Research Journal of Pharmacognosy (RJP) 10(1), 2023: 31–40
Received: 23 Oct 2022
Final revision: 6 Dec 2022
Accepted: 11 Dec 2022
Published online: 13 Dec 2022
DOI: 10.22127/RJP.2022.366963.1997

Original article

Use of Medicinal Plants and Its Association with Health Literacy in the General Population of Iran During the COVID-19 Pandemy: a Web-Based Cross-Sectional Survey

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Abstract

Background and objectives: During health crises like COVID-19, people with different health conditions turn to traditional/herbal remedies, which can affect their health status. This study aimed to determine medicinal plant consumption and its association with health literacy during the COVID-19 pandemic in Iran. **Methods:** This web-based cross-sectional study involved 1242 Iranians aged 18 to 65. Data were collected using the Iranian Health Literacy Questionnaire (IHLQ), COVID-19-related variables, and a socio-demographic information questionnaire, analyzed by simple and multiple logistic regression analyses using SPSS 16.0. **Results:** It was found that 51.4% (n=638) of participants had used medicinal plants and herbal products, with a mean Health Literacy (HL) score of 76.16. Thyme (50.6%), ginger (34.9%), and cinnamon (24.4%) were the most commonly used plants; the most popular methods were infusion (78.3%) and decoction (32.2%). According to the adjusted analysis, the use of medicinal plants was significantly associated with being older (odds ratio (OR)=1.85, 95% confidence interval (CI):1.14-3.00), having contact with suspected/confirmed COVID-19 cases (OR=1.94, 95% CI:1.39-2.71), and having family members, friends, and/or relatives infected with COVID-19 (OR=1.37, 95% CI:1.00-1.88). Also, people who consulted with a physician or pharmacist before using medicinal plants had statistically higher mean HL scores than those who did not ($p<0.001$), as do those who consider potential interactions with other medications or medicinal plants ($p<0.001$). **Conclusion:** Considering that at least half of the people used medicinal plants during the COVID-19 outbreak, providing accurate information by regulatory organizations on medicinal plants, their potential side effects, and interactions, especially during times of crisis, seems to be urgent.

Keywords: COVID-19; health literacy; Iran; medicinal plant; plant preparations

Citation: Dabaghian F, Hasanpour M, Maroufizadeh S, Joulani MH, Khanavi M. Use of medicinal plants and its association with health literacy in the general population of Iran during the COVID-19 pandemy: a web-based cross-sectional survey. Res J Pharmacogn. 2023; 10(1): 31–40.

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Introduction

Coronavirus was first diagnosed in 2019 (COVID-19) in Wuhan, China, and then this pandemic spread over time [1] with symptoms including coughing, sneezing, shortness of breath, gastrointestinal disorders such as nausea and vomiting, and general symptoms like fever, chills, and body aches [2-5]. People with underlying illnesses like diabetes, hypertension, cardiovascular, and cerebrovascular diseases, particularly the elderly, are at high risk for this disease, with a high mortality rate [5,6]. Despite advances in preventing this disease, there is still no proven medicine that can completely cure or prevent illness and future virus mutations. Hence, efforts to develop new medicines or test potential existing medicines are still underway. One solution to combat this disease is to use medicinal plants and traditional human knowledge [7].

Since ancient times, people have looked for healing in nature [8] and plants have been one of the most common strategies. In various locations worldwide, including China, India, Greece, Iran, and many African countries, various parts of herbs, according to local traditions and available plants, have been used to treat different diseases including infectious diseases [9,10]. Because of Iran's diverse climates and geographical areas, medicinal plant species have spread widely, and each tribe used its own plants and customs. In addition, traditional Persian medicine has provided a wide range of therapeutic prescriptions that include plants, animal parts, or inorganic components [11]. According to this evidence, the availability of these natural treasures encourages people to use medicinal plants.

Based on one study, 69% of patients who referred to specialist medical centers in Iran's Fars province used medicinal plants. The most common reasons for using medicinal plants were skin diseases (30%), respiratory (21.5%), urinary (20%), endocrine (18.5%), and gastrointestinal system (10%) disorders. Additionally, licorice, thyme, and borage were the popular herbs [12]. Another study found that 63.40 % of pregnant women who referred to Bojnourd health clinics in Iran have used medicinal plants during their pregnancy, and notably, 53.4% of them received information about medicinal plants from their relatives [13].

Due to the high prevalence rate of medicinal plant use among Iranians and, on the other hand, the lack of a specific medicine to cure COVID-19, the trends and amounts of medicinal plant consumption during the disease's outbreak in Iran may have changed, and this issue may have an impact on people's health. One of the most essential and relevant topics in people's health which allows them to understand and choose the factors that affect their health is health literacy. The term "health literacy" initially appeared in a 1974 health education panel on the healthcare system, and it has since received a lot of attention from researchers [14]. Health literacy is defined in a variety of terms, but in general, it refers to a wide range of knowledge and abilities related to the collecting, processing, comprehension, and application of health data [15]. Health literacy skills include reading, listening, analyzing, making decisions, and being able to use them; it is not always linked to years of education or reading skills [16]. Health literacy is now being discussed as a global issue [17]. Because of its critical role in health-related decision-making, policymakers regard health literacy as one of the fundamental tools for improving the society's health and the quality of service delivery [18,19].

Sedighi et al. [20] conducted a study on the level of knowledge and insight about complementary medicine in Tehran (Iran) and found that 75.6% of people are aware of herbal medicine. Another study cleared that 52.2% of healthcare professionals in Sanandaj (Iran) were enthusiastic about prescribing medicinal plants [21]. Now, regarding the history of the use of medicinal plants by Iranians for thousands of years, it is crucial to seek changes in attitudes, awareness, and consumption rates during COVID-19. As a result, the current study was designed to determine the relationship between medicinal plant consumption and health literacy, as well as the reasons and amount of medicinal plant consumption during the Covid-19 outbreak. Interpreting people's behaviors and the various factors influencing medicinal plant consumption can assist healthcare managers in managing healthcare services during natural disasters or possible future outbreaks.

To the best of our knowledge, this is the first study in Iran to look at the relationship between health literacy and medicinal plant use in the general population of Iran during the COVID-19

outbreak, as well as the level of attention paid to medicinal plant interactions and consultation with physicians and pharmacists prior to consuming plants.

Material and Methods

Ethical considerations

The Ethics Committee of Tehran University of Medical Sciences, Tehran, Iran, approved this study (Ethical Code: IR.TUMS.VCR.REC.1399.147). All respondents were made aware of the study's goal and the fact that their participation was entirely voluntary.

Participants and study design

We conducted a web-based cross-sectional study on 1242 Iranians between April 14 and July 14, 2020. An anonymous online questionnaire distributed via various social media platforms was used to collect data. The inclusion criteria for this study were (a) being between the ages of 18 and 65, (b) being willing to participate in the study, and (c) being able to read, write, and comprehend Persian.

Demographic variables

Participants' age, sex, marital status, location of residence, education, and occupation were all collected as demographic factors.

COVID-19-related variables

The COVID-19-related variables were as follows: (1) having chronic diseases, (2) times focusing on COVID-19 during the day, (3) having contact with suspected or confirmed COVID-19 cases, (4) having families, relatives, or friends infected with COVID-19, (5) death of families, relatives, or friends due to COVID-19.

Health literacy for Iranian adults (HELIA) questionnaire

To assess the health literacy of individuals, the HELIA questionnaire, that validity and reliability of that had been previously confirmed by Montazeri et al. [22], was used. The health literacy questionnaire contains 33 items and five components. Components include accessibility, items 1 to 6; reading skills, items 7 to 10; understanding, items 11 to 17; assessment, items 18 to 21; and the decision-making or health information application, items 22 to 33. The scoring scale of this questionnaire is a 5-point Likert scale in which one indicates never, two indicates rarely, three indicates sometimes, four indicates more often, and five indicates always. The minimum score for this questionnaire is 0, and the maximum is 100. The scores from 0 to 50 indicate inadequate health literacy, 50.1 to 66 indicate insufficient health literacy, 66.1 to 84 indicate sufficient health literacy, and 84.1 to 100 indicate an excellent level of health literacy. Also, Cronbach's alpha coefficient in the current study was 0.937.

Statistical analysis

Continuous variables were expressed as "mean (standard deviation (SD)") in this study, while categorical variables were expressed as "number (percentage)." The link between herbal medicine use and demographic and COVID-19-related characteristics was investigated using simple and multiple logistic regression models. The 95 percent confidence interval (CI) and crude and adjusted odds ratios (OR) were determined. SPSS for Windows, version 16.0, was used for statistical analysis (SPSS Inc., USA). All statistical tests were two-sided, and the level of significance was set at 0.05.

Results and Discussion

The mean age of the participants in this study was 36.90 (SD=11.14) years (range: 18-65 years). Of the 1242 respondents, 65.0% were female, 51.3% were young adults, 62.4% were married, 96.1% were residents of urban areas, 18.1% had primary/secondary education, 52.6% were employed, and 11.8% had chronic diseases. About 55% spent more than 0.5 hours daily focusing on COVID-19. Other demographic and COVID-19-related characteristics of the respondents are shown in Table 1.

The prevalence rate of herbal medicine use was 51.4% (n = 638), with 93.1% of people using it for prevention, 5.17%, and 0.63% for treatment and recovery periods after COVID-19 infection, respectively. Simple and multiple logistic regression analyses were undertaken to investigate factors associated with herbal medicine use (see Table 2). Based on unadjusted analysis, older adults reported higher use of herbal medicine compared with young adults (OR = 1.92, 95% CI: 1.20-3.09). Herbal medicine use was higher in females than males (OR = 1.18, 95% CI: 0.93-1.49), although this difference was not statistically significant (p = 0.173). Married participants were 1.37 times more likely to use

herbal medicine than single participants (OR = 1.37, 95% CI: 1.09-1.72). Those who had family members, friends, and/or relatives infected with COVID-19 were more likely to use herbal medicine (OR = 1.58, 95% CI: 1.21-2.07). Furthermore, those who reported contact with suspected or confirmed COVID-19 cases were more likely to use herbal medicine than those who did not (OR = 2.05, 95% CI: 1.50-2.80). The odds ratio of herbal medicine use increased with increasing times to focus on COVID-19 per day (OR = 1.17, 95% CI: 0.93-1.48), although this increase was not statistically significant (p = 0.177).

Table 1. Demographic and COVID-19-related characteristics of the participants (n = 1242)

Variables	n (%)
Age (years)	
Young adults (18-35)	637 (51.3)
Middle-aged adults (36-55)	520 (41.9)
Older adults (>56)	85 (6.8)
Sex	
Male	435 (35.0)
Female	807 (65.0)
Marital status	
Single	467 (37.6)
Married	775 (62.4)
Place of residence	
Urban	1193 (96.1)
Rural	49 (3.9)
Education	
Primary/Secondary	225 (18.1)
BSc/MSc	760 (61.2)
PhD	257 (20.7)
Occupation	
Employed	653 (52.6)
Housewife	243 (19.6)
Retired	63 (5.1)
Student	227 (18.3)
Unemployed	56 (4.5)
Chronic diseases	
No	1095 (88.2)
Yes	147 (11.8)
Times to focus on COVID-19* during a day	
<0.5 h	548 (44.1)
0.5-1 h	249 (20.0)
1-2 h	170 (13.7)
>2 h	275 (22.1)
Contact with suspected or confirmed COVID-19 cases	
No	1037 (83.5)
Yes	205 (16.5)
Families, relatives or friends infected with COVID-19	
No	959 (77.2)
Yes	283 (22.8)
Death of families, relatives or friends due to COVID-19	
No	1106 (89.0)
Yes	136 (11.0)

*: coronavirus disease 2019

In adjusted analysis, herbal medicine use was significantly associated with being older (OR = 1.85, 95% CI: 1.14-3.00), having contact with suspected or confirmed COVID-19 cases (OR = 1.94, 95% CI: 1.39-2.71), and having families, relatives or friends infected with COVID-19 (OR = 1.37, 95% CI: 1.00-1.88). The odds ratio of using herbal medicine were higher in females, rural residents, and unemployed people, according to the adjusted analysis, though these differences were not statistically significant. Also, the most commonly used medicinal plants were thyme (50.6%), ginger (34.9%), cinnamon (24.4%), chamomile (17.5%), and horsemint (14.7%), as shown in Table 3. In addition, infusion (78.3%) and decoction (32.2%) were the most popular methods of medicinal plant use among participants (Table 4).

According to the results stated earlier, getting older was associated with the use of medicinal plants (p = 0.007), and married people used medicinal plants or herbal products more than singles (p = 0.007). These results are consistent with the findings of Wayland et al. [23], who found that women are more likely to use and grow medicinal plants as they age. Also, this is supported by Inta et al.'s [24] study that revealed the number of medicinal plants reported by each informant was positively correlated with their age. Additionally, people who had contact with suspected or confirmed COVID-19 cases showed approximately twice the chance of using medicinal plants, which none of the other studies looked into based on a literature review. Furthermore, the presence of COVID-19 cases in families, relatives, or friends was linked to the use of medicinal plants, which supports the findings of Villena-Tejada et al. [25], who discovered an association between having family members or friends with COVID-19 infection and the use of medicinal plants.

Numerous studies have revealed the use of traditional medicine, particularly medicinal plants, for preventing or treating various health-related issues and combating emerging diseases like the SARS virus outbreak and the COVID-19 pandemic [26-31]. For instance, during the SARS virus outbreak, the Chinese significantly reduced patients' symptoms like cough, respiratory issues, and fever by using herbs and other herbal drugs [32]. In addition, after the first reports of COVID-19 infection, numerous studies were conducted to assess the effectiveness and safety of some existing medications and medicinal plants [33,34]. For example, *Valeriana officinalis, Cymbopogon citratus*, *Melissa officinalis*, *Passiflora incarnate,* and *Lavandula officinalis*

have been evaluated and suggested for anxiolytic effects during the pandemic [35], withanoside V and somniferine, bioactive compounds derived from *Withania somnifera*, can be used as potential SARS-CoV-2 M^{pro} (main protease) inhibitors, and some Ayurveda herbs have been suggested to alleviate some COVID-19-related comorbidities [36]. Furthermore, according to one meta-analysis, Chinese herbal medicines may aid in treating COVID-19 by improving clinical signs, imaging, and laboratory parameters [37].

Regarding an online survey conducted in India, more than 80% of respondents used *Zingiber officinale* (Ginger), *Emblica officinalis* (Amla), and *Allium sativum* (Garlic) to boost their immunity during the first wave of COVID-19 [38]. In addition, based on research conducted in Ethiopia, about 41.3% of respondents used medicinal plants at least once a day to prevent COVID-19, and the most commonly used medicinal plant was *Zingiber officinale* [39]. As a result, Complementary and alternative medicine (CAM) appears to be a common practice globally; however, CAM use is also influenced by age, marital status, geographical location, cultural beliefs, and religion [40].

Table 2. Relation of herbal medicine use and demographic/COVID-19 related variables among participants (n=1242)

Variables	Prevalence, n (%)	Simple logistic regression		Multiple logistic regression	
		OR* Crude (95% CI**)	P value	OR Adj (95% CI)	P value
Age (years)					
Young adults (18-35)	319 (50.1)	1		1	
Middle-aged adults (36-55)	263 (50.6)	1.02 (0.81 – 1.29)	0.866	1.03 (0.81 – 1.30)	0.827
Older adults (>56)	56 (65.9)	1.92 (1.20 – 3.09)	0.007	1.85 (1.14 – 3.00)	0.013
Sex					
Male	212 (48.7)	1		1	
Female	426 (52.8)	1.18 (0.93 – 1.49)	0.173	1.18 (0.91 – 1.53)	0.211
Marital status					
Single	217 (46.5)	1		1	
Married	421 (54.3)	1.37 (1.09 – 1.72)	0.007	1.30 (0.98 – 1.71)	0.065
Place of residence					
Urban	608 (51.0)	1		1	
Rural	30 (61.2)	1.52 (0.85 – 2.73)	0.162	1.62 (0.89 – 2.96)	0.114
Education					
Primary/Secondary	113 (50.2)	1		1	
University	525 (51.6)	1.06 (0.79 – 1.41)	0.704	1.11 (0.81 – 1.53)	0.508
Occupation					
Employed	333 (51.0)	1		1	
Housewife	137 (56.4)	1.24 (0.92 – 1.67)	0.152	1.22 (0.85 – 1.74)	0.283
Retired	32 (50.8)	0.99 (0.59 – 1.66)	0.976	1.06 (0.62 – 1.82)	0.834
Student	103 (45.4)	0.80 (0.59 – 1.08)	0.145	0.92 (0.66 – 1.28)	0.626
Unemployed	33 (58.9)	1.38 (0.79 – 2.40)	0.256	1.66 (0.94 – 2.95)	0.081
Chronic diseases					
No	563 (51.4)	1		1	
Yes	75 (51.0)	0.98 (0.70 – 1.39)	0.928	0.92 (0.64 – 1.32)	0.647
Times to focus on COVID-19* during a day**					
<1 h	398 (49.9)	1		1	
>1 h	240 (53.9)	1.17 (0.93 – 1.48)	0.177	1.10 (0.87 – 1.40)	0.417
Contact with suspected or confirmed COVID-19 cases					
No	503 (48.5)	1		1	
Yes	135 (65.9)	2.05 (1.50 – 2.80)	<0.001	1.94 (1.39 – 2.71)	<0.001
Families, relatives or friends infected with COVID-19					
No	468 (48.8)	1		1	
Yes	170 (60.1)	1.58 (1.21 – 2.07)	0.001	1.37 (1.00 – 1.88)	0.049
Death of families, relatives or friends due to COVID-19					
No	563 (50.9)	1		1	
Yes	75 (55.1)	1.19 (0.83 – 1.70)	0.351	0.94 (0.62 – 1.40)	0.748

*: odds ratio; **: confidence interval; ***: coronavirus disease 2019

Table 3. Various used medicinal plants among participants (n = 638)

No.	Plant common name	n (%)	No.	Plant common name	n (%)
1	Thyme	323 (50.6)	17	Saffron	25 (3.9)
2	Ginger	223 (34.9)	18	Turmeric	25 (3.9)
3	Cinnamon	156 (24.4)	19	Green tea	23 (3.6)
4	Chamomile	112 (17.5)	20	Nettle	18 (2.8)
5	Horsemint	94 (14.7)	21	Mallow	15 (2.3)
6	Mint	62 (9.7)	22	Sweet Violet	14 (2.1)
7	Jujube	56 (8.7)	23	Fennel	14 (2.1)
8	Cardamom	44 (6.8)	24	Valerian	10 (1.5)
9	Persian Oxtongue	44 (6.8)	25	Oregano	9 (1/.)
10	Garlic	44 (6.8)	26	Sage	6 (0.9)
11	Lavender	42 (6.5)	27	Sweet orange	6 (0.9)
12	Liquorice	38 (5.9)	28	Plantain	5 (0.7)
13	Marshmallow	30 (4.7)	29	Quince	4 (0.6)
14	Syrian Rue	30 (4.7)	30	Echinacea	1 (0.1)
15	Black Cumin	29 (4.5)	31	Coriander	1 (0.1)
16	Lemon	26 (4.0)			

In another part of the current study that was related to health literacy, we assessed five dimensions of health literacy in respondents including reading, access to information, understanding, appraisal, and decision-making/application of obtained information. The mean health literacy scores for these dimensions among people who used medicinal plants or herbal products were 74.86, 77.49, 84.55, 73.78, and 70.13, respectively (Table 5). Total health literacy scores for those who used medicinal plants or herbal products were 76.16 compared to 75.10 for those who did not. Among all participants (n = 1242), the total score of health literacy between the people that consulted with a physician or pharmacist before using herbs or herbal products in COVID-19 outbreak was 80.44 and the mean score of people who did not have any consultation was 73.88. Of all participants, 384 persons with a mean health literacy score of 79.50 paid attention to possible interactions of used medicinal plants with other medication or herbal products. Also, the mean score of health literacy for the people who had used medicinal plants or herbal products for the prevention, treatment or during recovering periods were 76.09, 77.93 and 74.51, respectively. Additional data are mentioned in table 6.

According to the current study's findings, people who consulted with a physician or pharmacist before using medicinal plants or herbal products had statistically significantly higher mean health literacy scores than those who did not, as did those who considered the potential interactions of medicinal plants or herbal products with other medications or medicinal plants. However, there was no significant association between total health literacy scores and the types of used herbal-based compounds (medicinal plants or herbal products), the reason for use, or the average weekly usage.

Both groups of participants who used medicinal plants and herbal products and those who did not, had a sufficient level of health literacy, and there was no statistically significant difference between them. However, the results showed that individuals who used medicinal plants and herbal products had significantly higher average scores for the appraisal domain of health literacy than those who did not ($p = 0.010$). It means that people who had used herbal-based compounds could adequately evaluate and analyze health-related information once they had access to and understand it.

Table 4. Common medicinal plant used methods

No.	Method	n (%)
1	Infusion	500 (78.3)
2	Decoction	206 (32.2)
3	Dried plant	162 (25.3)
4	Inhalation of smoke from burned plant	91 (14.2)
5	Fresh plant	78 (12.2)
6	Maceration in cold water	12 (1.9)
7	Other methods	89 (13.9)

Several studies have been designed to investigate the association between health literacy and the use of medicinal plants or herbal products. One study on the millennial generation (90 people aged 23 to 43) demonstrated that literacy is inversely proportional to medicinal plant consumption [41]. Barnes et al. [42] conducted a review on the health literacy of pregnant women and found that a woman's health literacy environment, along with other information sources, influenced her decision to use complementary medicine products.

In another research, Bains and Egede [43] studied the relationship between health literacy and the

use of CAM in the United States. They found that 75% of participants had adequate literacy, and 80% of them had used CAM. They also revealed that the association between health literacy and the use of CAM differed significantly depending on race. Also, Gardiner et al. [44] observed that CAM was used by 55% of those with higher health literacy at Boston Medical Center, an inner-city hospital.

To the best of our knowledge, no extensive research has been conducted during COVID-19 on the relationship between health literacy and medicinal plant use in Iran's general population.

During the COVID-19 pandemic, only one study with a small number of participants was conducted to analyze the types of CAM used in Iran, and it was found that 84% of participants used at least one type of CAM during the outbreak, and 48.8% of them used herbal medicines [45]. According to the findings of our study, more than half of the participants used medicinal plants or herbal products during the COVID-19 outbreak in Iran, with 94.1% using them for prevention and only 0.62% using them during the recovery period. These findings are consistent with another study conducted in Iran, which revealed that infection prevention and anxiety reduction were important reasons for using CAM [45] and a similar study by Alami et al. [46] in Morocco.

Limitations: there are some limitations to this study that should be noted. The study's principal shortcomings stem from the study's web-based approach. These limitations, like those of other web-based studies, include a low response rate, demographic biases, and variations in computer literacy and internet access. Another limitation was the study's cross-sectional design, which made it impossible to make inferences about herbal medicine use based on demographic/COVID-19-related characteristics. We did not have data on some potentially important factors such as economic status, and family income stability during the COVID-19 pandemic.

Table 5. Comparison of the total health literacy score and its domains in participants (n = 1242) based on their use of medicinal plants during the Covid-19 pandemic; values are presented as Mean (SD)

Domains	Use of herbal medicine		$t^{*}_{(1241)}$	P value
	No (n = 604)	Yes (n = 638)		
Reading	74.36 (21.96)	74.86 (21.53)	0.41	0.683
Access to information	75.59 (18.74)	77.49 (17.25)	1.87	0.062
Understanding	84.54 (14.48)	84.55 (14.69)	0.01	0.994
Appraisal	71.13 (19.02)	73.78 (16.98)	2.59	0.010
Decision-making/application of obtained information	69.86 (15.84)	70.13 (16.45)	0.30	0.762
Total score	75.10 (14.29)	76.16 (13.86)	1.34	0.181

*: independent t-test

Table 6. Relation of total health literacy score with some factors among participants who used medicinal plants or herbal products

	Mean (SD)	F^{*}/t^{**}	P value
Consulting with physician or pharmacist		$t_{(628)} = 5.77$	<0.001
No (n = 415)	73.88 (14.17)		
Yes (n = 215)	80.44 (12.23)		
Paying attention to possible Interactions		$t_{(626)} = 8.16$	<0.001
No (n = 244)	70.69 (14.66)		
Yes (n = 384)	79.50 (12.17)		
Type of herbal-based compound		$F_{(2,630)} = 1.13$	0.324
Medicinal plant (n = 431)	76.08 (13.24)		
Herbal products (n = 49)	73.76 (18.36)		
Both of them (n = 151)	77.16 (14.04)		
Reason for use		$F_{(2,628)} = 0.30$	0.737
Prevention (n = 594)	76.09 (13.92)		
Treatment (n =33)	77.93 (14.15)		
Recovering (n = 4)	74.51 (1.47)		
Number of use per week		$F_{(2,628)} = 1.47$	0.221
1-2 (n = 260)	74.88 (15.11)		
3-4 (n = 179)	76.68 (12.47)		
5-6 (n = 98)	76.71 (13.01)		
>6 (n = 95)	78.07 (13.64)		

*: one-way ANOVA; **: independent t-test

Also, the common names of the plants could not be matched with their scientific names because the study was web-based and face-to-face interviews were not possible due to the COVID-19 pandemic. As a result, the plant common names were used in the article.

Conclusion

In conclusion, we found that medicinal plants and herbal products are widely used in Iran, with more than half of respondents explicitly using them for prevention during the COVID-19 outbreak. Although we could not verify the direct connection between the use of medicinal plants and health literacy, people who used medicinal plants were statistically significantly higher in the appraisal domain of health literacy. Overall, more research is required to identify the other factors influencing the use of medicinal plants. Also, providing accurate information by regulatory organizations on medicinal plants, their potential side effects, and interactions, especially during times of crisis, seems to be urgent.

Acknowledgments

We thank the people who participated in this study, and the Tehran University of Medical Sciences, Tehran, Iran for supporting this study (Project No.: 99-1-104-47430).

Author contributions

Farid Dabaghian, Maryam Hasanpour, Saman Maroufizadeh, Mohammad Hossein Joulani, and Mahnaz Khanavi participated in the study concept, design, and drafting of the manuscript; data analysis was done by Farid Dabaghian and Saman Maroufizadeh; Mahnaz Khanavi supervised the study. All authors have critically revised the manuscript and agreed to be accountable for all aspects of the work. All authors approved the final version of the manuscript.

Declaration of interest

The authors declare that there is no conflict of interest. The authors alone are responsible for the accuracy and integrity of the paper content.

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Abbreviations

COVID-19: coronavirus disease 2019; CAM: complementary and alternative medicine; OR: odds ratio; CI: confidence interval