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Complementary and alternative medicine use during the COVID-19 pandemic: Community pharmacists' knowledge, attitudes, and practices

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ABSTRACT

Background: The challenges in COVID-19 treatment have driven patients to seek Complementary and Alternative Medicine (CAM) for the prevention and/or treatment of the disease. Pharmacists are uniquely positioned to promote the effective and safe use of CAM.

Objective: Assess the beliefs, practices, and knowledge of community pharmacists in Lebanon about existing evidence for the use of CAM for the prevention and/or treatment of COVID-19.

Methods: A national cross-sectional survey was conducted among community pharmacists during the COVID-19 pandemic in Lebanon ($n = 310$ respondents). Participants completed an online questionnaire addressing, in addition to the socio-demographic characteristics; the beliefs, practices, and knowledge of pharmacists regarding the existing evidence of CAM use for COVID-19 prevention and/or treatment.

Results: Pharmacists (70%) received frequent inquiries about CAM for COVID-19 prevention or treatment. Only 25.5% of the pharmacists reported having enough time to get information about CAM and COVID-19. Almost all participants believed that pharmacists have a major role in the fight against COVID-19 (98%) and that they have enough information to counsel patients in that regard (75%). For practices, the majority of pharmacists reported counseling their patients on proper use (98%) and possible adverse reactions (93%) of CAM, but only 51% reported toxic or undesirable effects. Regarding knowledge, although most pharmacists answered correctly the questions on the role of CAM in preventing COVID-19, few knew about its role in treating the infection. Pharmacists who trust the WHO website as a credible source had a higher knowledge score ($\beta = 0.52$, 95%CI: 0.05–0.986).

Conclusions: The positive beliefs and practices of pharmacists towards CAM during the pandemic were coupled with a few gaps, especially in their knowledge about existing evidence for CAM use. Concerted efforts ought to be dedicated to supporting pharmacists in playing a more prominent role during health crises such as the COVID-19 pandemic.

1. Introduction

Since its emergence in 2019, the COVID-19 pandemic has posed a heavy burden on many aspects of human life, overwhelming health systems around the world and jeopardizing economic, social, educational, and population wellbeing.¹ Despite the advancement in medicine and drug discovery, and the efficacy of some approved antiviral agents against COVID-19, availability and access to cure have been limited in

many countries around the globe.² Even when available and accessible, in many instances the treatment of COVID-19 continues to fall short of relieving symptoms, preventing recurrent exacerbations, preserving optimal lung function, and enhancing the quality of life.³ Such challenges of conventional medicine vis-à-vis the COVID-19 pandemic have driven a considerable proportion of the population to seek and explore alternative modalities for prevention and treatment of the disease; known as complementary and alternative medicine (CAM). CAM

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according to the National Institute of Health (NIH) (USA) is “a group of diverse medical and health care systems, practices, and products that are not generally considered part of conventional medicine.”⁴ In this manuscript, CAM will be used to refer to supplements and herbal products.

Historically, supplements and herbal products played a vital role in the global fight against many epidemics like SARS (emerged in 2003 in China) and MERS (emerged in 2012 in Saudi Arabia).⁵ Early May 2020, the World Health Organization’s Regional Office for Africa issued a statement of support for scientifically-proven traditional medicine in the search for potential treatments for COVID-19.⁶ Many studies reported the efficacy of natural immune boosters (like Garlic, ginger, black seeds, Echinacea, etc.) for COVID-19 prevention.⁷ In addition, emerging evidence suggested that nutritional supplements may also play a role in either preventative measures or supportive therapy in respiratory infections and intensive care settings.⁸ In fact, ecological studies revealed that the suboptimal consumption of some vitamins (vitamin D, vitamin C, vitamin B12, and iron) is correlated with either COVID-19 incidence or mortality indicators, particularly in populations genetically predisposed to show lower micronutrient status.⁹ Data from clinical trials supported a beneficial effect of higher dosage supplementation of vitamins D, C and zinc during COVID-19 infection through antioxidant effects, immunomodulation, enhancing natural barriers, and local paracrine signaling.¹⁰

In spite of a potential beneficial effect, the use of CAM products might be associated with health hazards related to their toxicity, side effects, improper dosage, interactions, or quality of the products.¹¹ For example, medicinal plants used for respiratory distress, such as *Salvia miltiorrhiza*, *Glycyrrhiza glabra*, *P. ginseng* and *Angelica sinensis*, were reported to have multiple interactions with conventional medicines used for this condition.¹² Even when recommending vitamin or nutritional supplementation, caution must be exerted since the effects of hypervitaminosis could be severe and lead to serious injury, particularly the fat-soluble vitamins A, D, and E.⁸ Such risks could be further amplified by the limited medical supervision or guiding for CAM use. Patients are usually reluctant to discuss CAM use with their health care professionals for fear of their disapproval, disinterest or inability to help,¹³ putting them at various risks of medical complications or delay in medical diagnosis.¹⁴

Pharmacists, as healthcare professionals, are uniquely positioned to promote the effective and safe use of CAM products by providing patients with evidence-based information and counseling. Professional associations, such as the American Society of Health-System Pharmacists (ASHP), the American College of Clinical Pharmacy (ACCP), and the Canadian Society of Hospital Pharmacists, have recommended that the profession of pharmacy actively embrace dietary supplements (natural health products, vitamins, and minerals) as part of the pharmacist’s scope of practice. The ACCP has stated that “the pharmacist’s involvement in herbal products is an extension of their roles in pharmaceutical care, clinical pharmacy practices, and collaborative health-care teams.”¹¹

During the COVID-19 pandemic, the probable use of many CAM modalities by the population and the critical role of community pharmacists in ensuring a safe and effective use of these modalities necessitate a good understanding of the knowledge, attitudes and practices of pharmacists’ vis-vis CAM use for the treatment and prevention of COVID-19. Such an understanding has the potential to inform the practice of pharmacy in pandemics, as well as the development and integration of specific CAM modules into mainstream educational programs of pharmacy. As such, the aim of this study is to assess the attitudes, practices, and knowledge about existing evidence related to the effective and proper use of CAM for the prevention or treatment of COVID-19 infections among community pharmacists. Given that very few CAM products were endorsed by the WHO or any other health agency, in this manuscript, we aimed to evaluate the knowledge of pharmacists regarding the existing evidence for commonly used CAM. A

secondary objective of the study is to investigate the sociodemographic determinants of knowledge related to CAM among study participants.

For the purpose of this study, CAM will be used to refer to supplements and herbal products, given their widespread use in Lebanon and the fact these CAM modalities were repeatedly reported to play a role in the treatment and prevention of COVID-19.^{15–17}

2. Methods

2.1. Study site, design and subject recruitment

The study objectives were examined in Lebanon, a small Eastern Mediterranean developing country with an estimated population of around five million citizens.¹⁸ Existing reports suggested a prevalent use of CAM in the country, whereby about 30% of Lebanese adults use a form of CAM, supplements and herbal products (SHP) being the most commonly used.¹⁹ Higher rates of CAM use were reported among patients with chronic diseases such as infertility (41%), lung cancer (41%), and HIV and AIDS conditions (46.6%).^{20,21} The use of CAM, specifically supplements and herbal products, among the patients’ populations in Lebanon is expected to have increased significantly over the last three years, not only because of the COVID-19 pandemic, but also due to the unprecedented economic meltdown and devaluation of the Lebanese currency.¹⁸ The unfortunate economic situation may have led to drug shortages and left many patients unable to access conventional medicine and purchase needed medications, when available. Such a situation underscores the role of community pharmacists in ensuring a safe and effective use of CAM during the COVID-19 pandemic.

A national cross-sectional survey was conducted to obtain information about pharmacists’ attitudes, knowledge, and practices regarding CAM use during the COVID-19 pandemic in Lebanon between May and September 2021. A de-identified list of the pharmacists was obtained from the directory of the Order of Pharmacists of Lebanon. Sample size calculations were done using Raosoft software. It showed that in order to estimate a 50% prevalence of the outcome at a power of 80% and a 5.5% margin of error, the participation of 290 pharmacists was needed. An online open survey was sent by SMS message to all active registered community pharmacists practicing in Lebanon via their mobile numbers. Invitation messages with the link and directions to participate were sent over three waves until we reached a saturation number. The saturation number was determined by achieving a number of responses equivalent to the calculated sample size, and proportional to the distribution of pharmacists among governorates. (see Table 1).

To be eligible to participate, subjects had to be 1) licensed pharmacists practicing in a community pharmacy setting in Lebanon 2) conversant in either Arabic or English. Before completing the questionnaire, participants agreed to a consent form which included information about the purpose of the study, the protocol, and the time needed to complete the questionnaire. Data collection was anonymous, participation was voluntary with the ability to withdraw at any point, and no incentives were given to participants. The consent form included information on the duration of the questionnaire (7–10 min), the study objectives and investigators. It also indicated that no incentive was offered in return for participation in the study.

The consent form, study protocol, and the Arabic and English versions of the questionnaire were approved by Institutional Review Board at the Beirut Arab University under the protocol number 2022-H-0078-P-R-0469.

2.2. Questionnaire used in data collection

The questionnaire used in the study was developed by a multidisciplinary team consisting of academic professors, pharmacists, a nutrition epidemiologist, and a health and nutrition instructor. The questionnaire was originally developed in English, translated to Arabic, and then back translated to English to ensure parallel reliability of

Table 1
Sociodemographic characteristics of the study sample (n = 310).

	Frequency	Percentage
Distribution of pharmacies across governorates^a		
Mount Lebanon	134	(43.2)
Beirut	64	(20.6)
South	39	(12.6)
North	34	(11.0)
Beqaa	29	(9.4)
Nabatieh	10	(3.2)
Age range		
20–30 years	55	17.7
31–40 years	107	34.5
41–50 years	86	27.7
Above 50 years	62	20.0
Gender		
Male	117	37.7
Female	193	62.3
Employment status		
Full-time employee	93	30.0
Part-time employee	24	7.7
Pharmacy owner	193	62.3
Highest educational level attained		
Bachelors	110	35.5
Masters	60	19.4
Pharm D	124	40.0
PhD	16	5.2
Have you received undergraduate/continuous education in virology?		
Yes	151	48.7
No	159	51.3
Have you received undergraduate/continuous education on supplements/herbal products?		
Yes	152	49.0
No	158	51.0
Years of work experience (in community pharmacy)		
1–5 years	48	15.5
6–10 years	66	21.3
11–15 years	72	23.2
Above 15 years	124	40.0

^a The distribution of pharmacies in Lebanon is as follows (Mount Lebanon (43.1%); Beirut (7.8%); South (11.6%); North (14.3%); Beqaa (15.8%) and Nabatieh (7.3%).

forms. Before launching the study, the questionnaire was piloted on 5 pharmacists to test ease of comprehension and the time needed for completion. The responses of the pilot study were not included in the data analysis. Once participants agreed to take part in the study, they were given the option to fill the English or Arabic versions of the questionnaire. Each page of the questionnaire included 5–7 items (depending on the length of the item), with a total number of 5 pages. Participants were asked to select one option for each of the questions. Where possible, an ‘I don’t know’ or ‘not applicable’ options were given. Back buttons were enabled in case participants wanted to review or edit their responses.

The questionnaire consisted of four main sections. In the first section, information was collected on sociodemographic characteristics such as age, gender, district of practice, highest level of education attained, and years of experience as a community pharmacist. Participants were further asked about their education in virology (basic/advanced) and in supplement/herbal product use.

The second section of the questionnaire explored attitudes among pharmacists with regard to the use of CAM for COVID-19. On a 5-point Likert Scale ranging from strongly agree to strongly disagree, participants expressed their attitudes towards the serious nature of the pandemic, the significant role pharmacists play in spreading awareness and fighting the pandemic, the effectiveness of CAM products in the prevention and treatment of COVID-19, CAM products desirability over conventional medication, and the perceived self-efficacy of pharmacists to give advice on CAM use for COVID-19. In the third section, the practices of pharmacists regarding CAM use during COVID-19 were examined. On a 5-point Likert Scale ranging from strongly agree to

strongly disagree, participants indicated if they offered to educate their customers on COVID-19 precautions, recommended to customers CAM use for prevention or treatment of COVID-19, and counseled them on the proper use of CAM for COVID-19 and the possible adverse reactions that may result. Participants were also asked if they followed up with customers who used CAM and whether they reported any toxic or undesirable side effects that occurred. The fourth section of the questionnaire evaluated the self-knowledge of pharmacists regarding CAM and COVID-19. This section aimed to examine the knowledge of community pharmacists about existing evidence for CAMs that are commonly used during the pandemic. Participants had the choices of true, false, or I do not know to answer to a set of ten statements. The statements looked at knowledge concerning the relation between vitamin D deficiency and COVID-19, as well as the benefit of supplementation with vitamin E, C, zinc, anise, liquorice root, probiotics, and ginger on the treatment and/or prevention of viral infections and their complications in general, and for COVID-19.

In addition to these sections, the questionnaire included questions addressing the experiences that the pharmacists had with their patients with regard to CAM use for COVID-19. More specifically, participants were asked about their access to scientific information on CAM and COVID-19, the amount of time they had to obtain information about COVID-19, the availability of scientific resources on CAM for COVID-19, and whether they felt supported enough to do their responsibilities towards COVID-19. Participants were also asked about the motives they believed were behind their customers’ choice to use CAM as well as about the sources that influenced their choices. In addition, the frequency of CAM purchase and the modality of its use modality were among the questions used to better illustrate the pharmacists’ experience vis-a-vis CAM use during COVID-19.

2.3. Statistical analysis

The collected data was imported, re-coded, and analyzed using Statistical Package for Social Sciences (SPSS). Software version 25.0 for windows. Data were summarized using descriptive statistics such as frequency and proportions. A knowledge score corresponding to the number of correctly answered questions was generated, with a minimum of zero and a maximum of 10. A score of 1 was given for the correct answer and a score of zero for the incorrect answer and for “I don’t know”. Simple and multiple linear regression analyses were used to investigate the associations between knowledge and socio-demographic factors and factors related to information resources on COVID-19, using the knowledge score as the dependent variable and the socio-demographic factors/information resources of COVID-19 as independent variables. P-value < 0.05 was considered statistically significant.

3. Results

A total number of 318 pharmacists participated in the survey. Questionnaires missing 10% or more answers were excluded from the study. As such data for 310 participants were included in this study (completeness rate 97%). Table 1 displays the socio-demographic characteristics of the study population. The distribution of the pharmacists in the study is shown in Table 1, the highest percentage of pharmacists were from Mount Lebanon (43.2%) followed by Beirut (20.6%). The pharmacists were of varied age groups, with most ranging between 31 and 40 years (34.5%) and 41–50 years old (27.7%). Sixty-two percent of the participants were females. More than 60% of the pharmacists who participated in the survey were pharmacy owners (62.3%), and the rest were either full-time (30.0%) or part-time (7.7%) employees. Concerning the education level, 35.5% of the study participants reported having a Bachelor’s degree, 19.45% a Master’s, 40.0% a Pharm D, and only 5.2% attained a PhD. More than half of the participants did not receive any education in virology (51.3%). Similarly, 51.3% did not receive any education on supplements/herbal products.

Over 60.0% of the participating pharmacists reported having more than 10 years of work experience (63.2%), 21.3% had between 6 and 10 years of experience and 15.5% had between 1 and 5 years of experience (Table 1).

Table 2 describes the experiences of pharmacists with regard to the use of supplements/herbal products for COVID-19. The pharmacists in the study reported that their patients are introduced to supplements/herbal products by media and social media (73.5%), self-decision (73.1%), health care prescription (65.9%), and other sources (21.4%). The main reasons patients use supplements/herbal products for COVID-19 as indicated by the pharmacists are “supplements/herbal products

Table 2
Experiences of pharmacists with regards to the use of supplements/herbal products for COVID-19.

	Frequency	Percentage
How are your patients introduced to supplements/herbal products (select all that apply)		
Media and social media	228	73.5
Self-decision	225	73.1
Health care prescription	203	65.9
Other	66	21.4
Reasons why patients use CAM for COVID-19		
Supplements/herbal products are natural	215	69.8
Supplements/herbal products are safer	183	59.4
Supplements/herbal products are more effective	135	43.8
No other alternatives are available	109	35.4
The cure for COVID-19 is more expensive than supplements/herbal products	101	32.8
Indicate how often you were asked for supplements/herbal products for COVID-19 prevention or treatment per day		
<1 time	55	19.4
1-3 times	86	30.3
4-6 times	45	15.8
7-10 times	66	23.2
>10 times	32	11.3
What are the supplements/herbal products you are selling for COVID-19 treatment?		
Zinc	227	73.2
Vitamin C	215	69.4
Vitamin D	193	62.3
Immuno-boosting herbs	49	16.0
Multivitamins	14	4.5
Probiotics	5	1.6
Other ^a	17	5.5
What are the supplements/herbal products you are selling for COVID-19 prevention?		
Zinc	199	64.2
Vitamin C	188	60.6
Vitamin D	157	50.6
Immuno-boosting herbs	64	20.6
Multivitamins	15	4.8
Probiotics	6	1.9
Other ^a	21	6.8
Patients are asking for supplements/herbal products for COVID-19 for		
Prevention more than treatment	139	44.8
Treatment more than prevention	41	13.2
Equally for prevention as well as treatment	130	41.9
Do you have time to get information about COVID-19?		
No time at all	3	1.0
Very limited time	89	28.7
Adequate time	139	44.8
Enough time	79	25.5
Which of the below do you trust as a credible source?		
MOPH	209	67.9
WHO website	246	79.9
Media (TV, radio, social media)	189	61.4
Scientific websites	289	93.8
Other sources	169	54.9
Information resources on natural products for COVID-19 are accessible by the pharmacists?		
Disagree	68	22
Neutral	96	31.0
Agree	146	36.8

^a Included different combination therapies for treatment or prevention.

are natural” (69.8%), “supplements/herbal products are safer” (59.4%), “supplements/herbal products are more effective” (43.8%), “no other alternatives are available” (35.4%) and “the cure for COVID-19 is more expensive than supplements/herbal products” (32.8%). Almost 70% of pharmacists are asked 1–10 times per day for supplements/herbal products for COVID-19 prevention or treatment. The most common supplements/herbal products that pharmacists are selling for COVID-19 treatment and prevention respectively are zinc (73.2%, 64.2%), vitamin C (69.4%, 60.6%), and vitamin D (62.3%, 50.6%). When asked whether patients ask for CAM more frequently for prevention, treatment, or both, 49% of pharmacists indicated prevention more than treatment, 41.9% equal frequency for prevention and treatment while 13.2% reported that patients ask for treatment more frequently as compared to prevention. Only 25.5% of the pharmacists reported having enough time to get information about COVID-19. Trusted sources by pharmacists as credible on COVID-19 are as follows: scientific websites (93.8%); WHO website (79.9%); MOPH (67.9%). In addition, more than 60% use Media such as TV, radio, and social media (61.4%), and over 50% use other sources (54.9%). When asked about the availability of information resources on natural products for COVID-19, only 36.8% agreed that these resources were accessible.

The pharmacist’s attitudes towards supplements/herbal products and COVID-19 are displayed in Table 3. Almost all the participants

Table 3
Pharmacist’s beliefs towards supplements/herbal products and COVID-19 (n = 310)^a.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I believe COVID-19 is a global pandemic which require prevention and treatment	259 (83.5)	49 (15.8)	0(0.0)	2(0.6)	0(0.0)
I believe pharmacists have a major role in the fight against COVID-19	233 (75.2)	71 (22.9)	3(1.0)	3(1.0)	0(0.0)
I believe supplements/herbal products are effective in the prevention of COVID-19	39(12.6)	137 (44.2)	95 (30.6)	29(9.4)	10(3.2)
I believe supplements/herbal products are effective in treating COVID-19 infection	28(9.0)	85 (27.4)	139 (44.8)	46 (14.8)	12(3.9)
I believe pharmacists should be involved in the awareness campaign against COVID-19 (precautions, measures, diagnosis..)	237 (76.5)	67 (21.6)	5(1.6)	1(0.3)	0(0.0)
I believe that supplements/herbal products are preferable over conventional medication in COVID-19 prevention and treatment	14(4.5)	68 (21.9)	108 (34.8)	88 (28.4)	32(10.3)
Do you believe that you have enough information to advice patients on supplements/herbal products for COVID-19	80(25.8)	149 (48.1)	63 (20.3)	14(4.5)	4(1.3)

^a Numbers in this table represent n(%).

(99.3%) strongly agreed/agreed that COVID-19 is a global pandemic that requires prevention and treatment. Similarly, the majority (98.1%) strongly agreed/agreed that pharmacists have a major role in the fight against COVID-19. While more than half of the pharmacists believed that supplements/herbal products are effective in the prevention of COVID-19 (56.8% strongly agreed/agreed) only 27.4% agreed that supplements/herbal products are effective in treating COVID-19 infection. The participants had positive beliefs concerning their involvement in the awareness campaign against COVID-19 with 98.1% strongly agreeing/agreeing that pharmacists should be involved. Almost 40% of the pharmacists did not believe that supplements/herbal products are preferable over conventional medications in COVID-19 prevention and treatment. Almost 75% of the pharmacists believed (by strongly agreeing/agreeing) that they have enough information to advise patients on supplements/herbal products for COVID-19.

Table 4 demonstrates the practices of the pharmacist toward supplements/herbal products and COVID-19. Ninety-eight percent reported that they educate their patients on precautions that should be taken to prevent COVID-19 (strongly agreeing/agreeing). When asked if they recommend supplements/herbal products for their patients to prevent or treat COVID-19, 80.6% reported that they do by strongly agreeing/agreeing to the statement, and 14.5% reported being neutral. With regards to the statement “Do you counsel patients on the proper use (dose, mode, etc.) of supplements/herbal products?” Almost all (98.3%) strongly agreed/agreed that they do. Similarly, the majority of participants (92%) strongly agreed/agreed with the statement “Do you counsel patients on the possible adverse reaction/interactions of the

Table 4
Pharmacist practices towards supplements/herbal products and COVID-19 (n = 310)^a.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Do you educate your patients on precautions that should be taken to prevent COVID-19?	214 (69.0)	94 (30.3)	2(0.6)	0(0.0)	0(0.0)
Do you recommend supplements/herbal products for your patient to prevent or treat COVID-19?	100 (32.2)	150 (48.4)	45 (14.5)	11(3.5)	4(1.3)
Do you counsel patients on the proper use (dose, mode, etc.) of supplements/herbal products for COVID-19?	196 (63.2)	98 (31.6)	9(2.9)	6(1.9)	1(0.3)
Do you counsel patients on the possible adverse reaction/interactions of the supplements/herbal products used for COVID-19?	154 (49.7)	131 (42.3)	19(6.1)	4(1.3)	2(0.6)
Do you report any toxic or undesirable effects that occurred with patients using supplements/herbal products for COVID-19?	68(21.9)	91 (29.4)	95 (30.6)	45 (14.5)	11(3.5)
Do you follow up with your COVID-19 patients who are taking supplements/herbal products?	107 (34.5)	107 (34.5)	63 (20.3)	27(8.7)	6(1.9)

^a Numbers in this table represent n (%).

supplements/herbal products used for COVID-19?” Contrary to the previously mentioned positive practice of the pharmacists in the study, only 51% strongly agreed/agreed and 30.6% were neutral to the statement “Do you report any toxic or undesirable effects that occurred with patients using supplements/herbal products for COVID-19?” In addition, only 69% strongly agreed/agreed and 20.3% were neutral for the following statement: “Do you follow up with your COVID-19 patients who are taking supplements/herbal products?”

Table 5 displays the results of the self-knowledge regarding supplements/herbal products section which was composed of 10 questions. The majority of the pharmacists answered correctly the questions related to vitamin D deficiency prevalence in people with COVID-19 (69.0%), zinc supplementation and management of viral infection (79.0%), and vitamin C supplementation for the treatment of COVID-19 infection (68.7%). Around half of the participants answered correctly the question related to anise and its effectiveness in the prevention of COVID-19 infection (49.0%) and the use of probiotic supplements to regulate the immune system that may help in the prevention or treatment of a viral infection (53.2%). However, the pharmacists showed low knowledge in the questions related to the treatment of COVID-19 infection such as; vitamin D deficiency and predisposition to COVID-19 infection (30.3%), the benefit of vitamin E supplementation in viral infection management (34.2%), the use of liquorice roots to

Table 5
Evaluation of self-knowledge among a national sample of pharmacists in Lebanon (n = 310)^a.

	True/false	% answered correctly	% answered incorrect	% answered I don't know
Vitamin D deficiency was highly prevalent in people with COVID-19 ^{30,31}	T	214(69.0)	48(15.5)	48(15.5)
Vitamin D deficiency predisposes to COVID-19 infection ^{30,31}	F	94(30.3)	160(51.6)	56(18.1)
Supplementation of Zinc could be effective in management of viral infection ^{32,33}	T	245(79.0)	32(10.3)	33(10.6)
Supplementation of vitamin E may be beneficial in viral infection management ^{8,32}	F	106(34.2)	95(30.6)	109(35.2)
Anise is effective in prevention of COVID-19 infection ^{34,35}	F	152(49.0)	32(11.0)	124(40.0)
Liquorice root could be beneficial in alleviating respiratory symptoms of COVID-19 infection ^{35,36}	T	98(31.6)	97(31.3)	115(37.1)
Vitamin C supplementation may be effective in treatment of COVID-19 infection ^{32,37}	T	213(68.7)	51(16.5)	46(14.8)
Vitamin C supplementation is effective in prevention of COVID-19 infection ³⁸	F	50(16.1)	228(73.5)	32(10.3)
Probiotics supplementation is beneficial to regulate immune system that may help in prevention or treatment of viral infection ^{32,39}	T	165(53.2)	58(18.7)	87(28.1)
Ginger may have positive effects on covid-19 management ^{34,40}	T	116(37.4)	55(17.7)	139(44.8)

^a Numbers in this table represent n (%).

alleviate respiratory symptoms of COVID-19 infection (31.6%), vitamin C supplementation in prevention of COVID-19 infection (16.1%) and the use of Ginger for COVID-19 management (37.4%). For the knowledge score, the mean was 4.69 ± 1.63 , and the distribution of the knowledge score is shown in Fig. 1. Results showed that trusting the WHO website as a credible source was the only significant predictor of a higher knowledge score. This association remained significant even after adjustment for potential confounders ($\beta = 0.52$, 95%CI: 0.05–0.986) (data not shown).

4. Discussion

This study aimed to examine the knowledge, attitudes, and practices of community pharmacists regarding CAM during the COVID-19 pandemic. Overall, surveyed participants displayed positive attitudes towards their role in supporting safe and effective CAM use during the pandemic and believed that they have enough information to do so. Such positive attitudes were also reflected on pharmacists' practices whereby most participants offered counseling on CAM use. However, fewer participants indicated that they follow up with their patients who have opted to use CAM for COVID-19 treatment. Similarly, almost one in two surveyed pharmacists did not report toxic or undesirable effects. The general positive attitudes and practices regarding the pharmacists' role in promoting safe and effective CAM use during COVID-19 observed in the study population were not mirrored by the knowledge results, which suggested major gaps in pharmacists' knowledge in the field. Only trusting WHO as credible source for information was found to positively affect the knowledge of pharmacists.

The findings of this study showed that the majority of community pharmacists have positive attitudes regarding their role in the combat of COVID-19, including promoting the safe and effective use of CAM during the pandemic. In support of the findings of this study, prior research by our team revealed that community pharmacists in Lebanon have positive beliefs and attitudes towards their role in promoting safer and effective use of CAM products in general.¹¹ Research in other countries, such as the United Arab Emirates also showed a positive attitude among pharmacists as to their role during pandemics.²²

In this study, the reported positive attitudes towards pharmacists' role in combatting COVID-19 and in promoting safe and effective CAM use during the pandemic were manifested when practices were investigated. The results showed that almost all participants educate their patients on safety measures and precautions to be undertaken. In addition, pharmacists seemed to be actively involved in guiding CAM use with 95% of participants indicating they recommend certain CAMs for their patients. The majority of participants indicated that they counsel their patients on the proper use of CAM and the possible adverse effects

associated with CAM use. Previous studies also showed that pharmacists were always/often advising patients on safe CAM use.¹¹

In this study, however, a few gaps were noted regarding practices, mainly in relation to pharmacist follow-up and adequate reporting of toxic or undesirable effects which occurred to patients who opted to use CAM. In a systematic review regarding the community pharmacists' responsibilities with regards to CAM, the authors identified seven main areas, two of which were following up on the use of CAM and reporting associated adverse effects of CAM.²³ These two roles are especially critical during the COVID-19 pandemic when little was known about the effects of certain CAM products and even less about their adverse and side effects.²⁴

The observed knowledge of the pharmacists in this study fell short of their generally positive attitudes and practices vis-à-vis CAM during the pandemic. The results showed a sizeable proportion of pharmacists either not knowing the right answer or answering wrongly. These findings come despite the fact that 74% of pharmacists reported believing that they have enough information to advise patients on CAM use during COVID-19. Such findings are alarming for first, they showed major gaps in the knowledge of pharmacists and second, they suggested that pharmacists are unaware of these gaps. These gaps are significant specifically in light of existing evidence showing that pharmacists are being increasingly requested information about dietary supplementation, vitamins, and any options on the shelves that could offer symptom relief and boost the immune system during COVID-19.²⁵ In this study, even though zinc, vitamin D and vitamin C were among the most sold CAM products, a considerable proportion of pharmacists did not answer correctly the related knowledge questions. While there were no association/correlation analyses conducted in this study to examine the sale of these supplements with their related knowledge, these observational findings suggest that pharmacists may not have the needed knowledge to dispense these supplements. Many of the previous studies addressing the knowledge of pharmacists in CAM showed good to very good knowledge levels, indicating that, in general, pharmacists are aware of the evidence-based recommendations in the field of CAM.^{11,26,27} That said, it is not surprising that this is not the case during the COVID-19 pandemic given the scarcity of evidence on the efficacy of CAM for the treatment or prevention of COVID-19.

The limited knowledge of the pharmacists observed in this study is further disconcerting in light of their reported experiences whereby over 50% of pharmacists were asked about CAM more than four times a day and pharmacists were approached with questions not only for prevention but also for the treatment of COVID-19. This situation underscores the critical and also opportune position of the community pharmacist, who, when equipped with the right knowledge is ideally situated to promote and support the safe and effective use of CAM.

In light of the study findings, a few overarching recommendations to support the role of pharmacists in ensuring a safe and effective use of CAM could be proposed as they apply to the community pharmacists globally. For instance, pharmacists are encouraged to seek information from credible sources in order to build their knowledge. In this study, out of all the variables studied in relation to knowledge, only pharmacists who trust WHO website as credible source was found to be positively associated with a better knowledge of CAM in relation to COVID-19 among the pharmacists. The WHO plays a pivotal role among all international organizations involved in addressing pandemics, and it is the only source of legal authority. Among the core functions of the WHO in combatting pandemics such as the COVID-19 is to develop guidelines and evidence-based recommendations.²⁸ Therefore, providing pharmacists with access to credible scientific resources should be a priority at times of health crises such as that of the COVID-19 pandemic, factoring in the limited time that pharmacists have. For this purpose, it is possible to use mobile applications and programs that maintain and improve the knowledge of pharmacists regarding the COVID-19 pandemic. Free access to courses about COVID-19 could be offered to pharmacists, including the prevention and treatment strategies and patient safety

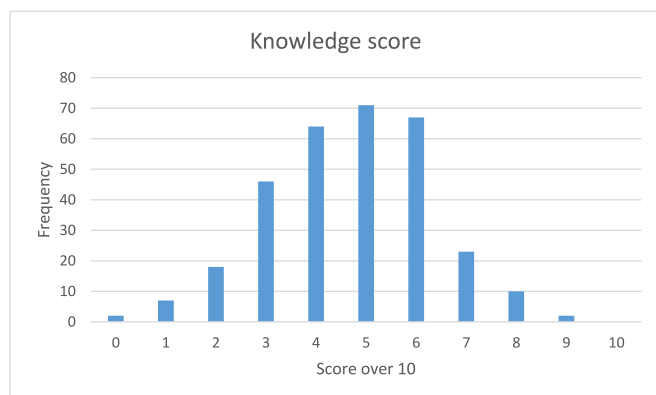


Fig. 1. Distribution of knowledge score on CAM by study population. *mean score 4.69 ± 1.63 .

concerns. In addition, while the attitudes and most of the practices of the community pharmacists during the pandemic were supportive of safe and effective use of CAM, certain gaps in the follow-up and adequate reporting of toxic or undesirable effects which occurred to patients who opted to use CAM were noted in this study. That said, pharmacists' resources during these difficult times could have been a hindrance to properly exercising their role. A situation that calls on governments to channel support for pharmacists. For example, In New Zealand, the government dispensed extra remuneration for pharmacists for their critical role during the pandemic.²⁹ Overall, the findings of this study further underscore the important role that pharmacists are set to play amidst health threats including pandemics and highlight an opportunity to build on their positive attitude to further support their role in promoting safe and effective CAM use. Concerted efforts between governmental and non-governmental entities ought to be dedicated so that pharmacists stay updated and use a reliable source of information during a pandemic.

While the aforementioned global recommendations also apply to the specific study site- Lebanon, certain findings of the study warrant further examination in light of the particularities of the country. More specifically, the recent economic meltdown and financial crises in Lebanon limited the access conventional medications. In the country, while doctors' visits became too expensive and out of reach for a large segment of the population, consulting the pharmacists remained free. Hence rendering the role of pharmacists critical in ensuring the effective and safe use of CAM.

The findings of this study ought to be considered in light of a few limitations. The data was collected using a self-completed online questionnaire. This method for data collection attenuates a potential interviewer bias and social desirability bias, however, it remains possible that participants may have misread or misunderstood certain questions. In addition, although no data were collected to examine the internal validity of the questionnaire, the panel of experts, consisting of academic professors, pharmacists, a nutrition epidemiologist, and a health and nutrition instructor, thoroughly reviewed the developed questionnaire in order to ensure both face and content validity. More specifically the panel of experts examined the questionnaire to confirm the logical link between the questionnaire and the research objective (face validity) and to verify that the important aspects of the research question are covered by the questionnaire (content validity). Furthermore, a self-selection bias could have taken place, and pharmacists who are interested in CAM were more likely to choose to participate. In this case, the results of this study represent a best-case scenario giving further weight to the gaps identified. Lastly, the COVID-19 pandemic has been a quickly evolving pandemic and a snapshot using cross-sectional study design may be limited in representing the overall conditions of pharmacists during the pandemic. Future longitudinal studies are hence warranted.

5. Conclusion

This study described the knowledge, attitudes, and practices of community pharmacists vis-à-vis CAM use during the COVID-19 pandemic. The findings of the study confirmed the positive attitudes which pharmacists have long displayed toward CAM and their role in promoting its safe and effective use. Even during the pandemic, the study showed that the pharmacists continued to practice according to standards and were offering counseling to their patients on the proper use of CAM, including discussing the dosages and possible adverse effects. However, certain serious gaps in the practice were identified especially in what related to follow-up with patients taking CAM for treatment of COVID-19 and to reporting adverse side effects. Furthermore, while the knowledge of pharmacists regarding the existing evidence about the uses of various CAM products was found to be suboptimal, access to scientific information was identified as an opportunity to reposition pharmacists as agents of public health education.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.sapharm.2022.10.009>.

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