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ORIGINAL RESEARCH

Factors Associated with Anxiety During COVID-19 Pandemic and Its Association with Hypertension in Saudi Arabia

Badria Said, Maryam O Gharawi, Fatimah H Dallak, Afnan Q Maashi, Eman Hurissi, Sarah O Gharawi, Melia M Tarshi, Alanoud I Hayyan, Suzan A Faqihi, Hafiz I AlMusawa, Ghadah M Hakami, Abdulaziz H Alhazmi

Faculty of Medicine, Jazan University, Jazan, Saudi Arabia

Correspondence: Abdulaziz H Alhazmi, Jazan University, Tel +966-7329-5000, Email abalhazmi@jazanu.edu.sa

Objective: Patients with chronic diseases such as hypertension (HTN) are considered a vulnerable group, and they are prone to anxiety and other psychological conditions during pandemics. Very few reports discussed factors related to anxiety and how it is associated with HTN during COVID-19 pandemic. In this project, we aimed to identify the prevalence of anxiety among hypertensive patients in Saudi Arabia during the COVID-19 pandemic.

Methods: A cross-sectional study was conducted, and data were collected using an electronic self-administered pretested questionnaire distributed via trained data collectors. Data were analyzed using *t*-test and chi-test.

Results: A total of 2135 participants were enrolled in this study. Anxiety was reported in 5% of all participants and 8% of the hypertensive participants. Older age, marital status, higher body mass index (BMI), smoking, and Khat chewing were strongly associated with anxiety among the general population. In addition, less adherence to medication made participants with HTN significantly more anxious.

Conclusion: The prevalence of anxiety among hypertensive individuals is higher compared to the general population. Moreover, anxiety is significantly associated with some sociodemographic in the general population, and with less adherence to medications in hypertensive patients. Further studies with data from medical record including more variables are needed to highlight this association.

Keywords: hypertension, anxiety, COVID-19, pandemic, Saudi Arabia

Introduction

In Wuhan city, China, in December 2019 the causative agent of coronavirus disease 2019 (COVID-19) was first identified and called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).[1] The World Health Organization declared it a pandemic on 11 March 2020.[2] As a response to this pandemic, accumulated evidence reported that psychological reactions, such as anxiety and stress, have increased.[3] Chronic disease patients, such as hypertensive patients, are under tremendous psychological stress due to various reasons and are considered a vulnerable group.[3] Hypertension (HTN), and its associated complications, is one of the most common causes of mortality,[4] and many investigations observed its association with anxiety.[5] The risk of HTN is higher in patients with anxiety than those without anxiety, and patients with HTN are at a higher risk of anxiety than those without HTN.[5,6] Plus, cardiovascular-related complications and mortality are higher in patients with both mental health disorders and HTN.[7]

The prognosis of cardio-metabolic disorders such as HTN during SARS-CoV-2 infection was shown to be worse.[8] The significant association between HTN and psychological disorders calls attention to conducting a study to find the incidence of new-onset anxiety in hypertensive patients during the COVID-19 pandemic. Various studies around the globe confirmed the significant association between anxiety and HTN during the COVID-19 pandemic.[9–12] For example, a published cross-sectional study from Turkey intended to assess the incidence of anxiety and depression in COVID-19

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patients, whether hospitalized or not and their association with HTN. Hospitalized patients with HTN were more likely to develop depression compared to non-hypertensive outpatients.[11] On the other hand, hypertensive patients were more likely to develop cardiovascular problems such as coronary artery disease and diabetes mellitus. The incidence of HTN and anxiety was higher in the female gender. As a result, the prevalence of anxiety was significantly associated with hypertension, DM, and gender.[10] Another example is a retrospective case–control study carried out, in April 2020, in Australia during the lockdown, which aimed to assess anxiety in hypertensive patients, compared to the healthy control group. It was found that anxiety was in both groups with a higher prevalence in patients with HTN.[9] Another study from China examined changes in morning blood pressure during the COVID-19 pandemic using a smartphone-based application. About 8% of the 3462 participants reported having more anxiety and anxious participants had higher morning systolic blood pressure than non-anxious patients.[12]

Thus, the association between anxiety and HTN is evident, and yet this topic was not investigated in our region.[13] Therefore, this study aimed to identify the prevalence of new-onset anxiety among hypertensive patients and compared it to the general population in Saudi Arabia during the COVID-19 pandemic.

Methods and Participants

This descriptive cross-sectional study was conducted in Saudi Arabia between June and August 2022. The data for this study were collected using an electronic self-administered questionnaire, which was designed in Arabic language using the Google Form platform. Validated translation of CAS is done and used in the survey.[14–16] It was actively distributed via trained data collectors, and it consisted of three sections: socio-demographic data, history of hypertension, and coronavirus anxiety questions. The coronavirus anxiety scale (CAS) was used to evaluate anxiety levels among participants.[17,18] To assess sociodemographic characteristics, the participants were asked to reveal their gender, age, marital status, education, job status, nationality, and region of residence. History of HTN includes the duration of the disease, number of used medications, drug compliance, other comorbidities, and any history of psychological disorders. The CAS questionnaire, which was developed and validated by others,[17,18] was used to assess anxiety related to COVID-19. Participants were asked to assess how often they experienced physiologically based sensations of dread or anxiety when exposed to coronavirus-related thoughts or information using a 5-point frequency scale (0 = "not at all" to 4 = "nearly every day during the last 2 weeks"). The total score for CAS was 20 and participants were considered positive for anxiety when they scored 9 or more, while others below this number were considered negative. We included participants who were diagnosed with HTN in Saudi Arabia and who are 18 years old and older. For comparison purposes, we allowed participants without HTN to continue answering the survey. However, any hypertensive patients who had pre-existing psychological disorders or those who received treatment prescribed by a psychiatrist, and those who refused to participate were excluded from this study. Participants have been selected conveniently from Saudi Arabia, and an online convenience sample technique was used to reach the targeted population. Data were analyzed using the SPSS package v23. Descriptive statistics were calculated for study variables, and correlation analyses were used to detect the association between HTN, and general anxiety disorders compared with normotensive participants during the COVID-19 pandemic. The data were analyzed using a *t*-test and a chi-square test and *P*-values less than 0.05 are considered statistically significant. Approval for this study was obtained from the Ethical Committee of Jazan University (approval No REC- 43/11/254). Patients' permission to participate was obtained before data collection. The data are stored in a computerized registry with strict confidentiality and are kept secure. Relevant participant details were not included in the study. All authors confirm that this study complies with the Declaration of Helsinki.

Results

In Figure 1 we compared anxiety prevalence during COVID-19 pandemic between all participants (4%) and those with HTN (8%), p-value=0.0001. In Table 1 we described the data of 2135 participants who were comprised in this study and their mean age was 40.26 years. Out of the total 58.1% (1240) were females and 41.9% (895) were males. About 61.5% of the participants were married and 63.1% got a university level of education. Nearly 28% of the participants were government employees, and about half of the participants earned less than 5K Saudi riyals (SAR) per month. The

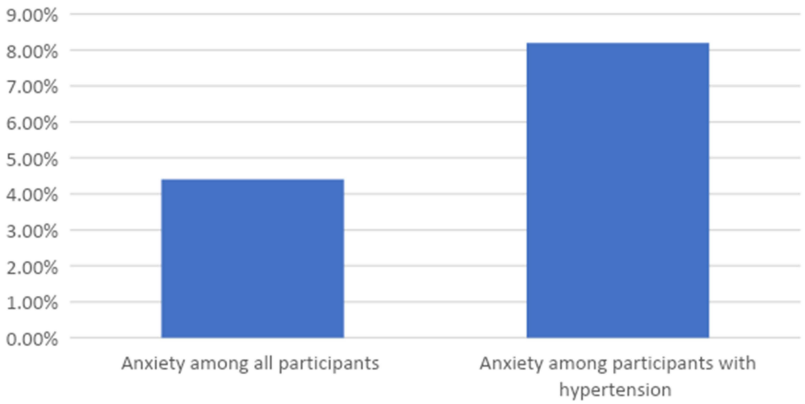

Figure 1 Prevalence of anxiety among all participants against those with HTN (p-value 0.0001).

majority 83.2% were urban residents, and the mean body mass index (BMI) of the participants was 27.78. Out of the total participants, 41.1% (878) were previously diagnosed with high blood pressure. Little physical activity, ie, once or twice a week, was recorded among 44.6%, followed by moderate physical activity, ie, three times a week in 26.8% and 20%

Table 1 Descriptive and Bivariate Analysis of the Included Participants with or Without Anxiety (n=2135)

Variable	Total Sample (2135)	Anxiety		P-value
		Participants with Anxiety, n=94	Participants Without Anxiety, n=2041	
Age in years (Mean ±SD)	40.26±15.84	45.23±16.39	40.03±15.77	0.005*
Gender (%)*N*				
Male	(41.9)*895*	(48.9)*46*	(41.6)*849*	0.166
Female	(58.1)*1240*	(51.1)*48*	(58.1)1192	
Marital status (%)*N*				
Married	(61.5)*1313*	(60.6)*57*	(61.5)1256	0.0001*
Single	(31)*661*	(21.3)*20*	(31.4)*641*	
Widower	(5.1)*109*	(14.9)*14*	(4.7)*95*	
Divorced	(2.4)*52*	(3.2)*3*	(2.4)*49*	
Education level (%)*N*				
Informal education	(5.9)*127*	(9.6)*9*	(5.8)*118*	0.0001*
General Education (Primary, Intermediate, Secondary)	(26.4)*564*	(47.9)*45*	(25.4)*519*	
University Education (Diploma, Bachelor)	(63.1)*1348*	(37.2)*35*	(64.3)*1313*	
Postgraduate	(4.5)*96*	(5.3)*5*	(4.5)*91*	
Job (%)*N*				
Student	(18.6)*398*	(9.6)*9*	(19.1)*389*	0.006*
Government employee	(28)*598*	(24.5)*23*	(28.2)*575*	
Private sector	(14.8)*315*	(12.8)*12*	(14.8)*303*	
Job seeker/housewife	(27.3)*583*	(31.9)*30*	(27.1)*553*	
Retired	(11.3)*241*	(21.3)*20*	(10.8)*221*	

(*Continued*)

Table 1 (Continued).

Variable	Total Sample (2135)	Anxiety		P-value
		Participants with Anxiety, n=94	Participants Without Anxiety, n=2041	
Monthly income in SAR (%)*N*				
Less than 5 thousand	(46.7)*997*	(53.2)*50*	(46.4)*947*	0.173
From 5 thousand to 10 thousand	(22.9)*488*	(24.5)*23*	(22.8)*465*	
From 10 thousand to 15 thousand	(18.1)*387*	(9.6)*9*	(18.57)*378*	
More than 15 thousand	(12.3)*262*	(12.8)*12*	(12.3)*250*	
Number of family members (%)*N*				
1 to 5	(49.8)*1063*	(56.4)*53*	(49.5)*1010*	0.206
More than 5	(50.2)*1072*	(43.6)*41*	(50.5)*1031*	
Place of residence (%)*N*				
City	(83.2)*1777*	(79.8)*75*	(83.4)*1702*	0.396
Village	(16.8)*385*	(20.2)*19*	(16.6)*339*	
BMI (Mean ±SD)	27.78±10.90	29.64±6.38	27.69±11.05	0.001*
Physical activity (%)*N*				
Little physical activity (sports or walking once or twice a week)	(44.6)*953*	(50)*47*	(44.4)*906*	0.179
Moderate physical activity (sports or walks three to four times a week)	(26.8)*572*	(20.2)*19*	(27.1)*553*	
High physical activity (exercise or walking more than five times a week)	(9)*192*	(5.3)*5*	(9.2)*187*	
No physical activity at all	(19.6)*418*	(24.5)23	(19.4)*395*	
Do you smoke? (%)*N*				
No	(75.7)*1616*	(64.9)*61*	(76.2)*1555*	0.014*
Yes, an active smoker	(17.8)*380*	(22.3)21	(17.6)*359*	
Yes, ex-smoker	(6.5)*139*	(12.8)*12*	(6.2)*127*	
Do you use khat? (%)*N*				
No	(97.7)*2085*	(92.6)*87*	(97.9)*1998*	0.003*
Yes, for the time being	(1.2)*26*	(4.3)*4*	(1.1)*22*	
Yes, before	(1.1)*24*	(3.2)*3*	(1)*21*	
Have you been diagnosed with high blood pressure? (%)*N*				
Yes	(41.1)*878*	(76.6)*72*	(39.5)*806*	0.0001*
No	(58.9)*1257*	(23.4)*22*	(60.5)1257	

Notes: Anxiety symptoms were reported among 94 participants out of the total 2135, and among 8.2% of hypertensive participants. About 77% of anxious participants were previously diagnosed with HTN as summarized in Table 2, and different factors affecting anxiety were evaluated. Older participants were found significantly more anxious (mean age 45.23 years) than younger (mean age 40.03 years), P-value= 0.005. Marital status has a significant impact on anxiety where widower individuals seemed more anxious, P value= 0.0001. Participants with a general education level and retired were more anxious than others (P value=0.0001 and 0.006 respectively). Further, participants with chronic medical conditions, such as HTN and obesity, reported significantly higher anxiety scores, P value =0.0001 and 0.001, respectively. Smokers and Khat users also were reported more anxious, P values = 0.014 and 0.03 respectively. However, other parameters such as gender, monthly income, number of family members, place of residence, and physical sports activity did not show a significant association with anxiety. * The alpha criterion for the p-value was set to 0.05.
Abbreviations: SD, Standard deviation; SAR, Saudi Riyals.

admitted no physical activity at all. The majority of the participants (75.7%) were not smoking, and 17.8% and 6.5% were active smokers or ex-smokers, respectively. Only 1.1% used Khat in the past and 1.2% still used it.

Anxiety symptoms were reported among 94 participants out of a total of 2135, and among 8.2% of hypertensive participants. About 77% of anxious participants were previously diagnosed with HTN as summarized in Table 2 and Table 3, and different factors affecting anxiety were evaluated. Older participants were found to be significantly more anxious (mean age 45.23 years) than younger (mean age 40.03 years), *P*-value= 0.005. Marital status has a significant

Table 2 Factors Associated with Anxiety Among Participants with Hypertensive Patients (n=878)

Variable	Total Hypertensive Sample (878)	Anxiety		P-value
		Participants with Anxiety. N=72	Participants Without Anxiety. N=806	
Since when you have been diagnosed with high blood pressure? (%)*N*				
Less than a year ago	(25.6)*225*	(33.3)*24*	(24.9)201	0.248
From two to five years	(38.8)*341*	(31.9)*23*	(39.5)*318*	
More than five years	(35.5)*312*	(34.7)*25*	(35.6)*287*	
The number of medicines used (%)*N*				
I do not use any medicines	(21.1)*185*	(12.5)*9*	(21.1)*176*	0.146
One or two medicines	(64.8)*569*	(69.4)*50*	(64.4)*519*	
Three or more medicines	(14.1)*124*	(18.1)*13*	(13.8)*111*	
Are you committed to using your medication? (%)*N*				
Yes	(60)*527*	(47.2)*34*	(61.2)*493*	0.015*
No	(21.5)*189*	(22.2)*16*	(21.5)*173*	
To some extent	(18.5)*162*	(30.6)*22*	(17.4)*140*	
The number of diseases associated with high blood pressure (diabetes, high cholesterol)? (%)*N*				
There are no comorbidities	(44.8)*393*	(34.7)*25*	(45.7)*368*	0.196
One comorbidity	(36.1)*317*	(41.7)*30*	(35.6)*287*	
Two diseases or more comorbidities	(19.1)*168*	(23.6)*17*	(18.7)*806*	

Notes: This table showed factors associated with anxiety among participants with hypertension. The hypertensive participants with anxiety were 72 and those with no anxiety were 806. The hypertensive participants with anxiety were significantly less committed to taking their medication (P-value=0.015) compared to those without anxiety. Other factors like duration of hypertension, number of used medications, and comorbidities have no significant impact on our hypertensive participants. * The alpha criterion for the p-value was set to 0.05.

Table 3 Multivariate Analysis Testing Variables Significantly Associated with Anxiety in Univariate Analysis [#]

Variables	p-value*	aOR	95% C.I.	
Age	0.019	0.974	0.952	0.996
Participants with HTN	0.0001	4.759	2.687	8.428

Notes: *The alpha criterion for the p-value was set to 0.05. # Multiple logistic regression was used for multivariate analysis using variables significantly associated with anxiety in univariate analysis. In Table 3, we used multivariate analysis which showed that anxiety is significantly associated with participants of younger age and those who have already been diagnosed with HTN.
Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; HTN, Hypertension.

impact on anxiety where widower individuals seemed more anxious, *P* value = 0.0001. Participants with a general education level and retired were more anxious than others (*P* value = 0.0001 and 0.006, respectively). Further, participants with chronic medical conditions, such as HTN and obesity, reported significantly higher anxiety scores, *P* value = 0.0001 and 0.001, respectively. Smokers and Khat users were also reported to be more anxious, *P* values = 0.014 and 0.03, respectively. However, other parameters such as gender, monthly income, number of family members, place of residence, and physical sports activity did not show a significant association with anxiety.

Discussion

The COVID-19 pandemic was an unprecedented situation that resulted in many psychological consequences and countries have taken different preventive measures to limit virus transmission such as social isolation. The pandemic itself and the taken measures had increased anxiety and depression among different populations.[16] Hypertensive patients are no exception, as they are considered at risk of severe COVID-19 outcomes and may experience many fluctuations in blood pressure along with psychological stress such as anxiety, depression, or other negative emotions.[19] Consequently, different studies have originated to search for the association between anxiety and HTN during the COVID-19 pandemic. Very few articles discuss this issue in our region and, therefore, our aim in this study is to evaluate the association between HTN and new-onset anxiety during COVID-19.

About 76.6% of participants with anxiety symptoms were hypertensive in our study, and older participants were found to be significantly more anxious. Likewise, many studies showed that individuals with anxiety were at higher risk of HTN than those without anxiety,[5,20] and hypertensive patients are at a higher risk of being anxious than those without HTN.[7,21] It is known that anxiety disorders activate the sympathetic nervous system and the hypothalamus-pituitary-adrenal axis, which may increase blood pressure.[22] In a study conducted in China, COVID-19- related anxiety was associated with an increase in morning systolic blood pressure among older patients, which might lead to a greater risk of cardiovascular events.[12] Besides older people, widower participants were found to be more anxious in our analysis, which indicated that married couples might have better support in decreasing anxiety, and this is in contrast with a study that was done in Malaysia and Pakistan where married individuals were the most anxious during the COVID-19 pandemic.[23,24] These results indicated cultural differences in the studied population and religious background may play a major role; thus, health officials in the region are required to contain disconnected people who have suffered from loneliness with social and psychological support.

Factors that are associated with anxiety among participants with HTN were assessed in this study and found that hypertensive participants with anxiety were significantly less committed to taking their medications, which may put them at an additional risk of cardiovascular complications of high blood pressure (Table 2). Further, as agreed by others,[25] participants with chronic medical conditions reported significantly higher anxiety, and smokers and Khat users were also reported more anxious. It was previously reported an inverse correlation between adherence and the number of pills prescribed when patients with one drug are more committed than those on three drugs or more.[26] Further, the longer history of HTN and comorbidities did not show a significant difference between participants with anxiety and those without anxiety in our study. Unlike the results of a systematic review and meta-analysis that was conducted before the pandemic and indicated a strong association between anxiety and depression with chronic medical conditions such as HTN, diabetes, and obesity.[27] A Chinese study showed that disorders of mood and anxiety disorders comorbid with diabetes and HTN were higher than comorbidity with any single disease.[28] These differences between current results and previous studies could be explained by either the timing or the methodology of the studies. However, we believe that after the COVID-19 pandemic, psychological disorders have increased globally, and our region is not an exception to that.[29] Further, a hospital-based study is deemed essential to evaluate this relationship among hospitalized individuals with HTN.

This study comes with many limitations. It is a cross-sectional study, a methodology that may detect association, but it has its own bias; thus, future studies using other methods are to assess the long-term effect of anxiety on cardiovascular diseases mainly in older patients with HTN. Further, we used an online survey questionnaire that was actively distributed via trained data collectors, because it was the most feasible data-collection method during the COVID-19 pandemic due to social distance measures, so the findings need to be interpreted, considering some limitations of online surveys. In addition, anxiety was measured merely based on the patient's perception, which was a subjective assessment tool.[29] Moreover, the

level of anxiety was not similar at different time points in the pandemic. This study was conducted during the third wave of the pandemic, when the population is already adapted to the situation, which may have affected the level of anxiety and depression in our participants. In addition, this study does not represent the whole population due to its design.

Conclusion

This study highlighted that the prevalence of anxiety among hypertensive individuals was high. Since anxiety is significantly associated with some sociodemographic and clinical characteristics of patients, so further research is needed to develop strategies for the prevention and control of psychological distress and anxiety among patients with HTN in Saudi Arabia. Further national studies based on medical record data are warranted to affirm this association.

Data Sharing Statement

Data is available upon request from the researchers.

Institutional Review Board Statement

The ethical approval to conduct this was given by the Jazan University Ethical Committee, with approval number REC42/10/220; date: 09 May 2022.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation. All authors took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare no conflict of interest.

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