

Medicinal Plants Traditionally Used in the Management of COVID-19 in Kurdistan Region of Iraq

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Abstract—Coronaviruses are infectious respiratory tract illnesses, but they can also affect the digestive tract and infect both humans and animals. The new coronavirus results in complicated health problems all over the world. The most urgent concern of all researchers around the world has been the treatment of the virus. The following study aimed to use quantitative ethnobotany to help scientist in addressing the deadly virus. Expert sampling method was adopted with the aid of an in-depth interview guide. Thirty-nine respondents were interviewed. Eighty-one medicinal plant species from 35 families were documented. Males 25 (64.1%) constitute the greater percentage of the total respondents. Majority of the respondents had formal education. Eighty-one medicinal plant species from 35 families were documented. Leaves are the most utilized 25.8 followed by seed 17.7 and fruits 12.1%, respectively. Relative frequency of citation ranged from 0.5 to 0.9, whereas the FL value ranged from 0.4 to 0.85, revealing how effective the documented plant species are in the management of COVID-19 in the region. A greater amount of research into documented medicinal plants is warranted because of the high likelihood that they contain many active ingredients.

Index Terms—Coronaviruses, Expert sampling method, Iraqi Kurdistan, Medicinal plant, Relative frequency of citation.

I. INTRODUCTION

Man has long been using plants to treat ailments. Since the dawn of time, man has been enthralled by the knowledge and application of traditional medicinal plants, which has been passed

down from generation to generation (Dogara, et al., 2022). Plants have long been known for their therapeutic properties, and people all over the world have traditionally employed them to cure a variety of diseases. Plant-based medicines are now commonly considered as the safest and most effective way to combat infectious diseases (Merouane, et al., 2022). Plant chemical compositions have a wide range of medical applications (Abdulrahman, et al., 2022). The most urgent concern of all researchers around the world has been the treatment of the virus. The dearth of effective vaccines against this devastating viral illness has prompted experts to look for natural remedies that could aid in the fight against the viral pandemic (Lim, et al., 2021). China has been using herbal traditional medicines since the start of the COVID-19 outbreak (Khadka, et al., 2021). Traditional medicines, on the other hand, were shown to help 90% of the 214 patients they were given. Healthy people were protected from SARS-CoV-2 infection, whereas patients with mild or severe symptoms saw improvements in their health after using specific traditional herbal remedies (Benarba and Pandiella, 2020). The pandemic has prompted researchers from a wide range of disciplines to investigate the virus's origin, structure, causes, diagnostic techniques, and therapeutic alternatives. The following study aimed to use quantitative ethnobotany to help scientist unaddressing the deadly virus.

II. MATERIALS AND METHODS

A. Sampling and Interview sessions

In this study, non-random probability approach and expert sampling methods were used. Traditional medical practitioners and elderly folks with traditional plant knowledge are interviewed. An in-depth questionnaire served as a guide for the interview.

B. Data Collection Procedure

Direct interviews with local people were done in the Kurdistan Region of Iraq from January 2021 to June 2022

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to gather data for this study. The responders' verbal consent was sorted. The significance of the study was communicated to them. Each respondent was visited two to three times to ensure that the data were accurate. If there was a discrepancy between the information provided previously and the information received during subsequent trips to a particular plant, it was deemed unreliable and dismissed. Data were gathered using communicable dialects within the area, as per the traditional inquiry approach.

C. Plant Collection and Herbarium Specimen Deposition

Species of plants were collected or purchased from the herbalist during the interview. Plants with different names were avoided. A licensed botanist (Dogara, et al., 2022) from Tishk International University, Faculty of Education, Department of Biology, identified the collected plant specimens. Letters plants species were confirmed in the Salahaddin University herbarium. Plant names were verified according to <http://www.worldfloraonline.org/>.

D. Data Analysis

Based on the below information, the study used a simple descriptive analysis of the ethnobotanical data to calculate the frequencies and percentages:

1. Demographic information of the participants
2. Documentation of the reported plants, parts of plants used, preparation methods, prescription, administration methods, and toxicity of reported plants
3. Symptoms of COVID-19
4. Quantitative analysis was computed based on the following:
 - a) Relative frequency of citation (RFC): $= Fc/N$, where Fc is the number of people who mentioned a particular plant species and N is the overall number of respondents interviewed (Mahmoud and Abba, 2021).
 - b) Fidelity level (FL): $= N_s/N \times 100$. Where N_s = Total number of respondents who indicated they employed a specific plant species to treat a specific condition and N = Total number of informants who mentioned the plant species during the interview (Mahmoud and Abba, 2021).

III. RESULTS AND DISCUSSION

A. Demographic Profile of the Participants

The COVID-19 pandemic has engulfed the entire globe; people are dying by hundreds every day without access to effective treatment, and it is impossible to bring this global health crisis to an end without it (Adhikari, et al., 2021). There have been several different experiments, but none of them have given promising results (Khadka, et al., 2021). COVID-19 has been the subject of numerous hoaxes on social media, including the use of medicinal plant products to prevent or treat the disease. To prevent erroneous knowledge from spreading, ethnobotanists should connect with local people and record the therapeutic plants used. Participants are the most important part of any ethnobotanical study. Their age, gender, education level, occupation, religion,

etc., provide insight into the survey and facilitate placing the data provided in its proper social context for analysis and interpretation (Abdulrahman, et al., 2022). Traditional practitioners in the research area were discovered, as they play an important part in the primary healthcare systems of the local people. Table 1 shows the demographic profile of the respondents, males 25 (64.1%) constitute the greater percentage of the total respondents, whereas females were represented by 14 (35.9%) respondents. The gender difference might be explained by the fact that male knowledge holders in communities are more comfortable to talk than female knowledge holders who faced cultural restrictions. Females were forbidden from conversing or discussing with stranger males. Due to these factors, fewer women participated in the documentation. Similar finding was also reported (Chinsebu, Hajarunguru and Mbangu, 2015; Kankara, et al., 2022). The survey also revealed that most of the respondents are members of the higher age group; the age range of 50 and above is shown in Fig. 1. This is an indication that there is a wide gap of ethnomedicinal knowledge between the elderly and the younger generation. This, however, poses a serious threat to the indigenous knowledge because it may eventually be lost following the demise of the older generation (Abdulrahman, et al., 2018; Kankara, et al., 2015). Cultural changes brought about by modernization have

TABLE 1
DEMOGRAPHIC INFORMATION OF THE INFORMANTS

Parameters	Frequency	Percentage (%)
Gender		
Male	25	64.1
Female	14	35.9
Education		
None	15	38.5
Basic	8	20.5
Secondary	9	23.1
Tertiary	7	17.9
Experience		
5–10	9	23.1
11–20	19	48.7
61–80	11	28.2

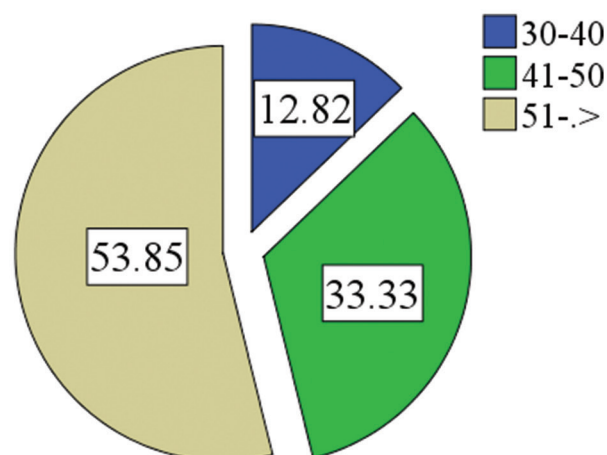


Fig. 1. Experience of the respondents.

TABLE 2
PLANTS WITH THE RECIPE USED FOR THE MANAGEMENT OF COVID-19 COMPLICATIONS IN KURDISH

S/N	Family	Scientific name	Vernacular name	Part used	Preparation	Administration
1	Apiaceae	<i>Cuminum cyminum</i> L.	zîrre kemun	Seeds	Add teaspoon of cumin seed or 1/2 teaspoons of cumin powder into a boiled cup of water, add 1 teaspoon of fresh ginger or 1/2 teaspoons of ginger powder, heat the mixture for 5 min, leave it to rest for 5–7 min, then strain and get rid of the seeds	Oral (drink 3 times a day after each meal)
2	Apiaceae	<i>Carum carvi</i> L.	kerrawye (zeytî kerrawye)	Seeds and oil	1. Grind and place 1 tablespoon of seed in cattle and add 2 cups of water, boil it for 5 min, and leave it to rest for 15 min (if you let it to rest for 1 h is better or overnight will be optimal) after it is done, strain, and get rid of the seeds. You can add honey or a few leaves of mint or 1/4 teaspoons of mint powder for more benefit and taste. 2. Mix a few drops (1–2 drops) of caraway oil with a carrier oil (warmed sweet almond, coconut, avocado oils, or any vegetable oil), and apply directly to the neck, throat, and chest. Massage the area gently for better absorption.	Oral (drink it at evening before you go to bed. keep the rest in the refrigerator for the 2 nd day). Dermal (Do this at the evening before bedtime).
3	Apiaceae	<i>Ridolfia segetum</i> (L.) Moris	toyi şwît (toyi şbît)	Seeds	Boiled the seed, then strain, and get rid of the seeds	Oral (2–3 times/day) for 2 weeks
4	Apiaceae	<i>Ammi visnaga</i> (L.) Lam.	xultan (toyi xultan)	Seed	1. Boiled water with tablespoon of seeds and cinnamon bark. 2. Place 1 tablespoon of seeds crushed and tied up in a small cloth bundle that is used for inhalation: for nasal congestion. Use a similar bundle, place it near the pillow while sleeping; for cough, drink hot water after chewing little	Oral (for 3 days 3 times a day)
5	Apiaceae	<i>Petroselinum crispum</i> (Mill.) Fuss	mu'dh nus	Leaves & stems	1. Add parsley into your food and salads. 2. Boil a cup of parsley leaves and stem in 1 L of water for 10–15 min, let it to seep and strain, and then drink a cup after each meal.	Oral
6	Apiaceae	<i>Pimpinella anisum</i> L.	yanison	Seeds	1. Place 1 teaspoon of Anise seed in one cup, water, boil for 2 min, let it to rest for 5 min, then strain and drink it. 2. Chew 1 teaspoon of anise seed for 5 min or grind the seeds and put it in a glass of warm water and drink it.	Oral
7	Apiaceae	<i>Foeniculum vulgare</i> Mill.	raziyane (şumerr yan hibe hlu zeytî)	Seeds	Taking 1 tablespoon of crushed fennel seeds in a glass cup, then pouring boiling water over it immediately, covering for 10 min, then strain and drink the extract.	Oral
8	Apiaceae	<i>Coriandrum sativum</i> L.	gjinîj (kezberre)	Leaves and seeds	1. Boiling 1/2 small cup of fresh leaves of coriander into 500 mL of boiled water for 30 min or 2. One tablespoon of powder coriander with boiled water for 10 min, then add 1 lemon and 1/2 teaspoon salt.	Oral (3 times a day after each meal, and the last cup you need to drink it before going to sleep)
9	Anacardiaceae	<i>Pistacia eurycarpa</i> Yalt.	talle binîşit yan binîşite tall	Trunk	1. Chew a small piece (like a chewing gum), this will enhance the secretion of saliva during coronavirus and solve the dry mouth and nose. 2. Grind and add 1 tsp to 1 cup warm water, drink 1 cup/day).	Oral
10	Anacardiaceae	<i>Rhus coriaria</i> L.	smaq	Seeds	1. Grind or use whole; mix 2 teaspoons of fresh or dry seed into 1 cup of warm water, leave it for 20 min. 2. Add sumac to your food and salads, it is good anti-inflammatory, fight coronavirus, and raise up the immunity of the body to resist the viruses.	Oral (1 time/day for 7 days)
11	Amaryllidaceae	<i>Allium cepa</i> L.	piyaz	bulb/ leaves	1. Add onion to your daily food and salad 2. Boil 1 chopped onion in 1 cup of water for 10 min. Leave it to cool a little and strain, then add a tablespoon of honey to it. 3. Roast or grill the onion for 5 min when the outer peel is burnt and is cooked	Oral (2/times a day).

(Contd...)

TABLE 2
(CONTINUED)

S/N	Family	Scientific name	Vernacular name	Part used	Preparation	Administration
12	Amaryllidaceae	<i>Allium sativum</i> L.	sîr (yarrawhî sîr)	Fruits, Oil	1. Place 12 garlic cloves and 1 cup of honey in a jar to make fermented garlic honey. 2. Add garlic into your foods 3. N.B: The above mixture has immune boosting properties and fights the inflammations in the body. .	Oral (to an empty stomach) 1 time/day, then eat after 30-45 min.
13	Apocynaceae	<i>Hoodia gordonii</i> (Masson) Sweet ex Decne.	xuba	Seeds and flowers (oil)	1. Put 1 drop of oil in each nose twice for 40 days. 2. Take 1 teaspoon of oil twice/day.	Oral
14	Arecaceae	<i>Phoenix dactylifera</i> L.	xurma	Fruit	1. The patient needs to eat 3 or 5 dates (odd numbers only) every day. Dates are a very good remedy for coughing, phlegm, and bronchitis and inflammation during COVID-19. Note: Do not use this recipe if diabetics.	Oral (1 time/day for 7-10 days)
15	Burseraceae	<i>Commiphora myrrha</i> (Nees) Engl.	binêşite tall	Bark	1. Put some of the gum and put in warm water then used for gargling 2. Take 1 g of gum	Oral (3 times/day)
16	Burseraceae	<i>Boswellia sacra</i> Flueck.	dar bun (darî binêşitî kurdi)	Gum resins	1. Crush 1 tablespoon of frankincense, 1 teaspoon of fenugreek seed, 1 teaspoon of black seeds, 1/2 teaspoon of mastic and place them in a small pan, add 2 cups of water, put it on a low heat for 5 min, 2. Place 1/2 tablespoon of frankincense in a cup of cold water for 12 h, then stir, filter and drink. 3. Eat 5-10 seeds with 1-2 cups of water	Oral (1/day on empty stomach)
17	Brassicaceae	<i>Brassica nigra</i> (L.) K. Koch	xirtele (xerdel)	Seeds	Boiling and filtrate or boiling with clove and filtration	Oral (1/7 days)
18	Asteraceae	<i>Bellis perennis</i> L.	gulle beybun	Flower	Put in hot water then filtration	Oral
19	Asteraceae	<i>Artemisia vulgaris</i> L.	şifî	Seed	1. Take 1 teaspoon of grinded dried roots, add it to 1 cup of warm water, then add 1 teaspoon of honey to get rid of the bitter taste. 2. Use thin slices of the roots of these herbs to prepare hot baths.	Oral (2/day)
20	Asteraceae	<i>Saussurea costus</i> (Falc.) Lipsch.	qst hndî (qst hndî)	Root	Place 1 tablespoon of leaves and roots of fresh or dry dandelion in a boiled cup of water, let it boil for 3-5 min, then leave it for 10 min, then filter it.	Oral (1 morning and evening).
21	Asteraceae	<i>Taraxacum fontanum</i> Hand. -Mazz.	tallîşk tallk	Roots, leaves, stems	1. Put 1 teaspoon of chamomile in 1 cup of warm boiled water, leave it for 10-15 min, strain and drink. It twice a day. 2. Mix 1 teaspoon of chamomile with 1/2 teaspoon of ginger in 1 cup warm water (boiled before), let it seep for 5 min, strain and drink twice	Oral (1 day, morning and evening before 1 h of sleeping)
22	Asteraceae	<i>Chamaemelum nobile</i> (L.) All.	gulle hâcile (beybune rumanî)	flower	Place 1 tablespoon of powered flowers in a cup of boiled water or cold water, for 2-3 min.	Oral (2/day)
23	Asteraceae	<i>Matricaria chamomilla tzvelevii</i> Pobed.	gullu hîlcîlu (bubunî ullmanî)	Flower	Boil 1 cup of flowers with 2 litter of water	Oral (1/2 cup/day, until better for 5 days)
24	Fabaceae	<i>Cercis siliquastrum</i> L.	gulle wenewşe	Flower	1. Add 1 teaspoon of Fenugreek powder to 2 cups of water and boiled for 1-2 min, then filtered and drink in multiple doses, 2. One tablespoon every h for 5 days or till feel better 3. Mix 2 tablespoon of fenugreek powder with 2 tablespoon of olive oil, take 1/2 tablespoon till feel better.	Oral (4 times a day)
25	Fabaceae	<i>Trigonella foenum-graecum</i> L.	şmillî yan hîlbu (şîmbuluk)	Seeds	1. Place 1 tablespoon of dried leaves or pods in hot water and boil it for 10 min, let it to seep for 3-5 min, strain and drink it. 2. Soak 7 leaves at night, and drink in the morning once every 4 nights,	Oral
26	Fabaceae	<i>Senna alexandrina</i> Mill.	sinemkî (zît)	Leaves, fruits, oil	Place 1 teaspoon of root and put it in a cup of boiling water and leave for ten min, then drain and drink it. N.B: High pressure patients should not use it as it raises blood pressure.	Oral (3/day/day)
27	Fabaceae	<i>Glycyrrhiza glabra</i> L.	mêkuk yan rhge buluk	Root		

(Contd...)

TABLE 2
(CONTINUED)

S/N	Family	Scientific name	Vernacular name	Part used	Preparation	Administration
28	Fabaceae	<i>Ceratonia siliqua</i> L.	doşawî xurînu	Carob pods	Take 1 tablespoon of carob extract twice a day after meals	Oral (twice a day)
29	Fabaceae	<i>Acacia senegal</i> (L.) Willd.	smîxî 'errebî	Bark	1. Chew the gum for 10 min five times daily for 7 days 2. Add 2 teaspoon of Arabic gum with 1 glass of water, and then drink it. 3. Add Arabic gum powder to food during cooking. N.B: Arabic gum relieving cough and sore throat, promote better digestion, anti-inflammatory, and enhance more secretion of saliva during dry mouth problem during COVID-19. N.B: Drink plenty of water after drinking it, as T contains a high amount of fiber.	Oral
30	Fagaceae	<i>Quercus cerris</i> L.	burruwî kurdi	Fruit	Put 5–6 oaks in a pot boiled in 4 cups (1 L) of water, let it seep and strain, then gargle and wash the mouth and throat.	Oral (2/morning and evening)
31	Lamiaceae	<i>Mentha piperita</i> L.	nu'nayi biburî	Leaves, flower, oil	1. Add up to 7–10 drops of oil to 4 cups of boiling water; cover your head with a towel and inhale the steam through your nose. 2. Add 2 or 3 drops of oil to a cotton ball; breathe deeply for direct inhalation. (Apply this for 10 days till you feel better). 3. Add 1/2 cups of chopped peppermints and fresh leaves combined with 1 teaspoon of basil or cilantro to be added to your salad and food on a daily basis till cure.	Oral
32	Lamiaceae	<i>Glechoma hederacea</i> L.	lawlaw	Leaves	Take a medium spoonful of crushed leaves and put it in a cup, leave it for 15 min, then drink.	Oral (1–2 cups/day, lunch, after dinner or when going to bed)
33	Lamiaceae	<i>Ocimum tenuiflorum</i> L.	şarreyhan	Leaves, flowers	Boil leaves (1 cup) with 1/2 tablespoon of clove in 2 cups of water, when the water gets reduced to half, strain the liquid, and drink immediately.	
34	Lamiaceae	<i>Thymus vulgaris</i> L.	catire û zeytî catire	Stems, leaves, oil	1. Add thyme to your daily food and salads 2. Fill a teaspoon of the powdered leaves to fill a cup of boiled water and leave for ten min, then drink a cup after each meal.	Oral
35	Lamiaceae	<i>Zataria multiflora</i> Boiss.	ze'ter (catire şîrazî)	Leaves, flower	Add 1 teaspoon of dried flower and leaves into 1 cup of warm water for 5 min. N.B: This mixture is good for calming coronavirus patients	Oral (2/day for 15 days).
36	Lamiaceae	<i>Lavandula latifolia</i> Medik.	zeytî gulle xezîm yan gulle erxewan	Flower, oil	Apply few drops of Lavender essential oil to the ears cotton stick and rub the nose, massaging it gently (the skin inside nose holes) do not put it inside the nose). N.B: Lavender oil is relaxing and giving the ability to have a good sleep and reduce stress and anxiety, depression, and insomnia during the coronavirus)	Dermal
37	Lamiaceae	<i>Thymus serpyllum</i> L.	(xuzamî yan lavînder)	Leaves, flowers	1. Add 1 teaspoon of dried thyme leaves into 1 cup of warm water, leave it for 15 min, and drink once a day before or after meal. 2. Gargle 1 teaspoon of soaked thyme in warm water for 30 min, keep it for a few min if you can, then spit out. 3. Place 1 teaspoon dried leaves into the cup of boiled water then leave it to rest for 15 min, strain add honey or lemon for more benefit.	Oral
38	Lamiaceae	<i>Salvia officinalis</i> L.	giya me yrh mî (mwîrh mî yan gullu mwîrh mî)	Leaves, flowers	1. Place teaspoon of dried sage (2 teaspoons of fresh sage) and 1 cup of water in a small pan to cover, heat or boil it for 2–3 min, then let it cool down and seep for 10 min but with putting a cover, then seep and add 1 teaspoon of honey. 2. Add 1 tablespoon of dried sage leaves into 1 cup of boiled water, leave it for 5-10 min then seep to get rid of the leaves, and drink it once a day	Oral (1 time/day)

(Contd...)

TABLE 2
(CONTINUED)

S/N	Family	Scientific name	Vernacular name	Part used	Preparation	Administration
39	Lamiaceae	<i>Clinopodium menthifolium</i> (Host) Stace	pung	Leaves	1. Make a tea from fresh or dried leaves. 2. Grind boil 1 tablespoon with 1 cup water.	Oral (1/day for 2 days)
40	Lamiaceae	<i>Mentha spicata</i> L.	awî ne'na	Leaves, oil	1. Wash fresh leaves or use dry leaves to make tea or use in food as much as you want. 2. Apply a few drops of mint oil to the ears cotton stick and rub the mixture onto the nose, massaging it gently for 5–7 days	Oral
41	Lamiaceae	<i>Rosmarinus officinalis</i> L.	rozimari	Leaves	Add 1 teaspoon of dried leaves onto 1 cup of warm water, let it rest for 10–15 min, strain, and then add teaspoon of honey.	Oral (1 cup/day) at early morning before breakfast to 1 h.
42	Lamiaceae	<i>Ocimum basilicum</i> L.	reyhan (şarreyhan)	Leaf, flower	Place 2–3 teaspoons of dried or 5 teaspoons of fresh leaves in a cup of boiled water and let it to rest for 5–6 min, strain, and drink.	Oral (once a day)
43	Lamiaceae	<i>Origanum majorana</i> L.	merde guş (merize)	Leaves	Place equal portion of 1 teaspoon of each of marjoram, melissa, and linden leaves into a cup of boiled water, drink it whereas it is warm. N.B: The above mixture will respiratory problems during coronavirus infection.	Oral (3 to 5 times a day)
44	Lamiaceae	<i>Salvia hispanica</i> L.	toyi şiya (bzur alşiya)	Seed	1. Place 1 teaspoon of seed into 1 glass of water, cover it and leave it for 20–30 min, then drink the jelly mixture to an empty stomach. 2. Add seed into your salad 3. Soak 1 teaspoon of seed in 1 cup of water, after 20 min, squeeze 1/2 lemon lime into it for more benefit and flavor. N.B: Chia seeds help in boosting immunity and transporting oxygen around the body, as well as reduce phlegm and inflammation during coronavirus infection.	Oral (1/day) most favorable time is on early morning on empty stomach before breakfast with 30–45 min
45	Lamiaceae	<i>Rosmarinus officinalis</i> L.	klil alçbil	Leaves and oil	1. Add 1 teaspoon of dried flowers into 1 cup of warm water, leave it for 10–15 min strain and drink it. 2. Add a few drops of oil to a few drops cinnamon oil, then rub and massage the mixture on the chest and throat and neck. 3. Dilute drops of oil in boiled water about 500 mL ⁻¹ L of water and inhale the steam N.B: rosemary oil or tea is good for clearing out your lungs during COVID-19.	Oral (once per day) Dermal (Morning and before sleeping)
46	Lamiaceae	<i>Melissa officinalis</i> L.	giyalîmo (gîrawe û zeyt)	Leaves, oil	1. Place 1/2 of teaspoon of dried lemon balm herb in hot water. Steep and drink up to 4 times daily. 2. Take 1 capsule (300–500 mg) of dried lemon balm, 2–3 times daily. 3. Use a few drops of dried lemon balm oil on the skin of chest, neck, and stomach and massage gently (2 times, morning and before sleep)	Oral, Dermal
47	Lauraceae	<i>Laurus nobilis</i> L.	gwallî bwîyi (urq alşar)	Leaves	Add 3–5 leaves with 1 teaspoon of ginger and 2 big Cinnamon sticks with 1 cardamom pod in chicken broth, eat every day till cure	Oral (once a day)
48	Lauraceae	<i>Cinnamomum verum</i> J. Presl	darçîn	Bark	1. Add 1 teaspoon of Cinnamon bark powder to 1 big cup of boiled water, mix them well. Let the water simmer for 2–3 min and add 1 teaspoon of honey and drink it right away. 2. Mix 1 big teaspoon of cinnamon bark powder with 2 teaspoons of honey to make a paste or added to a warm cup of water. N.B: Eating cinnamon with honey will fight coronaviruses, flu and inflammation.	Oral (1–2 on empty stomach)
49	Lauraceae	<i>Cinnamomum camphora</i> (L.) J. Presl	kafur	leaves and shoots (oil)	1. Put 3 drops of camphor oil with 2 drops of peppermint oil in a bowl, then put boiling water over it. Inhale the steam rising from the mixture of oils with boiling water. 2. Put in the palm of your hand 2 drops of camphor oil with 3–4 mL of apricot oil, 3 drops of pine oil, and add two drops of tea tree	Oral

(Contd...)

TABLE 2
(CONTINUED)

S/N	Family	Scientific name	Vernacular name	Part used	Preparation	Administration
					essential oil, massage the chest and back area against the lungs 2–3 times a day, for 4–6 days. N.B: Using the above oil for massaging will improve breathing and clean the lungs. N.B: The above remedy is not recommended for people suffering from asthma.	
50	Linaceae	<i>Linum usitatissimum</i> L.	toyi kutan	Seed	Mix 1/2 tablespoon of flaxseeds, 2 teaspoons of sesame seeds, and 1 tablespoon of honey with a small amount of salt and combine them properly and consume this mixture daily before bed.	Oral (daily before bed) for 5 days
51	Lythraceae	<i>Punica granatum</i> L.	hh nar û pullkî hh nar	Peel	1. Make pomegranate juice everyday so as your body fights the viruses and resist infection when immunity is raised up. 2. Boil 1 cup of pomegranate peel in 1 L of water for 15 min, when it cools down, try to drink 1 cup per day or gargling the mouth and throat with it.	Oral
52	Moraceae	<i>Ficus sycomorus</i> L.	hencîrî kêwî	Fruits, leaves	Place 10 fresh or 3–5 dried fig leaves in a small pot containing 1 L of boiled water for 15 min and then remove the leaves and drink the tea.	Oral (1/day)
53	Moraceae	<i>Morus alba</i> L.	doşawî tû	Fruits	Eat the fruits early morning because it gives energy.	Oral
54	Myrtaceae	<i>Eucalyptus globulus</i> Labill.	(zeytî kalıptos) zeytî kafûr	Leaves/ oil	Add a few drops of the oil in boiling water. Then cover the head with a towel and breathe in the steam.	Oral (once a day for 5–7 days)
55	Myrtaceae	<i>Myrtus communis</i> L.	murtk	Fruit, leaves, and branches	Take 1 tablespoon of the leaves and boil with a cup of water for 2 min, then cool filter.	Oral (1/day).
56	Myrtaceae	<i>Syzygium aromaticum</i> (L.) Merr. & L.M. Perry	mêxek	flower bud	1. Mix 1/2 teaspoon of clove powder with warm water and gargle with it 2. Chew some cloves raw 3. Mix it with hot water and drink it early morning.	Oral
57	Meliaceae	<i>Azadirachta indica</i> A. Juss.	tusbîlî (şerh alinîm yan sbîhbî)	Leaves, seeds	Boiled and take 2 tablespoon 3 times daily and birth with it twice	Oral, Dermal
58	Malvaceae	<i>Alcea kurdica</i> Alef.	gule hîro	Flower	Put 3–5 flowers in 2 cups of hot water and covered for 10–15 min, then strain and drink 1/2 cups.	Oral
59	Malvaceae	<i>Hibiscus sabdariffa</i> L.	kucerat (gulle kerkedî, çayî tirş yan gulle xene)	Flowers, leaves	1. Place 1/2 teaspoon flower or powder into 1 cup of warm water, shake well, leave it for 10 min to rest, strain or used without strain. 2. Place 1 cup of leaves/flower into 2 cups of water, add 1 teaspoon sugar, and 1 teaspoon of rose water, let it boil for 5 min, seep for 10 min, and strain.	Oral (1 cup at morning and a cup at evening)
60	Malvaceae	<i>Sphaeralcea angustifolia</i> (Cav.) G. Don	xuzamî (lavênder gulle xezêm û zeytî)	Flower	1. Inhale essential oils by sniffing the bottle directly or adding a few drops to a cotton ball. 2. Massage body of the COVID-19 patient with lavender oil every night until cure. N.B: Lavender oil can help the coronavirus patient to sleep better and speed the recovery process from viral and other infections.	Oral
61	Nitrariaceae	<i>Peganum harmala</i> L.	ħermell û zihyti ħerrmall	Seeds, bark, and root	One teaspoon of powdered seed and put it in a cup of warm water and drink it once until cure every day.	Oral 1/day/day and steaming once a day (at night before sleeping)
62	Oleaceae	<i>Olea europaea</i> L.	gelayî zeytun û zihyti zeytun	Leaves & seeds (oil)	1. Put olive oil into your food and salads. 2. Take 1 tablespoon of olive oil at early morning to an empty stomach. 3. Use a few drops of olive oil for massaging the chest, neck, back, and stomach. N.B: Olive mentioned in Verses of Holy Quran and Muhammad (PBUH) said “Eat olive oil and massage it over your body since it is a holy (Mubarak) tree”. He also stated that olive oil cures 70 diseases.	Oral/tropical (once a day)
63	Orchidaceae	<i>Masdevallia molossus</i> Rchb.f.	doşawî tû	Fruits	Eat fruits at early morning on an empty stomach, give the patient power and energy for whole day	Oral (1/day).

(Contd...)

TABLE 2
(CONTINUED)

S/N	Family	Scientific name	Vernacular name	Part used	Preparation	Administration
64	Pteridaceae	<i>Adiantum capillus-junonis</i> Rupr.	bîberî rhiş	Leaves, stalk	Mix 2 cups of fresh leaves or 1 cup of dry leaves with 4 cups of water, boil for 5 min, and leave it to rest for 3 h. Then, strain add 1 cup of honey.	Oral (take 1 tablespoon three times per day)
65	Piperaceae	<i>Piper nigrum</i> L.	bîberî reş	Seeds and fruits	1. Mix 1/2 teaspoon of black pepper and 1/2 of ginger (chopped), boil in 2 cups of water, then let it to rest for 5 min, shake well, and add 2 small teaspoons of honey. 2. Mix 1/2 of black pepper with 1/2 of turmeric to make a paste and eat it twice before meal. 3. Add black pepper to your food and salads.	Oral (twice/day)
66	Pinaceae	<i>Pinus sylvestris</i> L.	sinewber yan zeytî sinewber	Buds, leaves, oil	1. Soaked 1 cup of pine tree buds (ground buds) and place it in a liter of cold water and leave it for 3 h, filter and drink the extract. 2. Mix a few drops of oil with 1 tablespoon of coconut or almond oil and apply it directly to the chest, back, and neck. 3. Use 3 drops of oil for inhalation.	Oral (1 cup morning and evening)
67	Rutaceae	<i>Citrus limon</i> (L.) Osbeck	limo (hamz)	Fruits	1. Place 1 tablespoon of fresh Lemon juice to 1/4 teaspoons of turmeric powder in a glass of warm water, then add 3 teaspoons of honey. 2. Mix 1/2 of ginger (fresh or powder) with 2 tablespoons of fresh lemon juice in a cup or glass of warm water, add 1 teaspoon of honey. 3. Add lemon to your food and salads. 4. Use dried lemon peel for making a tea, to have it twice a day.	Oral
68	Rutaceae	<i>Citrus reticulata</i> Blanco	lalengî	Fruits	Mix 1 cup of cow yogurt with 1/2 cup honey with 3 fresh mandarin oranges and drink before meal twice a day.	Oral
69	Rutaceae	<i>Citrus aurantiifolia</i> (Christm.) Swingle	limo besirh	Fruits	Boil 1 fruit with 1 cup of water, leave it for 15–20 min. Strain and drink it two times a day after meal for 3 days.	Oral.
70	Ranunculaceae	<i>Nigella sativa</i> L.	reşke (bereke) (zeytî bereke)	Seeds, oil	1. Mix 3 drops of black seed oil with 1 teaspoon of honey in a cup of warm water (You can add two tablespoons of apple cider vinegar). 2. Heat few drops of black seed oil and massage the chest, back and throat properly 3. Eat 1 teaspoon of black seed on 1 teaspoon of honey with empty stomach at morning	Oral, Dermal
71	Rhamnaceae	<i>Rhamnus alaternus</i> L.	sîdr yan wereqet sîdr	Bud and leaves	Boiled tablespoon of dried buckthorn or leaves and drink it twice a day for treating infection in your body. N.B: Rhamnus (buckthorn) treats sweating problems, helps in relaxation, solving sleeping problems & insomnia. It treats the psychological problems such as anxiety and tension during COVID-19 infection by the calming the nerve of the patient.	Oral
72	Rosaceae	<i>Malus pumila</i> Mill.	sirkeyi sêw (xellî sêw)	Fruit	Boil 3 cups of water, add 1 cinnamon stick, 1 peeled and smashed clove garlic, then add 1 tablespoon apple cider vinegar, finally place 1 tablespoon honey and stirring all ingredients.	Oral (drink a cup 3 times a day (before the meal, if you have a problem with your stomach then drink a cup of it after meals)
73	Solanaceae	<i>Capsicum annuum</i> L.	bîberî surî tîj	Fruits	Bring one cup of warm water, put a dash of cayenne pepper (1/8 of teaspoon), then add 1 teaspoon of apple cider vinegar, ¼ teaspoon of ginger, then add ¼ of turmeric (either fresh or powder), to it, you can add ½ lemon and 1 clove of smashed garlic, but it optional.	Oral (drink three times a day after each meal)
74	Salicaceae	<i>Salix alba</i> L.	darebî (şorre bî yan çnar)	Bark, Leaves	Boil bark in 4 cups of water for 30 min. N.B: The above recipe reduces the pain fever during COVID-19.	Oral (take 1 cup/3 times a day)
75	Theaceae	<i>Camellia sinensis</i> (L.) Kuntze	çayi kesk yan sewz	Leaves	Boil water and add 1/teaspoon of green tea leaves, then add 2 slices of fresh ginger, 1/2 lemon slice. Afterward, add 1/2 tablespoons of honey.	Oral (2/day 30 min before breakfast and dinner)

(Contd...)

TABLE 2
(CONTINUED)

S/N	Family	Scientific name	Vernacular name	Part used	Preparation	Administration
76	Urticaceae	<i>Urtica dioica</i> subsp. <i>afghanica</i> Chrtk	ruwekî gezgeze (xerekeçuze) zeytî gezn	Leaves, root, oil	1. Make a tea of boiled leaves or roots for 15 min. 2. Heat several drops of nettle oil and massage your body, chest, back, muscles, and joints before bedtime to reduce the pain and give good sleep during coronavirus infection. N.B; The above recipe will open the pulmonary airways. The oil has analgesic and anti-inflammatory properties, so the nettle and the oil extracted from it becomes an effective treatment for joint pain and various body infections	Oral (once a day)
77	Violaceae	<i>Viola odorata</i> L.	gulle weneşşe	Flowers, root	Grind 1 teaspoon of the dried leaves and roots together and put in a cup of boiling water and left before using for 3–5 h, then drink 1 cup twice a day till feel better.	Oral (2 times/day)
78	Vitaceae	<i>Vitis vinifera</i> L.	mêwjî tirê reş	Fruits	Mix dates+raisins+dried figs as following: Make a syrup consisting of 1 cup of dried dates, 1 cup grams of black raisins, and 1 cup of dried figs. Place this mixture in a pot, then add a liter (or 5 cups) of water, leave it on the fire to boil until the contents of the pot soften, then it is eaten by dividing into three after each meal during the day. N.B: This treatment can be used for cough, taking out phlegm, and lung and breathing problems during coronavirus infection. Moreover, the grape is mentioned in Holy Quran. *This recipe should not be used by diabetics	Oral (3 times/day)
79	Zingiberaceae	<i>Curcuma longa</i> L.	zerdeçû	Rhizomes	1. Add 1 tablespoon of turmeric powder to a cup of milk, stirring and boiling it, then drink once a day. 2. Mix the powder of turmeric with honey and make a paste.	Oral (3/day on an empty stomach)
80	Zingiberaceae	<i>Zingiber officinale</i> Roscoe	zencefil	Rhizome and Root	1. Boiling (Zingiber+Thyme+clove+saffron) then filtered it and drink the extract. 2. Mix 2 teaspoons of honey with 1/2 teaspoons of ginger powder or 1 teaspoon of fresh ginger and 1/2 teaspoons of turmeric with make a paste and eat it early morning before breakfast. 3. Boil 2 cups of water, put 1 tablespoon of fresh ginger or 3 teaspoons of ginger powder, add 3 teaspoons of fresh turmeric or 2 teaspoons of turmeric powder, mix them together, then squeeze 1/2 lemon, then add 1 tablespoon of apple cider, afterward add 1 teaspoon of honey.	Oral (twice a day)
81	Zingiberaceae	<i>Elettaria cardamomum</i> (L.) Maton	hil	The seeds, pods and the oil from the Seeds	1. Put 2–3 seed or one pod of cardamom in a boiled cup of water and honey in it, leave it for 10 min then drink it after taking out the cardamom seed/pods. 2. Mix 1/2 teaspoon of cardamom powder with a cup of boiled water and drink it with a bit of sugar or 1 teaspoon of honey. 4. Chewing a cardamom pod or seed for 30 min	Oral

S/N=Serial number

been said to be more effective in the past since secondary metabolites are formed largely before being transferred to other areas of the plant (Kankara, et al., 2015). Respondents in the study reported using a variety of techniques to prepare the medicinal plants (Table 2). Water, honey, yogurt, vinegar, and many other substances were used as a diluent in the preparation of different recipes of medicinal plant species (Table 2). The results revealed oral treatment as the most popular form of administration (92.9%, Table 2 and Fig. 5). However, the complexity of the disease explains why a combination of approaches and oral treatments proved the

most effective. The finding of the study is in line with other studies in the region and other parts of the world (Achour, et al., 2022; Megersa and Woldetsadik, 2022). According to the study's findings, respondents in the study region said that they prepared traditional herbal medicine using one, two, three, or more plant species, respectively (Table 2).

D. Quantitative Ethnobotany

A significant quantitative parameter describing the relative value of medicinal plant species in the management of COVID-19 in the research area. The RFC calculated for the

TABLE 3
QUANTITATIVE INDICES

S/N	Scientific name	RFC%	FL%
1	<i>Cuminum cyminum</i> L.	0.85	0.85
2	<i>Carum carvi</i> L.	0.6	0.7
3	<i>Ridolfia segetum</i> (L.) Moris	0.6	0.7
4	<i>Ammi visnaga</i> (L.) Lam.	0.9	0.82
5	<i>Petroselinum crispum</i> (Mill.) Fuss	0.7	0.4
6	<i>Pimpinella anisum</i> L.	0.85	0.85
7	<i>Foeniculum vulgare</i> Mill.	0.7	0.4
8	<i>Coriandrum sativum</i> L.	0.5	0.6
9	<i>Pistacia eurycarpa</i> Yalt.	0.85	0.85
10	<i>Rhus coriaria</i> L.	0.7	0.4
11	<i>Allium cepa</i> L.	0.6	0.7
12	<i>Allium sativum</i> L.	0.5	0.6
13	<i>Hoodia gordonii</i> (Masson) Sweet ex Decne.	0.8	0.7
14	<i>Phoenix dactylifera</i> L.	0.7	0.4
15	<i>Commiphora myrrha</i> (Nees) Engl.	0.9	0.82
16	<i>Boswellia sacra</i> Flueck.	0.8	0.5
17	<i>Brassica nigra</i> (L.) K. Koch	0.5	0.6
18	<i>Bellis perennis</i> L.	0.7	0.4
19	<i>Artemisia vulgaris</i> L.	0.6	0.7
20	<i>Saussurea costus</i> (Falc.) Lipsch.	0.9	0.82
21	<i>Taraxacum fontanum</i> Hand-Mazz.	0.5	0.6
22	<i>Chamaemelum nobile</i> (L.) All.	0.9	0.82
23	<i>Matricaria chamomilla tzvelevii</i> Pobed.	0.7	0.4
24	<i>Cercis siliquastrum</i> L.	0.5	0.6
25	<i>Trigonella foenum-graecum</i> L.	0.7	0.4
26	<i>Senna alexandrina</i> Mill.	0.8	0.5
27	<i>Glycyrrhiza glabra</i> L.	0.9	0.82
28	<i>Ceratonia siliqua</i> L.	0.5	0.6
29	<i>Acacia senegal</i> (L.) Willd.	0.9	0.82
30	<i>Quercus cerris</i> L.	0.7	0.4
31	<i>Mentha piperita</i> L.	0.8	0.5
32	<i>Glechoma hederacea</i> L.	0.5	0.6
33	<i>Ocimum tenuiflorum</i> L.	0.9	0.82
34	<i>Thymus vulgaris</i> L.	0.5	0.6
35	<i>Zataria multiflora</i> Boiss.	0.7	0.4
36	<i>Lavandula latifolia</i> Medik.	0.5	0.6
37	<i>Thymus serpyllum</i> L.	0.9	0.82
38	<i>Salvia officinalis</i> L.	0.5	0.6
39	<i>Clinopodium menthifolium</i> (Host) Stace	0.8	0.5
40	<i>Mentha spicata</i> L.	0.8	0.4
41	<i>Rosmarinus officinalis</i> L.	0.5	0.7
42	<i>Ocimum basilicum</i> L.	0.5	0.7
43	<i>Origanum majorana</i> L.	0.9	0.82
44	<i>Salvia hispanica</i> L.	0.7	0.5
45	<i>Rosmarinus officinalis</i> L.	0.5	0.7
46	<i>Melissa officinalis</i> L.	0.6	0.7
47	<i>Laurus nobilis</i> L.	0.8	0.5
48	<i>Cinnamomum verum</i> J.Presl	0.5	0.7
49	<i>Cinnamomum camphora</i> (L.) J.Presl	0.9	0.82
50	<i>Linum usitatissimum</i> L.	0.8	0.4
51	<i>Punica granatum</i> L.	0.7	0.5
52	<i>Ficus sycomorus</i> L.	0.6	0.7
53	<i>Morus alba</i> L.	0.8	0.4
54	<i>Eucalyptus globulus</i> Labill.	0.8	0.5
55	<i>Myrtus communis</i> L.	0.5	0.7
56	<i>Syzygium aromaticum</i> (L.) Merr. & L.M. Perry	0.8	0.4
57	<i>Azadirachta indica</i> A.Juss.	0.5	0.7
58	<i>Alcea kurdica</i> Alef.	0.6	0.7
59	<i>Hibiscus sabdariffa</i> L.	0.85	0.85
60	<i>Sphaeralcea angustifolia</i> (Cav.) G.Don	0.5	0.6

(Contd...)

TABLE 3
(CONTINUED)

S/N	Scientific name	RFC%	FL%
61	<i>Peganum harmala</i> L.	0.7	0.5
62	<i>Olea europaea</i> L.	0.8	0.5
63	<i>Masdevallia molossus</i> Rchb.f.	0.5	0.6
64	<i>Adiantum capillus-junonis</i> Rupr.	0.7	0.5
65	<i>Piper nigrum</i> L.	0.85	0.85
66	<i>Pinus sylvestris</i> L.	0.7	0.5
67	<i>Citrus limon</i> (L.) Osbeck	0.6	0.7
68	<i>Citrus reticulata</i> Blanco	0.7	0.5
69	<i>Citrus aurantiifolia</i> (Christm.) Swingle	0.85	0.85
70	<i>Nigella sativa</i> L.	0.7	0.5
71	<i>Rhamnus alaternus</i> L.	0.6	0.7
72	<i>Malus pumila</i> Mill.	0.85	0.85
73	<i>Capsicum annum</i> L.	0.9	0.82
74	<i>Salix alba</i> L.	0.5	0.6
75	<i>Camellia sinensis</i> (L.) Kuntze	0.9	0.5
76	<i>Urtica dioica</i> subsp. <i>afghanica</i> Chrtek	0.6	0.7
77	<i>Viola odorata</i> L.	0.9	0.82
78	<i>Vitis vinifera</i> L.	0.6	0.7
79	<i>Curcuma longa</i> L.	0.85	0.85
80	<i>Zingiber officinale</i> Roscoe	0.6	0.7
81	<i>Elettaria cardamomum</i> (L.) Maton	0.9	0.82

S/N=Serial Number

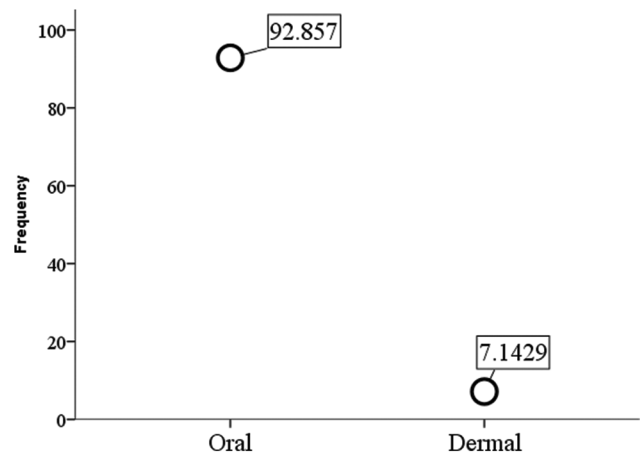


Fig. 5. Methods of administration of medicinal plants used in the area for the management of COVID-19.

different species ranged from 0.5 to 0.9, suggesting that the respondent made regular use of these plants. Whereas the FL value ranged from 0.4 to 0.85, revealing how effective the documented plant species are in the management of COVID-19 in the region. Consequently, high levels of RFC and FL in medicinal plants are suggestive of therapeutic efficacy and make them promising candidates for future, more in-depth studies (Kayfi and Abdulrahman, 2021; Mahmoud, et al., 2020).

E. Symptoms Considered by the Respondents

The primary signs and symptoms regarded by traditional herbalists as evidence of virus infection include breathing issues, obstructions of the airways brought on by mucus or phlegm, dizziness, fatigue, headache, fever, shortness of breath, insomnia, nausea, occasional vomiting, and diarrhea, cloudy

thinking, dementia, chest pain, digestive issues, sore throat, runny nose, muscle pain, chills, and eye redness (conjunctivitis). Since physical health has been harmed by the viral infection, patients' psychological conditions tend to be unstable, and they frequently experience anxiety, stress, and sadness.

IV. CONCLUSIONS AND RECOMMENDATIONS

This is the first study of its sort to document the medicinal application to the treatment of COVID-19 among the Kurdish people of Kurdistan, Iraq. Eighty-one plant species were identified with RFC and FL values that were employed for conventional COVID-19 management. Traditional practitioners and elders of the area are the keepers of the region's traditional knowledge. It is suggested in this study that these plants may be the subject of additional research, including phytochemical, toxicological, and clinical studies so that we can have a better understanding of the safety and efficacy of their dosages. The indigenous knowledge of medicinal plants and their use must be protected and preserved, and this can only be done if people are made aware of the importance of these plants. In addition, it's important to inspire the local population to work on conservation.

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