

Herbal Medicine Use and Attitudes during the COVID-19 Crisis in Libya: Cross-Sectional Study

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Abstract

Background: Herbal medicine is widely used worldwide to alleviate COVID-19 symptoms and boost the immune system. This study examined the general attitudes toward herbal medicine (HM) and its use during the COVID-19 pandemic in Libya.

Materials and Methods: A descriptive study with a cross-sectional design was conducted in Libya between 9 February and 9 August 9, 2022. This study used a questionnaire distributed via Google Forms. The collected Data were transferred into a Microsoft Excel sheet and then exported to the R statistical computing platform (version 4.2.1). A descriptive statistical analysis and Chi-square test were performed with a significance level set at $p < 0.05$.

Results: About 69% of study participants agreed that herbal medicine is natural and safe. 36% of participants believe that herbal medicine works better than conventional drugs. Most participants (73%) used HM during the COVID-19 pandemic. The most informative source about HM was Family and friends (67%), followed by local herbalists (14%), and only 08% asked pharmacists about HM before using it. HM's most common influencers and prescribers were family and friends (41.5%). The most frequently used HM were lemon and honey (17%), followed by thyme (15%), Indian costus (12%), ginger (11%), clove (10%), garlic (7%), and cinnamon (6%). Moreover, most symptoms that were relieved after using HM were respiratory symptoms (53.2%).

Conclusions: Many individuals perceive herbal medicine as a safer alternative to conventional pharmaceuticals, attributing this belief to its natural origins and the generally fewer side effects associated with its use. In the context of the COVID-19 pandemic, there has been considerable reliance on medicinal plants to help alleviate various symptoms linked to the virus. However, raising awareness about the proper use of herbal medicine with proper professional consultation is required to ensure the public health and safety.

Keywords

Herbal Medicine, Covid-19, Libya.

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Introduction

The COVID-19 pandemic has caused significant global socioeconomic disruption, resulting in a concerning number of deaths and health complications.¹ In December 2019, an outbreak of pneumonia linked to a novel coronavirus, COVID-19, was identified in Wuhan, Hubei Province, China. This infectious disease, caused by the SARS-CoV-2 virus, rapidly spread across the globe.² On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a pandemic, emphasizing the urgent need for global action and solidarity in addressing this unprecedented health crisis. This declaration was made in response

to the virus's rapid transmission and rising infection rates worldwide.³

The Libyan government reported its first confirmed case of COVID-19 on March 25, 2020. By August 3, 2022, the country's total number of confirmed cases had reached 505,386. Among these cases, 490,000 individuals recovered, while the total number of fatalities stood at 6,431.⁴ COVID-19 elicits an inflammatory immune response characterized by the release of inflammatory cytokines. This immune response can lead to a dysregulated cytokine storm, significantly increasing the risk of respiratory distress symptoms and

dysfunction of multiple organs.⁵

Due to the lack of effective therapeutic interventions for COVID-19, health authorities worldwide implemented various preventive procedures to reduce the virus transmission. These procedures included quarantine protocols, restriction on social gatherings, and the consistent use of face masks. In the Eastern and Middle Eastern regions, the use of herbal and complementary medicine gained popularity as a common approach to strengthening immunity and protecting against COVID-19 infection.^{6,7} Although empirical evidence supporting the efficacy of herbal supplements in managing viral infections, including COVID-19, remains limited, their use is still prevalent in many countries, especially in East Asia.⁵ The distinctive characteristics of various populations have highlighted a strong reliance on medicinal plants, natural products, and herbal formulations with antiviral and anti-inflammatory properties, often used to boost the immune system and respiratory illnesses.^{5,8} Furthermore, several countries, including China, India, Morocco, Saudi Arabia, Nepal, Peru, Tanzania, Vietnam, and Brazil, have employed traditional medicine as a complementary approach in combating COVID-19.⁹⁻¹⁸ Herbal medicine (HM) remains widely used, yet its safety and effectiveness require further study. Understanding its prevalence and perception can help shape healthcare policies and integrate evidence-based herbal treatments into modern medicine.

HM has demonstrated potential in alleviating the effects of infectious diseases, including SARS-CoV-2. Specifically, herbal remedies with documented anti-inflammatory properties may play a vital role in the treatment of COVID-19 by reducing inflammatory markers such as interleukin (IL)-6, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and tumor necrosis factor (TNF- α). These markers are associated with severe disease manifestations, particularly in the context of a cytokine storm cases.¹⁹ Thus, controlling the excessive inflammatory response triggered by COVID-19 may be essential in reducing the disease severity.²⁰ Combining herbal medicine with modern medical treatments for COVID-19 has led to several recommendations for herbal therapy.²¹

Due to the antiviral properties of many herbal medicines, their therapeutic potential should not be overlooked. Established herbal medicines with known antiviral effects are increasingly used as complementary treatments to help suppress SARS-CoV-2, given that conventional therapies have not yet achieved complete efficacy.⁵ Herbal practice involves medicinal herbs, infusions, standardized medicines, and phytopharmaceuticals. Some medical plants used in treating COVID-19 include turmeric, ginger, curcuma, guava, and Meniran.^{17,22}

The (WHO) and the European Medicines Agency (EMA) recognize several medicinal plants, such as garlic, echinacea, eucalyptus, anise, and ginger, for their evidence-based potential in treating infections.²³

In traditional Libyan medicine, herbal remedies are commonly used to treat chronic or incurable diseases.^{24,25} Consequently, the use of natural remedies was anticipated to rise among the Libyan population during the COVID-19 outbreak, particularly in the early stages when no effective treatment or vaccine was available. To the best of the authors' knowledge, no prior research has examined the natural remedies used by the Libyan population during the COVID-19 outbreak. Therefore, this study aims to assess the prevalence of herbal medicine use during the COVID-19 outbreak in Libya and identify the most frequently used herbal remedies for treating and preventing COVID-19. By exploring public reliance on herbal treatments, this research provides valuable insight into their role in healthcare, helping policymakers and healthcare professionals understand their significance and potential integration into future pandemic preparedness strategies.

MATERIALS AND METHODS

Study Design and Study Population

A descriptive cross-sectional study was conducted in Libya from February 9 to August 9, 2022. The information was gathered through an online survey using Google Forms, adapted from previously published studies,^{11,13} and consisting of three sections with 21 questions. The first section includes the demographic characteristics of the participants, the second section evaluates people's knowledge and attitude toward HM, and the third section considers the utilization of HM during the COVID-19 outbreak. Moreover, Open-ended questions were added to enable participants to provide responses not covered in the questionnaire. The questionnaire was translated from English into Arabic and underwent validation by experts to confirm the questions' clarity, content appropriateness, and readability. A final version of the questionnaire was tested on 100 participants. It should be noted that the participants from the pilot study were not part of the primary research.

Sample Size and Data Collection

The study population included individuals of different ages, from both sexes, with varying levels of education, and from various geographical areas. The Raosoft sample size calculator (<http://www.raosoft.com/samplesize.html>) was utilized to determine the sample size, taking into account the total population of Libya, which is approximately 6,812,341 (according to the General Authority for Statistics in Libya, 2022). To attain a 5% margin of error and a 95% confidence interval, the minimum sample size necessary for this study

was found to be 385 participants. The online questionnaire was sent via social media platforms (Telegram®, Twitter, Facebook®, Instagram®), and 1000 respondents were collected to minimize the errors and increase the study's reliability.

Statistical Analysis

The gathered data were imported into a Microsoft Excel spreadsheet, where they were reviewed, coded, and subsequently exported to R version 4.2.1. A descriptive statistical analysis was conducted, along with a Chi-square test, with a significance threshold established at $p < 0.05$. A descriptive analysis was carried out for categorical (demographic) variables to display the frequency and percentage of each response. The bivariate analysis utilized the chi-square test to assess the relationship between the variables under investigation.

RESULTS

Sociodemographic Characteristics of the Study Participants

The study analyzed responses from 959 participants, the majority of whom were female (68.9%). Most had a university degree (78.7%), while 9.6% held a higher degree. The age distribution showed that 63.4% were between 21 and 30 years old. Additionally, 44.6% of respondents resided in Zawia City, Libya and 22.7% in Tripoli (Data not shown). Table 1 presents a comprehensive overview of the participants' sociodemographic characteristics based on their use of herbal medicine during the COVID-19 pandemic. The estimated prevalence of HM use, based on participants who answered "Yes" to the question, "Have you used herbal medicine remedies during the COVID pandemic?" was 73.6%. There was a statistically significant difference between herbal users and non-users in terms of marital status and employment status (Table 1).

Table 1. Sociodemographic characteristics of the study participants (n=959) based on the use of Herbal Medicine (HM) during the period of the COVID pandemic.

	Overall (N=959)	HM users (N=706)	HM non-users (N=253)	P-value
Gender				
Male	281 (29.3%)	207 (29.3%)	74 (29.2%)	> 0.05
Female	669 (69.8%)	491 (69.5%)	178 (70.4%)	
Missing	9 (0.9%)	8 (1.1%)	1 (0.4%)	
Age Groups (years)				
< 20	173 (18.0%)	122 (17.3%)	51 (20.2%)	> 0.05
20-30	606 (63.2%)	438 (62.0%)	168 (66.4%)	
30-40	112 (11.7%)	95 (13.5%)	17 (6.7%)	
40-50	52 (5.4%)	38 (5.4%)	14 (5.5%)	
50-60	16 (1.7%)	13 (1.8%)	3 (1.2%)	
Level of Education				
High School or Lower	28 (2.9%)	22 (3.1%)	6 (2.4%)	> 0.05
Colleges	72 (7.5%)	55 (7.8%)	17 (6.7%)	
Undergraduate	758 (79.0%)	546 (77.3%)	212 (83.8%)	
Postgraduate	91 (9.5%)	75 (10.6%)	16 (6.3%)	
Missing	10 (1.0%)	8 (1.1%)	2 (0.8%)	
Marital Status				
Single	640 (66.7%)	452 (64.0%)	188 (74.3%)	0.001
Married	296 (30.9%)	239 (33.9%)	57 (22.5%)	
Divorced	11 (1.1%)	8 (1.1%)	3 (1.2%)	
Widowed	8 (0.8%)	3 (0.4%)	5 (2.0%)	
Missing	4 (0.4%)	4 (0.6%)	0 (0%)	
Employment Status				
Housewife	24 (2.5%)	17 (2.4%)	7 (2.8%)	0.009
Unemployed	73 (7.6%)	55 (7.8%)	18 (7.1%)	
Working	304 (31.7%)	245 (34.7%)	59 (23.3%)	
Retired	6 (0.6%)	5 (0.7%)	1 (0.4%)	
Student	546 (56.9%)	378 (53.5%)	168 (66.4%)	
Missing	6 (0.6%)	6 (0.8%)	0 (0%)	
Income Status (LYD)				
< 1000	509 (53.1%)	372 (52.7%)	137 (54.2%)	> 0.05
1000-3000	234 (24.4%)	178 (25.2%)	56 (22.1%)	
> 3000	38 (4.0%)	32 (4.5%)	6 (2.4%)	
Missing	178 (18.6%)	124 (17.6%)	54 (21.3%)	

Participants' Attitudes Regarding Herbal Medicines (HM)

The data in Table 2 shows that 68.8% of study participants agreed that herbal medicine is safe because it is natural, with a significantly higher percentage among HM users (73.2%) compared to 57.3% of non-users ($P < 0.001$). The study also showed that (36%) of participants believed that herbal medicine works better than conventional drugs. In comparison (28.6%) disagreed, and (35.4%) were neutral, with a statistically significant difference between HM users and non-users ($P < 0.001$). Most study participants (69.7%) agreed that herbal medicine has fewer side effects than conventional drugs, with a greater proportion of HM users (71.7%) than 63.6% of non-users ($P = 0.04$). Furthermore, most participants (86.2%), both HM users and non-users, stated that herbal medicine is effective for minor health conditions ($P = 0.5$), while only 19.6% of respondents believed that HM is effective for major illnesses with 22.1% of HM users agreeing compared to 12.6% of non-users ($P = 0.004$). A significantly higher proportion of HM users (70.4%) were satisfied with the outcomes of HM use, compared to only 45.8% of non-users ($P < 0.001$) (Table 2).

Characteristics of Herbal Medicine use during COVID-19 among respondents

Table 3 showed the key characteristics of herbal medicine use among the study participants, with 73.6% respondents reporting using HM during the COVID-19 pandemic, while 26.4% did not. Among HM users ($n = 706$), the most common reason for using HM was recommendation from relatives and friends (25.1%), followed by past personal experience (22.5%) and impact of social media/internet (13.6%). Furthermore, 10.7% of users were influenced by healthcare professionals, while only 0.9% reported using HM due to diminished confidence in modern medicine. In addition, HM users reported that the most common source of information regarding the use of herbal medicine were family and friends (67%), followed by spices dealers (14%), medical doctors (10%) and pharmacists (08%) as summarized in Figure 1A, and the most common source for obtaining herbal medicine were from Spices dealers (52%), and what is available at home (34%) (Figure 1B). Furthermore, respiratory symptoms showed the most improvements, a symptom (53.2%) that improved most frequently after HM use among HM users, and notable improvements in fever and headache (17.7%) symptoms, and gastrointestinal symptoms (15.9%) were also observed in Table 3.

Table 2. Participants' ($n=959$) attitudes toward herbal medicine (HM) stratified by their use of HM during the COVID-19 pandemic.

	Overall ($n=959$)	HM users ($n=706$)	HM non-users ($n=253$)	P-value
HM are natural, so it is considered safe				
Agree	662 (69.0%)	517 (73.2%)	145 (57.3%)	< 0.001
Disagree	84 (8.8%)	51 (7.2%)	33 (13.0%)	
Neutral	213 (22.2%)	138 (19.5%)	75 (29.6%)	
HM better than conventional Drugs				
Agree	345 (36.0%)	273 (38.7%)	72 (28.5%)	< 0.001
Disagree	271 (28.3%)	177 (25.1%)	94 (37.2%)	
Neutral	343 (35.8%)	256 (36.3%)	87 (34.4%)	
Less side effect from using HM comparing to conventional Drugs				
Agree	667 (69.6%)	506 (71.7%)	161 (63.6%)	0.04
Disagree	114 (11.9%)	75 (10.6%)	39 (15.4%)	
Neutral	178 (18.6%)	125 (17.7%)	53 (20.9%)	
HM effective for treating minor sicknesses				
Agree	829 (86.4%)	613 (86.8%)	216 (85.4%)	0.5
Disagree	31 (3.2%)	20 (2.8%)	11 (4.3%)	
Neutral	99 (10.3%)	73 (10.3%)	26 (10.3%)	
HM effective for major sicknesses				
Agree	188 (19.6%)	156 (22.1%)	32 (12.6%)	0.004
Disagree	492 (51.3%)	347 (49.2%)	145 (57.3%)	
Neutral	279 (29.1%)	203 (28.8%)	76 (30.0%)	
Satisfied with the outcome of using HM				
Yes	613 (63.9%)	497 (70.4%)	116 (45.8%)	< 0.001
No	49 (5.1%)	20 (2.8%)	29 (11.5%)	
Neutral	297 (31.0%)	189 (26.8%)	108 (42.7%)	

Table 3. Characteristics of herbal medicine use during COVID-19 pandemic among respondents (n=959).

Item	n (%)
HM use during COVID-19 pandemic (n = 959)	
Yes	706 (73.6%)
No	253 (26.4%)
Reasons for using HM among HM users (n = 706) *	
Suggestion from healthcare professionals	171 (10.7%)
Recommendations from relatives and friends	402 (25.1%)
Impact of social media, the internet	218 (13.6%)
Past personal experience	359 (22.5%)
Low cost	45 (2.8%)
Natural	119 (7.4%)
Easy access and availability	128 (8.0%)
Less side effects	138 (8.6%)
Diminished confidence in modern medicine	15 (0.9%)
The symptoms that most frequently showed improvement following the use of HM	
Respiratory Symptoms	464 (53.2%)
Fever and headache	163 (18.7%)
Gastrointestinal Symptoms	139 (15.9%)
All above	105 (12.0%)
Reasons for not using HM among non-users (n = 253) *	
Prolonged duration is required to observe effects.	42 (11.0%)
Not effective	21 (5.5%)
Not safe	13 (3.4%)
Difficult to reach, limited availability.	19 (5.0%)
Don't have enough experience, knowledge	67 (17.5%)
Bad taste	21 (5.5%)
I am in good health, and I do not require it.	76 (19.8%)
Lack of scientific proof regarding their application.	36 (9.4%)
Insufficient expert guidance on utilization.	42 (11.0%)
Prefer using conventional medication	41 (10.7%)

Additionally, the study results showed that the most common reason for not using HM among non-HM users (n =253), was the good health so no need to use it (19.8%) and the lack of experience or knowledge (17.5%), and 11.0% cited concern over the prolonged required time to observe effectiveness, while 10.7% preferred conventional medicine (Table 3).

Furthermore, Figure 2 presents the frequency of the most common herbal remedies used among HM users (n =706) during the COVID-19 pandemic. The most used herbal remedy was Lemon and Honey (17%), followed by Thyme (15%), Costus (12%), Ginger (11%), Cloves (10%), Garlic (7%), and Cinnamon (6%).

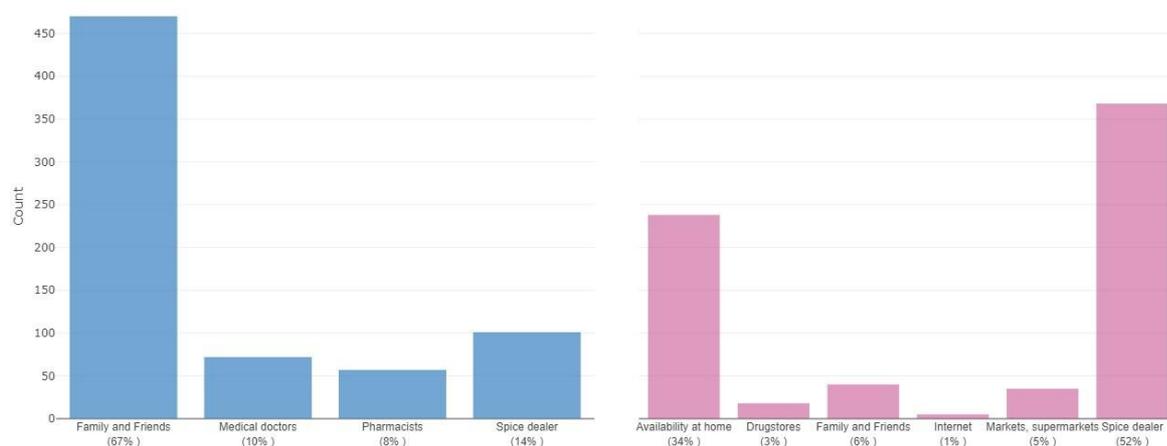


Figure 1. (A) Bar plot shows the distribution of the most frequent information sources and guide for using herbal medicine among HM users (n = 706) of the study respondents. (B) Bar plot shows the distribution of the most common source to obtain the herbal remedies to be used as HM among HM users (n =706) during the period of the COVID-19 pandemic.

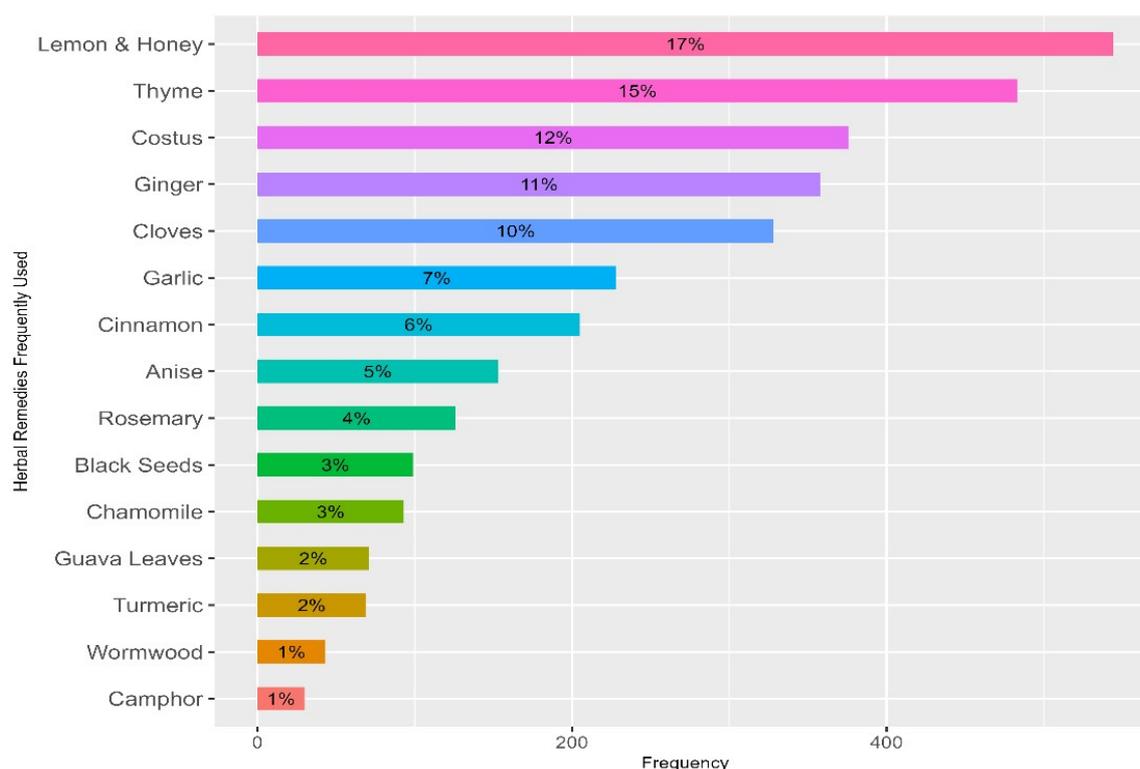


Figure 2. The most frequently used herbal remedies during the COVID-19 pandemic among HM users (n = 706). Lemon (*Citrus limon* L Osbeck), honey (*Apice* L), ginger (*Zingiber officinal* Roscoe L), cloves (*Eugenia caryophyllata* Thunb.L), garlic (*Allium sativa* L), cinnamon (*Cinnamomum zeylanicum* Blume L), wormwood (*Artemisia annua* L), black seed (*Nigella sativa* L), thyme (*Thymus vulgaris* L), anise (*Pimpinella anisum* L), turmeric (*Curcuma* L), chamomile (*Matricaria recutita* L), rosemary (*Rosmarinus officinalis* L), camphor (*Cinnamomum camphora* L), Costus (*Saussurea costus* L), guava leaf (*Psidium guajava* L).

DISCUSSION

COVID-19 is a significant respiratory disease caused by the coronavirus, also known as SARS-CoV-2. The virus spreads rapidly through close interactions and was declared a global pandemic by the WHO in December 2019.^{3,15} In response, the Libyan government implemented various measures to mitigate the impact of COVID-19, primarily by promoting vaccination.²⁶ As of August 3, 2022, Libya had reported 505,386 confirmed cases, with 490,000 recoveries and 6,431 deaths.⁴

Currently, no specific medication has been identified as an effective treatment for COVID-19. Patient care primarily focuses on symptom management.²⁷ In addition, Research is ongoing to assess the safety and effectiveness of potential treatments for treating SARS-CoV-2 infection.¹⁷ Notably, herbal remedies with antiviral properties have been considered as supplementary treatments to help control the virus and alleviate respiratory symptoms.⁹ Herbal medicine has long been a part of Libyan culture.²⁸ Individuals with a positive attitude toward it often turn to natural remedies for health concerns. This study found that 69% of participants believed herbal medicine is natural, safe, and has fewer side effects than conventional medications.

Various herbal plants are currently being studied for their potential role in preventing and treating COVID-19 infections. Current guidelines for managing SAR-COV-2 infections emphasize self-isolation, rest, hydration, and the use of antipyretics to manage fever. Supplementary herbal treatments require careful consideration of risks and benefits, particularly for herbs suggested for respiratory illnesses.²³ However, allergic reactions and digestive issues are common side effects of herbal treatments, and herb-drug interaction remains a significant concern and a public health issue. Therefore, herbal remedies should only be taken according to the dosage recommended by healthcare professionals.¹¹

Although pharmacists are the primary healthcare providers with knowledge of herbal medicine and its effects on the human body, only 6% of respondents consulted a pharmacist before using herbal medicine. Instead, most participants relied on family and friends for information about herbs and natural products. Similar results were observed in Saudi Arabia,¹⁷ whereas individuals in the United States of America and European countries primarily gathered information about herbal products from online sources during the pandemic. However, the accuracy

and reliability of these sources remain questionable, raising concerns about the potential misuse of herbal medicines and public safety.²⁹ Public awareness initiatives that focus on identifying trustworthy sources of medical information could improve individuals' understanding of herbal medicine's benefits and risks.

Data from 706 respondents who used herbal medicine showed that the most commonly consumed remedies were lemon and honey (17%), similar to findings from Saudi Arabia.²⁰ These were followed by thyme (15%), then Indian costus (12%), ginger (11%), clove (10%), garlic (7%) and cinnamon (6%). Previous studies have suggested that honey, lemons, ginger, and garlic may strengthen the immune system and enhance immunity.¹⁷ One study demonstrated that lemon essential oils and their compounds act as natural antiviral agents, potentially preventing SARS-CoV-2 from entering the human body.³⁰ Another in-silico study found that ginger contains phytochemical compounds that may help lower viral load and clear SARS-CoV-2 from nasal passages.³¹ Additionally, an in vivo study found that garlic oil extract reduced serum TNF- α , ICAM-1, and immunoglobulin levels, enhancing immune system activity.⁹

However, further extensive studies are necessary to confirm the efficacy and safety of herbal treatments for SARS-CoV-2 before being recommended as preventive or alternative measures for COVID-19 infections. Regarding using herbal plants to alleviate COVID-19 symptoms, this study found that the most commonly improved symptoms after herbal medicine were respiratory symptoms (53.2%), aligning with findings from studies conducted in Casco, Peru,⁹ and Vietnam.¹¹

CONCLUSION

This study indicates that the public perception of herbal medicine (HM) is highly positive. A majority of Libyans consider HM safer and believe it has fewer side effects compared to traditional medications. The belief that HM is entirely safe may lead to self-medication, improper dosing, or drug interactions, highlighting the need for public education on the risks. Lemon with honey is the most commonly used herbal remedy, followed by thyme and Indian costus, primarily for treating colds. Medicinal plants are also widely used to alleviate various COVID-19 symptoms. While herbal remedies may offer some preventive benefits against COVID-19, they are not a sufficient solution to combat the pandemic. Public health authorities should raise awareness about the proper use of herbal medicine, stressing the need for professional consultation before its use in COVID-19 management or other health problems. However, scientists can explore natural products to identify phytochemicals with potential antiviral properties against SARS-CoV-2. Establishing the efficacy and safety

of herbal medicines is crucial, particularly for individuals with chronic conditions, to ensure their appropriate use during the COVID-19 infection. Public health strategies should integrate evidence-based herbal medicine into healthcare, ensuring scientific validation, regulation, and professional oversight to maximize benefits and minimize risks, especially for those with chronic conditions.

REFERENCES

1. Clemente-Suárez VJ, Navarro-Jiménez E, Moreno-Luna L, Saavedra-Serrano, M.C., Jimenez, M, Simón, J.A, et al. The impact of the covid-19 pandemic on social, health, and economy. *Sustainability* (Switzerland). 2021;13, 6314.
2. Dhar Chowdhury S, Oommen AM. Epidemiology of COVID-19. *J Dig Endosc*. 2020;11:03-07.
3. Cucinotta D, Vanelli M. WHO declares COVID-19 a pandemic. *Acta Biomedica*. 2020;91:157-160.
4. Daw MA, El-Bouzedi AH, Ahmed MO, Alejenez AA. The epidemiological characteristics of covid-19 in libya during the ongoing-armed conflict. *Pan Afr Med J*. 2020;37:1-10.
5. Demeke CA, Woldeyohanins AE, Kifle ZD. Herbal medicine use for the management of COVID-19: A review article. *Metabol Open*. 2021;12:100141.
6. Ayouni I, Maatoug J, Dhoub W, Zammit N, Fredj SB, Ghammam R, et al. Effective public health measures to mitigate the spread of COVID-19: a systematic review. *BMC Public Health*. 2021; 21:1015.
7. Ang L, Song E, Hu XY, Lee HW, Chen Y, Lee MS. Herbal Medicine Intervention for the Treatment of COVID-19: A Living Systematic Review and Cumulative Meta-Analysis. *Front Pharmacol*. 2022;13 : 906764.
8. Tolouian A, Khosravian M, Haghi HR, Bolourian A, Mojtahedi Z, Asgharpour M. Herbal medicines in the treatment of coronavirus disease 2019 (Covid-19). *J Nephroarmacol*. 2021;10 : e18.
9. Villena-Tejada M, Vera-Ferchau I, Cardona-Rivero A, Zamalloa-Cornejo R, Quispe-Florez M, Frisancho-Triveño Z, 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, 22;16:e0257165.
10. Mlozi SH. The role of natural products from medicinal plants against COVID-19: traditional medicine practice in Tanzania. *Heliyon*. 2022;8 :e09739.
11. Nguyen PH, Tran V De, Pham DT, Dao TNP, Dewey RS. Use of and attitudes towards herbal medicine during the COVID-19 pandemic: A cross-sectional study in Vietnam. *Eur J Integr Med*. 2021;44.
12. Abdullah Alotiby A, Naif Al-Harbi L. Prevalence of using herbs and natural products as a protective measure during the COVID-19 pandemic among the Saudi population: an online cross-sectional survey. *Saudi Pharm J*. 2021;29:410-417.
13. Kurniasih TR, Juwita I. The Use of Herbal Medicine Among Sleman Residents during COVID-19 Pandemic. *IJMRAP*. 2021;4:78-81.

14. Zaidi SF, Saeed SA, Khan MA, Khan A, Hazazi Y, Otayn M, et al. Public knowledge, attitudes, and practices towards herbal medicines; a cross-sectional study in Western Saudi Arabia. *BMC Complement Med Ther.* 2022;22 :326.
15. Khadka D, Dhamala MK, Li F, Aryal PC, Magar PR, Bhatta S, et al. The use of medicinal plants to prevent COVID-19 in Nepal. *J Ethnobiol Ethnomed.* 2021;17 :26.
16. Phumthum M, Nguanchoo V, Balslev H. Medicinal Plants Used for Treating Mild Covid-19 Symptoms Among Thai Karen and Hmong. *Front Pharmacol.* 2021;12 :699897.
17. Alnajrany SM, Asiri Y, Sales I, Alruthia Y. The commonly utilized natural products during the COVID-19 pandemic in Saudi Arabia: A cross-sectional online survey. *Int J Environ Res Public Health.* 2021;18 :4688.
18. Chaachouay N, Douira A, Zidane L. COVID-19, prevention and treatment with herbal medicine in the herbal markets of Salé Prefecture, North-Western Morocco. *Eur J Integr Med.* 2021;42 : 101285.
19. Li C, He Q, Qian H, Liu J. Overview of the pathogenesis of COVID-19 (Review). *Exp Ther Med.* 2021;22 :1011.
20. AKBULUT S. Medicinal Plants Preferences for the Treatment of COVID-19 Symptoms in Central and Eastern Anatolia. *Kastamonu Üniversitesi Orman Fakültesi Dergisi.* 2021;21:196-207.
21. Ang L, Song E, Lee HW, Lee MS. Herbal medicine for the treatment of coronavirus disease 2019 (COVID-19): A systematic review and meta-analysis of randomized controlled trials. *J Clin Med.* 2020;9:1-20.
22. Panyod S, Ho CT, Sheen LY. Dietary therapy and herbal medicine for COVID-19 prevention: A review and perspective. *J Tradit Complement Med.* 2020;10:420-427.23.
23. Silveira D, Prieto-Garcia JM, Boylan F, Estrada O, Fonseca-Bazzo YM, Jamal CM, et al. COVID-19: Is There Evidence for the Use of Herbal Medicines as Adjuvant Symptomatic Therapy? *Front Pharmacol.* 2020, 23;11:581840.
24. Louhaichi M, Salkini AK, Estita HE, Belkhir S, Belkhir. Initial Assessment of Medicinal Plants Across the Libyan Mediterranean Coast. *Adv Environ Biol.* 2011;5:359-370.
25. Ashur ST, Shah SA, Bosseri S, Shamsuddin K. Use of Traditional Medicine among Type 2 Diabetic Libyans. 23.; 2017.
26. El Oakley R, El Saeh H. Guest Editorial. 2021;6:1-5.
27. Health Organization W. Guideline Clinical Management of COVID-19: Living Guideline.; 2023. <http://apps.who.int/bookorders>.
28. El-Mokasabi FM. The State of the Art of Traditional Herbal Medicine in the Eastern Mediterranean Coastal Region of Libya. *Middle-East Journal of Scientific Research.* 2014;21:575-582.
29. Abogmaza AF, Keer KF, Takrizzah AA, Yahya EB. A Review on the Medicinal and Aromatic Plants Growing in Libya and Their Therapeutic Properties . 2020;2:327-334.
30. Senthil Kumar KJ, Vani MG, Wang CS, Chen CC, Chen YC, Lu LP, et al. Geranium and Lemon Essential Oils and Their Active Compounds Downregulate Angiotensin-Converting Enzyme 2 (ACE2), a SARS-CoV-2 Spike Receptor-Binding Domain, in Epithelial Cells. *Plants (Basel).* 2020 19;9:770.
31. Kritis P, Karampela I, Kokoris S, Dalamaga M. The combination of bromelain and curcumin as an immune-boosting nutraceutical in the prevention of severe COVID-19. *Metabol Open.* 2020;8:100066.