

Perspectives on COVID-19 prevention and treatment using herbal medicine in Vietnam: A cross-sectional study

V.D. Tran^{1,2}, D.T. Pham³, T.T.N. Cao⁴, M. Bahlol^{5,6}, R.S. Dewey⁷, M.H. Le², V.A. Nguyen⁸

From the Editor in Chief

Once received the submission of the paper by Van De Tran “Perspectives on COVID-19 prevention and treatment using herbal medicine in Vietnam: a cross-sectional study” (1), we sent it to two anonymous Reviewers, according to the policy of this journal; after they looked at it, we agreed to publish the revised paper which comes from a Country where the folk medicine of herbs is popular and even practiced as a complement to the western medicine, though in substantial absence of evidence of effectiveness according to the scientific medicine. The first Author is a member of the Department of Traditional Medicine, Faculty of Medicine of the Can Tho University of Medicine and Pharmacy, Viet Nam.

The paper deals with an investigation on self-reported results about the use of herbal therapy by the population, which was conducted with shared techniques. Further, we decided also to ask two expert colleagues from the University of Pisa to make a general comment of the paper.

Gaetano M Fara, Editor in Chief, Ann Ig

1. Tran VD, Pham DT, Cao TTN, Bahlol M, Dewey RS, Le MH, Nguyen VA. Perspectives on COVID-19 prevention and treatment using herbal medicine in Vietnam: A cross sectional study. Ann Ig. 2022 Sept-Oct; 34(5): 515-31. Epub 2021 Dec 9.

Perspectives on COVID-19 prevention and treatment using herbal medicine in Vietnam: A cross-sectional study

V.D. Tran^{1,2}, D.T. Pham³, T.T.N. Cao⁴, M. Bahlol^{5,6}, R.S. Dewey⁷, M.H. Le², V.A. Nguyen⁸

Received: 2021 August 18

Accepted after revision: 2021 October 23

Published online ahead of print: 2021 December 9

Key words: COVID-19, herbal medicine, prevention, treatment, Vietnam

Parole chiave: COVID-19, medicina dei semplici, prevenzione, trattamento, Vietnam

Abstract

Introduction. The significance of herbal medicine (HM) during the COVID-19 pandemic has been confirmed. Nevertheless, limited studies have included the people perspectives on COVID-19 prevention/treatment using herbal medicine in Vietnam. Thus, this study tackled the aforementioned issue.

Methods. Online-based cross-sectional study was conducted in Vietnamese adults between February-April 2021. Descriptive analysis, regression and Chi-squared tests were implemented for the statistical purposes.

Results. A total of 787 respondents attended the study, 368 (46.8%) confirmed that they use herbal medicine/nutritional supplements for COVID-19 prevention/treatment. Over 50% of the respondents possessed positive perspective on vitamin C ingestion. Using herbal medicine for external use as a disinfectant was mostly preferred. Respondents who had a 'very good' health self-perception or who lived in rural areas, were more likely to have a positive opinion in the COVID-19 prevention/treatment using herbal medicine. The main barrier for herbal medicine utilization was the deficiency of personal experience or expert advice.

Conclusion. The Vietnamese people commonly utilize herbal medicine for the COVID-19 prevention/treatment. These data might help policy-makers in managing the public knowledge and practice on herbal medicine use in Vietnam.

¹ Department of Drug Administration, Faculty of Pharmacy, Can Tho University of Medicine and Pharmacy, Can Tho, Vietnam

² Department of Traditional Medicine, Faculty of Medicine, Can Tho University of Medicine and Pharmacy, Can Tho, Vietnam

³ Department of Chemistry, College of Natural Sciences, Can Tho University, Campus II, Can Tho, Vietnam

⁴ Department of Biology – Genetics, Faculty of Basic Science, Can Tho University of Medicine and Pharmacy, Can Tho, Vietnam

⁵ Pharmaceutical Management and Economics, Faculty of Pharmacy, Egyptian Russian University, Cairo, Egypt

⁶ Pharmaceutical Management and Economics, Department of Clinical Pharmacy, Faculty of Pharmacy, Jazan University, Jazan, Saudi Arabia

⁷ Sir Peter Mansfield Imaging Centre, School of Physics and Astronomy, University of Nottingham, Nottingham, United Kingdom

⁸ Department of Traditional Medicine, Can Tho General Hospital, Can Tho, Vietnam

1. Introduction

Herbal medicine (HM), also known as traditional medicine or folk medicine, includes the use of traditional products as health/dietary or herbal/nutritional supplements. The importance of HM has permeated the understanding of healthcare professionals and the public at an international level. HM has been traditionally practiced in developing countries for decades, especially Asian countries (1-3), as approximately 80% of the population practices HM in the primary healthcare (4, 5). For comparison, in developed countries, healthcare professionals in North America and Europe suggest patients for chiropractic techniques (40%), massage (21%), and acupuncture (43%), somewhat less often (6). Conversely, in Japan, a majority (80%) of healthcare workers mentioned HM in their treatments (7).

The COVID-19, an infectious pneumonia-like disease caused by a novel strain of coronavirus, was acknowledged as a pandemic in March 2020 (8-11). Consequently, the health crisis spread globally at an unprecedented rate, seriously affecting national healthcare systems and governments (12-15). Physical distancing and protective measures, as well as limited therapeutic options have all been considered to counter SARS-CoV-2. For instance, extensive vaccination programs have been implemented in numerous countries (10, 16, 17). As of May 5, 2021, more than 1.21 billion vaccine doses have been administered in 190 countries and territories (18, 19). Unfortunately, the coronavirus, like other viruses, constantly changes through mutation, and new deadly variants appear over time. For example, compared to the original variant, the variants denoted B.1.427, B.1.1.7, B.1.351, P.1, and B.1.429 demonstrate increased transmissibility, cause more severe disease states, reduce the neutralization capabilities of antibodies

(generated by vaccination), and/or are more difficult to diagnostically detect (20-24). As such, vaccination against these known variants is less effective, and to as yet undiscovered variants, potentially useless. In terms of the COVID-19 treatments, for those at high risk of disease progression, the use of anti-SARS-CoV-2 antibody-based therapies such as bamlanivimab plus etesevimab (AIIa) or casirivimab plus imdevimab (AIIa) is generally recommended (25). Remdesivir, an antiviral compound, is presently the single therapeutic compound approved by the US Food and Drug Administration for the management of COVID-19, as of May 5, 2021. However, this treatment is only recommended for hospitalized patients being treated with supplemental oxygen (26-28), and no drug is currently specified for outpatients with mild-to-moderate disease severity who are not at high risk for disease progression.

With limited effective therapeutic options, and since the approval process for new medications requires several stages of pre-clinical and clinical trial followed by lengthy regulatory processes, the utilization of HM might be an effective alternative approach. HM has been shown to relieve cold- and flu- like symptoms such as fatigue, sore throat, fever, muscle pain, and cough, to enhance the human immunity capabilities against coronavirus (29), and to effectively treat and prevent SARS-related diseases (30-32). Additionally, HM can be combined with Western medicine for synergistic effects against SARS-related diseases (33), specifically COVID-19 (34, 35). Moreover, the advantages of HM include it being a natural product with few and minor side effects, it being financially affordable and accessible to the population. Consequently, the Thailand Health Ministry has recently approved the use of HM to treat the early stages of COVID-19 (36).

In Vietnam, HM can either be prescribed or consumers can purchase it over-the-counter.

On the market, over 700 legally-registered medications containing HM ingredients. Moreover, in most of the hospitals across the country, a traditional medicine department is utilized. The healthcare authority has published a long term plan to increase the HM-based treatment rates to 30% of all prescriptions by the year 2025 (37). During the pandemic, the HM use for COVID-19 prevention and treatment has been further accelerated by the Vietnam Ministry of Health. Additionally, to avoid exacerbating cramped places including healthcare facilities and to address individuals' fear of becoming infected, people have been encouraged to use the available therapies in the safety of their own homes (38). HM use amongst Vietnamese people has increased significantly, mainly in treating cold- and flu-like symptoms (8). Public opinion of a given medication had been associated with an increase in its use. Studies on public opinions and HM use during the pandemic have been conducted in Nepal (39), Saudi Arabia (40), and Morocco (41). However, limited amount of work on this topic has been conducted in Vietnam. Moreover, the predictors of HM use have not yet been explored.

Thus, this work aimed to explore the predictors of and public opinion around the use of HM to combat COVID-19 in Vietnam. To achieve this aim, we conducted a cross-sectional survey of Vietnamese people to assess their use of HM to prevent and/or treat COVID-19, and their opinions about HM and associated factors. Individuals' motivation to use HM and barriers preventing them from using HM were also investigated.

2. Method

2.1. Study setting

Participants (Vietnamese adults who were at least 18 years old at the investigation period) were employed using a cross-sectional questionnaire-based survey through

public Facebook posts, Facebook Messenger, and Zalo platforms, as they cover more than 80% of all social media users in the country (42). The questionnaire was distributed using Google Forms as a self-administered questionnaire in accordance with physical distancing measures that precluded the use of interview-based data collection methods during the pandemic. The survey accessibility was maintained for 12 weeks from February to April 2021.

The study sample size was calculated using the Cochran formula (precision of 5%, confidence level of 95%, and maximum variable heterogeneity of $p = 0.5$). The minimum study sample size was 385. To increase the exploratory results rationalization, we doubled this to generate a target sample size of approximately 770 subjects.

2.2. Questionnaire design

To design the questionnaire, three main categories were employed. The first category consisted of the participants socio-demographic characteristics, namely; marital status, age, gender, region, education, urbanicity, occupation, and monthly income; and health-related variables such as whether they had a healthcare-related job, any chronic diseases, and their health status self-perception.

The second category consisted of polar questions (yes/no alternatives) around HM use as a protective/treatment measure, such as 'During the pandemic, have you used herbal medicine or nutritional supplements for the purpose of strengthening your body's immunity and reducing the chance of developing COVID-19, or for treating COVID-19?'. Respondents who answered 'no' were asked to respond to several further items about personal and systemic barriers to HM use. Participants who answered 'yes' were asked additional items exploring the types of HM used, mode of collection, and the reasons for their motivation to use

HM. All questionnaire respondents were then asked whether they agreed with the following 4 statements based on the work of Panyod et al. (43): 1. 'using foods and herbs as diet or supplement to prevent infection and strengthen immunity', 2. HM can be used 'as an anti-viral agent by coating on masks', 3. HM can be used 'as an air-disinfectant (essential oil) to stop aerosol transmission', and 4. HM can be used 'as a surface sanitizing agent to provide a disinfected environment'.

The last category consulted participants about their opinions around the use of HM as a protective or treatment measure against COVID-19. Participants were asked whether they agreed or disagreed with 10 statements, adapted from a previous study by Alyami et al. (40), with minor modifications. In particular, sesame oil was replaced by cajuput essential oil (*Melaleuca cajuputi*) because of its widespread use for medicinal application in Vietnam (44). To evaluate each statement, participants were asked to select from the options of 'yes', 'no', 'maybe', and 'don't know'. Participants who had more than five 'yes' answers out of the 10 items were considered having a 'positive' opinion of HM. On the contrary, they were deemed to have a 'negative' opinion of HM.

2.3. Ethical considerations

The present study was ethically approved by the Medical Ethics Council of Can Tho University of Medicine and Pharmacy, Can Tho, Vietnam (approval number: 245/HDDD-PCT). Participant anonymity was upheld throughout, with no personal data collection.

2.4. Statistical analysis

SPSS version 20.0 was used for all analyses. Descriptive statistics including frequencies and percentages were used to present categorical data. Chi-squared tests were used to assess the association between HM use (or opinion of HM)

and socio-demographic factors. Variables with statistically significant values were subsequently included in the regression model (45). The odds ratio (OR) with 95% confidence intervals (CI) for use of and opinion of HM was presented for each category of participants. Statistical significance was considered at a threshold of $P < 0.05$.

3. Results

3.1. Participant characteristics

A total of 787 individuals participated in the survey. The socio-demographic characteristics of participants are shown in Table 1. In summary, most participants were female (64.5%), lived in rural areas (51.1%) of Vietnam Southern region (59%), had a mean age of 26 years, had completed a university degree (65.7%), and worked in healthcare-related fields (62.4%). More than 80% of the respondents perceived their health to be good or very good and most did not have a chronic illness (96.2%).

3.2. Use of HM for COVID-19 prevention/treatment and associated factors

Out of 787 respondents, 368 (46.8%) reported that they had used HM to protect/treat against COVID-19 during the pandemic (Table 2). Vitamins/minerals (75.8%), traditional Vietnamese herbs (55.7%), and herbal supplements (31.5%) were the most commonly used forms of HM. These products were primarily obtained from home gardens (54.6%), herbal drugstores (41.3%), and traditional medicine hospital departments (35.3%). Of those reporting the use of HM against COVID-19, more than 70% of the participants reported they prefer using HM internally as dietary supplement to prevent infection and strengthen immunity (87.8%), and externally as a surface sanitizer to disinfect their environment (72.8%).

Among the 368 HM users, the main

Table 1 - Socio-demographic characteristics of respondents (n = 787)

Variable		n (%)
Region	North	159 (20.2)
	Central	164 (20.8)
	South	464 (59.0)
Urbanicity	Rural	402 (51.1)
	Suburban	68 (8.6)
	Urban	317 (40.3)
Age group, years	18 – 29	621 (78.9)
	30 – 39	123 (15.6)
	40+	43 (5.5)
Gender	Male	279 (35.5)
	Female	508 (64.5)
Education	High school or lower	81 (10.3)
	Colleges/Vocational schools	112 (14.2)
	Undergraduate	517 (65.7)
	Postgraduate	77 (9.8)
Occupation category	Unemployed/Retired/Housewife	57 (7.2)
	Student	476 (60.5)
	Working	254 (32.3)
Healthcare-related job	Yes	491 (62.4)
	No	296 (37.6)
Monthly income, VND million [#]	< 4.2	149 (18.9)
	4.2 – 8.3	220 (28.0)
	8.4+	386 (49.0)
Marital status	Single/Divorced/Widowed	620 (78.8)
	Married	167 (21.2)
Health status perception	Very poor/Poor/Fair	145 (18.4)
	Good	406 (51.6)
	Very good	236 (30.0)
Chronic disease	Yes	30 (3.8)
	No	757 (96.2)

[#] Data were missing for 32 (4.1%) of participant.

motivations to use HM were 1. HM being a natural source of medicine (52.4%), 2. a positive previous personal experience (50.3%), i.e., they used it before pandemic, and 3. the ease of accessibility and availability of HM (47.3%). Conversely, non-users (53.2%; 419 respondents) stated that the major barriers to using HM were 1. a lack of experience/understanding (58.5%) and 2. insufficient expert advice on its use (40.3%). The full lists of motivations and barriers,

as well as the frequencies of responses to each item, are expressed in Figures 1 and 2, respectively.

Table 3 presents the factors associated with HM use. A Chi-squared test showed that HM use varied significantly with age ($P = 0.027$), education ($P = 0.028$), marital status ($P < 0.001$), and self-perception of health status ($P = 0.011$). A regression model analysis on these factors showed that education, marital status, and self-perception

Table 2 - Characteristics of herbal medicine (HM) uses among HM user (n = 368)

Variables	Frequency, n (%)
Type of herbal medicine, herbal/nutritional supplements used	
Herbal supplements	116 (31.5)
Traditional Chinese herbs	52 (14.1)
Traditional Vietnamese herbs	205 (55.7)
Probiotics	57 (15.5)
Vitamins/Minerals	279 (75.8)
Amino acids, essential fatty acids	63 (17.1)
Source to obtain herbal medicines	
Traditional hospitals	130 (35.3)
Herbal drugstores	152 (41.3)
Drugstores	124 (33.7)
Availability at home gardens	201 (54.6)
Internet	40 (10.9)
Markets, supermarkets	128 (34.8)
Family, friends	106 (28.8)
Application reference of herbal medicine to fight COVID-19	
Using foods and herbs as diet or supplement to prevent infection and strengthen immunity	323 (87.8)
Use as an antiviral agent by coating on masks	156 (42.4)
Use as an air-disinfectant (essential oil) to stop aerosol transmission	176 (47.8)
Use as a surface sanitizing agent to provide a disinfected environment	268 (72.8)

of health status were independently related to HM use, while age was not a contributing factor. Accordingly, participants who had completed higher education had higher odds of using HM compared to those who had high-school or lower education level ($P < 0.05$). Those who were married were 1.8 times more likely to use HM than others ($P = 0.009$). Participants whose self-perceived health status was 'very good' were 1.8 times more likely to use HM than those responding 'very poor', 'poor', or 'fair' ($P = 0.009$).

3.3. Opinions about HM use and associated factors

Table 4 shows ten opinion statements and participant responses. Among the 787 respondents, 154 (19.6%) had a positive opinion of HM (i.e., answered 'yes' to more than 5 statements) and 633 (80.4%) had a negative opinion. More than half of the

total participants were of the opinion that normal saline (NaCl 0.9%, salted water) for external use (63.4%) and vitamin C found in orange, grapefruit, lemon (52.6%) played a role in treating or protecting against COVID-19. Conversely, less than 20% of the total participants considered that cajuput (*Melaleuca cajuputi*) essential oil (11.1%) would effectively treat or reduce the chances of getting COVID-19.

Associations between respondent socio-demographic characteristics and their opinions around HM use were assessed using the Chi-squared test (Table 5). Urbanicity ($P < 0.001$), being in a healthcare-related job ($P = 0.006$), self-perception of health status ($P < 0.001$), and HM use ($P < 0.001$) were significantly associated with opinion about HM. The logistic regression analysis of these factors revealed that respondents from rural areas were approximately twice as likely to

Table 3 - Factors associated with herbal medicine (HM) use among respondents (n = 787)

Variable	HM use, n (%)		Chi-squared test (P-value)	Logistic regression analysis	
	Yes	No		OR (95% CI)	p-value
Region					
North	69 (43.4)	90 (56.6)	0.482		
Central	74 (45.1)	90 (54.9)			
South	225 (48.5)	239 (51.5)			
Rural	191 (47.5)	211 (52.5)	0.860		
Suburban	30 (44.1)	38 (55.9)			
Urban	147 (46.4)	170 (53.6)			
Age group, years					
18 – 29	275 (44.3)	346 (55.7)	0.027	Reference	
30 – 39	69 (56.1)	54 (43.9)		1.162 (0.725–1.863)	0.533
40+	24 (55.8)	19 (44.2)		1.116 (0.541–2.303)	0.766
Gender					
Male	123 (44.1)	156 (55.9)	0.265		
Female	245 (48.2)	263 (51.8)			
Education					
High school or lower	28 (34.6)	53 (65.4)	0.028	Reference	
Colleges/Vocational schools	62 (55.4)	50 (44.6)		2.351 (1.285–4.302)	0.006
Undergraduate	238 (46)	279 (54)		1.817 (1.096–3.011)	0.021
Postgraduate	40 (51.9)	37 (48.1)		2.025 (1.047–3.917)	0.036
Occupation category			0.057		
Unemployed/Retired/Housewife	23 (40.4)	34 (59.6)			
Student	211 (44.3)	265 (55.7)			
Working	134 (52.8)	120 (47.2)			
Healthcare-related job					
No	129 (43.6)	167 (56.4)	0.165		
Yes	239 (48.7)	252 (51.3)			
Monthly income, VND million					
< 4.2	64 (43)	85 (57)	0.555		
4.2 – 8.3	107 (48.6)	113 (51.4)			
8.4+	181 (46.9)	205 (53.1)			
Marital status					
Single/Divorced/Widowed	269 (43.4)	351 (56.6)	< 0.001	Reference	
Married	99 (59.3)	68 (40.7)		1.819 (1.163–2.846)	0.009
Health status perception					
Very poor/Poor/Fair	10 (35.7)	18 (64.3)	0.011	Reference	
Good	175 (43.1)	231 (56.9)		1.068 (0.723–1.579)	0.741
Very good	131 (55.5)	105 (44.5)		1.768 (1.153–2.710)	0.009
Chronic disease					
No	354 (46.8)	403 (53.2)	0.992		
Yes	14 (46.7)	16 (53.3)			

Table 4 - Opinions about the use of the herbal medicine and/or food supplements as protective measure and/or treatment of COVID-19 (n = 787)

Statements	n (%)			
	Yes	No	Maybe	Don't know
Using turmeric, turmeric products helps to increase the immunity and reduce the chance of developing COVID-19	148 (18.8)	102 (13.0)	340 (43.2)	197 (25.0)
Using ginger, ginger products helps to increase the immunity and reduce the chance of developing COVID-19	255 (32.4)	60 (7.6)	347 (44.1)	125 (15.9)
Using garlic, garlic products helps to increase the immunity and reduce the chance of developing COVID-19	285 (36.2)	76 (9.7)	302 (38.4)	124 (15.8)
Using onions (or onion peel), onion products helps to increase the immunity and reduce the chance of developing COVID-19	148 (18.8)	124 (15.8)	274 (34.8)	241 (30.6)
Using fish oil, generally known as omega-3, helps to increase the immunity and reduce the chance of developing COVID-19	172 (21.9)	105 (13.3)	297 (37.7)	213 (27.1)
Using ginseng helps to increase the immunity and protect us from corona infection	166 (21.1)	108 (13.7)	323 (41)	190 (24.1)
The consumption of vitamin C found in orange, grapefruit, lemon has a role in treating or reducing the chances of developing COVID-19	414 (52.6)	51 (6.5)	257 (32.7)	65 (8.3)
Normal saline (NaCl 0.9%, salted water) for nose/throat cleansing and for external use plays a role in treating or protecting against the COVID-19	499 (63.4)	49 (6.2)	194 (24.7)	45 (5.7)
Applying <i>Melaleuca cajuputi</i> essential oil on the body helps to protect us from COVID-19	87 (11.1)	293 (37.2)	223 (28.3)	184 (23.4)
The consumption of nutritional and herbal supplements helps to increase the immunity and prevents the spread of COVID-19	224 (28.5)	125 (15.9)	313 (39.8)	125 (15.9)

Table 5 - Factors associated with opinions about HM use (n = 787)

Variable	Opinions about HM, n (%)		Chi-squared test (P-value)	Logistic regression analysis	
	Positive	Negative		OR (95% CI)	p-value
Region			0.148		
	North	135 (84.9)			
	Central	29 (17.7)			
	South	101 (21.8)			
Urbanicity	Rural	102 (25.4)	< 0.001	2.142 (1.407-3.259)	< 0.001
	Suburban	8 (11.8)		0.923 (0.396-2.150)	0.853
	Urban	44 (13.9)		Reference	
Age group, years	18 – 29	125 (20.1)	0.726		
	30 – 39	22 (17.9)			
	40+	7 (16.3)			
Gender	Male	60 (21.5)	0.310		
	Female	94 (18.5)			
Education	High school or lower	15 (18.5)	0.732		
	Colleges/Vocational schools	26 (23.2)			
	Undergraduate	97 (18.8)			
	Postgraduate	16 (20.8)			
Occupation category	Unemployed/Retired/Housewife	61 (79.2)	0.133		
	Student	7 (12.3)			
	Working	103 (21.6)			
Healthcare related job	No	44 (17.3)	0.006	Reference	
	Yes	43 (14.5)		1.407 (0.925-2.140)	0.110
Monthly income, VND million	< 4.2	111 (22.6)			
	4.2 – 8.3	33 (22.1)	0.319		
	8.4+	47 (21.4)			
Marital status	Single/Divorced/Widowed	67 (17.4)	0.944		
	Married	121 (19.5)			
Health status perception	Very poor/Poor/Fair	33 (19.8)	< 0.001	Reference	
	Good	18 (12.4)		1.371 (0.759-2.478)	0.296
	Very good	68 (16.7)		2.328 (1.267-4.276)	0.006
Chronic disease	No	68 (28.8)	0.142		
	Yes	145 (19.2)			
HM usage	No	9 (30)	< 0.001	Reference	
	Yes	32 (7.6)		5.905 (3.842-9.076)	< 0.001

hold a positive opinion of HM use as those from urban areas ($P < 0.001$). Similarly, people with a self-perceived health status as 'very good' were more than twice as likely to hold a positive opinion of HM ($P = 0.006$). HM users were around six times more likely to have a positive opinion of HM use than non-users ($P < 0.001$).

4. Discussion

During the COVID-19 pandemic, 49% of the Vietnamese people used HM to treat common illnesses and symptoms (8) associated with upper respiratory tract infections, which overlap with the common symptoms of COVID-19 (46). In the present study, 46.8% of a sample of Vietnamese participants used HM for COVID-19 prevention and/or treatment. With a similar sample size of 774, a recent study conducted in Nepal reported that 86.5% of respondents had used HM against COVID-19 (39). Conversely, in Saudi Arabia, only 22.1% of respondents have used HM for COVID-19

prevention (40). This variation is likely to result from societal differences in perceptions of HM in different countries.

Socio-demographic characteristics impact on the consumption of over-the-counter medication (47). Over half of the Vietnamese people live in rural areas or moved from rural areas in recent years (48). They are familiar with the practice of growing organic vegetables and herbs for their consumption and for use in traditional treatments. In relation to COVID-19 prevention and/or treatment, we found that participants mostly consumed vitamins/minerals (75.8%) and traditional Vietnamese herbs (55.7%), which were primarily grown at home (54.6%). Furthermore, the main motivations for using HM were preferring natural sources of medicines (52.4%), positive previous personal experiences (50.3%), and the ease of availability and accessibility in the home garden (47.3%) (Figure 1). Similar levels of availability and accessibility were reported in the previous Nepalese study, where people (45.61%) obtained medicinal plants from their home gardens (39). Moreover,

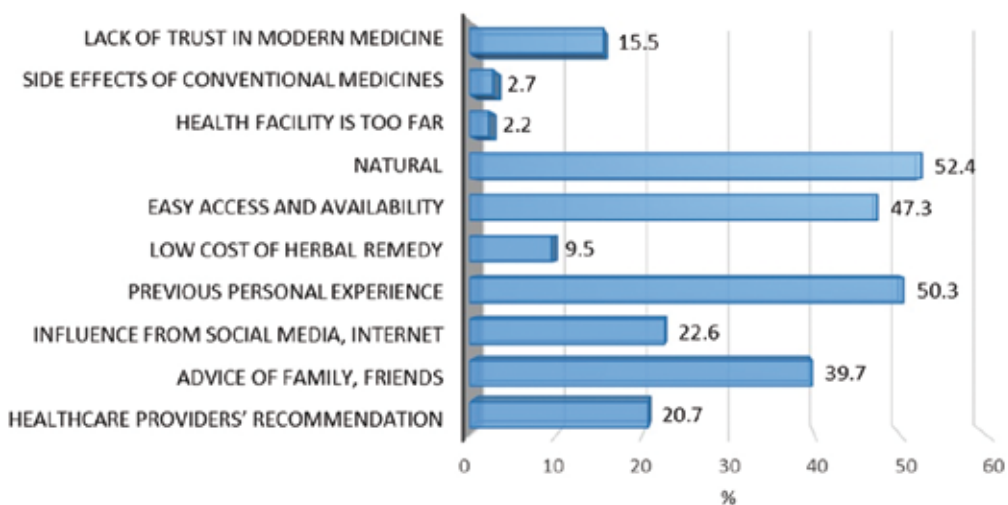


Figure 1 - Motivation to use herbal medicine among users (n = 368).

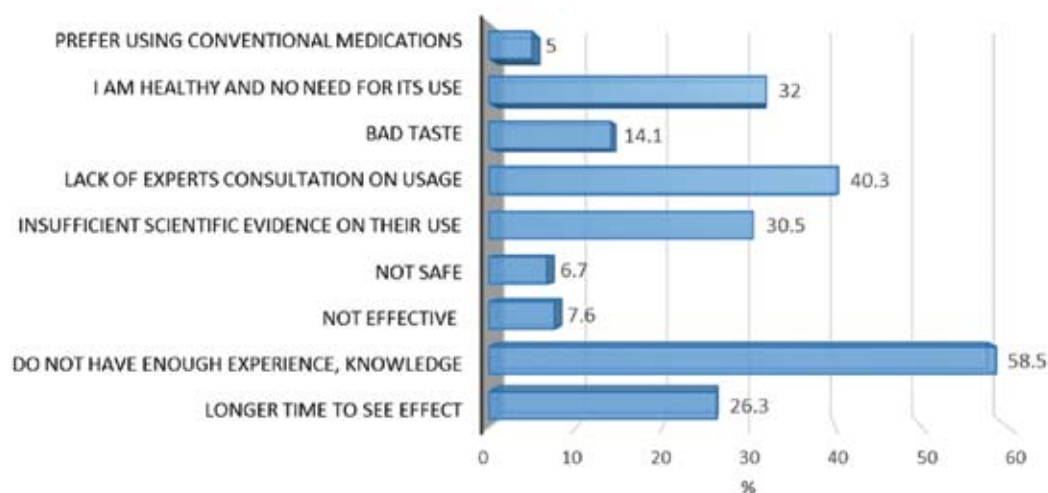


Figure 2. Barriers of using herbal medicines among non-users (n = 419).

the availability and accessibility of HM across Vietnam may have resulted in its widespread use, where HM was commonly preferred to be used both internally as a dietary supplement to prevent infection and strengthen immunity (87.8%) and externally as a surface sanitizer/disinfectant (72.8%). Thus, manufacturers may plan to develop HM-based products to satisfy the current demand. Conversely, the barriers to HM use for the prevention and/or treatment of COVID-19, expressed by non-users of HM, were the lack of understanding, a lack of previous personal experience, and insufficient expert advice (Figure 2).

In terms of the associations between socio-demographic characteristics and HM use, married people, those who perceived their health status as 'very good', or those with a high level of education, were twice as likely to use HM against COVID-19 (Table 3). The impact of a high level of education level on HM use against COVID-19 has been reported in previous studies conducted in other countries (39, 40, 49). These associations provide valuable information to healthcare authorities for the formation of strategic plans in Vietnam. For example,

policymakers might potentially relieve the pressure on crowded hospitals by utilizing the availability and accessibility of HM as an alternative approach that are compatible with self-isolation at home (38).

In terms of the Vietnamese people opinions around the efficacy of HM for the prevention/treatment of COVID-19. Of the 787 participants in the present study, predictably, HM users were six times more likely to have a positive opinion of HM use than non-users ($p < 0.001$). Only a fifth (19.6%) of participants expressed a positive opinion of HM for the prevention/treatment of COVID-19. The majority of participants responded 'maybe' to questions about their opinion of HM, demonstrating a general uncertainty in the effectiveness of HM. This highlights a key opportunity for policymakers to improve the awareness, understanding, attitudes towards, and practice around HM use among the Vietnamese people. Many authorities, including the WHO, use awareness campaigns and the media to reach out to people and modify public perceptions, trust, and knowledge as well as respond to misinformation (50). Most of the participants expressed positive

opinion (52.6%) towards the idea that the consumption of vitamin C found in orange, grapefruit, lemon has a role in preventing or treating COVID-19. This might be affected by the people general understanding that since antioxidative agents such as vitamin C can boost human immune system through their strong antioxidant effects (51-54), they could potentially help preventing viral infection including COVID-19. Conversely, opinions around the effectiveness of cajuput essential oil were low (11.1%). As cajuput essential oil is commonly mistakenly believed to be an all-purpose panacea (i.e., use to treat all diseases), the present result was likely represent a positive impact of education campaigns issued by healthcare authorities to increase the public information, understanding, and awareness of the COVID-19 infection over the past year,

In terms of socio-demographic characteristics, participants living in rural areas had a higher opinion of HM as they have a greater access to HM compared to people living in urban areas, and also have easier access to HM than to modern conventional treatments. Additionally, participants who perceived their health to be 'very good' would be more likely to overcome mild or moderate diseases states with only minor treatment, and as such will have better outcomes with HM than those with a worse perception of their health.

Limitations

The chosen study platform, an online survey, will systematically exclude individuals without access to or familiarity with the Internet. However, during the COVID-19 pandemic, online data collection provides increased convenience for both researchers and participants, and as such, a large number of respondents could be recruited in a short period of time. Another limitation was that more than a half of the

participants were located in the South of Vietnam, and most of them were young (i.e., the mean participant age was 26 years), which may contribute to recruitment bias. Future investigations should carefully consider these issues to minimize bias. The study population was entirely from Vietnam, thus, care must be taken in generalizing these findings to other contexts or locations.

5. Conclusions

This work investigated the use of HM and opinions around its efficacy for the prevention and treatment of COVID-19 in Vietnam. To this end, around half of the respondents had used HM for the prevention or treatment of COVID-19. Vitamins/minerals and traditional Vietnamese herbs were most commonly used. Among the surveyed participants, 19.6% thought HM to be effective. Specifically, more than half the respondents were of the opinion that vitamin C found in orange, grapefruit, lemon played a role in treating or protecting against COVID-19. Moreover, most respondents preferred HM for sanitizing or disinfecting. Overall, these findings suggest policymakers to considerably issues plans regarding the use of HM among the Vietnamese people. Finally, the data might also be of interest to manufacturers, as they advocate for the development of suitable HM-based products to satisfy current demand.

Authors' contribution: Conceptualization: V.D.T., D.T.P., M.H.L.; methodology: V.D.T., T.T.N.C., M.H.L., V.A.N.; validation: D.T.P.; investigation: V.D.T., T.T.N.C., M.H.L., V.A.N.; resource: D.T.P.; writing-original draft: V.D.T., D.T.P., M.B., M.H.L., V.A.N.; writing-review and editing: V.D.T., D.T.P., M.B., R.S.D., M.H.L., V.A.N.

Financial support: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interests: 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.

Acknowledgements: The authors would like to thank all the participants who responded to our online survey.

Data availability: The data that support the findings of this study are available from the corresponding author Duy Toan Pham (i.e. upon reasonable request).

Riassunto

Prospettive sulla prevenzione ed il trattamento della COVID-19 mediante l'uso di erbe medicinali in Vietnam: uno studio trasversale

Introduzione. La giustificazione della medicina erboristica in Vietnam durante la pandemia di COVID-19 è stata confermata. Tuttavia, pochi studi hanno preso in considerazione le convinzioni della popolazione vietnamita sulla prevenzione e sul trattamento della COVID-19 con le erbe medicinali. Pertanto, il presente studio ha affrontato il problema di cui sopra.

Metodi. È stato condotto uno studio trasversale online su adulti vietnamiti tra Febbraio ed Aprile 2021. A fini statistici sono state implementate analisi descrittive, regressioni e test del chi quadrato.

Risultati. Un totale di 787 intervistati ha partecipato allo studio: 368 (46,8%) hanno confermato di utilizzare erbe medicinali/integratori nutrizionali per la prevenzione e/o il trattamento della COVID-19. Oltre il 50% degli intervistati aveva un atteggiamento favorevole all'assunzione di vitamina C. L'uso di erbe medicinali per uso esterno come disinfettante è stato per lo più preferito. Gli intervistati che avevano un'auto-percezione di salute "molto buona", o che vivevano in aree rurali, avevano maggiori probabilità di avere un'opinione positiva sulla prevenzione e/o sul trattamento della COVID-19 utilizzando erbe medicinali. La principale barriera per l'utilizzo di erbe medicinali era la mancanza di esperienza personale o di consulenze di esperti.

Conclusioni. La popolazione vietnamita utilizza comunemente le erbe medicinali per la prevenzione e/o il trattamento della COVID-19. Questi dati potrebbero aiutare i decisori politici a gestire la conoscenza pubblica e la pratica sull'uso delle erbe medicinali in Vietnam.

References

1. Akerele O. WHO's traditional medicine programme: progress and perspectives. *WHO Chron.* 1984; **38**(2): 76-81.
2. Payyappallimana U. Role of Traditional Medicine in Primary Health Care: An Overview of Perspectives and Challenging. *Yokohama J Med Sci.* 2010; **14**(6): 57-77.
3. World Health Organization (WHO). Centre for Health Development. Proceedings: International Meeting on Global Atlas of Traditional Medicine. Kobe, Japan: World Health Organization, Centre for Health Development, 2003.
4. Bandaranayake WM. Quality Control, Screening, Toxicity, and Regulation of Herbal Drugs. In: Ahmad I, Aqil F, Owais M, eds. *Modern Phytomedicine: Turning Medicinal Plants into Drugs*. Chapter 2. Wiley-VCH Verlag GmbH & Co. KGaA, 2006: 25-57. <https://doi.org/10.1002/9783527609987.ch2>.
5. Wachtel-Galor S, Benzie IFF. Herbal Medicine: An Introduction to Its History, Usage, Regulation, Current Trends, and Research Needs. In: Benzie IFF, Wachtel-Galor S, eds. *Boca Raton (FL)*, 2011.
6. Astin JA, Marie A, Pelletier KR, Hansen E, Haskell WL. A review of the incorporation of complementary and alternative medicine by mainstream physicians. *Arch Intern Med.* 1998; **158**(21): 2303-10. <https://doi.org/10.1001/archinte.158.21.2303>.
7. Fujiwara K, Imanishi J, Watanabe S, Ozasa K, Sakurada K. Changes in attitudes of Japanese doctors toward complementary and alternative medicine comparison of surveys in 1999 and 2005 in Kyoto. *Evid Based Complement Alternat Med.* 2021; **85**: 153361. <https://doi.org/10.1093/ecam/nep040>.
8. Nguyen PH, De Tran D, Pham DT, Dao TNP, Dewey RS. Use of and attitudes towards herbal medicine during the COVID-19 pandemic: a cross-sectional study in Vietnam. *Eur J Integr Med.* 2021; **44**: 101328. <https://doi.org/https://doi.org/10.1016/j.eujim.2021.101328>.
9. Lu H, Stratton CW, Tang YW. Outbreak of pneumonia of unknown etiology in Wuhan, China: The mystery and the miracle. *J Med Virol.* 2020 Apr; **92**(4): 401-2. <https://doi.org/10.1002/jmv.25678>. Epub 2020 Feb 12.
10. Tran D, Pak TV, Gribkova EI, et al. Determinants of COVID-19 vaccine acceptance in a high infection-rate country: a cross-sectional study in Russia. *Pharm Pract (Granada)*. 2021 Mar-Apr; **19**(1): 2276. <https://doi.org/10.18549/PharmPract.2021.1.2276>. Epub 2021 Mar 22.
11. World Health Organization (WHO). Listings of WHO's response to COVID-19, (n.d.). Available on: <https://www.who.int/news/item/29-06-2020->

- covidtimeline [Last accessed: 2021 May 5].
12. Tornimbene B, Eremin S, Escher M, Griskeviciene J, Manglani S, Pessoa-Silva CL. WHO Global Antimicrobial Resistance Surveillance System early implementation 2016-17. *Lancet Infect Dis*. 2018 Mar; **18**(3): 241-2. [https://doi.org/10.1016/S1473-3099\(18\)30060-4](https://doi.org/10.1016/S1473-3099(18)30060-4). Epub 2018 Jan 29.
 13. Harapan H, Wagner AL, Yufika A, et al. Acceptance of a COVID-19 Vaccine in Southeast Asia: A Cross-Sectional Study in Indonesia. *Front Public Health* 2020 Jul **14**; 8: 381. <https://doi.org/10.3389/fpubh.2020.00381>.
 14. Barberia LG, Gómez EJ. Political and institutional perils of Brazil's COVID-19 crisis. *Lancet*. 2020 Aug 8; **396**(10248): 367-8. [https://doi.org/10.1016/S0140-6736\(20\)31681-0](https://doi.org/10.1016/S0140-6736(20)31681-0). Epub 2020 Jul 30.
 15. Alfano V, Ercolano S. The Efficacy of Lockdown Against COVID-19: A Cross-Country Panel Analysis. *Appl Health Econ Health Policy*. 2020 Aug; **18**(4): 509-17. <https://doi.org/10.1007/s40258-020-00596-3>.
 16. Lurie N, Saville M, Hatchett R, Halton J. Developing Covid-19 Vaccines at Pandemic Speed. *N Engl J Med*. 2020 May 21; **382**(21): 1969-73. <https://doi.org/10.1056/NEJMp2005630>. Epub 2020 Mar 30.
 17. Kaur SP, Gupta V. COVID-19 Vaccine: A comprehensive status report. *Virus Res*. 2020 Oct 15; **288**: 198114. <https://doi.org/10.1016/j.virusres.2020.198114>. Epub 2020 Aug 13.
 18. Coronavirus (COVID-19) Vaccinations - Statistics and Research - Our World in Data, (n.d.). Available on: <https://ourworldindata.org/covid-vaccinations> [Last accessed: 2021 May 6].
 19. Covid World Vaccination Tracker - The New York Times, (n.d.). Available on: <https://www.nytimes.com/interactive/2021/world/covid-vaccinations-tracker.html> [Last accessed: 2021 May 6].
 20. Emary KRW, Golubchik T, Aley PK, et al. Efficacy of ChAdOx1 nCoV-19 (AZD1222) Vaccine Against SARS-CoV-2 VOC 202012/01 (B.1.1.7). Preprint 2021. <https://doi.org/10.2139/ssrn.3779160>.
 21. SARS-CoV-2 Variants of Concern | CDC, (n.d.). Available on: <https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/variant-surveillance/variant-info.html#Concern> [Last accessed: 2021 May 6].
 22. Edara VV, Floyd K, Lai L, et al. Infection and mRNA-1273 vaccine antibodies neutralize SARS-CoV-2 UK variant *MedRxiv*. 2021. <https://doi.org/10.1101/2021.02.02.21250799>.
 23. Wang P, Nair MS, Liu L, et al. Antibody Resistance of SARS-CoV-2 Variants B.1.351 and B.1.1.7. *BioRxiv*. 2021. <https://doi.org/10.1101/2021.01.25.428137>.
 24. Davies NG, Abbott S, Barnard RC, et al. Edmunds, Estimated transmissibility and impact of SARS-CoV-2 lineage B.1.1.7 in England *MedRxiv*. 2021. <https://doi.org/10.1101/2020.12.24.20248822>.
 25. Therapeutic Management | COVID-19 Treatment Guidelines, (n.d.). Available on: <https://www.covid19treatmentguidelines.nih.gov/therapeutic-management/> [Last accessed: 2021 May 6].
 26. Goldman JD, Lye DCB, Hui DS, et al. Remdesivir for 5 or 10 Days in Patients with Severe Covid-19. *N. Engl J Med*. 2020 Nov 5; **383**(19): 1827-37. <https://doi.org/10.1056/NEJMoa2015301>. Epub 2020 May 27.
 27. Spinner CD, Gottlieb RL, Criner GJ, et al. Effect of Remdesivir vs Standard Care on Clinical Status at 11 Days in Patients With Moderate COVID-19: A Randomized Clinical Trial. *JAMA*. 2020 Sep 15; **324**(11): 1048-57. <https://doi.org/10.1001/jama.2020.16349>.
 28. Beigel HJ, Tomashek KM, Dodd LE, et al. Remdesivir for the Treatment of Covid-19 - Final Report. *N Engl J Med*. 2020 Nov 5; **383**(19): 1813-26. <https://doi.org/10.1056/NEJMoa2007764>. Epub 2020 Oct 8.
 29. Khanna K, Kohli SK, Kaur R, et al. Herbal immune-boosters: Substantial warriors of pandemic Covid-19 battle. *Phytomedicine*. 2021 May; **85**: 153361. <https://doi.org/10.1016/j.phymed.2020.153361>.
 30. World Health Organization (WHO). International Expert Meeting on the Treatment of SARS by Traditional Chinese Medicine and the Integration of Traditional Chinese Medicine with Western Medicine, SARS: clinical trials on treatment using a combination of traditional Chinese medicine and Western medicine: report of the WHO International Expert Meeting to review and analyse clinical reports on combination treatment for SARS. World Health Organization, Beijing, China, 2003.
 31. Luo H, Tang QL, Shang YX, et al. Can Chinese Medicine Be Used for Prevention of Corona Virus Disease 2019 (COVID-19)? A Review

- of Historical Classics, Research Evidence and Current Prevention Programs. *Chin J Integr Med.* 2020 Apr; **26**(4): 243-50. <https://doi.org/10.1007/s11655-020-3192-6>. Epub 2020 Feb 17.
32. Yang Y, Islam MS, Wang J, Li Y, Chen X. Traditional Chinese Medicine in the Treatment of Patients Infected with 2019-New Coronavirus (SARS-CoV-2): A Review and Perspective. *Int J Biol Sci.* 2020 Mar 15; **16**(10): 1708-17. <https://doi.org/10.7150/ijbs.45538>.
 33. Liu X, Zhang M, He L, Li Y. Chinese herbs combined with Western medicine for severe acute respiratory syndrome (SARS). *Cochrane Database Syst. Rev.* 2012 (2012). <https://doi.org/10.1002/14651858.CD004882.pub3>.
 34. Nugraha RV, Ridwansyah H, Ghazali M, Khairani AF, Atik N. Traditional Herbal Medicine Candidates as Complementary Treatments for COVID-19: A Review of Their Mechanisms, Pros and Cons. *Evidence-Based Complement Altern Med.* 2020; 2020: 2560645. <https://doi.org/10.1155/2020/2560645>.
 35. Fan AY, Gu S, Alemi SF. Chinese herbal medicine for COVID-19: Current evidence with systematic review and meta-analysis. *J Integr Med.* 2020 Sep; **18**(5): 385-94. <https://doi.org/10.1016/j.joim.2020.07.008>. Epub 2020 Jul 31.
 36. Thailand Clears Use of Herbal Medicine for Covid-19 Treatment - BNN Bloomberg, (n.d.). Available on: <https://www.bnnbloomberg.ca/thailand-clears-use-of-herbal-medicine-for-covid-19-treatment-1.1542171> [Last accessed: 2021 May 6].
 37. Vietnam Prime Minister, Decision No.1893/QD-TTg Promulgating the Program for Developing Traditional Medicine in Combination with Modern Medicine up to 2030, Vietnam Government, Hanoi, 2019.
 38. Emerging COVID-19 Success Story: Vietnam's Commitment to Containment. Jan-Dec 31, 2020. Exemplars in Global Health Platform. Available on: <https://ourworldindata.org/covid-exemplar-vietnam> [Last accessed: 2021 May 5].
 39. Khadka D, Dhamala MK, Li F, et al. The use of medicinal plants to prevent COVID-19 in Nepal. *J Ethnobiol Ethnomed.* 2021 Apr 8; **17**(1): 26. <https://doi.org/10.1186/s13002-021-00449-w>.
 40. Alyami HS, Orabi MAA, Aldhabbah FM, et al. Knowledge about COVID-19 and beliefs about and use of herbal products during the COVID-19 pandemic: A cross-sectional study in Saudi Arabia. *Saudi Pharm J.* 2020 Nov; **28**(11): 1326-32. <https://doi.org/10.1016/j.jsps.2020.08.023>. Epub 2020 Sep 1.
 41. Chaachouay N, Douira A, Zidane L. COVID-19, prevention and treatment with herbal medicine in the herbal markets of Salé Prefecture, North-Western Morocco. *Eur J Integr Med.* 2021 Feb; **42**: 101285. <https://doi.org/https://doi.org/10.1016/j.eujim.2021.101285>. Epub 2021 Jan 8.
 42. Leading active social media platforms among internet users in Vietnam as of 4th quarter of 2020. (2020). Available on: <https://www.statista.com> [Last accessed: 2021 May 5].
 43. Panyod S, Ho CT, Sheen LY. Dietary therapy and herbal medicine for COVID-19 prevention: A review and perspective. *J Tradit Complement Med.* 2020 May 30; **10**(4): 420-7. <https://doi.org/10.1016/j.jtcme.2020.05.004>.
 44. Barbarosa LCA, Silva CJ, Teixeira RR, Meira RM, Pinheiro AL. Chemistry and biological activities of essential oils from *Melaleuca L.* species. *Agric Conspec Sci.* 2013; **78**(1): 11-23.
 45. Sawalha AF, Sweileh WM, Zyoud SH, Jabi SW. Self-therapy practices among university students in Palestine: focus on herbal remedies. *Complement Ther Med.* 2008 Dec; **16**(6): 343-9. <https://doi.org/10.1016/j.ctim.2007.12.002>. Epub 2008 Feb 7.
 46. Australian Government - Health Department. Covid-19: Identifying the symptoms, (2020). Available on: <https://www.health.gov.au/resources/publications/identifying-the-symptoms-english> [Last accessed: 2021 May 5].
 47. Luketina-Sunjka M, Rancic N, Mihailovic N, Jakovljevic M. The Impact of the Socio-Demographic Characteristics of Complementary and Alternative Medicine Users in Serbia on OTC Drug Consumption. *Front Public Health.* 2019 Oct 24; **7**: 303. <https://doi.org/10.3389/fpubh.2019.00303>.
 48. The World Bank Group. Rural population (% of total population) - Vietnam, (n.d.).
 49. Zhong BL, Luo W, Li HM, et al. Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. *Int J Biol Sci.* 2020 Mar 15; **16**(10): 1745-52. <https://doi.org/10.7150/ijbs.45221>.
 50. Betsch C. How behavioural science data helps

- mitigate the COVID-19 crisis. *Nat Hum Behav.* 2020 May; **4**(5): 438. <https://doi.org/10.1038/s41562-020-0866-1>.
51. Carr AC, Maggini S. Vitamin C and Immune Function. *Nutrients.* 2017 Nov 3; **9**(11): 1211. <https://doi.org/10.3390/nu9111211>.
 52. Arreola R, Quintero-Fabián S, López-Roa RI, et al. Immunomodulation and anti-inflammatory effects of garlic compounds. *J Immunol Res.* 2015; **2015**: 401630. <https://doi.org/10.1155/2015/401630>.
 53. Dorsch W, Schneider E, Bayer T, Breu W, Wagner H. Anti-inflammatory effects of onions: inhibition of chemotaxis of human polymorphonuclear leukocytes by thiosulfinates and cepaenes. *Int Arch Allergy Appl Immunol.* 1990; **92**(1): 39-42. <https://doi.org/10.1159/000235221>.
 54. Casale M, Rinaldi V, Sabatino L, Moffa A, Ciccozzi M. Could nasal irrigation and oral rinse reduce the risk for COVID-19 infection? *Int J Immunopathol Pharmacol.* 2020 Jan-Dec; **34**: 2058738420941757. <https://doi.org/10.1177/2058738420941757>.

Corresponding author: Duy Toan Pham, PhD, Department of Chemistry, College of Natural Sciences, Can Tho University, Campus II, 3/2 Street, Can Tho 900000, Vietnam. ORCID ID: 0000-0002-8693-3367
e-mail: pdtoan@ctu.edu.vn

ORCID:

Van De Tran: 0000-0003-0421-5079

Duy Toan Pham: 0000-0002-8693-3367

Thi Tai Nguyen Cao: 0000-0003-2185-418X

Mohamed Bahlol: 0000-0002-2990-2708

Rebecca Susan Dewey: 0000-0002-6888-3298

Minh Hoang Le: 0000-0002-5968-078X