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Original Article

An Investigation on Use of Traditional Medicine during COVID-19 and Post-COVID-19

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Abstract

Background: The COVID-19 pandemic has emerged as one of the most significant health challenges in the 21st century, affecting millions worldwide. It was caused by the SARS-CoV-2 virus. This pandemic underscores the severe threats that infectious diseases can impose, regardless of a country's technological advancement. **Objective**: This research aims to understand the role and impact of traditional medicine in its treatment. **Methods**: The study employed a quantitative cross-sectional design and focused on a sample of 450 adults who had been diagnosed with COVID-19. Participants were chosen based on specific criteria through an online survey. The research spanned from July 5th to August 7th, 2021. **Results:** The findings revealed that in Libya, traditional remedies, particularly medicinal plants, were occasionally employed in treating COVID-19. Significantly, these natural remedies were found effective in managing respiratory symptoms associated with COVID-19. Notably, honey, Indian costus, ginger, turmeric, and moringa showed a positive correlation in treating respiratory complications. **Conclusion:** The research indicated a trend where younger respondents leaned more toward using a diverse range of plants for disease prevention. Additionally, it was observed that individuals with a lower income were more inclined to use various plants for treatment purposes. This study emphasizes the potential role of traditional remedies in managing and mitigating some of the symptoms of COVID-19.

Keywords: *COVID-19, Libya, SARS-CoV-2, Traditional Medicine*

Introduction

The SARS coronavirus species is the source of the zoonotic viral respiratory disease, commonly referred to as severe acute respiratory syndrome (SARS). The initial strain is known as SARS-CoV, sometimes known as SARS-CoV-1 or severe acute respiratory syndrome coronavirus. Late in 2017, research headed by Chinese scientists determined that the virus originated in cave-dwelling horseshoe bats and spread to humans through intermediate hosts such as Asian palm civets (Singhal, 2020; Elengoe, 2020a). At its height in June 2003, there were 8,422 confirmed cases of SARS, and the case fatality rate was 11%. Since 2004, there have been no newly reported cases of SARS-CoV-1 infection, marking the end of the outbreak. The new SARS-CoV-2 virus that caused the COVID-19 pandemic has caused unheard-of health and economic unrest throughout the world (Ansar, 2020). The World Health Organisation reported more than 200 million confirmed cases and four million deaths worldwide as of August 7, 2021. SARS-CoV-2 is a wrapping RNA virus that is part of the Nidovirales order and family of coronaviruses. Its virulence is increased by its striking genetic similarities to bat coronaviruses and respiratory secretions, as well as by contact with contaminated surfaces to a lesser degree (Elengoe, 2020b).

With the globe marking the first anniversary of the COVID-19 pandemic, it is clear how difficult it is to

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create an effective antiviral against SARS-CoV-2 (Chatki & Tabassum, 2021). The development of therapeutic solutions is complicated by the infectious nature of the virus and the disease's progression. Timely antiviral administration in public health scenarios is complicated by the fact that research modeling the virus's life cycle highlights the crucial importance of early antiviral intervention to curb infection and protect host cells. This intervention coincides with the timeline of symptom manifestation and peak viral loads (Goncalves *et al*., 2020).

It takes a long time to develop herbal medicines that meet therapeutic requirements for efficacy and consistency since plants naturally vary in their phytochemical makeup, which is further influenced by agronomic factors (Vitale *et al*., 2022). Compared to single-entity synthetic medications, many botanicals have several natural elements, making standardization of them more difficult (Das *et al*., 2016). Therefore, there is little chance that novel herbal remedies will be developed in the midst of severe health emergencies like the COVID-19 epidemic. Drug repurposing, including remdesivir, has been the standard approach because emergencies usually call for the prompt endorsement of therapeutic medicines with established safety profiles and proven potential efficacy (Singh *et al*., 2020; Eastman *et al*., 2020). This accelerated process may also be used for natural goods, provided that each formulation-even when derived from the same botanical sources-is distinct.

The investigation of alternative therapeutics has been spurred by the lack of a generally approved antiviral treatment for COVID-19, which can result in severe diseases such as ARDS and MODS. In China, Traditional Chinese Medicine (TCM) has been used for millennia to control epidemics. These days, it is used in conjunction with Western therapy to lower mortality and treat viral pneumonia, particularly infections brought on by earlier coronavirus strains like SARS and MERS. Furthermore, the preventive potential of Ayurvedic methods against COVID-19 has been recognized. These methods make use of natural compounds such as chyawanprash, golden milk, kadha, and Guduchi (Prajapati *et al*., 2022)

Interestingly, it is hypothesized that components in ashwagandha, tulsi, and guduchi interact with the ACE-2 receptor, which is essential for SARS-CoV-2 infection, implying a supportive function for these plants in treatment plans (Español *et al*., 2021). Amidst the pandemic, there has been a surge in interest in herbal and complementary remedies in Libya, a country renowned for its extensive history of traditional and alternative medicine. The scientific community studying biomedicine is currently evaluating how effective these conventional approaches are in fighting COVID-19, which is consistent with a global trend toward combining these treatments with accepted treatment regimens. Strong immune systems are essential for maintaining health and protecting the body from infections such as COVID-19. The virus has the ability to mutate, which undermines the long-term effectiveness of vaccines and treatments. Based on observations, it appears that the more restrained spread in India could be related to the widespread use of natural immune boosters. These native ways of strengthening immunological competency place a strong emphasis on implementing inclusive health initiatives to strengthen defenses against the rapidly changing viral ecology (Gajewski *et al*., 2021).

Anand *et al*. (2021) have shown that in silico research investigating the antibacterial activity of specific botanicals has suggested that neem may have antiviral properties against SARS-CoV-2. Although the FDA has approved the antiviral medication Remdesivir for use in hospitalized COVID-19 patients, research is still being done to see how it affects survival rates (Elsawah *et al*., 2021; Garibaldi *et al*., 2021). Remdesivir is thought to prevent the virus from replicating by prematurely stopping the synthesis of viral RNA (Eastman *et al*., 2020). Viral kinetics models suggest that a combined therapy targeting different stages of the virus life cycle could result in increased efficacy (Dodds *et al*., 2020).

Remdesivir targets different pathways than the ones that are targeted by neem-derived medicinal drugs, like nimbolin A and nimocin, which have different inhibitory activities on the viral E and M glycoproteins (Dyer, 2020). Nevertheless, practical challenges arise when attempting to provide these botanical medicines to critically ill patients, particularly those undergoing mechanical ventilation (Lim *et al*., 2021). Furthermore, in order to avoid possibly exacerbating cytokine storms, it is imperative to

carefully assess the immunomodulatory effects of specific plants, such as *Eurycoma longifolia* (Deva *et al*., 2023; He *et al*., 2019; Sitthisak *et al*., 2023; Demeke *et al*., 2021).

When taking into account the negative effects associated with long-term steroid therapy, examining the anti-inflammatory qualities of medicinal plants may offer helpful insights into treating COVID-19's post-infectious sequelae, such as pulmonary fibrosis and neuropsychiatric problems (Kamoka & Elengoe, 2023). Research on the long-term safety and pharmacokinetic characteristics of putative therapeutic plants may shed light on the burgeoning field of post-COVID-19 diseases.

The COVID-19 pandemic has posed a continuous threat to the stability of the global economy and public health, underscoring the critical need for increased preparedness in handling health emergencies. With over 152 million illnesses, 3.2 million fatalities, and over 272 million vaccinations worldwide as of May 3, 2021, the pandemic has had an astounding effect (Watson *et al*., 2022). The long-term implications of COVID-19, including post-COVID-19 syndrome, are still not fully known, despite significant advancements in medical study. The importance of traditional medicine in bolstering the immune system for both prophylactic and post-infection therapy is highlighted by this study. The study is to illustrate the significance of traditional medicine in enhancing immunity and providing an additional treatment alongside conventional medical treatments in battling SARS-CoV-2 by comparative investigation of acute COVID-19 infections and post-COVID-19 situations. Investigating the therapeutic advantages of medicinal plants becomes increasingly relevant as scientific research on COVID-19 treatments picks up steam. There are several benefits to using and advancing the body of scientific knowledge already available about their efficacy and safety. This study combines knowledge from traditional and Western medical perspectives to investigate how traditional medicine can improve immunological responses in those who have recovered from COVID-19. It promotes an all-encompassing approach to treatment that draws from conventional medicine to enhance immune function after recovery.

Methodology

The Study area

The Libyan population in 2021 was 7.03 million individuals (as of the second quarter of 2021). Over 80% of Libyan people live in or around urban areas such as Tripoli, which is the nation’s capital. Based on statistics reports from January 2020 to 27 May 2022, there have been 501,987 confirmed cases of COVID-19 reported to the World Health Organization (WHO). The highest infection was recorded between August to December 2021.

Study design and period

The study was carried out from July 5th to August 7th, 2021. The questionnaire was distributed via social networks such as Facebook, WhatsApp, Telegram, Viber and Instagram. The inclusion criteria of the study consisted of all Libyan people who live in Libya only. Additionally, IP filtering was employed to prevent duplicate replies, and participants had the option to withdraw at any moment throughout the survey.

Study population

The sample size was 450 participants who were infected with COVID-19. All those who met the inclusion criteria were chosen using an internet-based questionnaire. Inclusion criteria: Libyan; adult of more than eighteen years of age; diagnosed with COVID-19; currently using or had previously used complementary and alternative medicine (CAM) within the past three months. Exclusion criteria: Patients less than eighteen years of age; diagnosed with COVID-19 but not using CAM and not COVID-19 but using CAM.

Questionnaire preparation

The questionnaire consisted of three parts

Part (I): Demographics profile of the participant that included age, area living, gender, occupation, marital, education, income, smoker and some diseases

Part (II): Diagnosed with COVID-19

Part (III): Diagnosed with COVID-19 using and not using CAM

Study instrument

The questionnaire was constructed based on the available factors gleaned from the literature review. Despite the fact that components with comparable qualities are grouped together, each one was measured and analyzed separately. Each independent variable, whether continuous or categorical, was correctly and carefully assessed. Furthermore, it was separately accounted for in all queries. Expert and content validities were used to validate the questionnaire.

Data analysis

Data analysis was done in SPSS Inc., Chicago, IL, USA, version 26.0 with a significance level set at $p<0.05$. Descriptive analysis of categorical (demographic) variables was performed to show the frequency and percentage of each response. The results were summarized in one-dimensional tables for all data which include the comparison between COVID-19 and post-COVID-19. In addition, the most analysis used by the respondents and the most herbs used by the respondents. The chi-square test was performed in the bivariate analysis to determine the association between the studied variables.

Ethical consideration

This research was conducted on a voluntary basis where all respondents were given briefings on the conduct of the study. All respondents (COVID-19 cases) were asked to give their written permission before answering the questionnaire via the translated agreement form. Ethical permissions were given by Sabratha Teaching Hospital Libya dated 8.12.23.

Results

The respondents' sociodemographic characteristics

A total of 450 respondents participated in this study, in which the highest group (34.7 %) were under the age group 30-39 years which included 200 (44.4%) males and 250 (55.6%) females. Among the participants, 247 (54.9%) were from the West area and 134 (29.8%), 30 (6.7%) and 39 (8.7%) were from the East, South and Middle areas, respectively. In addition, all of the participants were educated. 296 (65.8%) of participants were in occupation and 188 (41.8%) were singles. 57.1% of their incomes were more than 1000 LYD. In addition, most participants were not smokers (90.9%) and did not suffer from diabetes, heart disease, respiratory diseases and asthma (92.0%, 92.9%, 98.4 and 97.1%, respectively). 34.7% of the participants were data-infected between January to March 2021. The duration of Infection for the participants was 2 weeks (51.3%). In this study, 85.1% of the participants took the treatment. 22.9 % of them were given herbs and foods and 77.1% were given medical treatment. The respondents' sociodemographic characteristics are demonstrated in Table 1.

Table 1: Socio-demographic characteristics of respondents during the COVID-19 pandemic in Libya

Variables	*Groups*	*Frequency (%)*
Age		
	18-29	133 (29.6)
	30-39	156 (34.7)
	40-49	46 (20.9)
	50-59	51 (11.3)
	≥60	3.6 (3.6)
Area		
	West	247 (54.9)
	East	134 (29.8)
	South	30 (6.7)
	Middle	39 (8.7)
Gender		
	Male	200 (44.4)
	Female	250 (55.6)
Occupation		
	No Working	154 (34.2)
	Working	296 (65.8)
Marital		
	Single	188 (41.8)
	Married	58.2 (58.2)
Educational		
	Non-Educated	00 (0.0)
	Educated	450 (100.0)
Income (LYD)		
	<1000	257 (57.1)
	>1000	193 (42.9)
Smoker		
	Non-Smoker	409 (90.9)
	Smoker	41 (9.1)
Diabetes		
	Non-Diabetes	414 (92.0)
	Diabetes	36 (8.0)
Hearth Disease		
	No	418 (92.9)
	Yes	32 (7.1)
Respiratory Diseases		
	No	443 (98.4)
	Yes	7.0 (1.6)
Respiratory Diseases		
	No	429 (95.3)
	Yes	21 (4.7)
Asthma		
	No	437 (97.1)
	Yes	13 (2.9)
Date Infection		
	Before 2020	134 (29.8)
	1-3/ 2021	156 (34.7)
	4-6/ 2021	93 (20.7)
	7-9/2021	37 (8.2)
	10-12/2021	28 (6.2)
Duration of Infection		
	< 1Week	37 (8.2)
	1 Week	45 (10.0)
	2 Weeks	231 (51.3)
	> 2Weeks	137 (30.4)
Take Treatment		
	No	67 (14.9)
	Yes	383 (85.1)
Type of treatment		
	Medicinal plants	103 (22.9)
	Medical treatment	347 (77.1)

Use of medicinal plants or/ and medical treatment

As shown in Table 2, the use of medicinal plants or/and medical treatment during COVID-19 infection as a treatment for the prevention of respiratory symptoms was associated with age (p<0.010) and income (p<0.021). However, no association was observed with the district of residence (p<0.635), gender (p<0.467), social situation (p<0.113), whether the respondent was smoking or not (p<0.308) and whether the respondent had diseases such as diabetes (p<0.573), heart disease (p<0.887), respiratory diseases (p<0.718) and asthma (p<0.513).

Table 2: Use of medicinal plants or /and medical treatment as treatment for respiratory symptoms during the COVID-19 pandemic in Libya

Variables	Medicinal plants (%)	Medical treatment (%)	x^2	*P*-value
Age			13.250	0.010
18-29	30.1	69.9		
30-39	26.3	73.7		
40-49	14.9	85.1		
50-59	13.7	86.3		
≥60	6.3	93.8		
Area			1.707	0.635
West	21.1	78.9		
East	25.4	74.6		
South	20.0	80.0		
Middle	28.2	71.8		
Gender			0.529	0.467
Male	24.5	75.5		
Female	21.6	78.4		
Occupation			0.423	0.515
No Working	24.7	75.3		
Working	22.0	78.0		
Marital			2.514	0.113
Single	26.6	73.4		
Married	20.2	79.8		
Educational			-	-
Non-Educated	0.0	0.0		
Educated	22.9	77.1		
Income (LYD)			5.322	0.021
<1000	26.8	73.2		
>1000	17.6	82.4		
Smoker			1.040	0.308
Non-Smoker	22.2	77.8		
Smoker	29.3	70.7		
Diabetes			0.099	0.753
Non-Diabetes	22.7	77.3		
Diabetes	25.0	75.0		
Hearth Disease			0.020	0.887
Non-hearth disease	23.0	77.0		
Hearth disease	21.9	78.1		
Respiratory Diseases			0.130	0.718
Non- Respiratory disease	22.8	77.2		
Respiratory disease	28.6	71.4		
Respiratory Diseases			0.403	0.526
Non-Respiratory disease	22.6	77.4		
Respiratory disease	28.6	71.4		
Asthma			0.427	0.513
Non-Asthma	23.1	76.9		
Asthma	15.4	74.7		

Use the medicinal plants as treatment options and respiratory symptoms associated with their use

As shown in Table 3, the use of some foods during COVID-19 infection as a treatment for the prevention of respiratory symptoms was associated with other foods such as fruit and vegetables,

nuts and moringa (p<0.003). However, the use of medicinal plants during post-COVID-19 was associated with honey (p<0.030), Indian cestus (p<0.004) and other food (p<0.015).

Table 3: Use of the medicinal plants as treatment options and respiratory symptoms associated with their use during COVID-19 and post-COVID-19 in Libya

Natural medicine		COVID-19			Post-COVID-19		
Common name	**Scientific name**	**No (%)**	**Yes (%)**	***p*-value**	**No (%)**	**Yes (%)**	***p*-value**
Garlic	*Allium officinale* Roscoe	56.9	43.1	0.798	56.9	43.1	0.163
Onion	*Allium cepa*	38.4	61.6	0.913	38.4	61.6	0.148
Lemon	*Melissa officinalis* L.	09.8	90.2	0.038	09.8	90.2	0.683
Thyme	*Thymus vulgaris* L.	34.2	65.8	0.368	34.2	56.8	0.923
Honey	-	23.3	76.7	0.758	23.3	76.7	**0.030**
Indian Costus	*Dolomiaea costus*	37.1	33.1	0.296	54.4	45.6	**0.004**
Black pepper	*Piper nigrum*	89.8	10.2	0.918	89.8	10.2	0.103
Cloves	*Syzygium aromaticum*	52.1	47.9	0.558	52.1	47.9	0.688
Black seed	*Nigella Sativa*	84.9	15.1	0.839	84.9	15.1	0.197
Ginger	*Zingiber officinale*	40.0	60.0	**0.009**	40.0	60.0	**0.022**
Turmeric	*Curcuma longa*	81.8	18.2	**0.049**	81.8	18.2	**0.048**
Other foods	-	74.2	25.8	**0.003**	74.2	25.8	**0.015**

The use of routine blood tests to assist in the diagnosis of COVID-19

A comparison of blood test types between groups of patients can be reviewed in Table 4. All the blood test types were associated with the age group (p<0.05). With age, all tests are checked for patients. CEP test was associated with the middle area (P<0.041). PCR checking and other tests were higher at the male's compression than the female (P<0.029 and P<0.028, respectively). Vitamin D, CEP and Ferritin tests were associated with the occupation. In addition, PCR, antigen tests and CEP tests were higher in the married group comparison with the single group. On the other hand, income, smoker and all diseases were not associated with all blood tests except for the Ferritin test which was associated with the diabetes group.

Discussion

This study demonstrated that 22.9% of the population of Libya used natural medicine for COVID-19 infection. Although the Libyan society had little use of natural medicine for the treatment of COVID-19 respiratory symptoms compression with another study, their use had a significant effect on the side effects of COVID-19 respiratory symptoms and post-COVID-19. There are populations in many countries of the world that are using medicinal plants for the prevention of COVID-19 because it is more readily available than medical treatment. In this regard, the Moroccan study and Peru study have reported that medicinal plants such as garlic, onion, ginger, thyme, turmeric and rosemary have shown prominent results in COVID-19 patients (Sunday, 2021; Parham, *et al*., 2020). The World Health Organization (WHO) stated that natural and traditional medicine, which includes treatment with medicinal plants, is the most natural, safe, effective and affordable medicine (WHO, 2002). 22.9 % of our study used medicinal plants to treat COVID-19 respiratory symptoms. There are studies describing the ethnomedicinal use of different communities and cultures around the world during the COVID-19 pandemic, particularly in Asian countries such as India, China, Japan, and Pakistan, as well as some parts of Africa (Jahan & Ahmet 2020).

Eugenol, a vital component of tulsi's essential oil that is recognized for its immunomodulating and antibacterial qualities, is one of the plant's phenolic elements that are most widely recognized. Other ingredients include apigenin (Orlo *et al*., 2021; Prajapati *et al*., 2021). Due to its dual function as an immunomodulator and an antiviral agent, tulsi is thus advised (Balkrishna *et al*., 2021; Devpura *et al*., 2021; Mohan *et al*., 2021; Shree *et al*., 2022). Turmeric's primary constituent, curcumin, has demonstrated potential in the field of immunomodulation (Prajapati *et al*., 2021) although studies on turmerones' impact on human peripheral blood mononuclear cells are ongoing (Andrin'iranto *et al*., 2021).

Table 4: Different types of blood tests for the patients who were ultimately diagnosed with COVID-19 in Libya

Variables	**PCR**			**Antigen-Tests**			**ELISA**			**Vitamin D**			**CEP**			**Ferritin**			**Others Analysis**		
	%	x^2	*P*-value	%	x^2	*P*-value	%	x^2	*P*-value	%	x^2	*P*-value	%	x^2	*P*-value	%	x^2	*P*-value	%	x^2	*P*-value
Age		11.35	**0.023**		11.35	**0.023**		15.97	**0.003**		03.26	0.514		19.48	**0.001**		13.18	**0.008**		8.23	0.083
18-29	25.0			07.6			02.3			15.0			14.3			15.0			09.0		
30-39	32.7			15.4			05.2			19.4			22.6			15.4			09.0		
40-49	35.1			20.4			04.3			21.3			29.3			17.2			13.8		
50-59	31.4			15.7			05.9			19.6			32.0			23.5			19.6		
≥60	43.8			31.3			25.0			5.9			56.3			50.0			25.0		
Area		2.32	0.508		1.375	0.711		3.40	0.334		1.06	0.786		8.27	**0.041**		1.22	0.747		2.86	0.413
West	30.1			15.4			06.1			19.5			18.8			16.2			09.7		
East	35.8			15.8			03.7			16.4			31.6			20.3			14.9		
South	26.7			10.0			06.7			20.0			24.1			16.7			10.0		
Middle	25.6			10.3			-			23.1			28.2			20.5			15.4		
Gender		4.75	**0.029**		1.57	0.209		0.12	0.727		2.01	0.155		3.16	0.075		0.11	0.735		4.80	**0.028**
Male	36.5			17.1			04.5			16.0			27.8			18.5			15.5		
Female	26.9			12.9			05.2			21.3			20.6			17.3			8.8		
Occupation		2.07	0.149		0.037	0.847		0.45	0.498		4.17	**0.041**		5.04	**0.025**		4.94	**0.026**		0.002	0.966
Yes	33.4			15.0			4.4			16.2			27.1			14.9			11.8		
No																					
Marital		8.74	**0.003**		6.860			0.308	0.579		3.435	0.064		4.533	**0.033**		1.888	0.169		0.868	0.351
Single	23.5			09.6		**0.009**	04.3			14.9			18.7			14.9			10.1		
Married	36.6			18.5			05.4			21.8			27.4			19.9			13.0		
Educational		-	-		-	-		-	-		-	-		-	-		-	-		-	-
Yes	31.2			14.7			4.9			18.9			23.8			17.8			11.8		
No	-			-			-			-			-			-			-		
Income (LYD)		2.158	0/142		0.001			5.698	0.17		2.530	0.112		0.007	0.934		1.101	0.294		3.431	0.064
<1000	28.4			14.8		0.970	7.0			21.5			23.6			19.5			9.3		
>1000	34.9			14.7			2.1			15.5			24.0			15.6			15.0		
Smoker		0.614	0.433		0.000	0.985		0.000	0.989		0.010	0.921		0.039	0.844		0.089	0.766		0.008	0.931
Yes	36.6			14.6			4.9			19.5			22.5			19.5			12.2		
No	30.6			14.7			4.9			18.9			23.9			17.6			11.7		
Diabetes		0.443	0.505		1.748	0.186		0.034	0.855		0.939	0.332		1.231	0.267		4.803	**0.028**		2.214	0.137
Yes	36.1			22.2			5.6			25.0			31.4			31.4			19.4		
No	30.8			14.1			4.9			18.4			23.1			16.7			11.1		
Hearth Disease		0.613	0.424		0.022	0.882					0.001	0.978		0.068	0.794		0.113	0.737		0.491	0.484
Yes	25.0			15.6			-	1.724	0.189	18.9			21.9			15.6			15.6		
No	31.7			14.7			5.3			18.8			23.9			18.0			11.5		
Respiratory Diseases		0.023	0.881		0.001	0.973		0.368	0.544		0.431	0.512		0.091	0.763		0.562	0.454		1.930	0.165
Yes	28.6			14.3			-			28.6			28.6			28.6			28.6		
No	31.2			14.7			5.0			18.8			23.7			17.6			11.5		
Respiratory Diseases		0.048	0.827		0.476	0.490		1.141	0.286		0.342	0.559		0.271	0.603		0.068	0.794		1.120	0.290
Yes	33.3			9.5			-			23.8			19.0			20.0			19.0		
No	31.1			15.0			5.2			18.7			24.0			17.7			11.4		
Asthma		0.331	0.565		0.005	0.946		0.693	0.405		0.150	0.699		0.519	0.471		0.253	0.615		1.645	0.200
Yes	38.5			15.4			-			23.1			15.4			23.1			23.1		
No	31.0			14.7			5.1			18.8			24.0			17.7			11.4		

While piperine from black pepper is praised for improving bioavailability and having immunomodulatory effects, withanolides from ashwagandha are known for their wide range of therapeutic advantages (Arnold *et al*., 2023). Compounds including germanium, selenium, and zinc are responsible for garlic's reputation as an immune-boosting food (Afifah *et al*., 2021; Bižanov *et al*., 2018; Abdullah *et al*., 1988). Amla's antioxidant potential is attributed to its rich profile of tannins, alkaloids, and phenolics. Nimbin, which has been shown to have antiviral and antibacterial properties, is found in neem. Pomegranates are known for their many health advantages because of their ellagitannin-rich polyphenols (Suručić *et al*., 2021; Sharma, 2020).

COVID-19 symptoms are characterized by inflammation and hemotoxicity, which suggests that blood-purifying plants with anti-inflammatory, antioxidant, and antiviral properties could be considered COVID-19 treatment candidates. Garlic (*Allium sativum* L.) inhibited SARS-CoV-2 replication, making it a promising agent against COVID-19 (Mirzaie *et al*., 2020). Another study on natural molecules from plants with antiviral properties, such as rosemary and cinnamon, found that they have low toxicity and a high concentration of active ingredients that can be used to treat viral infections (Mohan *et al*., 2020). Other studies have been conducted on medicinal plants, such as ginger (*Zingiber officinale* Roscoe), the rhizome of which has been used to treat fever and other COVID-19 symptoms in Africa (Vroh, 2020). A randomized controlled study was conducted on ginger (*Zingiber officinale Roscoe*) to assess its effects on respiratory manifestations in patients with acute respiratory syndrome caused by COVID-19. The experimental group received the standard treatment for COVID-19 according to the Iranian Ministry of Health protocol, as well as ginger tablets (Vomigone®) in a dose of 1000 mg three times a day for seven days. Within 7 days of treatment, clinical symptoms such as fever, dry cough, fatigue, and other symptoms such as thrombocytopenia, lymphocytopenia, and C-reactive protein improved (Safa *et al*., 2020). The consumption of ginger has been attributed to have properties against pneumonia and pulmonary fibrosis, and in the latter case, it reduces oxidative stress and the inflammatory response in animal models that were chemically induced with pulmonary fibrosis (Thota *et al*., 2020). Garlic (*Allium sativum* L.) is widely consumed as a condiment and is an important component of traditional Chinese and Indian medicine due to its active principles, which include organosulfides, saponins, and polysaccharides. Its immunomodulatory activity is primarily due to polysaccharides, which regulate immune system homeostasis, immune response maintenance, and the expression and proliferation of cytokine genes (Alhazmi *et al*., 2021). Garlic's bioactive compounds may have effects on respiratory tract infections, intra-alveolar edema, pulmonary fibrosis, sepsis, and acute lung injury (Thota *et al*., 2020).

Libya is one of the countries with an abundance of medicinal plants, which are used as one of the primary alternatives in health care to prevent and treat a variety of diseases. There is also a global wealth of knowledge, theories, and practices on the use of plants as natural medicines for disease treatment in various countries. Medicinal plants have been used for medicinal purposes since prehistoric times, and this tradition has been passed down from generation to generation. Traditionally, medicinal plants were consumed in their fresh form (for example, ginger) or as dry leave infusions with hot water. Medicinal plant use for respiratory conditions has also been reported in China (Fu *et al*., 2021), India (Ahmad *et al*., 2021), Saudi Arabia (Alyami *et al*., 2020), Mexico (Sotero-Garca *et al*., 2016), and Ecuador (Zambrano-Intriago *et al*., 2015). However, it should be noted that the ethnopharmacological use of medicinal plants for the prevention or treatment of COVID-19-related respiratory symptoms still needs to be evaluated in clinical settings in order to have solid evidence of their effectiveness and to isolate compounds with potential pharmacological use. Another important factor to consider is the impact of the COVID-19 pandemic on community dynamics, as well as the prevalence and fate of SARS-CoV-2 in environmental matrices, which could aid policymakers in developing mitigation strategies (Kumar *et al*., 2021).

Patients who present with a possible COVID-19 diagnosis require an accurate diagnosis as soon as possible in order to stop viral transmission. COVID-19 diagnosis can be difficult due to false negatives and delays in the processing of SARS-CoV-2 RNA RT-PCR on nasopharyngeal swabs (Parsons, *et al*., 2021). In Libya, the uses of routine blood tests were based primarily on age. It was conducted on

the elderly more than the young age. Ferritin test was one of the important tests conducted on diabetics in Libya. Ferritin levels may be a critical factor influencing COVID-19 severity. Ferritin, through direct immune-suppressive and pro-inflammatory effects, is a key mediator of immune dysregulation, particularly in extreme hyperferritinemia, contributing to the cytokine storm. It has been reported that fatal COVID-19 outcomes are accompanied by cytokine storm syndrome, implying that disease severity is dependent on the cytokine storm syndrome. Many diabetics have elevated serum ferritin levels 3-5, and it is well known to experience serious COVID-19 complications (Vargas-Vargas & Cortes-Rojo, 2020).

One of the study's limitations was that the results could not be extrapolated to the entire Libyan population. However, because this is the first study in this population, it could serve as a foundation for future studies that will cover a larger population. Another limitation was the selection bias caused by not using random sampling to collect responses. The definitive cause-and-effect relationships were unable to be established due to the nature of the study (cross-sectional study design). Similarly, respondents completed a self-reported assessment in an online data collection platform, which could result in under- or over-reporting and leave the data collector unable to verify or validate. Another limitation was not the frequency of consumption of medicinal plants, nor was the amount of plants consumed not assessed.

Post-COVID-19 manifestations were recorded for 91.5% of the recovered subjects, with a wide range of symptoms and conditions that varied from low-critical symptoms like a headache to more critical conditions such as kidney pain. Post-viral infection syndrome was previously reported after SARS. Follow-up for 4 years showed that chronic fatigue and psychiatric conditions continued to be clinically significant among subjects who survived from SARS infection (Lam *et al*., 2009). The relationship between age, comorbidities and severity of COVID-19 showed a strong link between the presence of other comorbidities and the severity of COVID-19 (Yang *et al*., 2020). Also increasing age was related to increased severity of the disease course (Li *et al*., 2020). There was a relationship between the severity of post-COVID-19 manifestations and the severity of the disease, the severe cases expressed high-severity manifestations compared with those suffering from mild conditions (Islam *et al*., 2020). In this study, there are no related between age and increased severity of the disease course. However, the severity of manifestations is also related to the comorbidities of the involved subjects.

Conclusion

In general, Libyan popularity had a few uses of natural medicine which included medicinal plants to treat COVID-19. However, their use had a significant effect on the treatment of COVID-19 respiratory symptoms and post-COVID-19. The present study reported an association between the use of honey, Indian costus, ginger, turmeric and moringa and the treatment of the respiratory symptoms related to COVID-19. Moreover, it was determined that the patients used a greater number of plants for disease prevention when the respondent was younger. It was also observed that respondents with low income used more plants for treatment. The results showed that the blood tests were related to age. The old age group had more blood tests. While the Ferritin test was linked to diabetics. Although the potential use of medicinal plants for respiratory conditions is recognized, more research is required to provide solid evidence of their effectiveness and to isolate compounds with potential pharmacological use. More research is needed to determine the proper doses and methods of preparation of these medicinal plants.

Most of the subjects recovered from COVID-19 experienced several manifestations after the last negative PCR which could be mild symptoms such as fatigue, headache or more critical manifestations like kidney pain and difficulty breathing. The most reported symptoms were fatigue, anxiety, joint pain and headache. The severity of post-COVID-19 manifestations was correlated to the severity of the infection which also was related to the presence of comorbidities. The post-COVID-19 manifestation is largely similar to the post-SARS syndrome. All subjects recovered from COVID-19

should undergo long-term monitoring for evaluation and treatment of symptoms and conditions that might be precipitated after recovery from the new coronavirus infection.

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Conflict of interest:

No conflict of interests.

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