a treatment for COVID-19. The fact that

cloves are available all year may also be a reason why they are often mentioned.

Most of the reasons given for using herbal medicine are that plants are natural and don't pose any risks, that they work well with pharmaceuticals, that some people say plants are more effective and safer than pharmaceuticals, and that herbalists recommend inhalation as the safest way to take herbs.

According to the interviewees, the leaves and aerial portions of the plant were the most used. They were preferred because they were readily accessible, simple to harvest, and easy to cook. In addition, they are the primary locations of photosynthesis and serve as a repository for specific metabolites. During this period, infusion was the most common technique for preparing herbs, followed by decoction. This is due to the fact that by employing the infusion, the numerous useful herbal components can be quickly gathered, while the toxic component can be simply removed. Herbalists believe that the infusion is used for the most delicate portions of the plant, while the decoction is used for the hardest parts of the plant, such as the stems, bark, seeds, and roots. Our findings are consistent with those of a number of studies on the frequency of use of the leaves and the infusion technique for the manufacture of herbal medicine [6, 9, 11]. There is no proof that the plant combinations that herbalists recommend are dangerous.

Conclusion

Numerous plants have been suggested by herbalists for COVID-19 prevention and therapy in Morocco, where traditional herbal medicine is still extensively practiced. In our investigation, we discovered 14 plant species, with *Eucalyptus globulus*, *Lavandula angustifolia*, *Artemisia herbacea alba*, *Syzygium aromaticum*, and *Thymus vulgaris* being the most often suggested. A chemical screening of medicinal plants in a lab would

be useful to find their bioactive chemicals and learn about the structure of each constituent, which would help with the chemical identification of the different plants in search of a possible COVID-19 curing drug.

References

1. Islam, ATM Rafiqul, Jannatul Ferdousi, and Md Shahinozzaman. Previously published ethno-pharmacological reports reveal the potentiality of plants and plant-derived products used as traditional home remedies by Bangladeshi COVID-19 patients to combat SARS-CoV-2. Saudi journal of biological sciences. 2021; 28(11): 6653-6673.
2. Fuzimoto, Andréa D. An overview of the anti-SARS-CoV-2 properties of *Artemisia annua*, its antiviral action, protein-associated mechanisms, and repurposing for COVID-19 treatment. Journal of Integrative Medicine. 2021; 91(5): 375-388.
3. Khalifa, Shaden AM, et al. Screening for natural and derived bio-active compounds in preclinical and clinical studies: One of the frontlines of fighting the coronaviruses pandemic. Phytomedicine. 2021;85: 153311.
4. Islam, Sk Saruk, et al. Natural medicinal plant products as an immune-boosters: A possible role to lessen the impact of Covid-19. Case Studies in Chemical and Environmental Engineering. 2021;4: 100105.
5. Mukherjee, Pulok K., et al. Role of medicinal plants in inhibiting SARS-CoV-2 and in the management of post-COVID-19 complications. Phytomedicine. 2022; 153930.
6. Kachmar, Mohamed Reda, et al. Traditional knowledge of medicinal plants used in the Northeastern part of Morocco. Evidence-Based Complementary and Alternative Medicine. 202.

7. Ouakrouch, I. A., and N. EL Ansari. Enquête ethnobotanique à propos des plantes médicinales utilisées dans le traitement traditionnel du diabète de type II à Marrakech: médecine interne au CHU Mohamed VI de Marrakech. Enquête 2015.
8. Achour, Sanae, et al. Ethnobotanical Study of Medicinal Plants Used as Therapeutic Agents to Manage Diseases of Humans. Evidence-Based Complementary and Alternative Medicine. 2022.
9. Chaachouay, Noureddine, Allal Douira, and Lahcen Zidane. COVID-19, prevention and treatment with herbal medicine in the herbal markets of Salé Prefecture, North-Western Morocco. European journal of integrative medicine. 2021;42: 101285.
10. Salhi, N., et al. Ethnopharmacological study of medicinal plants used in the treatment of skin burns in occidental Morocco (area of Rabat). South African journal of botany. 2019;121: 128-142.
11. Cordoba-Tovar, Leonmir, et al. Cultural belief and medicinal plants in treating COVID-19 patients of Western Colombia. Acta Ecologica Sinica. 2022; 42(5): 476-484.
12. Villena-Tejada, Magaly, et al. Use of medicinal plants for COVID-19 prevention and respiratory symptom treatment during the pandemic in Cusco, Peru: A cross-sectional survey. PloS one. 2021;16(9): e0257165.
13. Khadka, Dipak, et al. The use of medicinal plants to prevent COVID-19 in Nepal. Journal of ethnobiology and ethnomedicine. 2021;17(1): 1-17.
14. Chandorkar, Nikhil, et al. A systematic and comprehensive review on current understanding of the pharmacological actions, molecular mechanisms, and clinical implications of the genus Eucalyptus. Phytomedicine Plus. 2021; 1(4): 100089.
15. Panikar, Sukanya, et al. Essential oils as an effective alternative for the treatment of COVID-19: Molecular interaction analysis of protease (Mpro) with pharmacokinetics and toxicological properties. Journal of Infection and Public Health. 2021;14(5): 601-610.
16. Koga, Adriana Y., Flávio L. Beltrame, and Airton V. Pereira. Several aspects of Zingiber zerumbet: a review. Revista Brasileira de Farmacognosia. 2016;26: 385-391.
17. Musdja, Muhammad Yanis. Potential bangle (Zingiber montanum J. König) rhizome extract as a supplement to prevent and reduce symptoms of Covid-19. Saudi Journal of Biological Sciences. 2021;28(4): 2245-2253.
18. Bora, Kundan Singh, and Anupam Sharma. The genus Artemisia: a comprehensive review. Pharmaceutical Biology. 2011;49(1): 101-109.
19. Radulović, Niko S., et al. Toxic essential oils. Part II: Chemical, toxicological, pharmacological and microbiological profiles of Artemisia annua L. volatiles. Food and chemical toxicology. 2013;58: 37-49.
20. De Oliveira, Jonatas Rafael, Samira Esteves Afonso Camargo, and Luciane Dias De Oliveira. Rosmarinus officinalis L.(rosemary) as therapeutic and prophylactic agent. Journal of biomedical science. 2019; 26(1): 1-22.
21. Andrade, Joana M., et al. Rosmarinus officinalis L.: an update review of its phytochemistry and biological activity. Future science OA. 2018;4(4): FSO283.