Rafidain Journal of Science
https://rsci.mosuljournals.com

Vol. 32, No.4, pp. 25-37, 2023

Enhancing Performance of Libyan Traditional Medicine: Comprehensive Survey Insights During the COVID-19 Pandemic

Hana M. Kamoka **Asita Elengoe**
Department of Biotechnology/ Faculty of Science/ Lincoln University College/ Malaysia

p-ISSN: 1608-9391
e -ISSN: 2664-2786

Article information

Received: 2/10/2023
Revised: 10/11/2023
Accepted: 20/11/2023

DOI: 10.33899/rjs.2023.181263

corresponding author:
Asita Elengoe
asitaelengoe@yahoo.com
Hana M. Kamoka
hanakm1983@gmail.com

ABSTRACT

The COVID-19 pandemic, precipitated by SARS-CoV-2, has become a defining global health crisis of the 21st century, demonstrating the capacity of infectious diseases to cause widespread morbidity, mortality, and societal upheaval. This investigation seeks to dissect and contrast the symptomatic expression of acute and post-acute COVID-19 phases and explore traditional medicine's impact on disease progression and the emergence of complications. A quantitative cross-sectional approach involving 450 adult participants with laboratory-confirmed COVID-19 was employed. Selection adhered to specified inclusion criteria with data from internet-based questionnaires between July 5 and August 7, 2021. The study rigorously scrutinized clinical symptoms during the infection and recovery phases and assessed the contribution of traditional medicinal practices to complication management. The research design, population, data collection methods, analysis, and ethical compliance are meticulously outlined to elucidate the research process. Traditional medicinal remedies were notably prevalent among participants, with a marked utilization reported during the infection phase. The analysis indicated that those engaging in traditional medicine experienced milder symptoms acutely and a decreased frequency of persistent post-COVID-19 symptoms, suggesting a beneficial modulation of immune function.

Keywords: COVID-19, SARS-CoV-2, Traditional medicine (TM).

INTRODUCTION

Severe Acute Respiratory Syndrome (SARS) is acknowledged as a zoonotic viral respiratory illness caused by the SARS coronavirus species. The first strain is called severe acute respiratory syndrome coronavirus (SARS-CoV or SARS-CoV-1) (Ou *et al*., 2020). Studies in late 2017 led by Chinese researchers traced the virus's genesis to horseshoe bats in caves, with human transmission via intermediate hosts like Asian palm civets (Ye *et al*., 2020a). The SARS outbreak peaked in June 2003 with 8,422 reported cases and an 11% case fatality rate, Fig. (1). Post-2004, no new cases of SARS-CoV-1 infection have been reported, indicating the outbreak's end (Ye *et al*., 2020b; Yen *et al*., 2022a). The COVID-19 pandemic, instigated by the novel SARS-CoV-2, has precipitated unprecedented global health and economic turmoil (Yen *et al*., 2022b). As of August 7, 2021, the WHO disclosed over two hundred million confirmed cases and four million deaths globally. SARS-CoV-2, belonging to the Coronaviridae family and Nidovirales order, is a wrapped RNA virus with notable genomic parallels to both SARS-CoV and bat coronaviruses, enhancing its virulence and spread through respiratory secretions and, to a lesser extent, contaminated surfaces (Liu et al., 2023). The lack of a universally sanctioned antiviral treatment for COVID-19, which can engender severe conditions like ARDS and MODS, has prompted the exploration of alternative therapies (Filip *et al*., 2022). Traditional Chinese Medicine (TCM) has been employed for millennia in epidemic management in China (Chen and Chen, 2020). It is now combined with Western medicine to reduce mortality and alleviate symptoms in viral pneumonia, including illnesses caused by previous coronavirus strains such as SARS and MERS (Liu *et al*., 2023). Additionally, Ayurvedic methodologies have been acknowledged for their preventative potential against COVID-19, employing natural substances like Guduchi, chyawanprash, golden milk, and kadha (Gajewski *et al*., 2021). Notably, constituents in Ashwagandha, Tulsi, and Guduchi are theorized to engage with the ACE-2 receptor, a crucial component in SARS-CoV-2 infection, suggesting their supportive role in therapeutic regimens (Venugopal *et al*., 2020). In Malaysia, known for its rich legacy of traditional and complementary medicine, there has been an increased interest in herbal and complementary treatments during the pandemic (Filip *et al*., 2022). The biomedical research community is actively assessing the Effectiveness of these traditional methods in combating COVID-19, mirroring a global inclination towards integrating these practices with established treatment protocols (Sanyaolu *et al*., 2021). The significance of a robust immune system in sustaining health and guarding against pathogens like COVID-19 is fundamental. Despite vaccine and therapeutic advances, the enduring potency of these interventions is compromised by the virus's mutation capacity (Li *et al*., 2021). Observations have inferred that the relatively contained spread in India may be linked to the prevalent utilization of herbal immune boosters (Li *et al*., 2021). Such indigenous practices, which enhance immune competency, emphasize incorporating inclusive health strategies to fortify defences against the swiftly altering viral landscape (Kumar *et al*., 2021a; Rastogi *et al*., 2022).

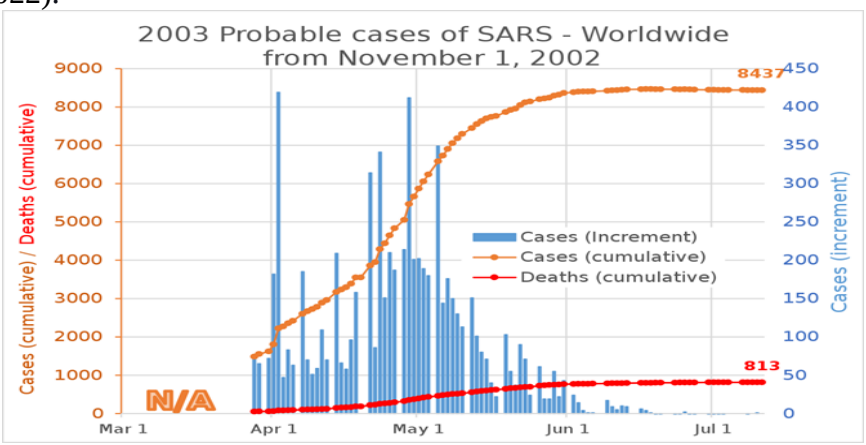

Fig. 1: Probable cases of SARS Worldwide from November 2002

The COVID-19 pandemic has persistently challenged global economic and public health stability, highlighting the urgent need for improved readiness in managing health crises (WHO, 2021a). As of May 3, 2021, the pandemic has had a staggering impact, with over 152 million infections, 3.2 million deaths, and more than 272 million people vaccinated globally (Sibeko *et al*., 2021). Despite notable progress in medical research, the long-term effects of COVID-19, including post-COVID-19 syndrome, remain inadequately understood (Christie *et al*., 2021). This research emphasizes the role of traditional medicine in reinforcing the immune system for both preventative and post-infection care (Covid *et al*., 2021; Sayers *et al*., 2021). Through comparative analysis of acute COVID-19 infections and post-COVID-19 conditions, our study aims to demonstrate the importance of traditional medicine in boosting immunity and offering a supplementary treatment alongside mainstream medical approaches in combating SARS-CoV-2 (Sibeko *et al*., 2021). As research into COVID-19 treatments intensifies within the scientific community, exploring the therapeutic benefits of medicinal plants gains critical relevance. Harnessing and expanding upon existing scientific knowledge regarding their safety and effectiveness offers significant advantages (Christie *et al*., 2021). This study explores traditional medicine's effects on enhancing immune response in individuals who have recovered from COVID-19, integrating insights from both Western and traditional medical paradigms (Covid *et al*., 2021). We advocate for a holistic treatment strategy based on traditional medicine to improve immune function post-recovery (Sayers *et al*., 2021; Sibeko *et al*., 2021). An online survey was conducted to evaluate symptoms experienced during and post-COVID-19 (from 14 weeks to 6 months), identifying gender and age as risk factors and examining the impact of certain foods on the immune system. The participants, primarily from suburban/urban areas in Libya, consisted of a convenience sample of young and older adults aged between 18 and 80 (Allaq *et al*., 2021).

Perspective: Developing Herbal Medicine for Covid-19

As the world commemorates the first anniversary of the COVID-19 pandemic, the intricate challenges of crafting an efficacious antiviral against SARS-CoV-2 have become starkly apparent (Allaq *et al*., 2021). The contagious nature of the virus and the progression of the disease add layers of complexity to the development of therapeutic solutions. Research modelling the virus's life cycle underscores the critical importance of early antiviral intervention to curb infection and safeguard host cells, which coincides with the timeline of symptom manifestation and peak viral loads, thus complicating timely antiviral administration in public health scenarios (Gonçalves *et al*., 2020).

Investigations into the antimicrobial potential of certain botanicals have led to in silico studies proposing that neem might possess antiviral capabilities against SARS-CoV-2 (Borkotoky and Banerjee, 2021). The antiviral drug remdesivir has received FDA approval for use in hospitalized COVID-19 patients, yet its effect on survival rates is still being evaluated (Administration, 2020). Remdesivir is hypothesized to obstruct the virus's replication by terminating the synthesis of viral RNA prematurely (Dyer, 2020). According to viral kinetics models, a combination therapy that targets various stages of the virus's life cycle might yield enhanced effectiveness (Dodds *et al*., 2021).

The therapeutic agents derived from neem, such as nimbolin A and nimocin, present alternative inhibitory actions on the viral E and M glycoproteins, pathways distinct from those targeted by remdesivir (Allaq *et al*., 2021; Borkotoky and Banerjee, 2021). However, administering these botanical treatments to critically ill patients, especially those under mechanical ventilation, presents pragmatic obstacles (Wiersinga *et al*., 2020). Moreover, the immunomodulatory effects of certain plants, like *E. longifolia*, demand careful evaluation to prevent potential aggravation of cytokine storms (Allaq *et al*., 2020; George and Britto, 2015).

Examining the anti-inflammatory attributes of medicinal plants may provide valuable perspectives on treating COVID-19's post-infectious sequelae, such as pulmonary fibrosis and neuropsychiatric issues, particularly when considering the adverse effects linked with prolonged

steroid therapy (Pan *et al*., 2020; Xia *et al*., 2020). The emerging domain of post-COVID-19 conditions could be informed by studies into potential medicinal plants' long-term safety and pharmacokinetic profiles (WHO, 2020b).

The development of herbal medications that fulfil therapeutic standards for efficacy and uniformity is a protracted journey, impeded by the natural variance in phytochemical composition within plants, further affected by agronomic conditions (Español *et al.*, 2021). The standardization of these botanicals presents challenges, given their multifaceted natural constituents, as opposed to single-entity synthetic drugs (WHO, 2020b; Dyer, 2021). Thus, the prospects of formulating new herbal interventions during urgent health crises such as the COVID-19 pandemic remain slim (Li *et al*., 2021). Emergencies typically require the expedited endorsement of therapeutic agents with known safety profiles and demonstrated potential efficacy, which is why drug repurposing, including remdesivir, has been the prevalent strategy (Vandecandelaere *et al*., 2017). This expedited approach may also apply to natural products, with the understanding that each formulation, even from identical botanical sources, is unique (Gonçalves *et al*., 2020; Borkotoky and Banerjee, 2021).

Chemical Constituents and Properties of Selected Phytochemicals

During the coronavirus pandemic, in silico computational docking studies have highlighted phytochemicals with promising antiviral attributes. Investigations have surfaced various natural polyphenols, including Tulsi (Ocimum sanctum), Ashwagandha (Withania somnifera), Amla (Phyllanthus emblica), Piperine, and Guduchi (Tinospora cordifolia) for their potential efficacy in combatting SARS-CoV-2 (Español *et al*., 2021). Tulsi is celebrated for its phenolic constituents such as apigenin and eugenol, the latter a key component of its essential oil, noted for its antimicrobial and immunomodulating properties (Zeng *et al*., 2020; Orlo *et al*., 2021). Thus, Tulsi is recommended for its dual role as an immunomodulator and an antiviral agent (Balkrishna *et al*., 2021; Devpura *et al*., 2021). Curcumin, the main component of turmeric and its extracts has shown promise in immunomodulation (Prajapati *et al*., 2019; Shree *et al*., 2022), while turmerones are researched for their influence on human peripheral blood mononuclear cells (Andrin'iranto *et al*., 2021). With an olides in Ashwagandha are recognized for their broad therapeutic benefits and Piperine, from black pepper, is acclaimed for enhancing bioavailability and providing immunomodulatory effects (Kumar *et al*., 2021b). Garlic's reputation for immune enhancement is attributed to its compounds like germanium, selenium, and zinc (Bižanov *et al*., 2018; Abdullah and Seulalae, 2020; Afifah *et al*., 2021) . Amla's rich profile of tannins, alkaloids, and phenolics contributes to its antioxidant capacity (Abu Taleb *et al*., 2012). Neem contains Nimbin, noted for its antiviral and antibacterial prowess. With their ellagitannin-rich polyphenols, pomegranates are recognized for their extensive health benefits (Sharma, 2020). The collective research emphasizes the significance of traditional medicinal plants in managing viral ailments like COVID-19 and calls for further inquiry into their efficacy and mechanisms of action (Badr *et al*., 2020).

COVID-19 Outbreak in Libya

As of May 3, 2021, Libya has reported a total of 178,672 COVID-19 cases, including 3,049 fatalities, as documented by the National Centre for Disease Control (Allaq *et al*., 2021). Tripoli has registered the highest incidence, with 3,960 confirmed cases as of the same date. The government has declared four districts, including Tripoli (487 cases), Sabha (465), Misurata (330), and Benghazi (201), as red zones due to their significant cumulative case counts. Libya's first COVID-19 case was identified on March 25, 2020, in a 73-year-old man who returned from Saudi Arabia after performing Umrah (Allaq *et al*., 2021). He entered Libya on March 21, 2020, and received care at the National Centre for Disease Control in Tripoli. In response, the Ministry of Health promptly established standard management guidelines for COVID-19, designating 12 hospitals and screening centres across Libyan cities for specialized care, such as Maiteka Hospital in Tripoli,

Sabratha Hospital, Misurata Hospital, Sabha Hospital, and Benghazi Hospital (Allaq *et al*., 2021). The first confirmed case in Libya involved an older adult exhibiting fever and cough symptoms after his return from Saudi Arabia. He was isolated at Maiteka Hospital, Tripoli. Shortly after that, a family from Misurata was quarantined at Misurata Hospital from March 26, 2020. Following a national event in May 2020, COVID-19 cases surged, leading to the highest recorded figures on March 7, 2021. On May 3, 2020, the Prime Minister announced a Movement Control Order to curb transmission, enforcing a week of social distancing measures from May 4 to May 12, 2020, and restricting inter-state travel.

However, following the national celebration on February 17, 2021, social practices undermined control measures, new variants (South African, British) emerged, and a shortage of medical supplies, prompting a shift towards a herd immunity approach. As mentioned earlier, this led to the caseload as of May 3, 2021 (The National Centre for Disease Control, Libya).

Traditional Medicine

Traditional medicine (TM), also known as folk medicine, represents an ancient and culturally rooted practice employed in managing and treating diverse ailments. The World Health Organization defines TM as "the total of knowledge, skills, and practices based on the theories, beliefs, and experiences indigenous to different cultures" (Challenge, 2009). Before the widespread adoption of allopathic or cosmopolitan medicine, TM was the primary healthcare system for millions across both rural and urban settings (Gandra *et al*., 2021a). In various Asian and African countries, up to 80% of the population relies on TM for primary healthcare. When used outside its cultural context, TM is often considered an alternative medical practice (Ali, 2016). Ayurveda, Siddha, Unani, Persian, Islamic, Muti, and Ifá are traditional medicine systems, including traditional European, Chinese, and European medicine and indigenous practices such as Mayongia magic and medicine (Assam). Scientific disciplines such as herbalism, ethnomedicine, ethnobotany, and medical anthropology are involved in studying traditional medicine (WHO, 2008). The WHO has formulated a strategic plan to bolster the role of TM in public health over nine years, aiming to guide Member States in establishing proactive policies and action plans (WHO, 2013). However, the WHO warns that improper use of TM can lead to adverse or dangerous outcomes (WHO, 2020a). Historically, the Sumerians were among the first to document herbal knowledge about 5,000 years ago (WHO, 2021b).

In India, during the first millennium BC, herbalists like Charaka and Sushruta chronicled various herbs and minerals used in Ayurveda. The Shennong Bencao Jing, originating in the Han Dynasty, is the seminal text in Chinese herbal medicine, expanded upon during the Tang Dynasty in the Yaoxing Lun (Treatise on the Nature of Medicinal Herbs). In Greece, early compilations of herbal knowledge by figures such as Pythagoras, Hippocrates, Aristotle, Theophrastus, Dioscorides, and Galen laid the foundations for European medical thought. Romans contributed with works such as Pliny the Elder's Natural History and Celsus's De Medicina, with Pedanius Dioscorides' De Materia Medica encapsulating a wealth of ancient and contemporary herbal knowledge, later supplemented by translations and additions in Turkish, Arabic, and Hebrew (Organization, 2021c, 2021b). Manuscripts of De Materia Medica, alongside the Latin herbal Herbarium Apuleii Platonici, were preserved in the Anglo-Saxon codex Cotton Vitellius C.III. These foundational texts, translated by Persian scholars such as Rhazes, Maimonides, and Avicenna, significantly influenced European medical thought (Buchan *et al*., 2010).

Fossils have been used in traditional medicine since ancient times (Vandecandelaere *et al*., 2017). Folk medicine, differentiated from TM, refers to remedies known within a community, passed down orally, and utilized without formal training (Acharya and Shrivastava, 2008). This medicine coexists with conventional medicine in many countries and encompasses practices like traditional Chinese, Korean, Arabic, Uyghur, Japanese, Aboriginal, Native Hawaiian, and Georgian folk medicine (WHO, 2020). In a modern context, the

Harvard T.H. Chan School of Public Health advocates for a healthy lifestyle, including a balanced diet, regular exercise, stress management, and sufficient sleep as pivotal for maintaining health. Recent studies corroborate that meeting the recommended guidelines of 150+ minutes of weekly exercise can significantly reduce the risk of hospitalization and death from COVID-19 (Allaq *et al*., 2021; Sallis *et al*., 2021).

Methodology

This study's backdrop and geographical setting outline the research design, targeted demographics, and participant pool. Additionally, it expounds on the methodology regarding sample size determination, the instruments employed for data gathering, the analytical techniques utilized for data interpretation, and the ethical protocols adhered to throughout the research process. Each aspect of the study's methodology is articulated comprehensively to elucidate the systematic approach to conducting this research.

Study Area

The target population of our study consisted of all Libya population. 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 (Worldpopulationreview.com). Based on statistics reports from January 2020 to 27 May 2022, there have been 501,987 confirmed cases of COVID-19 reported to WHO the highest infection was between Augusts to December 2021 (www.covid19.who.int).

Study Design and Period

The survey was conducted from July 5th to August 7th, 2021, utilizing an online questionnaire disseminated through various social networking platforms, including Facebook, WhatsApp, Telegram, Viber, and Instagram. The study's eligibility criteria were confined to Libyan residents within the national borders. To ensure the integrity of the data, IP filtering was implemented to preclude multiple submissions from the same participant. Moreover, participants were allowed to withdraw from the survey at any point. The sample encompassed 450 individuals who had confirmed COVID-19 infections and were reached through social media. Selection was based on meeting the stipulated inclusion criteria, with the questionnaire being administered via an internet-based platform.

Data Analysis

Data analysis was conducted using SPSS Inc., Chicago, IL, USA, version 26.0, with the significance threshold established at $p<0.05$. A descriptive analysis of categorical variables, primarily demographic, was executed to ascertain each response category's frequency and percentage distribution. The findings were collated into unidimensional tables, encapsulating a comprehensive summary that includes a comparative evaluation of data about COVID-19 and post-COVID-19 conditions. Furthermore, the analysis delineated the most prevalent analytical methods employed by the respondents and the most frequently utilized herbal remedies. For the bivariate analysis, the Chi-square test was utilized to assess the relationships between the variables under study.

RESULTS

During COVID-19 Respiratory Symptoms

Table (1) elucidates the diverse symptomatic presentation reported by COVID-19 patients in Libya, encompassing a range of symptoms such as headache, fever, pain, diarrhoea, anosmia (loss of sense of smell), ageusia (loss of sense of taste), dyspnoea (difficulty breathing), cough, rhinorrhoea (runny nose), renal pain, and other less common symptoms including ocular pain, photalgia and gonangia (pain in the feet and knees), gastritis (stomach inflammation), emesis

(vomiting), increased sinus sensitivity, and arthritis associated with coronavirus infection. Statistical analysis revealed no significant differences in the prevalence of symptoms among the patient groups, except for the group experiencing diarrhoea, which also reported a higher incidence of anosmia and ageusia. Additionally, patients with pre-existing respiratory diseases were more likely to experience dyspnoea.

Table 1: Many Covid-19 patients have reported a vastly different set of symptoms in Libya

Variables	Headache	Fever	Pain	Diarrhea	Loss of Sense of Smell and Taste	Difficulty Breathing	Cough	Runny Nose	Kidney Pain	Others
Age										
X^2	3.77	4.77	6.06	3.99	4.71	16.43	3.97	0.80	1.36	3.42
P-value	0.439	0.311	0.194	0.408	0.319	0.002	0.410	0.938	0.852	0.490
Area										
X^2	3.98	3.06	1.70	1.61	0.95	2.19	1.21	0.57	0.68	0.94
P-value	0.263	0.381	0.637	0.656	0.811	0.533	0.750	0.903	0.876	0.815
Gender										
X^2	0.85	0.87	1.15	0.19	0.024	0.29	0.98	2.07	0.91	0.22
P-value	0.357	0.351	0.282	0.663	0.878	0.585	0.321	0.150	0.338	0.881
Occupation										
X^2	1.24	0.26	0.009	0.05	1.16	0.88	0.03	3.36	0.25	0.51
P-value	0.264	0.609	0.923	0.813	0.280	0.348	0.852	0.066	0.611	0.471
Marital										
X^2	0.00	0.43	2.93	0.02	1.40	0.89	0.01	0.01	0.02	0.76
P-value	0.997	0.508	0.87	0.879	0.236	0.344	0.901	0.904	0.865	0.382
Educational										
X^2	-	-	-	-	-	-	-	-	-	-
P-value	-	-	-	-	-	-	-	-	-	-
Income (LYD)										
X^2	1.84	0.83	0.98	0.83	0.00	2.60	0.26	0.005	1.53	1.96
P-value	0.174	0.360	0.321	0.362	0.997	0.107	0.605	0.943	0.215	0.658
Smoker										
X^2	2.94	0.005	0.04	0.36	0.04	1.58	1.60	0.69	0.66	0.30
P-value	0.086	0.942	0.839	0.545	0.827	0.208	0.205	0.405	0.415	0.579
Diabetes										
X^2	1.55	0.12	1.87	0.01	4.87	1.64	0.63	0.02	0.43	0.43
P-value	0.213	0.727	0.171	0.897	**0.027**	0.200	0.426	0.865	0.507	0.511
Hearth Disease										
X^2	0.98	2.42	2.45	1.19	0.58	0.26	0.25	0.49	0.28	0.05
P-value	0.322	0.119	0.117	0.275	0.446	0.610	0.615	0.484	0.597	0.817
Respiratory Diseases										
X^2	0.81	0.72	0.31	1.22	0.70	6.33	1.89	6.12	1.23	4.54
P-value	0.366	0.394	0.577	0.269	0.401	**0.012**	0.168	**0.013**	0.267	0.033
Respiratory Diseases										
X^2	0.72	0.36	0.00	0.13	0.23	4.75	1.51	0.50	3.82	0.22
P-value	0.393	0.549	0.938	0.714	0.625	**0.029**	0.218	0.479	0.051	0.634
Asthma										
X^2	0.48	0.01	0.00	0.23	0.03	5.96	0.007	1.03	2.91	1.83
P-value	0.487	0.90	0.998	0.631	0.855	0.015	0.935	0.309	0.088	0.176

Post- COVID-19 Manifestations

Post-COVID-19 manifestations, as detailed in (Table 2), indicate a prevalence of fatigue in 59.3% of subjects, muscular weakness in 41.8%, joint pain in 34.0%, anxiety in 34.2%, sleep

disturbances in 36.4%, headaches in 35.6%, chest pain in 22.0%, and anosmia or ageusia in 32.1%. A minority of the recovered cohort reported hair loss (14.2%), renal pain (1.3%), difficulty breathing (8.9%), and respiratory diseases (4.7%). Notably, a significant proportion of participants (77.2%) experienced a recovery from post-COVID-19 symptoms, whereas 22.8% presented with persistent symptoms. The incidence of post-COVID-19 symptoms was markedly higher among those with comorbid conditions, such as diabetes, respiratory diseases, and asthma, with statistical significance ($p<0.001$ for each).

Table 2: Characterization and percentage of different post-COVID-19 manifestations that appeared on recovered COVID-19 subjects in Libya

Item	%
Manifestations	
Fatigue	59.3
Muscular Weakness	41.8
Joint Pain	34.0
Dysnoea	10.4
Cough	27.6
Constant need for Oxygen	2.2
Anxiety	**34.2**
Sleep Disturbances	36.4
Headaches	35.6
Chest Pain	22.0
Hair Loss	14.2
Loss of Sense of Smell and Taste	32.7
Kidney Pain	1.3
Difficulty Breathing	8.9
Respiratory Diseases	4.7
Others	5.6
Extra investigations for post-COVID-19 manifestations	
Yes	25.3
No	74.7
Received medications for post-COVID-19 manifestations	
Yes	91.5
No	8.5
Condition improved on treatment	
Yes	77.2
No	22.8

DISCUSSION

Patients presenting with a potential diagnosis of COVID-19 necessitate prompt and accurate diagnostic processes to halt the spread of the virus. The diagnosis of COVID-19 can present challenges, such as false negatives and procedural delays associated with SARS-CoV-2 RNA RT-PCR tests administered via nasopharyngeal swabs (Parsons *et al*., 2021).

In Libya, routine blood tests, which often included ferritin levels, were predominantly conducted based on age demographics, focusing on the elderly. Elevated ferritin levels, particularly prevalent among diabetic patients, may play a critical role in the severity of COVID-19 by

contributing to immune suppression, pro-inflammatory effects, and, in severe cases, the exacerbation of cytokine storms (Vargas-Vargas and Cortés-Rojo, 2020; Allaq *et al*., 2021). This study, the first of its kind in the Libyan context, provides a preliminary foundation for subsequent research despite limitations such as its inability to generalize findings to the broader Libyan population. Selection bias due to non-random sampling and the cross-sectional nature of the study design hindered the establishment of causative relationships. Furthermore, self-reported online data might lead to inaccuracies due to potential under- or over-reporting.

Another significant finding of the study is the high prevalence of post-COVID-19 conditions in 91.5% of recovered patients, ranging from mild symptoms like headaches to severe conditions such as renal pain. These post-viral syndromes mirror those observed after SARS, where long-term follow-up indicated persistent chronic fatigue and psychiatric issues (Gandra *et al*., 2021a, 2021b). A robust association has been noted between comorbidities, advancing age, and increased COVID-19 severity (Fu *et al*., 2021). While our study did not find a direct correlation between age and disease severity, the intensity of post-COVID-19 manifestations was nonetheless linked to the patient's comorbid conditions (Mardani, 2020; Sibeko *et al*., 2021).

CONCLUSION

Our review endeavors to carve out a distinct niche in the extensive research landscape on Traditional Chinese Medicine (TM) in COVID-19. This is the inaugural synthesis of TM in COVID-19 that amalgamates evidence-based scientific findings from clinical practice to research, underpinned by the most comprehensive and current literature. We systematically articulate the pathogenesis and potential mechanisms of TCM treatments across three distinct COVID-19 stages, presenting a unified framework that consolidates both clinical and fundamental evidence. One crucial insight from China's response to COVID-19 is the advantageous synergy of TCM with Western medicine (WM), which has emerged as a prudent approach. As we look to the future, prepared to confront similar or graver global health challenges, several pivotal concerns must be addressed. The evolving nature of the pandemic means the pathogenesis of COVID-19 remains to be fully deciphered. The interplay of viral toxicity, endothelial damage, cytokine storms, immune response, and microthrombi are hypothesized to be critical factors in severe cases, meriting further validation. Skepticism regarding the efficacy of TCM in treating COVID-19 persists, in part due to a need for deeper understanding. Enhanced evidence through more Randomized Controlled Trials (RCTs) with precise, safe, and rigorous methodologies, coupled with detailed mechanistic studies, is imperative.

Furthermore, the rehabilitation potential of TM warrants continued attention and longitudinal observation, especially in the elderly recovering from COVID-19. Recent findings indicate TM's benefits in post-discharge outcomes, including reducing inflammatory markers and improving hematological parameters. This investigation aims to scientifically and systematically assess TM's role in the COVID-19 response. While the advent of vaccines and the rollout of global vaccination efforts offer hope, the persistent threat of viral variants and new epidemics remains. Hence, it is scientifically valuable to objectively and historically document TCM's contributions during the pandemic, which may serve as a strategic resource against future infectious disease outbreaks globally.

REFERENCES

Abdullah, A.; Seulalae, A.V. (2020). Antioxidant activity of bio pigment fractions from golden apple snail eggs (*Pomacea canaliculata*). *IOP Conference Series: Earth and Environm. Sci.*, **404**(1), 12003.

Abu Taleb, A.M.F.; Mohamed, M.S., Abdel-Latif, R.S.; Gouda, M. (2012). The role of Ica operon and biofilm formation in coagulase negative staphylococcal infection. *Egyptian J. Med. Microbiol.*, **38**(1228), 1–13.

Acharya, D.; Shrivastava, A. (2008). "Indigenous Herbal Medicines". Aavishkar Publishers, Distributors.

Administration, U.S.F. (2020). FDA approves first treatment for COVID-19. *Food and Drug Administr. News Rele.*, **22**.

Afifah, D.; Arief, M.; Al-Arif, M.A. (2021). The effect of garlic (Allium sativum) and turmeric (Curcuma longa) extract addition in commercial feed on feeding rate, feed efficiency and feed conversion ratio of gourami fish (*Osphronemus gouramy*). *IOP Conference Series: Earth and Environm. Sci.*, **679**(1), 012073.

Ali, S. (2016). Healthcare in the remote developing world: Why healthcare is inaccessible and strategies towards improving current healthcare models. *Harvard Health Pol. Rev*.

Allaq, A.A.; Kamoka, H.M.E.; Sidik, N.J.; Abdul-Aziz, A.; Abdulrazzaq, A.I.; Agha, H.M.; Abdulsamad, M.A.; Yahya, E.B.; Elengoe, A. (2021). The link between black fungus and Covid-19 disease in diabetes mellitus patients. *Biomed. Res. Ther.*, **8**(11), 4689–4694.

Allaq, A.A.; Sidik, N.J.; Abdul-Aziz, A.; Ahmed, I.A. (2020). Cumin (*Cuminum cyminum* L.): A review of its ethnopharmacology, phytochemistry. *Biomed. Res. Ther.*, **7**(9), 4016–4021.

Allaq, A.A.; Sidik, N.J.; Abdul-Aziz, A.; Ahmed, I.A. (2021). Antioxidant, antibacterial, and phytochemical screening of ethanolic crude extracts of Libyan Peganum harmala seeds. *J. Pharmaceut. Res. Internat.*, 74–82.

Allaq, A.A.; Sidik, N.J.; Abdul-Aziz, A.; Alkamil, A.M.A.; Elengoe, A.; Yahya, E.B.; Abdulsamad, M.A. (2021). Epidemiological studies of the novel coronavirus (covid-19) in Libya. *Pakistan J. Biotechnol.*, **18**(1), 7–16.

Andrin'iranto, R.A.; Narindra, R.; Jules, R.; Rokiman, L.; Octavie, R.E. (2021). EDXRF and GC characterization of *Curcuma longa* L. (*Zingiberaceae*) Rhizome from Madagascar. *Discov. Phytomed.*, **8**(1), 15–23.

Badr, H.S.; Du, H.; Marshall, M.; Dong, E.; Squire, M.M.; Gardner, L.M. (2020). Association between mobility patterns and COVID-19 transmission in the USA: A mathematical modelling study. *Lanc. Infect. Dise.*, **20**(11), 1247–1254.

Balkrishna, A.; Raj, P.; Singh, P.; Varshney, A. (2021). Influence of patient-reported treatment satisfaction on psychological health and quality of life among patients receiving Divya-Swasari-Coronil-Kit against COVID-19: Findings from a cross-sectional "Satisfaction Covid" survey. *Patient Prefer. Adher.*, 899–909.

Bižanov, G.; Normantienė, T.; Jonauskienė, I.; Vyšniauskis, G. (2018). Evaluation of herb extracts and germanium oxide as immunological adjuvants in quails (*Coturnix japonica*). *Revista. MVZ Córdoba.*, **23**(3), 6838–6849.

Borkotoky, S.; Banerjee, M. (2021). A computational prediction of SARS-CoV-2 structural protein inhibitors from Azadirachta indica (Neem). *J. Biomol. Structure and Dynam.*, **39**(11), 4111–4121.

Buchan, B.; Kay, G.; Heneghan, A.; Matthews, K.H.; Cairns, D. (2010). Gel formulations for treatment of the ophthalmic complications in cystinosis. *Internat. J. Pharmac.*, **392**(1–2), 192–197.

Challenge, F.G.P.S. (2009). WHO Guidelines on Hand Hygiene in Health Care. *Retrieved from: Whqlibdoc Who Int/Publications/009 Pdf*.

Chen, K.; Chen, H. (2020). "Traditional Chinese Medicine for Combating COVID-19". Springer. In Frontiers of Medicine. Vol. 14, pp. 529–532.

Christie, A.; Brooks, J.T.; Hicks, L.A.; Sauber-Schatz, E.K.; Yoder, J.S.; Honein, M.A.; COVID, C.D.C.; Team, R. (2021). Guidance for implementing COVID-19 prevention strategies in the context of varying community transmission levels and vaccination coverage. *Morbid. Mortal. Weekly Report*, **70**(30), 1044.

Covid, C.D.C.; Team, V.B.C.; Birhane, M.; Bressler, S.; Chang, G.; Clark, T.; Dorough, L.; Fischer, M.; Watkins, L.F.; Goldstein, J.M. (2021). COVID-19 vaccine breakthrough

infections reported to CDC—United States, January 1–April 30, 2021. *Morbid. Mortal. Weekly Report*, **70**(21), 792.

Devpura, G.; Tomar, B.S.; Nathiya, D.; Sharma, A.; Bhandari, D.; Haldar, S.; Balkrishna, A.; Varshney, A. (2021). Randomized placebo-controlled pilot clinical trial on the efficacy of ayurvedic treatment regime on COVID-19 positive patients. *Phytomed.*, **84**, 153494.

Dodds, M.G.; Krishna, R.; Goncalves, A.; Rayner, C.R. (2021). Model- informed drug repurposing: viral kinetic modelling to prioritize rational drug combinations for COVID- 19. *British J. Clin. Pharmacol.*, **87**(9), 3439–3450.

Dyer, O. (2020). Covid-19: Remdesivir has little or no impact on survival, WHO trial shows. *British Med. J. Publishing Group.*

Dyer, O. (2021). Covid-19: India sees record deaths as "Black Fungus" spreads fear. *British Med. J. Publishing Group.*

Españo, E.; Kim, J.; Lee, K.; Kim, J.K. (2021). Phytochemicals for the treatment of COVID-19. *J. Microbiol.*, **59**, 959–977.

Filip, R.; Gheorghita Puscaselu, R.; Anchidin-Norocel, L.; Dimian, M.; Savage, W. K. (2022). Global challenges to public health care systems during the COVID-19 pandemic: A review of pandemic measures and problems. *J. Personal. Med.*, **12**(8), 1295.

Fu, R.; Li, J.; Yu, H.; Zhang, Y.; Xu, Z.; Martin, C. (2021). The Yin and Yang of traditional Chinese and Western medicine. *Medic. Research Rev.*, **41**(6), 3182–3200.

Gajewski, A.; Kośmider, A.; Nowacka, A.; Puk, O.; Wiciński, M. (2021). Potential of herbal products in prevention and treatment of COVID-19. Literature review. *Biomed. Pharmacoth.*, **143**, 112150.

Gandra, S.; Ram, S.; Levitz, S.M. (2021a). "The "Black Fungus" in India: The Emerging Syndemic of COVID-19–Associated Mucormycosis". American College of Physicians.

Gandra, S.; Ram, S.; Levitz, S.M. (2021b). "The "Black Fungus" in India: The Emerging Syndemic of COVID-19–Associated Mucormycosis". American College of Physicians.

George, M.; Britto, S.J. (2015). Phytochemical and antioxidant studies on the essential oil of the rhizome of Curcuma aeruginosa Roxb. *Internat. Res. J. Pharm.*, **6**(8), 573–579.

Gonçalves, A.; Bertrand, J.; Ke, R.; Comets, E.; De Lamballerie, X.; Malvy, D.; Pizzorno, A.; Terrier, O.; Rosa Calatrava, M.; Mentré, F. (2020). Timing of antiviral treatment initiation is critical to reduce SARS- CoV- 2 viral load. *CPT: Pharmacom. Systems Pharmacol.*, **9**(9), 509–514.

Kumar, G.; Kumar, D.; Singh, N.P. (2021a). Therapeutic approach against 2019-nCoV by inhibition of ACE-2 receptor. *Drug Res.*, **71**(04), 213–218.

Kumar, G.; Kumar, D.; Singh, N. P. (2021b). Therapeutic approach against 2019-nCoV by inhibition of ACE-2 receptor. *Drug Res.*, **71**(04), 213–218.

Li, B.H.; Li, Z.Y.; Liu, M.M.; Tian, J.Z.; Cui, Q.H. (2021). Progress in traditional Chinese medicine against respiratory viruses: A review. *Front. in Pharmacol.*, **12**, 743623.

Li, Z.Y.; Xie, Z.J.; Li, H.C.; Wang, J.J.; Wen, X.H.; Wu, S.Y.; Chen, J.; Zhang, J.J.; Li, L.; Guo, Q.Q. (2021). Guidelines on the treatment with integrated traditional Chinese medicine and western medicine for severe coronavirus disease 2019. *Pharmacol. Res.*, **174**, 105955.

Liu, J.; Wei, H.; He, D. (2023). Differences in case-fatality-rate of emerging SARS-CoV-2 variants. *Public Health in Practice*, **5**, 100350.

Mardani, M. (2020). Post COVID syndrome. *Arch. Clin. Infect. Dis*, **15**, e108819.

World Health Organization (2013). WHO traditional medicine strategy: 2014-2023.

World Health Organization (2020a). Coronavirus Disease (COVID-19): How is it transmitted. *Recuperado de Https://Www. Who. Int/ Emergencies/ Diseases/ Novelcoronavirus*.

World Health Organization (2020b). Coronavirus disease (COVID-19).

World Health Organization (2021a). COVID-19 weekly epidemiological update, 9 March 2021.

World Health Organization (2021b). Evaluation of COVID-19 vaccine effectiveness: interim guidance, 17 March 2021. World Health Organization.

World Health Organization (2021c). WHO-convened global study of origins of SARS-CoV-2: China Part.

Orlo, E.; Russo, C.; Nugnes, R.; Lavorgna, M.; Isidori, M. (2021). Natural methoxyphenol compounds: Antimicrobial activity against foodborne pathogens and food spoilage bacteria, and role in antioxidant processes. *Foods*, **10**(8), 1807.

Ou, X.; Liu, Y.; Lei, X.; Li, P.; Mi, D.; Ren, L.; Guo, L.; Guo, R.; Chen, T.; Hu, J. (2020). Characterization of spike glycoprotein of SARS-CoV-2 on virus entry and its immune cross-reactivity with SARS-CoV. *Nature Communications*, **11**(1), 1–12.

Pan, L.; Mu, M.; Yang, P.; Sun, Y.; Wang, R.; Yan, J.; Li, P.; Hu, B.; Wang, J.; Hu, C. (2020). Clinical characteristics of COVID-19 patients with digestive symptoms in Hubei, China: a descriptive, cross-sectional, multicenter study. *American J. Gastroenterol.*, **115**.

Prajapati, S.K.; Jain, A.; Jain, A.; Jain, S. (2019). Biodegradable polymers and constructs: A novel approach in drug delivery. *European Polymer J.*, **120**, 109191.

Rastogi, S.; Pandey, D.N.; Singh, R.H. (2022). COVID-19 pandemic: A pragmatic plan for ayurveda intervention. *J. Ayurveda and Integrative Med.*, **13**(1), 100312.

Sallis, R.; Young, D.R.; Tartof, S.Y.; Sallis, J. F.; Sall, J.; Li, Q.; Smith, G.N.; Cohen, D.A. (2021). Physical inactivity is associated with a higher risk for severe COVID-19 outcomes: a study in 48 440 adult patients. *British J. Sports Med.*, **55**(19), 1099–1105.

Sanyaolu, A.; Okorie, C.; Hosein, Z.; Patidar, R.; Desai, P.; Prakash, S.; Jaferi, U.; Mangat, J.; Marinkovic, A. (2021). Global pandemicity of COVID-19: Situation report as of June 9, 2020. *Infectious Diseases: Research and Treatment*, **14**, 1178633721991260.

Sayers, E.W.; Beck, J.; Bolton, E.E.; Bourexis, D.; Brister, J.R.; Canese, K.; Comeau, D.C.; Funk, K.; Kim, S.; Klimke, W. (2021). Database resources of the national center for biotechnology information. *Nucleic Acids Research*, **49**(D1), D10.

Sharma, A.D. (2020). Eucalyptol (1, 8 cineole) from eucalyptus essential oil a potential inhibitor of COVID 19 corona virus infection by molecular docking studies.

Shree, P.; Mishra, P.; Selvaraj, C.; Singh, S.K.; Chaube, R.; Garg, N.; Tripathi, Y.B. (2022). Targeting COVID-19 (SARS-CoV-2) main protease through active phytochemicals of ayurvedic medicinal plants–Withania somnifera (Ashwagandha), Tinospora cordifolia (Giloy) and Ocimum sanctum (Tulsi)–a molecular docking study. *J. Biomolec. Struct. Dynam.*, **40**(1), 190–203.

Sibeko, L.; Johns, T.; Cordeiro, L.S. (2021). Traditional plant use during lactation and postpartum recovery: Infant development and maternal health roles. *J. Ethnopharmacol.*, **279**, 114377.

Vandecandelaere, I.; Van Nieuwerburgh, F.; Deforce, D.; Coenye, T. (2017). Metabolic activity, urease production, antibiotic resistance and virulence in dual species biofilms of Staphylococcus epidermidis and Staphylococcus aureus. *PLoS One*, **12**(3), e0172700.

Vargas-Vargas, M.; Cortés-Rojo, C. (2020). Ferritin levels and COVID-19. *Revista Panamericana de Salud Pública*, **44**, e72.

Venugopal, A.; Ganesan, H.; Raja, S.S.; Govindasamy, V.; Arunachalam, M.; Narayanasamy, A.; Sivaprakash, P.; Rahman, P.K.S.; Gopalakrishnan, A.V.; Siama, Z. (2020). Novel wastewater surveillance strategy for early detection of coronavirus disease 2019 hotspots. *Current Opinion in Environm. Sci. Health*, 17, 8–13.

World Health Organization (2020). Advice for the public on COVID-19.

Wiersinga, W.J.; Rhodes, A.; Cheng, A.C.; Peacock, S.J.; Prescott, H.C. (2020). Pathophysiology, transmission, diagnosis, and treatment of coronavirus disease 2019 (COVID-19): A review. *Jama.*, **324**(8), 782–793.

Xia, Y.; Jin, R.; Zhao, J.; Li, W.; Shen, H. (2020). Risk of COVID-19 for cancer patients. *Lancet Oncol.*, **21**(4).

Ye, Z.W.; Yuan, S.; Yuen, K.S.; Fung, S.Y.; Chan, C.P.; Jin, D.Y. (2020a). Zoonotic origins of human coronaviruses. *International J. Biolog. Sci*, **16**(10), 1686.

Ye, Z.W.; Yuan, S.; Yuen, K.S.; Fung, S.Y.; Chan, C.P.; Jin, D.Y. (2020b). Zoonotic origins of human coronaviruses. *Internat. J. Biolog. Sci.*, **16**(10), 1686.

Yen, H.L.; Sit, T.H.C.; Brackman, C.J.; Chuk, S. S.; Gu, H.; Tam, K.W.S.; Law, P.Y.; Leung, G.M.; Peiris, M.; Poon, L.L. (2022a). Transmission of SARS-CoV-2 delta variant (AY. 127) from pet hamsters to humans, leading to onward human-to-human transmission: A case study. *The Lancet*, **399**(10329), 1070–1078.

Yen, H.L.; Sit, T.H.C.; Brackman, C.J.; Chuk, S.S.Y.; Gu, H.; Tam, K.W.S.; Law, P.Y.T.; Leung, G. M.; Peiris, M.; Poon, L.L.M. (2022b). Transmission of SARS-CoV-2 delta variant (AY. 127) from pet hamsters to humans, leading to onward human-to-human transmission: A case study. *The Lancet*, **399**(10329), 1070–1078.

Zeng, Y.; Liu, P.; Yang, X.; Li, H.; Li, H.; Guo, Y.; Meng, X.; Liu, X. (2020). The dietary c9, t11- conjugated linoleic acid enriched from butter reduces breast cancer progression *In vivo*. *J. Food Biochem.*, 13163.