RESEARCH

Gender differences in patients with corona virus disease-2019 presenting with psychiatric disturbances: a multicentre study

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Abstract

Background The coronavirus disease known as COVID-19 (2019) pandemic may increase the likelihood of psychological symptoms that can reach the level of psychiatric disorders.

Aim We aimed to study psychiatric morbidity in patients with COVID-19 concerning gender differences and disease severity in the acute phase of infection and after 6 months.

Methods This is a multicenter follow-up study registered in ClinicalTrials.gov (NCT04459403). Patients were recruited consecutively from three quarantine hospitals in Egypt. Data were collected through a questionnaire built using Google Forms including the Arabic versions of General Health Questionnaire (GHQ-12), Beck Depression Inventory (BDI), and Taylor Manifest Anxiety Scale (TMAS). Depression, anxiety, and post-traumatic stress disorder (PTSD) symptoms were assessed after 6 months.

Results The study questionnaire was offered to 400 patients and 199 patients agreed to fill it. BDI and TAMS were higher in mild than moderate and severe COVID-19 (14, 8, 8, *P*-value = 0.009, 17, 13.5, 14, *P*-value = 0.04, respectively). Females showed a higher prevalence of depression, anxiety, sleep problems, and insomnia due to anxiety than males. Education level, marital status, previous psychiatric illness, and severity of COVID-19 independently affected depression. Marital status, family history of psychiatric illness, and chronic medical illness independently affected anxiety. On 6-month follow-up, BDI significantly decreased in males but not females. TMAS showed no significant changes, but the severity of anxiety was still higher in females. PTSD was more frequent in females (26 (37.1%) versus 4 (9.5%), respectively, *P*-value = 0.02).

Conclusion The prevalence and severity of depression and anxiety were higher in females than male participants, suggesting that females are more affected by the COVID-19 pandemic.

Keywords COVID-19, Depression, Anxiety, Sleep disturbances, Gender

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Introduction

The coronavirus pandemic is swiftly spreading across the world. It is inducing a significant degree of concern and fear in the general population. The first case infected with coronavirus disease 2019 (COVID-19) was announced in Egypt on the 14th of February 2020. The number of infected cases is still increasing [1].

In public mental health terms, COVID-19 and its sequelae pose a challenge to the mental health of people due to elevated rates of stress and anxiety. The COVID-19 pandemic predisposes to psychiatric symptoms that may reach the level of psychiatric disorders similar to the past coronavirus (non-COVID-19) epidemics. Previous studies found that COVID-19 is associated with an increase in substance and alcohol use disorders [2, 3]. Anxiety, depression, delirium, agitation, altered consciousness [4], new-onset psychosis, and mania [5]were reported in patients with COVID-19. Patients with pre-existing psychiatric disorders, e.g., schizophrenia, experienced an exacerbation of their symptoms or developed new psychiatric symptoms or disorders [6]. There are several biologic and psychosocial explanations underlying the psychiatric affection of patients with COVID-19. The suggested biologic factors include marked inflammatory and cytokine responses, physiologic derangements in critically ill patients, and medications in addition to direct viral invasion of the central nervous system [7, 8].

From another perspective, the COVID-19 pandemic carries global psychosocial consequences. This psychosocial burden is expected to rise because of social stresses like death of relatives and friends, physical distances, unemployment, and stigma [9]. The additional stress of self-quarantine has a considerable psychological impact on people's usual activities, routines, or livelihoods as it causes sense of loneliness, depression, and increased use of alcohol and drugs. Self-harm or suicidal behavior is also expected to rise. Sedentary behavior and low levels of physical activity can have negative effects on the health, well-being, and quality of life of individuals [10].

Previous studies on severe respiratory viruses, e.g., severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS), revealed a high prevalence of post-traumatic stress disorder (PTSD) [11]. Few studies, mostly Chinese, have examined post-traumatic stress symptoms (PTSS)/PTSD due to COVID-19. One study found that nurses exposed to COVID-19 had a PTSD incidence of 16.8%, with the highest scores in avoidance symptoms [12]. Another study, that included hospitalized but stable patients, found a high prevalence of PTSS (96.2%) [13].

Susceptibility to psychiatric disorders is different between males and females. Depression and anxiety are more prevalent in females, whereas substance abuse is higher in males [14]. Early research has suggested that females may experience or respond more negatively to COVID-19-related events [15, 16]; however, the impact on psychological stress has not been well investigated.

This work aimed to (a) assess depression, anxiety, and sleep disturbances in Egyptian patients with COVID-19 during the acute phase of infection and after 6 months; (b) detect PTSD symptoms after 6 months of COVID-19 infection; (c) associate these psychiatric disturbances with demographic and clinical data with special emphasis on gender differences and COVID-19 severity.

Methods

Study design

This is a multicentre follow-up observational study. Patients were recruited consecutively (as convenient sample) from 3 quarantine hospitals of the Ministry of Health and Population, Egypt, namely, 15 Mayo Smart Hospital in Cairo, National Hepatology and Tropical Medicine Research Institute (NHTMRI) in Cairo, and Students Hospital in Giza. Patients were either admitted to these hospitals or quarantined at home and followed up by physicians of the included hospitals. Patients were initially recruited from 8 June 2020 to 19 July 2020. Follow-up assessments were done after 6 months from the acute infection.

Ethics statement

The Helsinki Declaration of 1975, as amended in 2008, and the ethical guidelines established by the relevant national and institutional committees on human experimentation, according to the authors, apply to all procedures used in the course of this work. The study ethical committees of Cairo University's Faculty of Medicine (number N-36-2020, date: May 14, 2020) and the Ministry of Health and Population (number 15-2020/1, date: June 2, 2020) authorized all operations involving human subjects or patients. The research project was registered on ClinicalTrials.gov under the NCT04459403 designation.

Subjects

Both male and female people over the age of 18 were included in this study. Individuals who had a positive real-time reverse-transcriptase polymerase-chain reaction (RT-PCR) test result for nose and pharyngeal swab specimens, indicating a confirmed diagnosis of SARS-CoV-2 virus infection, were enrolled. Before each patient took part in the trial, their written informed consent was obtained through Google Forms as part of the study questionnaire. Patients who did not complete the tools of the study, e.g., due to internet problems, not familiar with

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the Google Form, fear of stigma, or not interested, were excluded from the final analysis of the data.

Measures

Data was collected through a survey built using Google Forms and filled by the patients. The included data were demographic data such as the patients' age, gender, cigarette smoking, level of education, marital status, previous psychiatric illness, substance use, comorbid medical disorders, e.g., underlying chronic liver (e.g., chronic hepatitis C), pulmonary disorders (e.g., bronchial asthma), cardiac (e.g., ischemic heart diseases) or chronic kidney diseases, diabetes mellitus, and systemic hypertension.

The Egyptian Ministry of Health and Population's protocol for COVID-19 diagnosis and treatment divided cases into three severity categories: mild, moderate, and severe [17].

Tools for psychiatric assessment

The General Health Questionnaire (GHQ-12), Arabic version [18] was utilized because it is the most widely used screening tool for common mental disorders and a more comprehensive indicator of mental health. Using the Likert grading systems, it yields a total score of 36 (0–1-2–3). The Arabic version of the Beck Depression Inventory (BDI) [19], a self-report measure intended to evaluate depressive symptoms during the preceding 2 weeks, was utilized. The patient chooses the statement that most accurately describes their current condition from 21 groupings of statements on a four-point scale (0–3). The severity of depression is calculated by adding the scores: minimum depression=0–13, mild depression=14–19, moderate depression=20–28, and severe depression=29–63.

The Arabic version of the Taylor Manifest Anxiety Scale (TMAS) [20] was used where a person answers by reflecting on themselves, to determine their anxiety level. True (1)-false (0) responses are used for each item, and the true replies are counted, giving a score from 0 to 50. Scores are interpreted as follows: 0–16=no anxiety, 17–20=mild anxiety, 21–26=moderate anxiety, 27–50=severe anxiety.

Sleep disturbances were assessed through questions in BDI and TMAS targeting sleep. They included unspecified sleep problems (question 16 in BDI), interrupted sleep (question 1 in TMAS), insomnia due to anxiety (question 16 in TMAS), and unpleasant dreams (question 47 in TMAS). BDI and TMAS were included in the survey sent to the participants together with the section concerned with the demographic and clinical data. Patients took 20–30 min to fill out the survey. Investigators entered the patients' data through a code number.

So, the patient's identifiable data were known to the investigators only and were not recorded or identified in the results table.

Follow-up

After 6 months from the acute infection, follow-up assessments were done for depression (using the BDI) and anxiety (using the TMAS). In addition, post-traumatic stress disorder (PTSD) symptoms were assessed using the PTSD Checklist for DSM-5 (PCL-5) [21], Arabic Version [22], which is a commonly used self-report measure in clinical and research settings. It is a new version of the PTSD Checklist (PCL) [23] which was updated according to the new diagnostic criteria for PTSD in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition. It contains 20 items rated on a five-point Likert-type scale, with scores ranging from "Not at all" (0) to "Extremely" (4), resulting in a symptom severity score between 0 and 80. A cutoff score of 33 was suggested for a diagnosis of PTSD (which was used in this study), while validation studies recommended a variety of cutoff scores ranging between 28 and 37 [22].

Statistical analysis

Data analysis was carried out using Windows SPSS 25. Depending on how the data were distributed, numerical variables like age and computed scores were shown as mean, standard deviation (SD) or median, 25th, and 75th percentiles. The presentation of categorical variables was done using percentage (%) and count (*n*). Appropriate tests were employed for inferential statistics based on the numerical data distribution. The Mann-Whitney *U* test or the Student *T*-test was utilized to compare two sets of independent variables. The chi-square test was used to compare two category variables ($\times 2$). When one or more predicted cells were less than five, the Fisher exact test was utilized rather than the chi-square test. To find possible factors of anxiety and depression scores, univariate and multivariate logistic regression analyses were conducted. Wilcoxon matched pairs signed ranks test used to test for a difference in the medians of paired observations (at baseline and after 6 months). Statistical significance was expressed by using the *P*-value and the confidence interval. *P*-value≤ 0.05 was considered significant.

Results

The study questionnaire was distributed to 400 PCR-confirmed patients with COVID-19 from the 3 included hospitals. Two hundred and one patients (50.25%) did not fill out the questionnaire (Fig. 1). One hundred ninety-nine (49.75%) patients agreed to fill out the questionnaire: 108 patients from 15 Mayo Smart Hospital, 62 patients from

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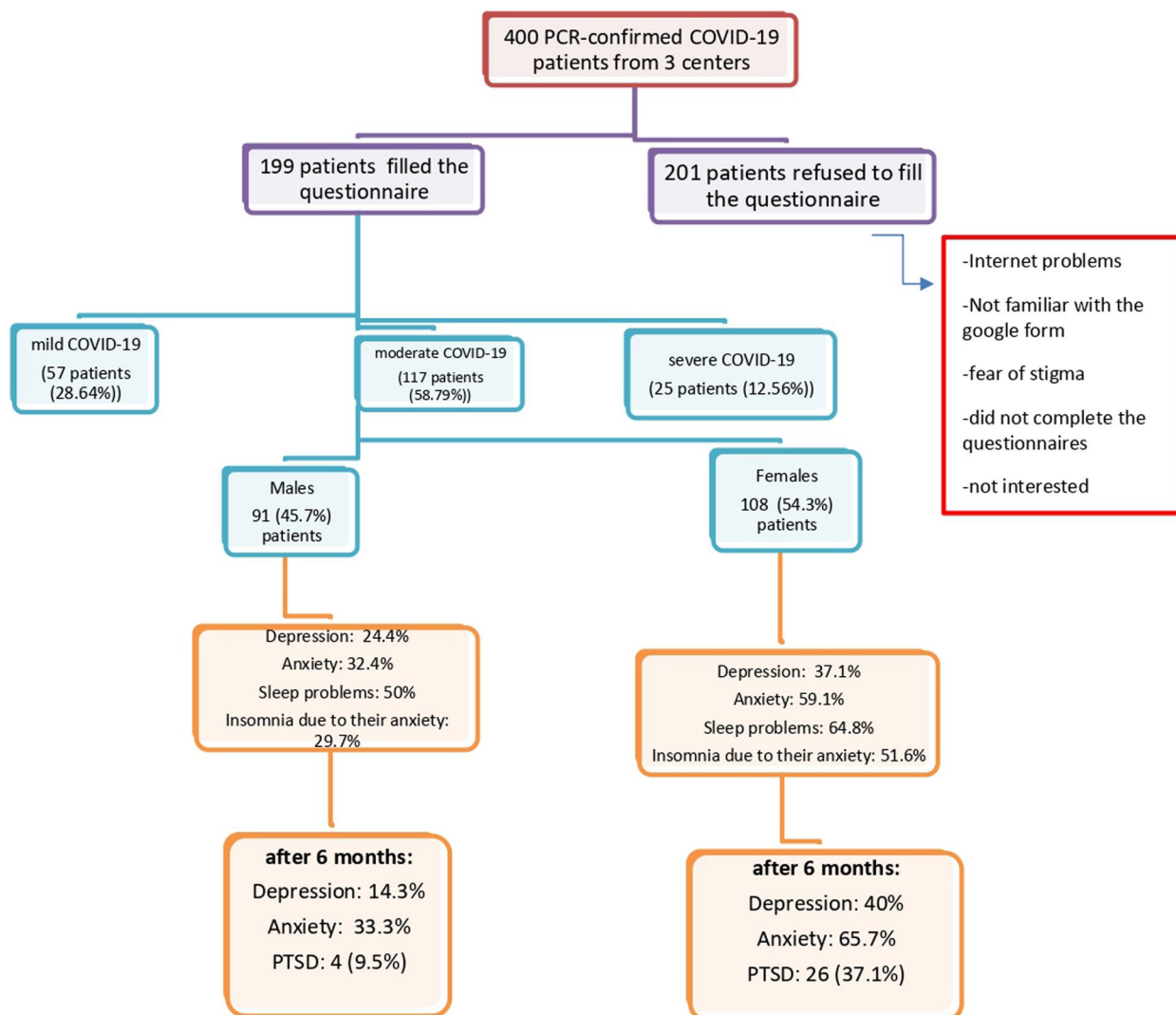
Fig. 1 Flow chart of the studied patients

NHTMRI, and 29 patients from Students Hospital. The mean age ± SD of the participants was 43.82 ± 15.51 years. Depression, anxiety, and sleep disturbances were present among 31.4%, 47.6%, and 57.6% of the participants, respectively. Socio-demographic and clinical data of the participants are represented in Supplementary Table 1. The flowchart of the studied patients is provided in Fig. 1.

The included patients were divided according to the severity of COVID-19 into mild cases (57 patients (28.64%)), moderate cases (117 patients (58.79%)), and severe cases (25 patients (12.56%)). The mean age of participants with severe COVID-19 (56.16 ± 11.96 years) was significantly greater than those with mild and moderate conditions (*P*-value < 0.001). There was no statistically significant difference (*P*-value = 0.281) between male and female participants as regards the severity of COVID-19. Seventy-six percent of moderate and severe cases were

married. 97.4% of moderate cases and 96% of severe cases were hospitalized. Seventy-six percent of severe cases had comorbid medical illnesses. The median scores of the BDI and that of the TMAS were significantly higher in mild cases of COVID-19 than in moderate and severe cases. 51.8% of patients with mild COVID-19 were depressed and 7.2% of them showed severe depression. 50.9% of patients with mild COVID-19 had anxiety where 22.8% of them had severe anxiety (Supplementary Table 2).

As regards the gender differences, 70.3% of the male participants had high education (≥ 10 years of formal education), 81.3% were married, and 19.8% were cigarette smokers. On the other hand, 13.9% of the female participants had a history of bronchial asthma, 37.1% had depression, 59.1% had anxiety, 64.8% had sleep problems, and 51.6% had insomnia due to their anxiety. The median

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scores of GHQ-12 ($p = 0.021$) and TMAS ($p < 0.001$) for the female participants were significantly higher than those for males (Table 1).

Female participants with mild and moderate COVID-19 showed higher levels of depression than the correspondent males. However, male participants with severe COVID-19 showed a higher level of depression than females with severe COVID-19. Female participants, with different grades of severity of COVID-19, showed a higher level of anxiety than male participants (Fig. 2).

Variables considered for logistic regression modelling of depression and anxiety were age, gender, level of education, marital status, presence of previous psychiatric illness, family history of psychiatric disorders, cigarette smoking, presence of chronic medical illness, severity of COVID-19, and steroid intake. For depression, the model was significant (*P*-value < 0.001) with correct classification = 78.2 and adjusted R square = 0.345. The model showed that the higher the level of education, the less the odds ratio for depression. Married patients had a low odds ratio for depression. Previous psychiatric illness (odds ratio = 7.74) and the severity of COVID-19 (odds ratio = 0.234 for moderate depression and 0.441 for severe depression) were also independent factors (Table 2).

For anxiety, the model was significant (*P*-value < 0.001) with correct classification = 67.3 and adjusted R square = 0.297. The model showed that married patients have a low odds ratio for anxiety. The presence of a family history of psychiatric illness was associated with a high odds ratio for anxiety (odds ratio = 4.844, *P*-value = 0.029). The presence of chronic medical illness was also associated with a high odds ratio for anxiety (odds ratio = 2.5, *P*-value = 0.034) (Table 2).

One hundred and twelve patients (56.28%) agreed to complete the questionnaire after 6 months from acute COVID-19 infection. Results revealed that the median (percentile 25:percentile 75) of the total BDI scores significantly increased in respondents compared to baseline scores (9 (4:15) to 10 (4:16), *P*-value 0.006), while there was no significant difference in TMAS (15 (8:23) to 17 (9:26), *P*-value 0.19). Post-traumatic stress disorder was present in 30 (26.8%) patients with a median value of 15 (6:33).

A comparison of baseline and follow-up values revealed that males showed a significant reduction in the total BDI scores after 6 months from COVID-19 infection (*P*-value 0.05) but not in females ($p = 0.06$). There was no significant change in the number of patients (either males or females) with anxiety during the acute infection and after 6 months from COVID-19 infection (Table 3). However, the median values of the BDI and TMAS were significantly higher in the females than the males (*P*-values

0.001, 0.02, respectively). Females showed significantly more severe levels of anxiety (*P*-value 0.03) than males after 6 months from COVID-19 infection, but not for depression (*P*-value 0.18). PTSD was significantly more common in females than males (26 (37.1%) versus 4 (9.5%), respectively, *P*-value 0.02) (Table 4).

Discussion

Psychiatric disturbances, particularly depression, and infectious diseases are cross-linked in several ways. Nevertheless, more data are still needed regarding the prevalence of mental health sequelae associated with COVID-19 in the general population. This Egyptian follow-up study provided data about the psychiatric distress associated with COVID-19 disease. It included hospitalized patients as well as patients in home isolation. Patients with different severity of COVID-19 were represented in this study, with special emphasis on gender differences. There was evidence of depression, anxiety, and sleep disturbances where the female participants showed higher psychological distress than men.

The prevalence rates of anxiety, depression, and sleep disorders in this study generally matched those of a systematic review that looked at mental health issues in patients hospitalized for Middle East respiratory disease or SARS ($n > 2500$ cases) [4]. According to the study, 33% of patients experienced depression following an acute infection, 36% experienced anxiety, and 42% experienced insomnia. Also, the prevalence of depression in our study (31.4%) was similar to the study conducted by Hawryluck et al. [24] who examined a sample of 129 quarantined Canadian persons during the SARS epidemic and found depression rates of 31.2% caused mainly by excessive contamination fears. An Italian study conducted by Cellini et al. [25] reported that 32.6% of the sample had moderate to extremely severe symptoms of anxiety which was also similar to our results as 33.6% of our sample showed moderate to severe anxiety.

A prominent finding in our study was the high prevalence of depression (51.8%) and anxiety (53.7%) in mild cases of COVID-19. This can be explained as mild cases were isolated while they did not experience too much distressing physical symptoms related to the COVID-19 disease, so they were more capable of inquiring about the disease and its sequelae. They were locked with their cell phones and were probably subjected to stressful social media information, a lot of rumors, and uncertainty about the progress of their disease and the possible outcomes. They also experienced excessive worries about receiving the best and enough treatment options. This would have amplified their psychological distress up to the development of severe anxiety
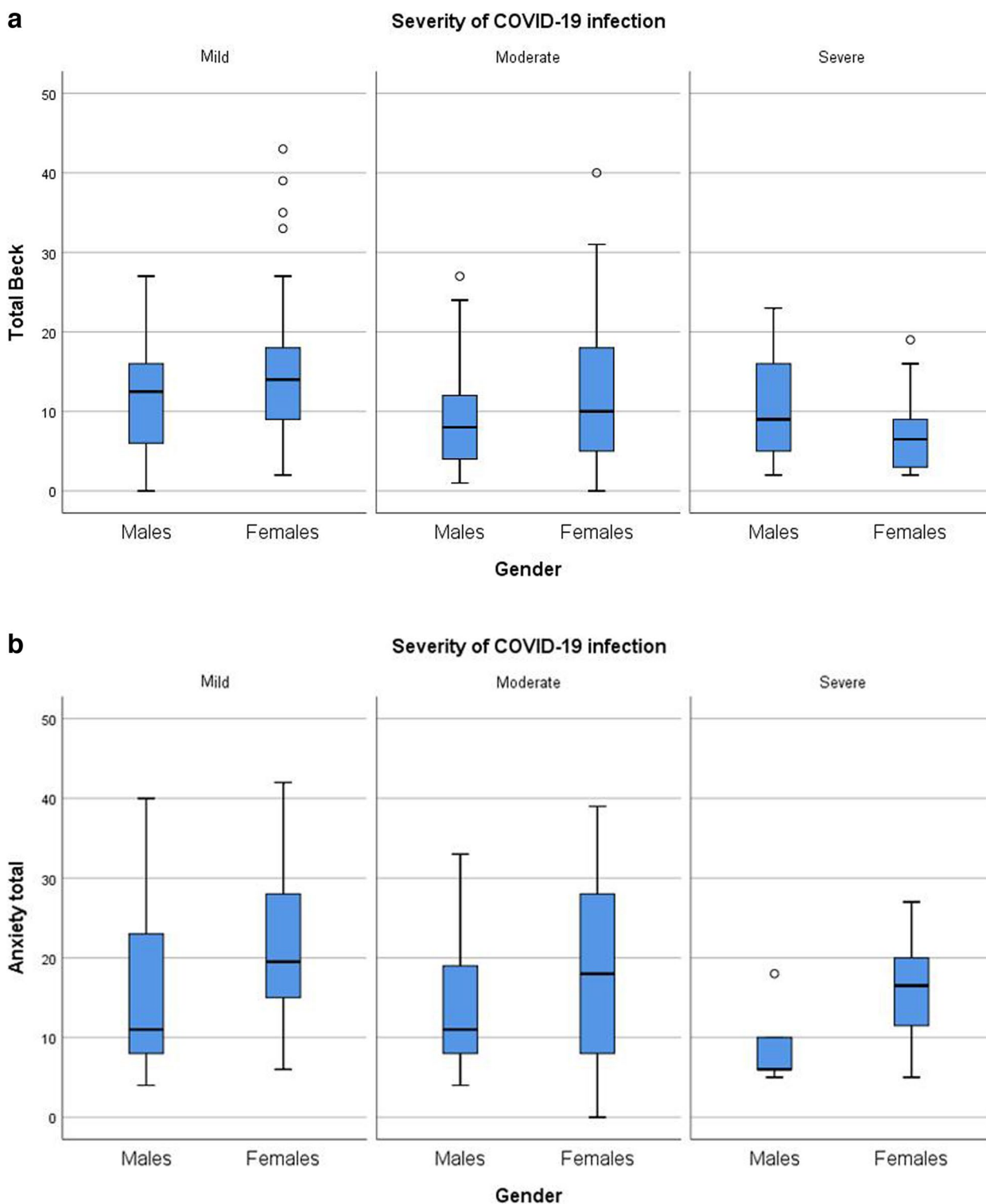
Table 1 Gender differences in the characteristics of patients with COVID-19 disease

		Males (*n* = 91)		Females (*n* = 108)		*P*-value
		Count	Percent	Count	Percent	
Age (years) mean (standard deviation (SD))		44.67 (15.32)		43.1 (15.69)		0.449
Education level	≤ 6 years of formal education	3	3.3%	17	15.7%	**0.006***
	7–9 years of formal education	24	26.4%	33	30.6%	
	≥ 10 years of formal education	64	70.3%	58	53.7%	
Marital status	Single	16	17.6%	25	23.1%	**0.011***
	Married	74	81.3%	70	64.8%	
	Divorced	0	0.0%	4	3.7%	
	Widow	1	1.1%	9	8.3%	
Place of isolation	Home	12	13.2%	15	13.9%	0.885
	Hospital	79	86.8%	93	86.1%	
History of previous psychiatric illness		5	5.5%	3	2.8%	0.331
Family history of psychiatric illness		8	8.8%	3	2.8%	
History of cigarette smoking		18	19.8%	4	3.7%	**< 0.001****
History of substance use		3	3.3%	1	0.9%	
Comorbid chronic medical illness		38	41.8%	55	50.9%	0.197
Diabetes mellitus		16	17.6%	22	20.4%	0.618
Systemic hypertension		16	17.6%	24	22.2%	0.416
Bronchial asthma		5	5.5%	15	13.9%	0.05
Ischemic heart diseases		6	6.6%	9	8.3%	0.643
Chronic hepatitis C		5	5.5%	1	0.9%	0.06
History of medications for chronic medical illness		39	43.3%	53	49.5%	0.385
The severity of COVID-19 infection	Mild	22	24.2%	35	32.4%	0.281
	Moderate	59	64.8%	58	53.7%	
	Severe	10	11.0%	15	13.9%	
Severity of depression (*n* = 191)	Minimal depression	65	75.6%	66	62.9%	**0.039***
	Mild depression	15	17.4%	20	19.0%	
	Moderate depression	6	7.0%	11	10.5%	
	Severe depression	0	0.0%	8	7.6%	
Severity of anxiety (*n* = 164)	No anxiety	48	67.6%	38	40.9%	**0.005***
	Mild anxiety	5	7.0%	18	19.4%	
	Moderate anxiety	11	15.5%	14	15.0%	
	Severe anxiety	7	9.9%	23	24.7%	
Sleep disturbance	Unspecified sleep problem	42	50.0%	68	64.8%	**0.041***
	Interrupted sleep	39	52.7%	63	67.0%	0.059
	Insomnia due to anxiety	22	29.7%	49	51.6%	**0.004***
	Nightmares	11	14.9%	14	15.1%	0.973
The total score of General Health Questionnaire-12 Median (percentile 25-percentile 75)		12 (8–15)		13 (10–17)		**0.021***
The total score of the Beck Depression Inventory Median (percentile 25-percentile 75)		8 (4–13)		10 (5–18)		0.059
The total score of the Taylor Manifest Anxiety Scale Median (percentile 25-percentile 75)		11 (7–19)		19 (11–25)		**< 0.001****

Chi-square test; Mann-Whitney *U* test

* Statistically significant *P*-value

** Statistically highly significant *P*-value

a

b

Fig. 2 a, b Gender differences of depression and anxiety in patients with different COVID-19 disease severity

in 24.1% of them. Besides, their feelings of loneliness due to the social isolation might have resulted in their depressive symptoms.

This study has demonstrated that compared to their male counterparts, females with COVID-19 disease continued to have greater rates of depression and anxiety.

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Table 2 Multivariate analysis for factors associated with depression and anxiety

	B	*P*-value	Odds ratio	95% confidence interval	
				Lower	Upper
Factors associated with depression					
Education		**0.024***			
7–9 years formal education	−0.720	0.302	0.487	0.124	1.909
≥ 10 years formal education	−1.566	**0.021***	0.209	0.055	0.793
Marital status		**0.013***			
Married	−1.372	**0.003***	0.254	0.103	0.625
Widow	−2.979	**0.024***	0.051	0.004	0.674
Previous psychiatric illness	2.047	**0.030***	7.741	1.217	49.219
Chronic medical illness	0.779	0.072	2.179	0.934	5.085
The severity of COVID-19 infection		**0.002***			
Moderate	−1.453	**<0.001****	0.234	0.103	0.530
Severe	−.818	0.209	0.441	0.123	1.582
Constant	1.799	0.024	6.042		
Factors associated with anxiety					
Gender (female)	0.737	0.072	2.090	0.937	4.662
Marital status		**0.025***			
Married	−1.366	**0.004***	0.255	0.100	0.650
Widow	−2.247	0.054	0.106	0.011	1.041
Presence of family history of psychiatric illness	1.578	**0.029***	4.844	1.179	19.891
Chronic medical illness	0.916	**0.034***	2.500	1.074	5.820
Treatment with hydroxyl-chloroquine	−0.833	**0.039***	0.435	0.197	0.959
Constant	−0.239	0.640	0.788		

Logistic regression modelling

* Statistically significant *P*-value

** Statistically highly significant *P*-value

Table 3 Comparison of baseline and follow-up BDI and TMAS between males and females

Variable	Males		*P*-value	Females		*P*-value
The total score of the Beck Depression Inventory	**Baseline**	8 (4:13)	**0.05***	**Baseline**	10 (5:18)	0.06
	Follow-up	6 (2:9)		**Follow-up**	11 (8: 21)	
The total score of the Taylor Manifest Anxiety Scale	**Baseline**	11 (7:20)	0.64	**Baseline**	19 (11: 26)	0.19
	Follow-up	10 (3:25)		**Follow-up**	19 (13: 26)	

Data are presented as median (percentile 25:percentile 75)

Mann-Whitney *U* test

* Statistically significant *P*-value

In addition, people who were female mentioned having more sleep issues. This implies that women may be more affected psychologically by the COVID-19 epidemic. However, looking at it from a different angle, male subjects with severe COVID-19 disease displayed a more severe form of depression than female ones, but not anxiety. Some studies have frequently reported female gender as one of the important socio-demographic factors associated with depression and/or anxiety [26, 27], but this was not consistent [28, 29].

The study findings were in contrast with another longitudinal study conducted by Fenollar-Cortés and colleagues [30] who found that women showed negative emotions and symptoms of stress and avoidance in the first assessment, but they recovered after 6 weeks. The main difference between both studies was that the Spanish study included normal participants during general confinement of the population; however, the current study detected the gender difference in patients with COVID-19.

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Table 4 PTSD and follow-up depression and anxiety of the studied patients

Variable		Males (*n* = 42)	Females (*n* = 70)	Total	*P*-value
Severity of follow-up Depression	Minimal depression	36 (85.7%)	42 (60.0%)	78 (69.6%)	0.18
	Mild depression	4 (9.5%)	8 (11.4%)	12 (10.7%)	
	Moderate depression	2 (4.8%)	14 (20.0%)	16 (14.3%)	
	Severe depression	0 (0.0%)	6 (8.6%)	6 (5.4%)	
Severity of follow-up Anxiety	No anxiety	28 (66.7%)	24 (34.3%)	52 (46.4%)	**0.03***
	Mild anxiety	0 (0.0%)	14 (20.0%)	14 (12.5%)	
	Anxiety to some extent	10 (23.8%)	16 (22.9%)	26 (23.2%)	
	Severe anxiety	4 (9.5%)	16 (22.9%)	20 (17.9%)	
	Very severe anxiety	0 (0.0%)	0 (0.0%)	0 (0%)	
Post-traumatic stress disorder (PTSD)	No	38 (90.5%)	44 (62.9%)	82 (73.2%)	**0.02***
	Yes	4 (9.5%)	26 (37.1%)	30 (26.8%)	
The total score of the follow-up Beck Depression Inventory (BDI)[a]		6 (2:9)	11 (8:21)	10 (4:16)	**<0.001****
The total score of the follow-up Taylor Manifest Anxiety Scale (TMAS)[a]		10 (3:25)	19 (13:26)	17 (9:26)	**0.02***
PTSD[a]		11 (3:22)	20 (9:39)	15 (6:33)	**0.02***

[a] Data are presented as Median (percentile 25:percentile 75)

Chi-square test; Mann-Whitney *U* test

* Statistically significant *P*-value

** Statistically highly significant *P*-value

The follow-up finding proving that more female participants showed more PTSD symptoms than the male correspondents was in line with Tu and colleagues [31] who found that female COVID-19 survivors self-reported more PTSS than male survivors. This might be understood by typically applying the bio-psychosocial model where changes in the immune and endocrine responses in the periphery or in the central nervous system were suggested to be involved in the association between SARS-CoV-2 infection and impaired mental health. Social isolation, unemployment, economic losses, and family stressors can lead to neuroendocrine-immune changes [32]. All these factors might trigger the higher vulnerability of females to develop affective and anxiety symptoms compared to males. Taking into consideration that COVID-19 is still an ongoing pandemic, females might still be in an acute stress state from a long-term perspective.

The finding that the mean age of participants with severe COVID-19 was significantly greater than those with mild and moderate conditions was in concordance with that of Zhang et al. [33] and Chen et al. [28]. This can be associated with the finding that 76% of this group of patients had a comorbid medical illness with significantly increased rates of diabetes mellitus (*P*-value 0.013), systemic hypertension (*P*-value < 0.001), and ischaemic heart disease (*P*-value 0.006). These findings agreed with other studies [34–36] which found that certain underlying medical conditions, e.g., diabetes mellitus and hypertension, are linked to a higher chance of contracting the SARS-CoV-2 virus and a more severe form of COVID-19.

This study identified independent factors for depression and anxiety in the quarantined Egyptian sample. Married participants and those with a higher level of education showed a decreased risk of depression. On the other hand, mild cases of COVID-19 and those who had a history of previous psychiatric illness were more prone to experience depression. Similarly, married participants and those receiving hydroxyl-chloroquine showed decreased risk of anxiety, while patients with a previous history of psychiatric or comorbid medical illness were more likely to suffer from anxiety. These results were consistent with a Turkish study by Özdin S and Bayrak Özdin [27] which discovered that people with at least one comorbid chronic disease, women, people living in urban areas, and people receiving psychiatric treatment either now or in the past, were more severely affected by depression and anxiety.

Predictors of psychiatric illness in adults are multiple and variable across different cultures, i.e., can stem from clinical and psychosocial factors. Future larger and longitudinal researches are still needed to find consistent predictors of psychiatric illness in patients with COVID-19.

The study has some limitations. Delivering the questionnaires as online self-assessment had some drawbacks. About 50% of the PCR-confirmed patients with COVID-19, who were offered the study survey, refused or were not able to participate in the study due to disinterest,

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unavailability of internet access, or fear of stigma for both COVID-19 and mental illness. Besides, there was missing data, and up to 14% of the patients did not complete the questions until the end. The study's cross-sectional methodology does not demonstrate a causal association between the associated clinical characteristics and depression, anxiety, or sleep problems. Therefore, longitudinal research is required to investigate the risk variables for psychiatric illness in more detail. That being said, this is the first investigation looking into how gender affects psychiatric morbidity in COVID-19 patients. In the future, more extensive clinical studies on gender and other prognostic variables will be required.

Strengths

This study had several strengths. It focused on investigating the role of gender in psychiatric morbidity in patients with COVID-19 disease. It was designed as a prospective multicenter follow-up study where patients were recruited from three quarantine hospitals in Egypt during the peak of COVID-19 disease, then reassessed after 6 months from the acute infection. The longitudinal part of this work pointed out the long-term effects of COVID-19 on mental health.

Limitations

Delivering the questionnaires as online self-assessment had some drawbacks. About 50% of the PCR-confirmed patients with COVID-19, who were offered the study survey, refused or were not able to participate in the study due to disinterest, unavailability of internet access, or fear of stigma for both COVID-19 and mental illness. The number of patients who completed the follow-up study was relatively small. The inaccessibility of evaluating the residual respiratory symptoms was another shortcoming. Larger longitudinal research associating gender and other prognostic factors with the mental health sequelae of COVID-19 is still needed in the future to enhance mental health care options, better prepare for future pandemics, and develop preventative strategies.

Conclusion

This multicenter cross-sectional study showed that depression affected 31.4%, anxiety affected 47.6%, and sleep disturbances affected 57.6% of our quarantined Egyptian sample during the COVID-19 pandemic. Depression and anxiety were significantly higher in patients with mild COVID-19 than in moderate and severe cases. Prevalence and severity of depression and anxiety were higher in female participants than male participants, suggesting that females are more affected by the COVID-19 pandemic. Education level, marital status, previous psychiatric illness, and severity of COVID-19 were the independent variables affecting depression. Marital status, family history of psychiatric illness, chronic medical illness, and hydroxyl-chloroquine were affecting anxiety.

Abbreviations

COVID-19	Coronavirus disease-2019
GHQ-12	General Health Questionnaire
BDI	Beck Depression Inventory
TMAS	Taylor Manifest Anxiety Scale
SARS-CoV-2 virus	Severe acute respiratory syndrome coronavirus-2
RT-PCR	Real-time reverse-transcriptase polymerase-chain-reaction

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s43045-024-00445-2.

> Supplementary Material 1: Supplementary Table 1. Socio-demographic and clinical data of the participants. Supplementary Table 2. Characteristics of participants according to the severity of COVID-19 infection.

Availability of data and materials
All relevant data are included in the manuscript. The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
All procedures involving human subjects/patients were approved by the research ethics committee, Faculty of Medicine, Cairo University, number N-36-2020, date: 14 May 2020, and the research ethics committee of the Ministry of Health and Population, number 15-2020/1, date: 2 June 2020.
All participants provided their written informed consent to participate.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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