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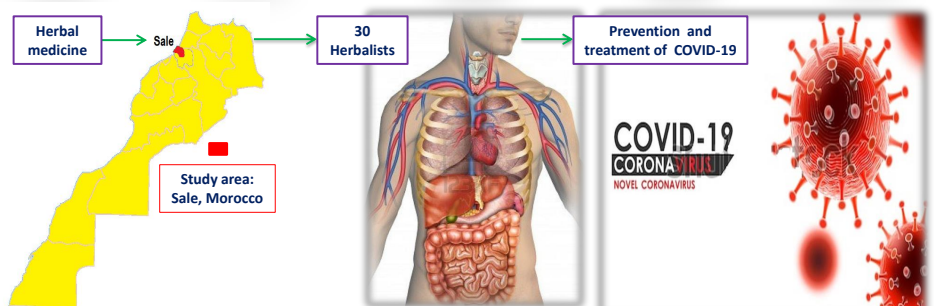
The practice of herbal medicine to prevent Sars-CoV-2 in Salé, Morocco

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Graphical Abstract



Abstract.

Coronaviruses are important animal and human pathogens. Towards the end of 2019, a novel coronavirus was identified in Wuhan, China, the basis of which consisted of a cluster of pneumonia problems. Its quick spread resulted in a worldwide pandemic. This research was aimed to document detailed ethnopharmacological information on the medicinal plant species used by herbalists against coronavirus disease. The study was conducted in Salé Prefecture, from March 1st, 2020 to May 31st, 2020. Semi-structured direct interviews were held with 30 herbalists to collect the socio-demographic features, the name of local species, and traditional remedies. The data were analyzed through the use reports (UR) and medicinal use value (MUV). In total, 20 plant species from 20 genera and 14 families had been the most frequently used by herbalists from Salé Prefecture for the prevention and treatment of Sars-CoV-2. The most mentioned plant is *Eucalyptus globulus* Labill, followed by *Azadirachta indica* A. Juss, and *Ziziphus lotus* (L.) Lam. Moreover, the most commonly used plant parts for herbal preparations were leaves (28.43%) and seeds (17.5%), whereas the majority of remedies were prepared through infusion. The present study is the first contribution to the ethnopharmacological of this Prefecture. It is recommended that the constituents of indigenous species be studied to determine the therapeutic effects and mechanisms of action. Urgent attention must be paid to the conservation of medicinal species, in addition to comprehensive documentation of traditional medicinal knowledge, on top of phytochemical validation of reported plants.

Keywords: Sars-CoV-2, Phytotherapy, Herbalists, Medicinal plants, Salé, Survey.

Introduction

Coronavirus (CoVs), a class of single-stranded RNA viruses, can affect both animals and humans, causing respiratory, gastrointestinal, hepatic, and neurologic diseases [1]. The first case of the novel coronavirus was reported on December 30, 2019, in the city of Wuhan, Hubei province, P.R. China [2]. This causative virus has been temporarily named as severe acute respiratory syndrome coronavirus 2 and the relevant infected disease has been named as coronavirus disease 2019 (COVID-19) by the World Health Organization, respectively [3]. On March 11th, the WHO formally announced that COVID-19 was a pandemic. The latter was confirmed to have reached Morocco on March 2th 2020, when the first Sars-CoV-2 case was confirmed in Casablanca, after being contracted by a Moroccan Immigrant who came from Italy on February 27th, 2020. Since the very beginning of human civilization, plants have been an essential supply for prevention and healing for humans and livestock, especially in developing countries. This is illustrated by the following quote from Hippocrates, which dates from the 4th century

BC: “nature is the medicine of the sick”. Accordingly, the research for plant species and their employment is one of the most fundamental human interests and has been widespread all over the world. [4, 5]. Developing countries have a penchant for traditional medicine, due to the limitation of medical personnel and provisions such as remedial devices and access to fundamental medicine. The ratio of medical doctors to patients in Morocco is not reasonable. For example, according to the latest available information, it has revealed the following numbers for Doctors in Morocco (0.5% per 1 000 inhabitants) and hospital beds (% 1.0 beds per 1 000 inhabitants) [6]. It is why mankind managed diverse medicinal plants long known in ancient popular medicine as alternatives. However, in the healthcare system whether in cities or rural communities, medicinal plants continuously contributed in the field, because of the low cost and effortless availability of plant products in all markets across the country [7]. Morocco is one of the nations of the Mediterranean area with diverse climate conditions that favorable for the development of rich and varied vegetation, including a rich potential of plant species. Moreover, Morocco has excellent medical knowledge and traditional experience of basic medicinal plants [8]. On the other hand, in Morocco, as is the case in other countries internationally, notably in emerging countries, the relocation of the rural population towards cities is considered a significant phenomenon of the twentieth century that led to rapid changes in economic, social, and cultural fields. This study aimed to investigate traditional herbalists use of plants for therapeutic purposes in response to the coronavirus pandemic in the Salé Prefecture, Morocco, during 2020.

Materials and Methods

Study area

Salé is located in North-Western Morocco, on the right of its coast in the Atlantic Ocean, near the Moroccan capital Rabat. Its approximate geographic location is 34° 3' 11 Northern latitude and 6° 47' 54 Western longitude. Founded in about 1030 by Arabic-speaking Berbers, the Banu Ifran later became a haven for pirates in the 17th century as an independent republic, before being incorporated into Alaouite Morocco. The total surface area of Salé is 672 km² with a population of about 890 403 inhabitants, according to the 2014 Moroccan census [9]. Located along the Atlantic Ocean, Salé has a mild, moderate climate, shifting from cool in winter to warm days in summer. The winter typically gets as cold as 17.2°C during December–February. As for summer daytime the temperature usually ranges from 25°C and may occasionally exceed 30°C, especially during heatwaves. Summer nights are usually pleasant and cool, ranging between 11°C and 19°C and rarely exceeding 20°C. Salé belongs to the sub-humid bioclimatic zone with an average annual precipitation of 560 mm [10].

Epidemiological situation of Salé prefecture

At the time the study was conducted (March 1st, 2020 to May 31st, 2020), the Ministry of Health in Morocco had reported that 7,807 confirmed Sars-CoV-2 cases have been reported at the national level. Out of the cases, 225 were from Salé, including Tabriquet (75 cases), Hssaine (89 cases), Bettana (36 cases), Lamrissa (17 cases), and Bouknadel (8 cases). Laboratory confirmation of Sars-CoV-2 was performed at the military hospital laboratory Mohammed V, in Rabat. RT-PCR assays were performed following the protocol established by the World Health Organization (WHO). The largest number of patients (198) had been admitted to Moulay Abdellah Hospital Salé. The rest of the patients continued their treatment at the Military Hospital Mohammed V, in Rabat [6]. As for the treatment protocol, the Moroccan health authorities have allowed their hospitals to use antimalarial drugs to treat novel coronavirus. The Minister of Health, Mr. Khaled Ait Taleb, invited, through a note addressed to the directors of the hospital centers, who receive Sars-CoV-2 patients to use the drugs "Hydroxychloroquine", "Azithromycin" "Paracetamol", "Zinc sulfate", and "Vitamin C" to treat the cases from the virus symptoms.

Herbalists in Morocco:

The herbalists in Morocco are both male and female, from the age of 20 years upwards. The training to become an herbalist is usually either an inherited traditional knowledge from parents, or acquired through formal training. Among the herbalists, some followed old popular lifestyle, while others, notably the young, were more associated with a modern western lifestyle. These herbalists fall under a legal framework called the "Union of Moroccan Herbalists (UMH)". Unfortunately, there are no official statistics on their total number. From a legislative point of view, the profession of herbalists in Morocco is regulated by three legal chapters all dated before 1960:

- **The Dahir of February 27, 1923 (corresponding to Rajab 11, 1341 AH)**, subjecting the practice of herbalist to the provisions of the Dahir of April 12, 1916, whose second article is: "it is especially forbidden for herbalists to sell any poisonous or toxic plants"[11].
- **The Dahir of August 20, 1926 (corresponding to Safar 11, 1345 AH)**, where "any person who has the herbalist certificate and authorized under the conditions provided for in the article, may hold and sell all plants or parts of medicinal plants, fresh or dried, mixed or not, except poisonous plants listed in Codex" [12].
- **The Dahir of February 19, 1960 (corresponding to Chaabane 22, 1379 AH)**, with article 17: "Anyone with the herbalist certificate and authorized under the conditions of Article 2 will be able to hold and sell all plants or parts of medicinal plants, fresh or dry, except plants classified in the various tables of poisonous substances provided by the Dahir of December 2, 1922 [13].

Methodology

- ***Ethnopharmacological data collection***

A semi structured questionnaire was prepared in order to document an indigenous anti-coronavirus plant, traditional knowledge and determine the level of utilization of traditional medicinal plants for prevention and treatment of Sars-CoV-2 by the 30 herbalists (24 male and 06 female) from different districts of the Prefecture of Salé, namely (Bab Lmrissa: 10 herbalists, Tabriquet: 7 herbalists, Laayayda: 6 herbalists, Bettana: 4 herbalists and Bouknadel: 3 herbalists). The data was collected through face-to-face interviews over the period of March 1st, 2020 to May 31th, 2020, ranging from 20 to 40 min. The interview period corresponds to the period when the coronavirus first began spreading in Morocco and the world at large. The interviews were mostly carried in the local language (Arabic Moroccan dialect) spoken by the herbalists in the study area. The inclusion criterion was that the herbalists must be qualified healthcare professionals and had always lived in the area. The exclusion criterion was not living in the study area. Although quarantine was imposed on all the inhabitants of Morocco, including the inhabitants of Salé Prefecture. The shops of herbalists remained open to their customers to buy necessities, which made it easier for us to visit them and conduct interviews on this subject. The information gathered during the present study includes the socio-demographic features of the interviewed herbalists (age, gender, level academic, and experience in herbalism) and ethnopharmacological information, including the local and scientific name of the species, local names, plant parts used, modes of use, conservation method, administration mode and toxicity, all documented data were then translated into English and Latin ([Appendix A](#)).

- ***Taxonomic identification of the species***

Medicinal plants being mentioned by the herbalists were recorded with local names and photographed. Each reported medicinal plant species was gathered, compressed, dehydrated, and identified. The identification and nomenclature of the collected material vegetal were done first in the field and completed at the ***Plant, Animal Productions and Agro-industry Laboratory*** by our great Moroccan botanist **Zidane L.** These plant species mentioned by the sources were taxonomically identified using floristic and taxonomic references, especially ‘The medicinal plants of Morocco’ [14], ‘Practical flora of Morocco’, volumes I, II and III [15–17] and ‘Catalogs of vascular plants of northern Morocco’, including identification keys, volumes I and II [18]. Taxonomy and denominations of species were validated using “The Plant List 2020” database (<http://www.theplantlist.org>). All voucher specimens have been preserved during documentation and deposited in the Ibn Tofail University, Morocco Herbarium for future reference.

Ethical Approval

The study was authorized by the ethical committee of Ibn Tofail University. Before starting data collection, we obtained oral informed permission in each case on a site level and then individually before each interview. We also informed herbalists that it was a student academic project and the investigation was only for our research purposes, not for any financial or other benefits. Herbalists provided verbal informed consent to engage in this study; they were free to withdraw their information at any point of time. Those suppliers have accepted freely the idea and they have consented to have their names and personal data to be published.

- ***Data analysis***

The data obtained from the field and collected from the herbalists were classified and examined with the statistical program IBM SPSS Statistics 21 Premium (SPSS 2019), to determine the proportions of different variables socio-demographics of the herbalists and ethnopharmacological data. Quantitative value indices were also calculated for the general uses of these medicinal plants using the use reports (UR) and medicinal use-value (MUV).

Use reports (UR) and Medicinal use-value (MUV)

The use reports (UR) of a species or its importance in the culture of a community is appreciated by its mentioning rate or its mention frequency by suppliers. The UR of the species of plants being utilized was evaluated using the formula: $UR = \frac{N_i}{n}$ [19]. Where, N_i is the number of times a particular species was mentioned, and n is the total number of times that all species were mentioned. The MUV of recorded medicinal plants was determined by applying the following formula [20]: $MUV = \frac{\sum UR_i}{N}$. Where $\sum UR_i$: the total number of use reports per plants and N is the total of interviewees questioned for given medicinal specie. The MUV rate will be more important if there are several useful records for a species, implying that the plant is significant, whereas they will be near 0 if there are few reports compared to its use [21].

Results

Demography information of suppliers

In total, 30 herbalists were interrogated using semi-structured questionnaires. 33.33% of the surveyed herbalists were from five Districts: Bab Lamrissa, 23.34% were from Tabriquet, 20% were from Laayayda, 13.33% were from Bettana and 10% were from Bouknadel. In the Prefecture of Salé, both sexes are interested in herbal medicines. However, the numbers of male participants were higher (26

herbalists) than females participants (04 herbalists). In this study, results showed that the utilization of medicinal species is widespread in all age groups with different percentages. The majority of herbalists interviewed were over 50 years old (22), while 17 of the suppliers were between 30 and 50 years old. One of them was younger than thirty years old. Regarding the academic level, our results showed that more than half of the suppliers (53.33%) have secondary education, 26.67% have primary education, 16.67% were illiterate and only 3.33% of the suppliers had graduate education.

Botanical families of plants used

The present research showed that a total of 20 plant species belonging to 20 genera and 14 families were frequently used by herbalists from Salé Prefecture in the prevention and treatment of Sars-CoV-2. The family Lamiaceae was represented by the largest number of plant species (three species, 15%), whereas Apiaceae, Asteraceae, Fabaceae, and Myrtaceae contributed with two species to each family. The remaining nine botanical families were represented by one species in each. The vernacular names, scientific names of documented species, their families, mode of preparations, used parts, MUV, and UR were illustrated in [Table 1](#).

Medicinal use plants (MUV)

plants intended for medicinal use are utilized to find the most frequently used plant species in the study area. Its value ranged from 0.200 to 0.967 ([Table 1](#)). The calculated results of MUV showed that *Eucalyptus globulus* Labill. was ranked first (MUV=0.967) followed by *Azadirachta indica* A. Juss. (MUV=0.933), *Ziziphus lotus* (L.) Lam. (MUV=0.9), *Allium sativum* L. (MUV=0.867), and *Eugenia caryophyllata* Thunb. (MUV=0.833), while the lowest value was found for *Spinacia oleracea* L. (MUV=0.200).

Parts of the plant used

In our study area, different plant parts harvest for the preparation of herbal remedies (e.g., seed, root, flower, and leaf). The interview result revealed that leaves are the most frequently used part of the medicinal plants 28.43% of the total, followed by seed (17.5%), whole plant (13%), bulb (11.27%), rhizome (8.4%), other parts (7.6%), flower (7%) and fruit (6.8%) ([Table 1](#)).

Modes and conditions of medicine preparation

In Salé Prefecture, the bulk of the herbal remedies (70.8%) were made from fresh material followed by their dried form (29.2%). Preparations in the most cases were obtained from individual plants, but some plant compounds were also reported. The preparation of ancestral medicine needs components and solutions. The major solvent was water, but milk, butter, tea, and honey, cereal oils and vinegar, were

equally extensively used ingredients. Concerning the preparation of herbal medicine, herbalists employ various methods of preparation for Sars-CoV-2. The principal method of traditional medicine preparation reported was infusion (34.63%), followed by decoction (25.1%), powder (15.2%), and maceration (13.8%). The percentage of the other modes of preparation grouped (cataplasm, fumigation, cream, bath, and plaster) does not exceed 11.27% (Table 1).

Table 1. List of medicinal plant species employed to treat Sars-CoV-2 in the Sale Prefecture, Morocco.

Family	Scientific name	Vernacular name	Part used	Mode of preparation	UR	MUV
Amaranthaceae	<i>Spinacia oleracea</i> L.	Sabanikh: السبانخ	Leaf	Infusion	06	0.200
Amaryllidaceae	<i>Allium cepa</i> L.	Basla: البصل	Bulb	Other	14	0.467
	<i>Allium sativum</i> L.	Touma: الثوم	Bulb	Other	26	0.867
Apiaceae	<i>Petroselinum crispum</i> (Mill.) Fuss	Maadnous: البقدونس	Whole plant	Decoction	13	0.433
	<i>Pimpinella anisum</i> L.	Hbat Hlawa: حبة حلاوة	Seed	Infusion	07	0.233
Asteraceae	<i>Artemisia annua</i> L.	Chih: الشيح	Leaf	Decoction	14	0.467
	<i>Matricaria recutita</i> L.	Lbabounj: البابونج	Whole plant	Infusion	16	0.533
Fabaceae	<i>Glycyrrhiza glabra</i> L.	Arq Sous: عرقسوس	Rhizome	Decoction	10	0.333
	<i>Trigonella foenum-graecum</i> L.	Lhalba: الحلبة	Seed	Decoction	21	0.700
Lamiaceae	<i>Rosmarinus officinalis</i> L.	Azir: الأزير	Leaf	Infusion	08	0.267
	<i>Salvia officinalis</i> L.	Salmya: السالمية	Leaf	Infusion	12	0.400
	<i>Thymus vulgaris</i> L.	Zaatar: الزعتر	Whole plant	Infusion	17	0.567
Lauraceae	<i>Cinnamomum zeylanicum</i> Blume	Lqarfa: القرفة	Seed	Powder	19	0.633
Meliaceae	<i>Azadirachta indica</i> A.Juss.	Neem: النيم	Leaf	Infusion	28	0.933
Myrtaceae	<i>Eucalyptus globulus</i> Labill.	Lqalitous: الكاليتوس	Leaf	Infusion	29	0.967
	<i>Eugenia caryophyllata</i> Thunb.	Lqronfel: القرنفل	Flower	Maceration	25	0.833
Oleaceae	<i>Olea europaea</i> L.	Zitoun: الزيتون	Leaf	Decoction	18	0.600
Ranunculaceae	<i>Nigella sativa</i> L.	Hbat Lbaraka: حبة البركة	Seed	Powder	15	0.500
Rhamnaceae	<i>Ziziphus lotus</i> (L.) Lam.	Sedr: السدر	Other	Decoction	27	0.900
Rutaceae	<i>Citrus limon</i> (L.) Osbeck	Lhamed: الحمض	Fruit	Maceration	24	0.800
Zingiberaceae	<i>Zingiber officinale</i> Roscoe	Sqinjbir: الزنجبيل	Rhizome	Powder	20	0.667

Symptoms, and treatment of Sars-CoV-2

Herbalists (23) perceived the common Sars-CoV-2 as a combination of several symptoms. The most frequent ones were fever, tiredness, Sore throat, loss of taste and smell, headache, and dry cough. The rest of the herbalists (7) presented other different combinations of described symptoms. Anecdotally, herbalists have claimed herbal medicines and kept them healthy or improved their symptoms. However, the bulk of research on these herbs used is inconclusive. Besides, herbalists believe that the treatment with herbal remedies for 7 days led to a marked improvement in the rate of recovery from symptoms, and the herbalists found that the herbal capsules shortened the duration of fever by three days and symptoms of fatigue and cough by five days.

Discussion

Natural products have always been intriguing to scientists for drug research to develop novel candidates. COVID-19 caused by the novel coronavirus (SARS-CoV-2) is a deadly infectious disease against which no specific drug or vaccine is available, yet. Medicinal plants are considered very useful by traditional healers in many societies to prevent and to treat several diseases and ailments. Since the COVID-19 pandemic outbreak, various traditional herbal medicines have been used and resulted in positive health effects among Sars-CoV-2 patients, mainly in Salé Prefecture. In this study, both sexes are interested in herbal medicines. However, the numbers of male participants were higher than those of females. Men were predominantly represented in the sampling because of working. Females were rarely found at herbal markets during our interviews. These outcomes validate the findings of other ethnobotanical national and international studies [22–27] which have confirmed that men are predominantly knowledgeable in traditional herbs. Regarding the age groups, results showed that herbalists over 50 years old had more experience with traded medicinal species, while herbalists with age fewer than 30 years old were less informed about it. It is due to the high secrecy of ancestral information by older peoples, these factors are very interesting in determining the transmission of traditional knowledge from one generation to another in a Prefecture. Concerning the academic level, our results revealed that more than half of the suppliers (53.33%) have secondary education. None of the herbalists participating in our survey have a certificate or diploma in herbalism. While the Dahir of February 19, 1960, with Article 17 stipulates that to hold and sell the plants or parts of medicinal plants, whether fresh or dry, except plants classified in the various tables of poisonous substances, the person concerned must be provided with the herbalist certificate and authorized under the conditions provided in Article 2 of the same Dahir. This indicates that with a greater level of instruction, the experience of traditional herbal medicine decreases. Therefore, advanced instruction reduces the ancestral therapeutic knowledge of the young generation [28]. Previous ethnobotanical studies [29–34] report similar findings. All stated that they have acquired their traditional knowledge and experiences in medicinal plants from their parents, friends, and elderly relatives. 41.18% of the herbalists had experience as herbalists over 20 years. The present study revealed that a total of 20 medicinal species relating to 19 genera and 14 botanical families were generally utilized by herbalists in the prevention and treatment of Sars-CoV-2. The Lamiaceae family was present in a high number of medicinal plants (3 species, 15%). The calculated results of MUV showed that *Eucalyptus globulus* Labill. was ranked first (MUV =0.967) followed by *Azadirachta indica* A. Juss. (MUV =0.933), and *Ziziphus lotus* (L.) Lam. (MUV =0.9). These results are similar to international work, particularly in Pakistan. These medicinal species having high MUV must be further assessed for phytochemical, pharmacological, and toxicological studies to identify their active constituents for an effective and non-toxic drug extraction.

The interview results revealed that leaves are the most frequently used part of the medicinal plants 28.43% of the total, followed by seed (17.5%), and whole plant (13%). The choice of leaves was due to its easy availability, collection, and simplicity in drug preparation. Furthermore, photosynthesis takes place in the leaves, and sometimes the storage of the secondary metabolites is effective for the biological characteristics of the medicinal plant. Comparable conclusions showed leaves as a main principal plant part in Morocco [35–41] or in Africa [42–44] for herbal medicine preparation. In Salé Prefecture, the drugs bulks (70.8%) were prepared from fresh substances. The research carried by Abdurhman [45] registered that 86% of products were in fresh form, [46] declared that most of (64%) plant species were employed in fresh form and 36% in freeze-dried form and Jima et al., [47] indicated that the preponderance of the drugs (78.6%) was prepared from fresh pieces of plant species. The dependency of herbalists on fresh substances is often due to the effectiveness of fresh plant species in therapy as the ingredients are not lost before practice related to the dried plant forms. The main method for herbal medicine preparation described was infusion (34.63%). The frequent employment of the infusion can be justified by the fact that it makes it possible to accumulate the multiple effective components and attenuates or eliminates some remaining poisonous ingredients. Ethnobotanical studies conducted in other parts of Morocco found that the majority of suppliers prepared herbal remedies by infusion and decoction [48–53]. This result corroborates the fact that there is an ongoing transfer of knowledge on the effectiveness of plant species between the inhabitants of Morocco. These medicinal plants contain a wide variety of bioactive compounds including flavonoids (quercetin, kaempferol, hesperetin, eriodictyol, naringenin, and luteolin), alkaloids (pyrrolidine, pyridine, quinoline, isoquinoline, indole, and quinazoline), saponins (escinidin, glycyrrhizin, saikosaponin B2), terpenes (curcumin, betulinic acid, savinin, iguesterin, dihydrotanshinone I, cryptotanshinone, 3 β -friedelanol, chrysanthemum B), coumarins (leptodactylone, xanthoangelol E), organosulfur compounds, glycosides, secoiridoid, tannin, mucus, lignans, anthraquinones, aromatic constituents, phenolic lipids, carotenoids, steroids, and many other compounds. The plant species of this mixture also include a large number of essential oils. A large number of chemicals and compounds extracted from different higher plants is responsible for many pharmacological effects [54–56] such as antiviral, antibacterial, antifungal, anti-inflammatory, antioxidant, antipyretic antiseptic, antibiotic, analgesic, antitumor, anticancer, antiallergic, antiatherogenic, antimutagenic, and antinociceptive activities. A variable number of alkaloids such as emetine, tylophorine, and mycophenolate mofetil were reported to be very significant antiviral compounds [57, 58] Chloroquine is a good candidate, asynthetic derivative of quinine for the development of an effective drug to treat Sars-CoV-2 because of its DNA-intercalating properties [59]. The isoquinoline alkaloids tetrandrine, fangchinoline, and cepharanthine could inhibit the expression of spike and nucleocapsid proteins in SARS-CoV- OC43 in human lung cells [60].

Essential oils (Chamazulene, Limonene, Thymol, Eucalyptol, Verbenone, γ -Terpinene, Sabinene, trans-Anethole, Caryophyllene, Linalool, Disulfide, Myrcene, Camphenilone, Camphene, Camphor, Borneol, Menthol, Eugenol, Carvacrol, Myrtenol, Verbenone, etc.) from many medicinal plants such as *Artemisia annua* L., *Rosmarinus officinalis* L., *Salvia officinalis* L., *Pimpinella anisum* L., *Citrus limon* (L.) Osbeck, *Eugenia caryophyllata* Thunb., and other aromatic plants with antiviral activities were well documented by several researchers [56, 61–63]. Eucalyptol, a vital essential oil from *Eucalyptus globulus* Labill. was identified as an effective antiviral compound against coronavirus, especially Sars-CoV-2 because this major component of eucalyptus oil consists of ether (-O), ketone (=O), and hydroxyl (-OH) groups which play the main inhibitory role against SARS-CoV-2 [64]. Essential oils can insert nonspecifically into the lipid double layer of the viral envelope, which alters the fluidity of the membrane [62]. The antimicrobial activity of alkaloids has been extensively reviewed [65, 66] Recently, Özçelik et al., [67] published another comprehensive review on this subject. The review considered many alkaloids, flavonoids, and phenolic acids with antimicrobial activity and reported that bioactive alkaloids could be found within acridone-, aporphine-, benzophenanthridine-, bisbenzylisoquinoline-, indole-, isoquinoline-, piperidine-, protoberberine-, quinoline-, terpenoid- and steroid-type alkaloids. Flavonoid derivatives have also been reported to possess antiviral activity against a wide range of viruses such as HSV, HIV, Coxsackie B virus, coronavirus, cytomegalovirus, poliomyelitis virus, rhinovirus, rotavirus, poliovirus, sindbis virus, and rabies virus [68, 69]. Phenolic compounds, polyphenols, steroid, terpenoid, other active phytochemicals, and their derivatives are common plant secondary metabolites that contain aromatic rings with 1 or several hydroxyl groups. For a wide range of viruses, several studies confirmed the abovementioned activity of several phenolic antiviral compounds such as curcumin, luteolin-7glucoside, epicatechin gallate, catechin, demethoxycurcumin, bavachinin, apigenin-7 glucoside, silvestrol, hypericin, psoralidin, mycophenolate mofetil, corylifol, and tomentin [58, 70, 71]. According to Wink [63], polyphenols are capable of binding easily with the lipoproteins of the virus envelope, which can prevent the viral invasion in host cells. Even though herbal remedies may seem harmless, if misused, they could increase a person's risk for Sars-CoV-2. We may find that certain herbs are effective in preventing and treating Sars-CoV-2 for some people, however, there currently is not enough data regarding the use of herbal remedies for the novel coronavirus. According to the World Health Organization, there are no medicines that have been shown to prevent or cure Sars-CoV-2.

Conclusions

Our study showed that medicinal plants continue to play an essential role in the fundamental healthcare system for the local people living in the Salé Prefecture. Herbalists appear to have a beneficial role in the healthcare of the local population, despite the revolution in modern health technology. The abundance of plant species documented for the prevention and treatment of Sars-CoV-2 is a major indication of the potential that exists locally, so long as the scientific procedure is added to the indigenous knowledge. Furthermore, additional research on the sustainable use and conservation of medicinal species is highly suggested. Finally, pharmacological, phytochemical, and toxicological investigations on medicinal plant species with possible anti- Sars-CoV-2 effects are carried out for laboratory validation of the ancestral uses of these plants and to obtain the traditional medicines Bios. A combination of natural products or herbal mixtures with validated anti- Sars-CoV-2 drugs may constitute a promising preventive and therapeutic alternative to be assessed.

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Declaration of Competing Interests

We declare that there is no conflict of interest with any business organization concerning the study.

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Appendix A : Questionnaire card N°...

Section A

Date	District	Age	Sexe	Academic level			
.....	Illiterate	Primary	Secondary	University
			

Section B

		Botanical name		Scientific name			Names: Arab/Amazigh		
			
Years of experience as herbalist		Between 01-10 years		Between 10-20 years			Over 20 years		
			
Mode of preparation	Decoction	Infusion	Fumigation	Maceration	Powder	Cream	Bath	Plaster	Other

Part used	Root	Leaf	Seed	Fruit	Bulb	Rhizome	Flower	Whole plant	Other

Plant Type								
Conservation method								
Dose used								
Form of employment								
Administration mode								
Expiration date								
Toxicity								

Section C

	Botanical name	Scientific name	Names: Arab/Amazigh
Plants associated
Period, Mode, Dose, Amount, Nature		
		