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Research article

Exploring COVID-19 anxiety in Iranian adult based on health literacy by moderating demographic variables: A structural equation model

Fatemeh Mohammadkhah [a], Abbas Shamsalinia [a], Fatemeh Shirinkam [a], Mahboubeh Daneshnia [a], Amaneh Mahmoudian [b], Nastaran Rafiei [c], Abolfazl Atashpoosh [d], Fatemeh Ghaffari [a,*]

[a] Nursing Care Research Center, Health Research Institute, Babol University of Medical Sciences, Babol, Iran
[b] Golestan University of Medical Sciences, Iran
[c] Mazandaran University of Medical Sciences, Ramsar Health Network, Health Education Department, Ramsar, Iran
[d] Department of Psychology, Lahijan Branch, Islamic Azad University, Lahijan, Iran

ABSTRACT

The COVID-19 (coronavirus disease 2019) pandemic is associated with far-reaching psychological consequences, such as anxiety. The incidence and severity of this anxiety depend on several individual, family and social factors that need to be identified and planned for effective interventions. One of these factors is health literacy (HL). The aim of this study was to determine the relationship between HL and demographic characteristics with COVID-19 anxiety in adults living in Iran at the time of coronavirus outbreak. This is a descriptive and correlational study conducted in Iran in 2021. Convenience and snowball sampling methods were used, and as the result, the number of samples reached to 560. Data were collected online through the demographic questionnaire, COVID-19 anxiety scale (CAS) and health literacy questionnaire for adults (HLQ for adults). Data were analyzed using Amos 26, SPSS 26 software and structural equational modeling (SEM) based on covariance. Significance level in this study was considered 0.05. The results of this study showed that the fit of the modify model is confirmed and HL explains 54% of the changes in anxiety in the model ($\beta = -0.709$). The variables of gender, history of chronic disease, positive history of COVID 19 and receiving social support have a moderating role in the relationship between HL and COVID-19 anxiety. Due to the great predicting role of HL in COVID-19 anxiety, it is recommended that programs be developed and implemented during the outbreak of the disease by experts and the public health policy makers to increase HL in physical and mental dimensions.

1. Introduction

According to the latest statistics of the World Health Organization (WHO), 158,651,638 people have been infected with this disease in the world so far and 3,299,764 people have died, the number of new cases in the last 24 hours (on 11 May 2021) was 606,077, of which 10,769 died. In Iran, 2,673,219 people have been infected and 75,261 people have lost their lives, the number of new cases in the last 24 hours (on 11 May 2021) was 18,408, of which 351 died [1].

The prevalence of COVID 19 for reasons such as loss of income, feeling of loneliness and inactivity due to home quarantine, unpredictable consequences of the disease and uncertainty about its treatment, limited access to basic services, increasing alcohol use, reducing family and social support [2], the need to comply the obligation of social distance [3, 4, 5] and major changes in people's lifestyles, such as the need

for using personal protective equipment (PPE) are subjects to high stress [6, 7]. These stressors, along with other risk factors such as following the news of COVID-19, widespread rumors about the HL of the disease, and the onslaught of negative and inaccurate information in cyberspace may lead to anxiety associated with COVID-19 [8]. In addition to the above, COVID-19 anxiety may be related to various factors related to the cultural structure and health facilities of different communities that need to be identified and preventive measures in this regard. One of the factors that may affect the prevention and disruption of the disease transmission chain in the pandemic of infectious diseases is HL [9]. Nutbeam states that HL includes functional, interactive and vital areas [10], and that its importance and impact on the health of individuals in the community in various dimensions is well known and plays an important role in individuals deciding on their health-related needs [11]. Improving HL is associated with consequences such as increasing the potential ability to

make informed decisions, reducing health threats, increasing preventive behaviors, improving security, increasing quality of life, and increasing the quality of self-care [12, 13, 14].

Since the crisis of HL has been highlighted in epidemics such as severe acute respiratory syndrome (SARS) and middle east respiratory syndrome (MERS) [15, 16]; therefore, it is very common in COVID-19 pandemic [17]. Prevention or management of the COVID-19 requires the individual's readiness and ability to adapt to the rapid development of HL related to the epidemic and crisis [17]. In the current situation, the importance of HL is because the rapid and successful implementation of crisis control measures requires the promotion of disease-related HL and collective compliance of all individuals [18, 19]. However, low HL at the time of COVID-19 outbreak may lead to neglecting personal health, improper self-medication, and the use of drugs that are not approved by a health organization [20]. Although HL is one of the modulators of health in different societies today [20], but the results of studies show low levels of HL in different groups. For example, the results of a systematic review showed that the HL related to COVID-19 was low in 4.3–57.9% and 4.0–82.5% of medical and non-medical groups [17]. The low rate of HL in different social groups highlights the need for studies on measuring HL and its consequences in different societies. Previous studies have shown HL as a protective factor for mental health (e.g., depression), fear of COVID-19 [21], and health-related quality of life and the general quality of life [9]. But so far no study has been done on the predictive role of HL related to COVID-19 anxiety.

Most studies in Iran have focused on the psychological consequences of COVID-19 [22,23] and despite the high importance of HL, the role of it in the control of COVID-19 and its psychological consequences has not been addressed [24, 25]. Therefore, this study was conducted to describe HL and COVID-19 anxiety in different dimensions and to determine the relationship between HL and demographic characteristics with COVID-19 anxiety in adults living in Iran during the outbreak of COVID-19.

2. Materials and methods

2.1. Participants and procedure

This is a descriptive and correlational study conducted in Iran. Between January and April 2021, a web-based survey of adults living in Iranian society was conducted. Participants were selected using convenience and snowball sampling methods. In order to collect data, social networking programs available to the Iranian community such as WhatsApp and Telegram were used. Then a message including the objectives of the study and inviting these people to participate in the study was sent to them. If they are satisfied with participating in the study, the tool links were sent to them. Participants were asked to send tool links to their adult friends and acquaintances if they wished. For the samples that were included in the study by snowball sampling method, completing the tools and sending them to the researcher (first author) meant that the satisfaction of participating in the study was considered. The inclusion criteria were being Iranian and 18 years old and older. Finally, 560 people participated in the present study.

2.2. Measures

2.2.1. Demographic information questionnaire

This questionnaire included the variables of age, sex, marital status, income, cohabitation, level of education, occupation, place of residence, history of chronic illness, type of chronic illness, adherence to religious beliefs, receiving social support, history of getting COVID-19, history of having a family member getting COVID-19, and history of death of a family member due to COVID-19.

2.2.2. COVID-19 anxiety scale (CAS)

This scale has been designed and validated by Alipour et al. (2020) to measure COVID-19 anxiety disorder. The reliability of this tool using Cronbach's alpha method was $\alpha = 0.879$ for the first factor, $\alpha = 0.861$ for the second factor and $\alpha = 0.919$ for the whole questionnaire. The final version of this tool has 18 items and 2 factors. Items 1 to 9 measure psychological symptoms and items 10 to 18 measure physical symptoms. The instrument is scored in a 4-point Likert scale (never $= 0$, sometimes $= 1$, most of the time $= 2$ and always $= 3$); The highest and lowest scores that the respondents get in this questionnaire are between 0 and 54. High scores on this scale indicate a higher level of anxiety to COVID-19 [26].

2.2.3. Health literacy questionnaire for adults (HLQ for adults)

This tool has been designed by Montazeri et al. (2014) and its validity and reliability have been investigated. The questionnaire has good internal consistency (Cronbach's alpha 0.72 to 0.89). It includes 33 items and five dimensions of "access", "reading", "understanding", "appraisal" and "decision". The raw score of each participant in the subscales is obtained from the sum of the scores of each subscale; this score is then converted to a range of zero to one hundred. To calculate the score, the total scores of the subscales (based on the range from zero to 100) are added and divided by the number of subscales. The HL level of the participants is (0–50) inadequate; (50.1–66) not enough, (66.1–84) sufficient and (84.1–100) excellent [11].

2.3. Data analysis

Independent t-test, analysis of variance (ANOVA), Pearson correlation test and logistic regression test were used. Structural equation modeling (SEM) method based on covariance method was used to test the proposed model of the relationship between HL and COVID-19 anxiety among the Iranian adults during the COVID-19 pandemic based on the moderating role of gender, age, history of chronic disease, history of getting COVID-19 and receiving social support in adults.

In order to investigate the moderating role of demographic variables, multi-group analysis through the test of comparison with models with measurement weights was performed. In this method, the unconstrained model is compared with the Measurement weights model, and if the Chi-square test is significant, the moderating role of the research variables is confirmed.

The fit of the proposed model with the data was calculated based on the fit indices of relative chi-square chi-square (CMIN/DF), soft parsimony fit index (PNFI), comparative fit index (CFI), comparative fit index of parsimony (PCFI), incremental fit index (IFI), goodness-of-fit index (GFI) and root mean square approximation error (RMSEA). To test the research hypotheses before using the structural equation method, the assumptions of this method were examined. Univariate and multivariate distributions of data were examined separately to investigate the natural distribution and outlier data. The presence of multivariate outliers was assessed using the Mahalanobis d square method ($P < 0.001$), the normal multivariate distribution using the Mardia coefficient (above 20) and the multiple alignment using [27].

Data were analyzed using AMOS 26, SPSS 26 software and structural equation modeling based on covariance. Significance level in this study was considered 0.05.

2.4. Ethical considerations

Obtaining permission from the ethics committee of Babol University of Medical Sciences (IR.MUBABOL.HRI.REC1399.204), explaining the goals and working methods to the research participants and obtaining their consent, observing the principle of loss and observing the principle of confidentiality of information and not including. The name of the

participants on the research tools were the ethical considerations in this study.

2.5. Conceptual model

Based on reviewing literature [2, 3, 4, 5, 6, 7, 8] of the conceptual model of this study, the relationship between HL and COVID-19 anxiety level with modulating demographic variables of sex, age, history of chronic disease, history of COVID-19 and social support in adults living in Iran was investigated at the time of COVID-19 outbreak (Figure 1).

2.6. Hypotheses

H1. There is a significant negative relationship between HL and COVID-19 anxiety.

H2. Demographic variables moderate the relationship between HL and COVID-19 anxiety.

3. Results

3.1. Participants characteristics and their relationship with health literacy and COVID-19 anxiety

Of 560 adults living in Iran who participated in the present study, 33.6% were in the age group of 25–35 years. The mean age of the subjects was 35.19 ± 11.83 years. 54.3% of the participants were women and 83% lived in their private houses. The results showed that the mortality rate due to COVID-19 among the family members was 8.4%. Other demographic characteristics of the study participants are presented in Table 1.

The results of Kolmogorov-Smirnov test showed that the hypothesis of normality of HL and COVID-19 anxiety variables is confirmed ($P > 0.05$). The results showed that there was a statistically significant relationship between HL and gender ($P = 0.035$), age ($P = 0.004$) and receiving social support ($P = 0.022$). The average HL of women was higher than that of men, under the age of 35 compared to the age of more than 45 years, and in people who receive social support than in those who don't.

The results also showed a statistically significant relationship between COVID-19 anxiety and the variables of history of chronic diseases ($P = 0.025$), type of chronic disease ($P = 0.012$), history of getting Covid-19 ($P = 0.007$), marital status ($P = 0.006$) and receiving social support ($P = 0.043$). The average COVID-19 anxiety was higher in people with chronic disease compared to people without chronic disease, in people with cancer compared to people with other chronic diseases, in people with the positive history of COVID-19 compared to people with negative history of COVID-19, in divorced participants compared with single individuals and in those who received social support compared with those who don't received social support (Table 1).

3.2. Health literacy and its dimensions in adults living in Iranian society

The results of the present study showed that the mean scores of HL were 66.55 ± 28.96 and the highest mean score (69.92 ± 34.12) was
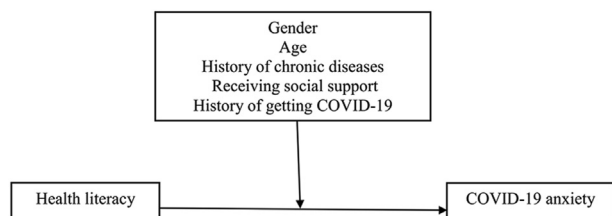
related to the dimension of understanding and the lowest mean score (64.48 ± 26.33) was related to the decision dimension of HL. The level of HL of 180 (32.1%) of the subjects was at an excellent level and 129 (23%) of the subjects had inadequate (Table 2).

3.3. COVID-19 anxiety and its dimensions

The results also showed that the mean scores of COVID-19 anxiety was 12.88 ± 9.42, the mean scores of subscale of mental symptoms and subscale of physical symptoms were 9.84 ± 5.83 and 3.03 ± 4.49, respectively. The severity of COVID-19 anxiety in 20 patients (3.6%) of the participants was severe and 440 (78.6%) of the subjects were experiencing mild severity level (Table 3).

3.4. Correlation coefficient between health literacy and its dimensions and COVID-19 anxiety

The results of Pearson correlation matrix showed that there is a significant negative relationship between HL and its dimensions with COVID-19 anxiety in adults living in Iranian society ($P < 0.001$) (Table 4).

3.5. Results of fitting logistic regression model

Forward likelihood ratio method was used to enter the variables into the model. In this method, the variables enter and exit the model step by step and based on the significance of the likelihood ratio statistic. Therefore, the variables are entered into the model step by step based on their maximum impact on the dependent variable.

Logistic regression was used to investigate the effect of demographic variables and independent variables of HL and its dimensions on COVID-19 anxiety (less than 65 = no COVID-19 anxiety, more than 65 = COVID-19 anxiety) in adults living in Iranian society. The Forward likelihood ratio method was used to enter the variables into the model. The Hosmer-Lemeshow test demonstrated the model fit accuracy ($P = 0.012$). By fitting the logistic regression model, the predictor variables were entered into the model in five stages as a block and the model was fitted. The results of the fifth stage of the model showed that the variables of HL, age, sex, history of getting COVID-19 and receiving social support affect COVID-19 anxiety in adults. The results showed that, according to the odds ratio of variable HL (OR = 0.476), per unit increase in HL, the probability of COVID-19 anxiety decreases by about 53.3%. The odds ratio of the age variable is equal to 1.881. Thus, per unit of age increase, the probability of COVID-19 anxiety increases by about 88.1%. Meanwhile, the results showed that men are 28% less likely to get COVID-19 anxious than women (OR = 0.720). Also, those who had previously been infected with the COVID-19 were 37.1% more likely to be COVID-19 anxiety than those who had not previously been infected with the Covid-19. Finally, participants who received social support were 73.3% less likely to have COVID-19 anxiety than those who did not receive social support (Table 5).

3.6. Structural equation model (SEM) results

3.6.1. Fit indices of the primary and modified model

First we have done the confirmatory factor analysis, in which we found the factor load of all the questions to be greater than 0.4. The structural model was then analyzed and the results were reported. In this study, the fit of the proposed model was evaluated based on the introduced fit indices. Model fit tests are performed using GFI and AGFI indices, RMSEA index, chi-square, NFI index and CFI index [28]. The results showed that according to CMIN/DF values < 5 and RMSEA <0.1, the fit of the proposed model is accepted. To improve the fit of the proposed model, in the next step, the model was modified by drawing a correlation between the errors (Figure 2). The fit indices of the research model before and after modification are shown in Table 6.

Figure 1. Conceptual model.

Table 1. Demographic characteristics of adults living in Iranian society and their relationship with health literacy and Covid-19 anxiety (n = 560).

Personal Information		Number	Percent	Health literacy		Covid-19 anxiety	
				Mean ± SD	Test Result	Mean ± SD	Test Result
Gender	Male	256	45.7	63/74 ± 30/55	T = -2/117	12/75 ± 9/06	T = -0/299
	Female	304	54.3	68/92 ± 27/38	P = 035/0	12/99 ± 9/73	P = 0/765
Age (years)**	25>	120	21.4	71/15 ± 23/05	F = 4/489	10/97 ± 8/10	F = 2/335
	25-35	188	33/6	69/64 ± 26/24	P = 0/004	13/60 ± 9/82	P = 0/073
	36-45	144	25/7	64/31 ± 32/25		13/63 ± 9/01	
	45<	108	19/3	59/07 ± 33/07		12/75 ± 10/39	
Housing*	Personal	465	83	67/61 ± 28/12	T = 1/908	12/99 ± 9/69	T = 0/609
	Rented	95	17	61/40 ± 32/44	P = 0/057	12/34 ± 8/02	P = 0/543
Adherence to religious beliefs**	Low	62	11/1	70/14 ± 26/92	F = 2/993	12/01 ± 9/19	F = 0/677
	Average	284	50/7	63/62 ± 29/93	P = 0/051	13/30 ± 9/52	P = 0/509
	High	214	38/2	69/41 ± 27/93		12/57 ± 9/36	
Occupation**	Self-employed	230	41/1	68/94 ± 24/38	F = 2/503	12/45 ± 9/16	F = 0/408
	Employee	251	44/8	63/71 ± 33/57	P = 0/058	13/04 ± 9/13	P = 0/747
	Farmer	17	3	57/80 ± 25/45		14/52 ± 13/44	
	Student	62	11/1	71/64 ± 23/72		13/37 ± 10/38	
Having a history of chronic diseases*	Yes	74	13/2	65/68 ± 30/35	T = -0/279	15/17 ± 11/50	T = 2/253
	No	486	86/8	66/69 ± 28/77	P = 0/780	12/53 ± 9/02	P = 0/025
Type of chronic disease**	Coronary	11	1/96	66/78 ± 28/69	F = 0/741	12/52 ± 9/01	F = 2/772
	Hypertension	20	3/57	79/58 ± 18/93	P = 0/617	14/01 ± 13/66	P = 0/012
	Migraine	9	1/61	59/09 ± 35/97		12/11 ± 8/71	
	Diabetes	21	3/75	64/90 ± 32/57		15/01 ± 5/83	
	Asthma	7	1/25	61/73 ± 30/12		15/57 ± 11/81	
	Cancer	6	1/07	70/10 ± 28/78		25/16 ± 17/38	
	No Chronic Disease	486	86/79	58/77 ± 40/62		20/40 ± 14/13	
History of getting COVID-19*	Yes	59	10/5	72/99 ± 25/90	T = 1/809	16/03 ± 10/51	T = 2/730
	No	501	89/5	65/80 ± 29/23	P = 0/071	12/51 ± 9/22	P = 0/007
History of having a family member getting COVID-19*	Yes	109	19/5	70/91 ± 26/42	T = 1/755	14/38 ± 10/04	T = 1/857
	No	451	80/5	65/50 ± 29/47	P = 0/080	12/52 ± 9/24	P = 0/064
Cohabitation**	Family	528	94/3	66/74 ± 28/77	F = 0/894	13/01 ± 9/38	F = 0/731
	Friends	26	4/6	66/38 ± 30/54	P = 0/409	10/76 ± 10/10	P = 0/482
	Hired caregiver	6	1/1	50/84 ± 39/52		11/83 ± 10/92	
Income level*	Adequate	414	73/9	65/67 ± 29/88	T = -1/215	12/61 ± 8/88	T = -1/154
	Inadequate	146	26/1	69/06 ± 26/11	P = 0/225	13/65 ± 10/81	P = 0/249
Marital status**	Single	174	31/1	66/33 ± 27/80	F = 0/259	11/01 ± 7/73	F = 5/180
	Married	373	66/6	66/85 ± 29/63	P = 0/772	13/68 ± 10/01	P = 0/006
	Divorced	13	2/3	61/05 ± 26/08		15/01 ± 9/54	
Level of education**	Primary School	25	4/5	56/77 ± 29/34	F = 1/885	13/52 ± 10/35	F = 0/380
	High School	53	9/5	72/66 ± 22/03	P = 0/131	14/01 ± 12/69	P = 0/768
	College	108	19/3	67/96 ± 22/41		13/01 ± 10/16	
	University	374	66/8	65/94 ± 31/26		12/64 ± 8/59	
History of death of a family member due to COVID-19*	Yes	47	8/4	63/31 ± 32/56	T = -0/803	13/12 ± 8/06	T = 0/185
	No	513	91/6	66/85 ± 28/63	P = 0/422	12/86 ± 9/54	P = 0/853
Address location*	Urban	491	87/7	66/59 ± 29/12	T = 0/078	12/69 ± 9/25	T = -1/297
	Rural	69	12/3	66/30 ± 27/98	P = 0/938	14/26 ± 10/54	P = 0/195
Receiving social support*	Yes	369	65/9	68/57 ± 27/83	T = 2/294	12/30 ± 9/50	T = -2/031
	No	191	34/1	62/67 ± 30/73	P = 0/022	14/01 ± 9/19	P = 0/043

* Independent t-test, ** Analysis of variance test.

3.6.2. Path coefficients of the relationship between health literacy and Covid-19 anxiety in terms of moderating variables

The results showed that HL explained 54% of the changes in COVID-19 anxiety in the model. The standardized regression coefficient showed that there is a strong negative relationship between HL and COVID-19 anxiety in adults. Thus, the higher the level of HL among individuals, the greater the likelihood of reducing COVID-19 anxiety (S.E. = 0.056; C.R. = - 12.478; p < .001; β = -.709) (Table 7).

According to chi-square-difference, degree of freedom and level of significance, the results indicate that the variables of gender ($\Delta\chi^2$ (2) = 6.06, P = 0.048), age ($\Delta\chi^2$ (2) = 7.32, P = 0.025), history of chronic disease ($\Delta\chi^2$ (2) = 6.54, P = 0.038), history of getting COVID-19 ($\Delta\chi^2$ (2) = 6.39, P = 0.040) and receiving social support ($\Delta\chi^2$ (2) = 8.32, P = 0.015) have a moderating role in the relationship between HL and COVID-19 anxiety (Table 8, Figure 3).

4. Discussion

The results of the present study showed that the level of HL of 23% of study participants was insufficient. This finding may be due to the fact

Table 2. Frequency distribution, mean and standard deviation of health literacy and its dimensions in adults living in Iranian society.

Health Literacy Scale and its dimensions	Mean ± SD	Health literacy levels			
		Insufficient Number (%)	Not Enough Number (%)	Sufficient Number (%)	Excellent Number (%)
Health literacy	66/55 ± 28/96	129 (23)	67 (12)	184 (32/9)	180 (32/1)
Access	67/07 ± 30/98	140 (25)	49 (8/8)	176 (31/4)	195 (34/8)
Reading	65/83 ± 32/70	160 (28/6)	52 (9/3)	146 (26/1)	202 (36/1)
Understanding	69/92 ± 34/12	135 (24/1)	35 (6/2)	116 (20/7)	274 (48/9)
Appraisal	65/46 ± 30/37	165 (29/5)	69 (12/3)	151 (27)	175 (31/2)
Decision	64/48 ± 26/33	153 (27/3)	77 (13/8)	204 (36/4)	126 (22/5)

Table 3. Distribution of frequency, mean and standard deviation of COVID-19 anxiety and its dimensions in adults living in Iranian society.

COVID-19 anxiety and its dimensions	Mean ± SD	Severity levels of COVID-19 anxiety		
		Mild number (%)	Average number (%)	Severe number (%)
COVID-19 anxiety	12/88 ± 9/42	440 (78/6)	100 (17/9)	20 (3/6)
mental symptoms	9/84 ± 5/83	295 (52/7)	219 (39/1)	46 (8/2)
physical symptoms	3/03 ± 4/49	515 (92)	33 (5/9)	12 (2/1)

Table 4. Correlation coefficient between health literacy and its dimensions and Covid-19 anxiety in adults living in Iranian society.

	1	2	3	4	5	6	7
COVID-19 anxiety	1						
Health literacy	**-0/652	1					
Access	**-0/598	**0/942	1				
Reading	**-0/720	**0/942	**0/870	1			
Understanding	**-0/455	**0/957	**0/888	**0/873	1		
Appraisal	**-0/403	**0/936	**0/843	**0/851	**0/869	1	
Decision	**-0/398	**0/903	**0/800	**0/801	**0/835	**0/820	1

**P $< 01/0$.

that the researchers did not have access to specific tools for measuring COVID-19-related HL at the time of data collection. Therefore, in this study, general HL tools were used to assess the HL of participants. However, a significant percentage of participants had inadequate levels of HL in all aspects of HL (access, reading skills, comprehension, decision making).

This finding is not consistent with the results of other studies. In a study that examined knowledge and attitudes toward COVID-19 among patients with chronic disease in the United States of America, it was worrying to note that one-third of participants were unable to identify the symptoms of COVID-19 due to low HL and 24.6% of participants stated that they may not have been exposed to the coronavirus [29]. The results of another study by Roy et al. (2020) showed that only 43% of respondents considered COVID-19 to be a contagious disease and 18.2% considered fever to be a symptom of COVID-19 [29]. In contrast, the results of a study in China showed that HL was high among study participants. Considering the importance of the role of HL in promoting the level of physical and mental health of individuals and preventing the spread of the disease and reducing its complications in different

communities, it is necessary to take effective measures in this regard [18, 20]. Improving HL through raising people's awareness, educating people and strengthening their knowledge in the field of prevention and control of COVID-19 disease, as well as the formation of educational campaigns, and the use of remote medical capacity can help the governments with managing and controlling the disease, and therefore, reducing infections and mortality trends [18].

The results of the present study showed that the highest level of HL was related to the dimension of understanding. This finding is probably due to the fact that 66.8% of the samples had a university education and also in this study, the research team had access to students or adult colleagues who had health information due to their field of study and being employed in a university of medical sciences. The results also showed that the lowest HL score was related to the decision dimension. This may also be due to the fact that 80.5% of the samples had a positive history of COVID-19 and 91.6% of the samples had a positive history of death due to COVID-19 in their family. However, increased risk perception and health and self-care behaviors often occur when a person is directly exposed to the consequences of illness.

Table 5. Results of fitting logistic regression model.

| Variable	Coefficient estimation	The standard error	OR (95%CI)	The significance level
Health Literacy	-0/742	0/038	0/476 (0/206-0/752)	0/012
Age	0/631	0/011	1/881 (1/298-2/763)	0/037
Gender (0 = female and 1 = male)	-0/328	0/202	0/720 (0/520-0/842)	0/024
history of getting COVID-19 (0 = No and 1 = Yes)	0/315	0/326	1/371 (1/031-1/738)	0/002
Receiving Social Support (0 = No and 1 = Yes)	-1/320	0/209	0/267 (0/073-0/771)	0/006
Constant	1/316	0/762	3/729	0/000
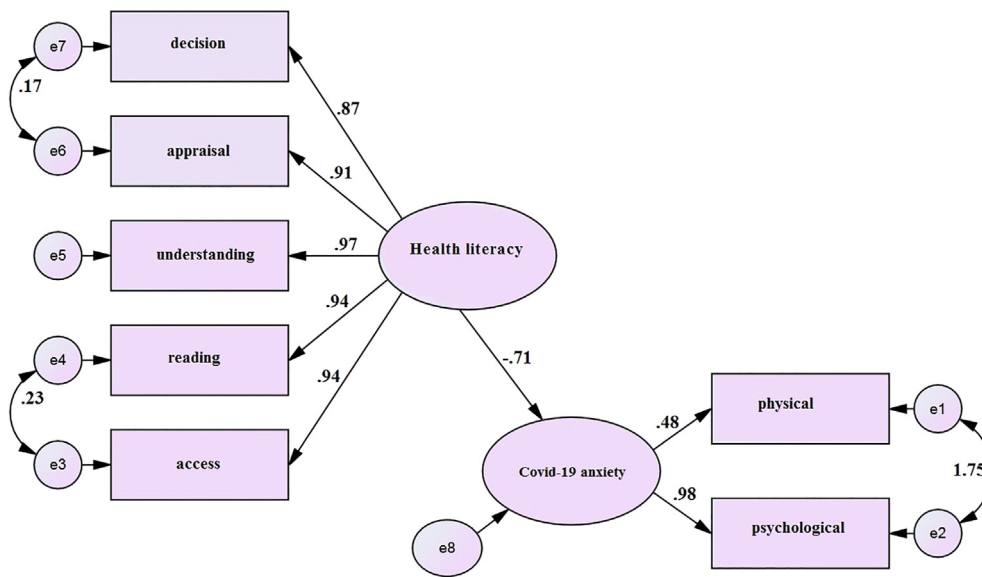
Figure 2. Standard coefficients of the modified model.

Table 6. Fit indices of the primary and modified model.

	GFI	IFI	PCFI	CFI	PNFI	RMSEA	CMIN/DF	P-Value	Df	$\chi 2$
Primary model	.936	.972	.694	.971	.691	.081	4.700	.000	15	70.503
Modified model	.986	.997	.569	.997	.568	.046	2.072	.016	12	24.858

Abbreviations: CFA: Confirmatory Factor Analysis; CMIN/DF: Chi-square/degree-of-freedom ratio; RMSEA: Root Mean Square Error of Approximation; PCFI: Parsimonious Comparative Fit Index; GFI: Goodness of Fit Index; PNFI: Parsimonious Normed Fit Index; IFI: Incremental Fit Index; CFI: Comparative Fit Index. Fit indices: PNFI, PCFI (>.5), CFI, IFI, GFI (>.9), RMSEA (<0.05 good, 0.05–0.08 accept, 0.08–0.1 marginal), CMIN/DF (<3 good, <5 acceptable).

Table 7. Standardized path coefficients of the modified model.

Path	Standardized coefficient	S.E.	t-value	P
Covid-19 Anxiety <-- Health literacy	-0.709	0.056	-12.478	<0.001

The results of the present study showed that COVID-19 anxiety was severe in 3.6% of the subjects and mild in 78.6%. This finding may be due to the fact that the time interval between the outbreak of the COVID-19 crisis in Iran and the time of data collection was approximately 7 months. Therefore, over time, risk perception may decrease due to the normalization of the risk factor. However, studies have shown that anxiety associated with COVID-19, if mild, may lead to perception of threat and effective preventive measures [24, 30]. However, due to the continuation of the crisis in societies and the onset of the third wave of the disease in

most countries, including Iran, it is necessary to periodically screen COVID-19 anxiety in adults to take preventive measures. The results of other studies also showed that the adult population suffers from anxiety at the onset of COVID-19 disease. For example, the results of a study by Nakhostin-Ansari et al. (2020) showed that 38.1% of medical students during the COVID-19 crisis suffer from mild to severe anxiety [31]. The prevalence of anxiety in Chinese students was 24.9% [32].

The results showed that there is a significant negative relationship between HL and COVID-19 anxiety in adults living in Iranian society. So that with an increase of one unit in HL, 53.3% decrease in COVID-19 anxiety has occurred. The results of Nguyen et al.'s (2020) study also show that increasing HL is associated with decreasing COVID-19 fear scores (coefficient, B, .060.06; 95% confidence interval, 95% CI, .00.08, .040.04; p < 0.001). Nguyen believes that during the pandemic, many myths and misinformation worry people, and that people with higher HL are less likely to experience psychological problems because they have a

Table 8. Path coefficients of the relationship between health literacy and Covid-19 anxiety in terms of moderating variables in adults living in Iranian society.

| Moderate		Standardized coefficient	S.E.	T-Value	P	$x^2\Delta$	Δdf	P Value	IFI	CFI	GFI	RMSEA
Gender	Male	-0.203	0.102	-3.518	0.026	6.06	2	0.048	.001	.003	.032	.001
	Female	-0.301	0.079	-5.638	0.001							
Age	<45	-0.005	0.023	-0.237	0.812	7.32	2	0.025	.006	.004	.001	.005
	>45	-0.024	0.032	-0.762	0.443							
History of Chronic Diseases	Yes	-0.452	0.075	-7.756	0.001	6.54	2	0.038	.003	.005	.015	.024
	No	-0.050	0.096	-1.202	.0708							
History of Getting COVID-19	Yes	-0.526	0.089	-9.835	0.001	6.39	2	0.040	.014	.021	.002	.016
	No	-0.624	0.074	-10.695	0.001							
Receiving Social Support	Yes	-0.495	0.061	-8.649	0.001	8.32	2	0.015	.001	.001	.003	.010
	No	-0.015	0.024	-0.615	0.539							
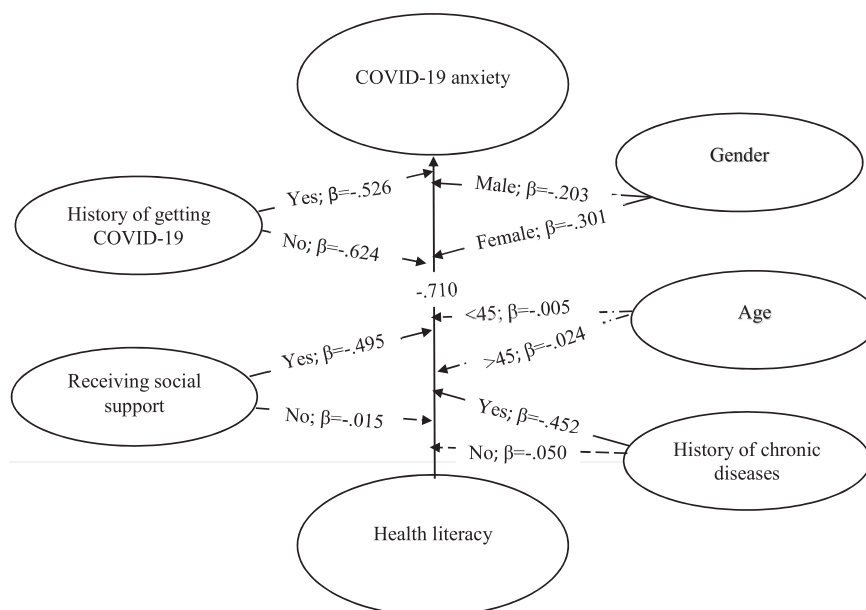
Figure 3. The moderating role of demographic variables in the relationship between health literacy and Covid-19 anxiety.

better understanding of health information [21]. Therefore, it is necessary to consider HL as a key element of responsibility and social solidity and a fundamental tool to reduce and control the current epidemic and the potential future epidemic of COVID-19. Given the continuing crisis and the possibility of a repeat of the COVID-19 pandemic, an interdisciplinary approach is critical to improving HL while home quarantine is recommended as a way to control the disease, the results of studies show that this solution is associated with financial, social, family and extensive psychological damage in adults [33]. Therefore, it is necessary to focus on other strategies to prevent and control COVID-19 disease, such as increasing HL. In this way, the HL of other family members, especially children and the older adults can be increased.

In the present study, the results showed that the effect of HL on COVID-19 anxiety in people with chronic disease was equal to β = -0.452 and this variable moderated the relationship in a negative and direct direction. Therefore, it can be concluded that increasing HL in people with chronic disease reduces COVID-19 anxiety among them. Although in our study the number of participants over 45 years of age who were more likely to develop chronic disease was 108, this finding may be due to the fact that specimens may feel threatened by following news of COVID-19, as at the beginning of the disease outbreak in Iran, the highest mortality rate due to COVID-19 was among the middle-aged and older adults with chronic diseases [34]. However, with the continuation of the crisis and the onset of the second and third epidemics of the disease, it was observed that the age range of patients and the resulting mortality has decreased [35]. On the other hand, people with chronic disease suffer from problems related to the complications of chronic disease and its treatment process. Therefore, they feel unable to accept and adapt to new stressors such as emerging and contagious diseases. These people are more likely than other adults to experience fear and anxiety about COVID-19 and its consequences [36].

According to the results of the present study, the effect of HL on COVID-19 anxiety in men and women was β = -0.203 and = - = 0.301, respectively, and this variable adjusted the relationship between HL and COVID-19 anxiety in a negative and direct direction. Therefore, considering that the path coefficient obtained in women is higher than men, it can be said that increasing HL in women has a greater effect on reducing COVID-19 anxiety. In this study, 54.3% of the samples were women, and this may affect this finding. Women are more likely to follow the news on

social media and messaging applications as our findings showed, which exposes them to the widespread rumors associated with the disease and, therefore, increases their COVID-19 anxiety about the subject. The results of the study by Nakhostin-Ansari et al. (2020) also showed that higher levels of COVID-19 anxiety were related to women [31].

The results showed that the effect of HL on COVID-19 anxiety in people who had a positive history of COVID-19 and in who didn't, was β = -0.526 and β = -0.624, respectively, and this variable correlated the relationship in a negative direction. Therefore, due to the fact that the path coefficient obtained in participants with negative history of COVID-19 was higher than in experienced ones, it can be said that increasing HL in those who have never been infected with this emerging diseases has a greater effect on reducing COVID-19 anxiety. Findings of Nakhostin-Ansari et al. (2020) showed that experiencing the symptoms and consequences of COVID-19 has led to anxiety in medical students [31]. The results of the study by Nakhostin-Ansari et al. (2020) also showed that there is a direct and significant relationship between the history of COVID-19 symptoms and the resulting anxiety [31].

The results of the present study showed that the effect of HL on COVID-19 anxiety in people who received social support was equal to β = -0.495 and this variable moderated the relationship in a negative and direct direction. Therefore, it can be concluded that increasing HL in such people can reduce COVID-19 anxiety. In anticipation of continuation of the COVID-19 pandemic or its resumption in the future, the notion of lack of psychological, mental, financial, and care support can cause the creation of the COVID-19 anxiety [3].

Due to the difference in the level of HL in different parts of Iran, especially between residents of urban and rural areas, the use of convenience and snowball sampling method can impair the generalizability of the results.

In this study, a general HL questionnaire was used. Therefore, in future studies, it is recommended to use tools that include items for measuring HL associated with COVID-19 disease. Data is collected by using the social media platforms (i.e. Telegram, and WhatsApp). Participants may not be in a good mood at the time of response or family members or friends might complete the tool instead of them, which may damage the validity of the results.

The use of self-reporting tools is another limitation of the present study. Asking for free participation and the critical situation that existed

in all provinces of the country, may be one of the reasons that led to the small number of samples in the present study.

5. Conclusion

Due to the great predicting role of HL in COVID-19 anxiety, it is recommended that programs be developed and implemented during the outbreak of the disease by experts and policy makers in the field of public health to increase HL in physical and mental dimensions through mass media and cyberspace available to adults living in the community. The results showed that female gender, a positive history of chronic disease, COVID-19 disease and lack of social support are moderating factors in the relationship between HL and COVID-19 anxiety. Therefore, these people need educational interventions to promote their HL, as well as interventions such as periodic screening for COVID-19 anxiety and, if necessary, psychological counseling and more serious and longer supportive interventions than other adults in the community.

Declarations

Author contribution statement

Fatemeh Gaffari: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Fatemeh Mohammadkhah: Conceived and designed the experiments; Contributed reagents, materials, analysis tools or data.

Abbas Shamsalinia: Conceived and designed the experiments.

Ameneh Mahmoudian, Nastaran Rafiei, Mahbobeh Daneshnia, Abolfazl Atashpoush: Performed the experiments.

Fatemeh Shirinkam: Analyzed and interpreted the data.

Data availability statement

Data included in article/supplementary material/referenced in article.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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