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Original Article

Fear of COVID-19 Higher among Food-Insecure Households: A Model-Based Study, Mediated by Perceived Stress among Iranian Populations

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Abstract

Objective: The COVID-19 pandemic is a crisis accompanied by multiple psychological consequences (including fear of COVID-19) and threatens the food security status of millions of people. This study aimed to examine the association between fear of COVID-19 and food insecurity, mediated by perceived stress.
Method: This cross-sectional study was conducted among 2871 Iranian participants (18-80 years), recruited through the Social Media during the COVID-19 epidemic. The demographic and socio-economic information questionnaire, Household Food Insecurity Access Scale (HFIAS), COVID-19 fear scale (FCV-19S), Cohen's Perceived Stress Scale (PSS-14) and Perceived Social Support Questionnaire (MSPSS) were used in data gathering. Descriptive and analytical analyses were done using SPSS 22.0 and Amos 22.0 was used for structural equation modeling (SES).
Results: Food insecurity has significant positive direct and indirect (mediated by perceived stress) correlations with fear of COVID-19 ($P < 0.05$). It was also shown that perceived social support could negatively relate to fear of COVID-19 through the pathways of food security status or perceived stress ($P < 0.05$). Among women, the presence of a child under 5 had a significant direct association with fear of COVID-19 ($P < 0.05$).
Conclusion: Food insecurity was associated with more perceived fear of COVID-19 among the studied population. The crisis caused by COVID-19 highlights the need to increase social resilience through developing and implementing appropriate strategies to prevent and mitigate social costs (whether physical, psychological, or nutritional).

Key words: *COVID-19; Fear; Food Security; Perceived Social Support; Stress*

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More than a year and a half ago, the first cases of COVID-19 were reported in Wuhan, China. This disease can lead to death through causing chronic dysfunction of the lungs. It became a global pandemic due to high contagion rates (1). According to global statistics on the World meters' website, more than 368 and 6 million people (until January 28, 2022) have been infected by COVID-19 in the world and Iran, respectively (2). People's mental health was also severely affected by the pandemic for reasons such as fear of getting infected, socio-financial disruptions, lockdowns, and so on (3). Fear of COVID-19 is a mental health disorder (4), accompanied by different psychological consequences like anxiety, depression (5), stress (6), and suicide in some severe cases (3, 7, 8).

There are studies that have examined the fear of COVID-19 among samples of the Iranian population. In the study conducted by Varasteh *et al.*, fear of COVID-19 was recognized as one of the main reasons why nurses quit their jobs during the epidemic (9). In another study which was conducted on patients with multiple sclerosis, the greater score of fear of COVID-19 was associated with more symptoms of anxiety and depression (10). Pregnant women and their husbands were another vulnerable group to fear of COVID-19 in Ahorsu *et al.'s* study (11).

The COVID-19 pandemic threatens the food security status of millions of people all over the world due to its negative impacts on the global food system. The number of people with severe food insecurity is projected to nearly double due to the impact of COVID-19 by the end of the year 2020. Also, the number of malnourished children will increase due to increased wasting and stunting (12). Damage to the food value chain has also been reported during an epidemic in Iran (13). Food insecurity has negative effects on health, and may lead to conditions such as obesity and non-communicable diseases (NCDs) (14), which are in turn associated with higher mortality and morbidity among COVID-19-infected people (15,16). It is also associated with other mental health conditions, including perceived stress (17). Perceived stress and fear of COVID-19 may lead to other serious mental health disorders, such as anxiety and depression (18). The purpose of the current study was to examine how food insecurity may be associated with fear of COVID-19 (a mental disorder which developed during the pandemic). Although studies have been conducted on the fear of COVID-19 in the areas of food packaging (19), fast food consumption (20), or food supply (21), but the fear of COVID-19 scale has not usually been used. Since mental health and food security have been severely damaged during the epidemic, examining their relationship can provide policymakers with evidence on how to adopt the strategies. This study was performed to examine this relationship, using structural equation modeling, mediated by perceived stress.

Materials and Methods

Study design and population

This nationwide web-based cross-sectional study was conducted on 2871 Iranian people (18-80 years), from all 31 provinces; the proportion of geographical population distribution was taken into account. It ran from August to September 2020. The study inclusion criteria included: being adults (18 years and older), living in Iran and being interested to participate in the study. Participants were excluded from the study if they were under 18 years of age.

Study procedure

The invitation to the questionnaire was a text that included research objectives and inclusion criteria. It stated that participants would not be asked for identity information and could be excluded from the study whenever they felt uncomfortable answering questions. They were also told that their information was confidential and would only be analyzed by the researcher. The questionnaires were uploaded to a site with the address (https://porsall.com/), and distributed by popular social media platforms (namely Instagram, WhatsApp Messenger, and Telegram Messenger). It has been shown that the use of social media in Iran has an increasing trend and includes a significant population (about 40% based on the Digital 2020 website), and is a safe way to gather data in the situation of the COVID-19 epidemic. Three researchers were directly involved in data collection. Invitations were distributed on social networks through groups, channels and pages with different topics. If participants were willing to participate in the research, they would enter the questionnaire page by clicking the link mentioned in the invitation. It took about ten minutes for each person to complete the questionnaire, and there was no time limit. Each participant could answer the questionnaire only once.

Study tools

Demographic and Socio-Economic Information

The demographic and socio-economic information of participants (including age, sex, household size, educational level, employment status, family residence status and household monthly income) were obtained via the online questionnaire. The participants were also asked about the presence of vulnerable people in the household. These included: pregnant woman, children under 5, elderly people (over 65), and people with NCDs (such as cardiovascular disease, diabetes, cancer, endocrines disorder, etc.).

Household Food Security Assessment

In this study, the Household Food Insecurity Access Scale (HFIAS) was used in order to determine the status of food insecurity among studied participants. This questionnaire consists of nine questions with four frequencies of occurrence (most of the time; sometimes; rarely; and never), which are scored on a Likert scale

(lowest score = zero, highest score = 3). The total scores obtained from the questionnaire are divided into four categories: food secure (0-1), mild food insecure (2-7), moderate food insecure (8-14) and severe food insecure (15-27). The validity and reliability of the Persian questionnaire has been previously assessed by Mohammadi *et al.* (Cronbach's alpha = 0.85) (22).

COVID-19 Fear Assessment

COVID-19 fear scale (FCV-19S) is a 7-item questionnaire that assesses the Fear of COVID-19 among participants, and is rated on a 5-point Likert scale (strongly disagree = 1 to strongly agree = 5). The total score is obtained by summing the scores of all individual items (score range 7-35); and the higher the score, the more severe the fear. This tool has also been used in various studies around the world (23). The reliability and validity of the Persian version of this questionnaire was previously examined by Kwasi Ahorsu *et al.* (Cronbach's alpha = 0.82) (5). An acceptable Cronbach's alpha (0.87) was also obtained in the current study.

Perceived Stress Assessment

Cohen's Perceived Stress Scale (PSS-14) is a self-report instrument that is used to assess perceived stress among a study population. This questionnaire contains 14 items that examine the levels of thoughts and feelings of the person during the past month, and is scored on a 5-point Likert scale (Never = 0; Almost Never = 1; Sometimes = 2; Fairly Often = 3; Very Often = 4). Questions 4-7, 9-10 and 13 are scored in reverse. In this scale, the minimum perceived stress score is 0 and the maximum is 56. The higher the score, the more the perceived stress (24). The internal reliability for the current questionnaire was previously measured by Qazvini *et al.* and was found to be acceptable (Cronbach's alpha = 0.73) (25).

Perceived Social Support Assessment

In the current study, the Multidimensional Scale of Perceived Social Support Questionnaire (MSPSS) was used in order to assess the perceived social support. This 12-item scale consists of three subscales, examining the perceived social support from three sources (family, friends, and others), and is scored on a 5-point Likert scale (strongly disagree = 1 to strongly agree = 5). The total score is obtained by summing all the individual item scores. The minimum and maximum perceived social support scores are 12 and 60, respectively. Cronbach's alpha of 0.93 was obtained for the Persian MSPSS questionnaire by Salimi *et al.* (26).

Statistical Analysis

The information that was collected using the site containing the questionnaire was transferred to the IBM SPSS Statistics for Windows, Version 22.0. Descriptive and analytical analysis (including: Pearson correlation, T-test, ANOVA test and linear regression) were performed using SPSS 22.0; and IBM SPSS Amos Version 22.0 was used for structural equation modeling (SES).

Ethics

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Ethics Committee of the National Nutrition and Food Technology Research Institute, Shahid Beheshti University of Medical Sciences, 26 July 2020 (ethical code: IR.SBMU.nnftri.Rec.1399. 028).

Results

The mean age of participants was 32.99 ± 8.31 years, and many of them were employees (24.7%), with associate or bachelor's degree (47.1%). The detailed characteristics of the participants are presented in Table 1. Since the frequency of women in the raw data was much higher than men (82.8% vs. 17.2%), data weighting was applied by sex, according to the latest census of the Statistics Center of Iran (51% men, 49% women).

In the current study, socio-economic variables (including household residence status, monthly income, participant's educational level, and employment status) were analyzed by the Principal Component Analysis (PCA) method [Kaiser-Meyer-Olkin test (KMO) > 0.5 and Bartlett test < 0.001]. A socio-economic status variable was developed and split into three levels. Based on the results, more than half of the participants (55.2%) were from food-secure households, and about 6.5% were reported as severely food-insecure. For subsequent analyses, the third and fourth groups (food-insecure with moderate and severe hunger) were merged.

The Pearson correlation showed a significant association between fear of COVID-19 and quantitative variables, including age ($r = 0.05$, $P < 0.05$), total perceived stress score ($r = 0.37$, $P < 0.001$), and total social support score ($r = -0.05$, $P < 0.05$). However, household size was not an important predictor of fear of COVID-19 ($r = 0.01$, $P > 0.05$). The analysis by T-test showed that the mean score of fear of COVID-19 was significantly higher among women ($P < 0.001$); in households with a child under 5; and in patients with NCDs ($P < 0.05$) (Table 2). The association between the fear of COVID-19 score and household food security status indicated that the higher the degree of food insecurity, the higher the score of fear of COVID-19 ($P < 0.001$). However, the ANOVA test showed no significant association between fear of COVID-19 and the socio-economic status ($P > 0.05$) (Table 2).

In the next step, a linear regression model was used for predicting fear of COVID-19, by including the significant variables ($P < 0.05$) identified by Pearson correlation, T-test and ANOVA test. Results showed that age, sex, perceived social support, perceived stress, food security status and the presence of a child under 5 were significant predictors of fear of COVID-19 ($P < 0.05$) (Table 3).

Finally, the structural equation modeling (SES) of fear of COVID-19 was constructed using the significant

variables. Figures 1 and 2 show the pathways by groups (sex), for men and women, respectively. The proposed model (by sex) includes three exogenesis variables (age, perceived social support and the presence of a child under 5), hierarchical mediator variables (food security status and perceived stress), and an endogenous variable (fear of COVID-19). The results of the model indicated that all pathways are significant in both sexes, except for having a child under 5, which was significant only in the female group (Table 4). There was also a significant sex difference between fear of COVID-19 and food security status pathways ($P < 0.05$), as it was seen to be stronger among men. A comparison of the between-pathways coefficient by sex also showed a greater inverse association between age and fear of COVID-19 among men. The standardized total, direct and indirect effects are provided in Table 4, and confirm the indirect effect of food insecurity on fear of COVID-19, in terms of perceived stress. Acceptable fit indices were obtained for the model, which are presented in Table 4 (end of table).

Table 1. The Demographic and Socio-Economic Information of the Studied Participants

Quantitative variables	**(Mean ± SD[a])**
Age	32.99 ± 8.31
Household size	3.49 ± 1.29
Total fear of COVID-19 score	20.48 ± 6.12
Total perceived stress score	29.69 ± 8.14
Total social support score	43.16 ± 9.57
Qualitative variables	**N (%)**
Educational level	
High school diploma and lower	621(21.6)
Associate Degree and Bachelor	1352(47.1)
Masters and higher	897(31.3)
Employment status	
University student	377(13.1)
Home keeper	511(17.8)
Employee	709(24.7)
Healthcare personnel	223(7.8)
Laborer	120(4.2)
Farmer	90(3.1)
Self-employed	539(18.8)
Retired	149(5.2)
Unemployed	153(5.3)
Monthly household income	
Under 1800000 Rials	494(17.2)
18000000-36000000 Rials	621(21.6)
36000000-54000000 Rials	670(23.3)
54000000-72000000 Rials	408(14.2)
72000000-90000000 Rials	254(8.8)
90000000-108000000 Rials	121(4.2)
108000000-126000000 Rials	94(3.3)
More than 126000000 Rials	210(7.3)
Household residence status	
Tenant	835(29.1)
Owner	1749(60.9)
Living with others	287(10)
Presence of a pregnant woman in the household	
Yes	72(2.5)
No	2799 (97.5)

Presence of an under-5 child in the household	
Yes	765(26.6)
No	2106(73.4)
Presence of an old person (> 65 years) in the household	
Yes	347(12.1)
No	2524(87.9)
Presence of a person with NCDs[b] in the household	
Yes	742(25.8)
No	2129(74.2)
Household food security status	
Food secure	1583(55.2)
Food insecurity without hunger	777(27.1)
Food insecurity with moderate hunger	322(11.2)
Food insecurity with sever hunger	188(6.5)

[a] Standard Deviation
[b] Non-Chronic Disease

Table 2. The Association of Fear of COVID-19 with Qualitative Variables (Nominal and Ordinal) among Studied Participants

Variables	Total score of fear of COVID-19 (Mean ± SD[a])	95% CI[b]	P-value
Sex			
Women	21.67 ± 5.93	1.89, 2.77	< 0.001*
Men	19.33 ± 6.08		
Presence of a pregnant woman in the household			
Yes	20.14 ± 6.28	-1.09, (1.78)	0.05*
No	20.49 ± 6.12		
Presence of an under-5 child in the household			
Yes	21.10 ± 6.48	-1.37, (-0.32)	< 0.05*
No	20.25 ± 5.97		
Presence of an old person (> 65 years) in the household			
Yes	20.94 ± 5.98	-1.21, (0.15)	< 0.05*
No	20.41 ± 6.14		
Presence of a person with NCDs[c] in the household			
Yes	20.92 ± 6.06	-1.10, (-0.07)	< 0.05*
No	20.33 ± 6.14		
Household food security status			
Food secure	9.60 ± 5.95		
Food insecurity without hunger	21.28 ± 6.05	20.25, 20.70	< 0.001**
Food insecurity with moderate- sever hunger	21.99 ± 6.30		
Scio-economic status			
First tertile	20.49 ± 6.06		
Second tertile	20.74 ± 6.15	20.25, 20.70	< 0.05**
Third tertile	20.21 ± 6.14		

***** T-test
****** ANOVA
[a] Standard Deviation
[b] Confidence Interval
[c] Non-Chronic Disease

Table 3. Final Models of Linear Regression to Examine the Association between Fear of COVID-19 and Household Food Security Status

Variable	B	SE [a]	β	t	95% CI[b]	P- value
Age	0.80	0.013	0.109	6.381	0.055, 0.105	< 0.001
Total social support score	0.058	0.012	0.091	4.857	0.035, 0.81	< 0.001
Total perceived stress score	0.278	0.014	0.370	19.352	0.250, 0.306	< 0.001
Household Food security status	0.757	0.146	0.095	5.199	0.471, 1.042	< 0.001
Presence of a person with NCDs[c] in the household	0.243	0.241	0.017	1.007	-0.230, 0.716	<0.05
Presence of an under-5 child in the household	0.635	0.239	0.046	2.656	0.166, 1.104	< 0.05
Sex	-1.582	0.214	-0.129	-7.377	-2.002, (-1.161)	< 0.001
Notice: R = 0.429 R^2 = 0.184 ADJ.R^2 [d] = 0.182						

[a] Standard Error
[b] Confidence Interval
[c] Non-Chronic Disease
[d] Adjusted R Square

Table 4. Summary of Models for Predicting the Fear of COVID-19, by Sexes

Women's model pathways	Standardized Direct Effects	Standardized Indirect Effects	Standardized Total Effects	Estimate	S.E.	C.R.	P-value
Fear of COVID-19 < ---Age	0.090	-0.054	0.036	0.067	0.018	3.619	< 0.001
Fear of COVID-19 < --- Perceived social support	0.084	-0.167	-0.083	0.052	0.017	3.134	0.002
Fear of COVID-19 < --- Having under-5 child	0.085	0.000	0.085	1.129	0.327	3.451	< 0.001
Perceived stress < --- Food security status	0.120	0.000	0.120	1.384	0.293	4.719	< 0.001
Fear of COVID-19 < --- Food security status	0.095	0.045	0.140	0.775	0.145	5.329	< 0.001
Fear of COVID-19 < --- Perceived stress	0.375	0.000	0.375	0.268	0.019	13.991	< 0.001
Men's model pathways	**Standardized Direct Effects**	**Standardized Indirect Effects**	**Standardized Total Effects**	**Estimate**	**S.E.**	**C.R.**	**P-value**
Fear of COVID-19 < ---Age	0.131	-0.030	0.101	0.092	0.017	5.433	< 0.001
Fear of COVID-19 < --- Perceived social support	0.102	-0.167	-0.065	0.066	0.017	3.927	< 0.001
Fear of COVID-19 < --- Having under-5 child	0.003	0.000	0.003	0.039	0.333	0.117	0.907
Perceived stress < --- Food security status	0.294	0.000	0.294	2.818	0.229	12.281	< 0.001
Fear of COVID-19 < --- Food security status	0.102	0.108	0.210	0.775	0.145	5.329	< 0.001
Fear of COVID-19 < --- Perceived stress	0.367	0.000	0.367	0.291	0.021	13.750	< 0.001
fit indices	**TLI**	**GFI**	**AGFI**	**IFI**	**CFI**	**RMSEA**	
	0.93	0.99	0.98	0.97	0.97	0.03	

S.E = Standard Error; C.R = Critical Ratio; TLI = Tucker-Lewis index; GFI = Goodness of Fit Index; AGFI = adjusted goodness of fit index; IFI = Incremental Fit Index; CFI = comparable fit index; RMSEA = Root Mean Square Error of Approximation

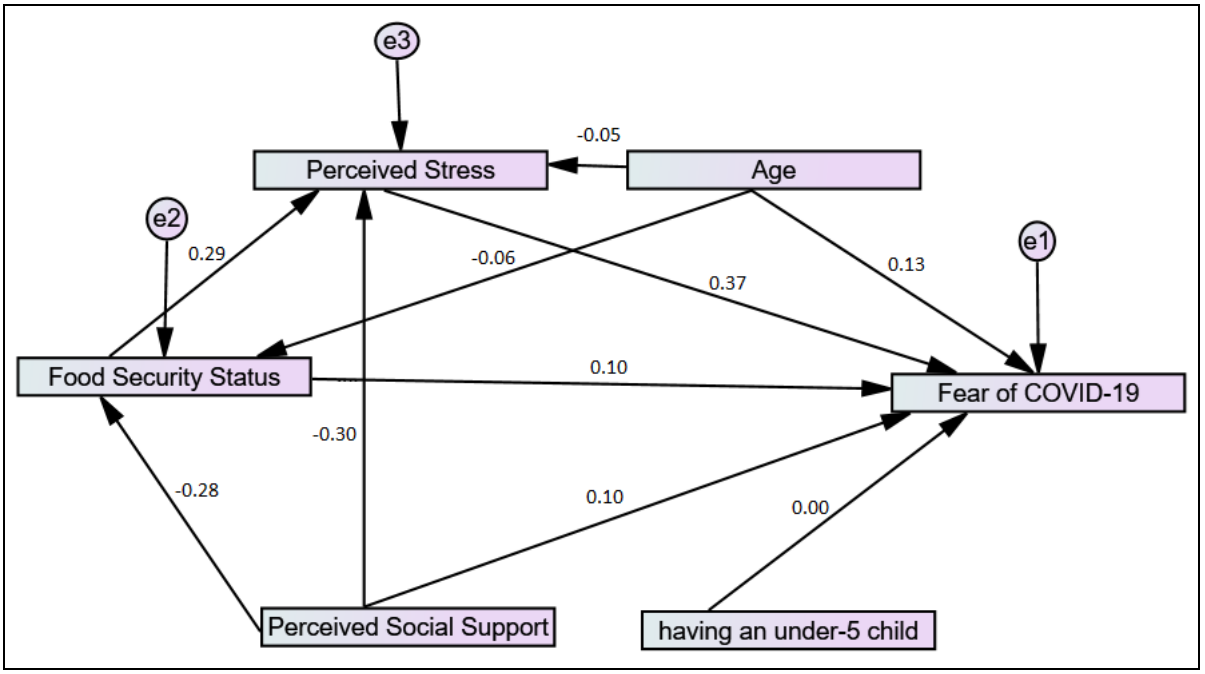

Figure 1. Proposed Model for Predicting the Fear of COVID-19, based on Household Food Security Status in Men

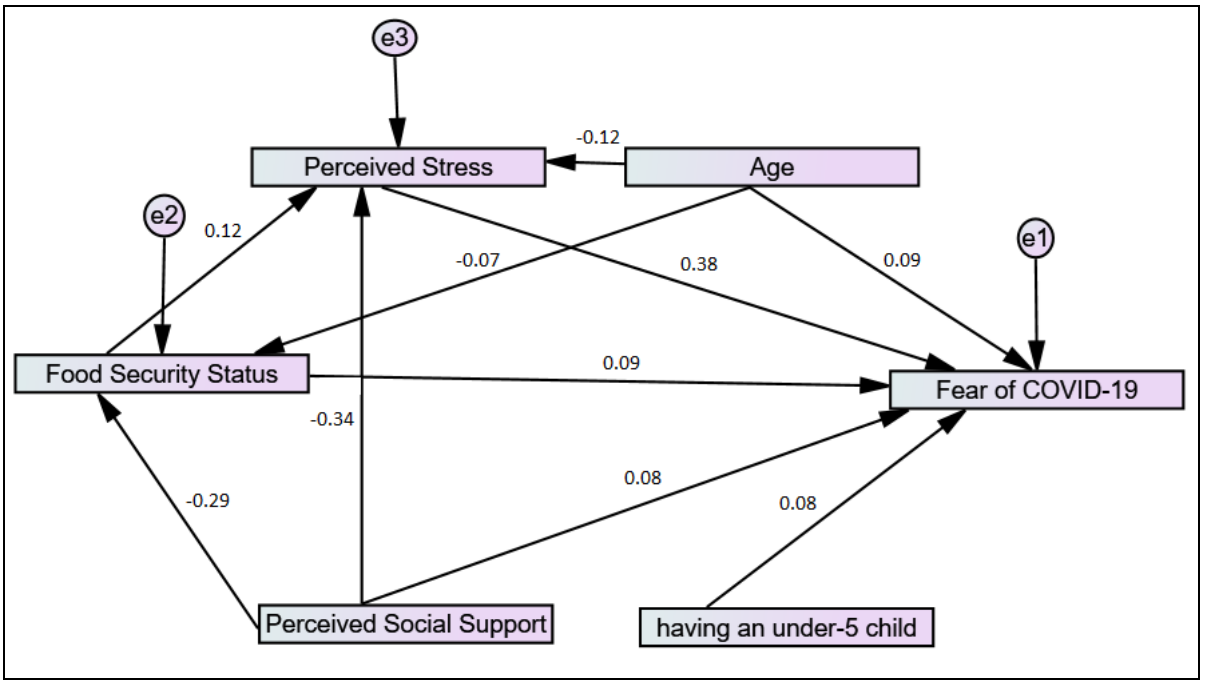

Figure 2. Proposed Model for Predicting the Fear of COVID-19, based on Household Food Security Status in Women

Discussion

The current study was conducted among an Iranian online population, in order to determine the association of food insecurity with fear of COVID-19, mediated by perceived stress, in structural equation modeling. The results indicated the presence of both direct and indirect associations between food insecurity and fear of COVID-19. It was also shown that perceived social support could be associated with fear of COVID-19, through food insecurity or perceived stress.

Investigating the relationship between food insecurity and mental health disorders is an ongoing topic of interest to researchers. It has been shown that depressive symptoms, anxiety and stress are higher among food-insecure households (27, 28). Food-insecure households usually consume low quality diets, which in turn, are

associated with poor mental health (29). Worries about family food sources can also be stressful (30). In the current study, food insecurity was significantly associated with higher perceived stress and fear of COVID-19. The COVID-19 pandemic has created conditions that put additional stress on people (31). Taylor *et al.* showed that concerns about meeting household needs, due to the social and economic disruption following the COVID-19 outbreak, can be associated with perceived stress (32). In another study conducted by Rehman *et al.* among Indians during the COVID-19 pandemic, it was shown that an insufficient food supply during quarantine was associated with greater mental distress, including perceived stress (33). The COVID-19 pandemic has left many people with job losses, reduced income, (34) and increased food prices (12), raising concerns about the growing prevalence of food insecurity. It has been shown that these economic problems in households are associated with insufficient food intake, both in terms of amount and quality. However, families with persistent income or enough savings were seen to be less affected during the quarantine period (35). Food insecurity also makes people more vulnerable, both physically (36) and mentally (37). In a study conducted by Kelly *et al.*, the death risk from Ebola was 18.3 times higher among food-insecure patients (36). A sufficient and nutritious diet plays an important role in stimulating an appropriate immune system response to COVID-19 (38). Stress reduction, nutritious diet, adequate levels of vitamin D in the blood, and adequate physical activity are other important factors associated with better immune system function (39). Long-term fear and stress due to COVID-19 can also alter the body's neuro-endocrine-immune system, which may lead to an increase in other diseases (40). Thus, in order to reduce the effects of food insecurity on various aspects of health, policymakers and planners need to develop both short- and long-term strategies to increase the community's resilience to such shocks. Inevitably, this requires cooperation and partnership at the global, national, and local levels.

According to the results of the current study, perceived social support related to fear of COVID-19 via different pathways: direct and indirect. The indirect effect of social support was such that, as the score increased, perceived stress decreased. This finding is consistent with a study conducted by Ye *et al.* among college students in China (41). It has been shown that social support is also an important factor that is negatively associated with perceived stress and anxiety among healthcare workers during the pandemic (42, 43). Social support has played an influential role on mental health and wellbeing during the pandemic, but unfortunately, it has suffered due to social distancing practices (44, 45). Access to technology (and its functions in maintaining social relationships), however, may be able to mitigate feelings of loneliness and mental health problems (45). Another indirect pathway that links perceived social support to fear of COVID-19 is through its positive impact on food security. This finding is consistent with studies by Ashe (46) and Nascimento Dos Santos (47). People with higher social support are more likely to be wealthy, and less likely to experience food insecurity (48).

Limitation

The study had some limitations, including the lower participation of older people (over 65). Therefore, convenience sampling, which was used in data gathering, may be accompanied with some bias and be less generalizable (5). In order to address these limitations, this study utilized a relatively high sample size, a proportional approach to geographical distribution, and data weighting.

Conclusion

In addition to threatening people's physical health, the pandemic threatens food security and mental health. Based on the results of the present study, food insecurity has significant direct and indirect (mediated by perceived stress) associations with fear of COVID-19. The crisis caused by COVID-19 highlights the need to increase social resilience through developing and implementing appropriate strategies to prevent and mitigate social costs; whether physical, psychological, or nutritional. This study showed that increasing food security resilience can play a key role in achieving these goals. Further studies can examine the trend of psychological disorders, such as fear of COVID-19, in socio-economic vulnerable groups through nutritional intervention, including providing food baskets or financial assistance.

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Conflict of Interest

None.

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