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ORIGINAL RESEARCH

Association Between Big Five Personality Traits and Hypertension in Saudi Patients: A Case Control Study

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Background: The association between personality traits and hypertension is complex and has so far not been studied in depth.

Objective: The present study aims to explore the connection between the Big Five personality traits and hypertension.

Methods: This case control study includes 310 participants, and the relationship between personality traits and hypertension was investigated in normotensive and hypertensive patients by the Big Five Inventory-10. We examined the association of each of the Big Five personality traits in hypertensive patients and a control group using binary logistic regression analysis.

Results: The findings of the study revealed that amongst the Big Five personality factors, low conscientiousness (OR: 1.09, 95% CI: 0.92–1.29, $P<0.005$) and high neuroticism (OR: 0.54, 95% CI: 0.45–0.66, $P<0.001$) were related with high risk of hypertension. Male, older people, and physically inactive individuals have been found to be at a higher risk of hypertension. No significant relationship was found between hypertension and marital status, education, or smoking habits.

Conclusion: These results suggested that a low score in conscientiousness trait and a high neuroticism score may be an additional risk factor of hypertension. Thus, it may be worthy to investigate further in order to identify patients at risk and develop a more individual treatment strategy. Cognitive behavioral therapy and pharmacological options can be used preemptively in high-risk patients.

Keywords: Big Five personality, hypertension, conscientiousness, neuroticism

Introduction

Hypertension is a well-known risk factor for cardiovascular disease, and it has been considered as a global disease burden and public health concern.[1] Among the various risk factors identified for development of cardiovascular disease, psychosocial determinants have been found to play an important role in the manifestation and outcome of cardiac illness/disease.[2,3] In addition, among the many psychological and social factors, an individual's personality characteristics or traits have been investigated as a significant factor influencing the morbidity of cardiovascular disease. Personality traits are defined as behavioral and psychological tendencies that endure over time and across different contexts.[4] The primary indicator of personality functioning is the Big Five personality traits which explains personality into five broad traits: Agreeableness, Extraversion, Conscientiousness, Neuroticism, and Openness to experience. In brief, agreeableness refers to the degree to which a person requires cordial relationship with others. Extraversion is the tendency to be outgoing, active, assertive, and to have positive emotions. Conscientiousness is characterized by the propensity for self-control, task and goal orientation, planning, and rule following. Neuroticism is the tendency to experience negative emotions such as sadness and anxiety, as well as mood swings. Finally, openness to experience refers to originality, complexity, creativity, and receptivity to new ideas.[5,6]

Multiple pathways exist by which personality may affect health, but the exact mechanisms of these pathways are still unclear.[7] Certain personality traits, particularly conscientiousness, may enhance health because those who exhibit high conscientiousness are more likely to engage in healthy behaviors.[8,9] Other personality traits, such as extraversion, neuroticism, and agreeableness, may have an impact on individuals' emotional and social lives, including susceptibility

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to negative experiences,[10] poor social support,[11] and less ability to adapt to difficult and changing life circumstances.[12] As a result, psychosocial stress may increase risk of atherosclerosis, high blood pressure, and other physiological risk factors[13,14] and then lead to aggravated risk of cardiovascular mortality.[15] There may also be additional personality-related pathways.[16] It has been found that a person's temperament and hypertension are related.[17] Previous studies reported that hostile people of different age groups are prone to high blood pressure particularly in adulthood.[18,19] In a study of Finnish males, it was found that a threefold increase in the incidence of hypertension was associated with high levels of hopelessness.[20] The development of hypertension in normotensive people over a three-year period has been found to be correlated with high levels of defensiveness.[21] Although there is conflicting evidence from various studies, it appears that a tendency toward hostile impulses, antagonism, and denial may be related to elevated blood pressure.[22]

Personality traits have long been linked with physical activity.[23] Previous research on the relationships between personality traits and physical activity confirmed the importance of extraversion, neuroticism, and conscientiousness as correlates of physical activity.[24] It was also confirmed in meta-analysis that undertaking physical activity was linked with higher conscientiousness, openness, and extraversion, and lower neuroticism.[25] Recent research found that moderate exercise is negatively associated with agreeableness and sensitivity to anxiety.[26] Personality traits also appear to influence smoking. Previous research reported differences in personality characteristics between smokers and non-smokers.[27] A meta-analysis of cross-sectional studies of extraversion and neuroticism reported that smokers had higher neuroticism and higher extraversion than non-smokers.[28] Another meta-analysis of published cross-sectional studies on health correlates of conscientiousness reported that smoking was more common among individuals with low compared with high conscientiousness.[8] In sum, current smokers are characterized by high neuroticism, high extraversion, low agreeableness, and low conscientiousness.

Studies using the Big Five personality traits have found that extraversion and neuroticism scales have been linked with higher risks of cardiovascular disease.[29,30] In contrast, it has been asserted that openness to experience and conscientiousness are cardio-protective traits.[29,31] Personality may also have interaction with other factors such as sex and socio-economic status that mediate the risk of cardiovascular disease.[32,33] For instance, high neuroticism and low socio-economic status may increase the risk of coronary heart disease mortality in women, whereas high neuroticism and high socio-economic status may lower the risk of coronary heart disease.[34] Existing literature suggested that low scores in conscientiousness and agreeableness, high score on neuroticism,[35] affective temperaments,[17] and type D personality[36] are associated with hypertension. However, other studies did not find any significant relationship between personality factors and hypertension.[37–39] Although many researchers have explored risk factors in cross-sectional research,[17] the predicted values of risk and protective factors can only be determined through case control design. Therefore, the aim of this study was to explore the association between Big Five personality traits and patients with hypertension in Eastern Saudi Arabia.

Materials and Methods

Study Design

In this case control study, the participants were recruited from health care centers of AlHasa, eastern part of Saudi Arabia between January and March 2023. These centers are maintaining a household file of each family under their respective catchment area. These health care centers are run by general physicians and nurses. These centers provide out-patient care and refer the patients to higher level of care. This research was conducted in accordance with the Helsinki Declaration and had received ethical approval from the Deanship of Scientific Research, King Faisal University, AlHasa, Saudi Arabia. Informal verbal consent was taken from all the respondents, and this verbal informed consent was acceptable and approved by the Deanship of Scientific Research King Faisal University prior to their participation in the study.

Participants

In the case group, 164 volunteer hypertensive patients were recruited to participate in this research. Inclusive criteria were as follows: diagnosis primary hypertension, aged >18 years old, and verbal informal consent. Hypertensive patients

are defined having blood pressure readings equal to or greater than 140/90 mmHg during three different blood pressure measurements in the clinic. Patients who have one or more of the following are excluded: secondary hypertension, and history of psychiatric illness including neurotic disorder (anxiety, obsessive compulsive disorder, post-traumatic stress disorder) and psychotic disorders (bipolar disorder, mania, schizophrenia, dementia). In the control group, 146 normotensive controls were recruited who also fulfilled the inclusion and exclusion criteria.

Demographic data including age, gender, area of residence, educational level, and marital status were collected with the help of a questionnaire. In addition, information about physical activity (exercise >150 min/week or <150 min/week) and smoking status (never smoked, and current smoking) were also recorded. Physical examination including blood pressure, pulse, weight, height, and waist circumferences were recorded by the trained nurse.

Study Sample Calculation

Presently, there is no research examining Big Five personality traits in patients with hypertension in Saudi Arabia, and there were no previous studies that help us to calculate the sample size. The present study was a case control study, and we used a convenience sampling method which was suitable for this study.

Measures: Big Five Personality Traits

Personality was measured using the Arabic version of the Big Five Inventory-10 (BFI-10).[40] This scale comprises five dimensions of personality, ie Extraversion (items 1 and 6), Agreeableness (items 2 and 7), Conscientiousness (items 3 and 8), Neuroticism (items 4 and 9), and Openness to experience (items 5 and 10). Each personality dimension is measured by two items, with one item positively keyed and the other negatively keyed. Responses are obtained on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Total score is produced by adding each subscale score together that ranges from 10 to 50. A high score on this scale indicates a higher trait level. In the present study, internal consistency reliability (Cronbach's alpha) of different subscales of the Big Five Inventory-10 were 0.76 (Extraversion), 0.42 (Agreeableness), 0.78 (Conscientiousness), 0.68 (Neuroticism), and 0.72 (Openness to experience).

Statistical Analysis

After ensuring the data's quality and consistency, the data were coded and exported to Statistical Package for Social Sciences (IBM SPSS, version 27) for analysis. To gain clear understanding of socio-demographic characteristics of the study participants, frequency, percentage, mean, standard deviation, and other descriptive statistics were calculated. Student's *t*-test was performed to examine the differences in the means between the hypertensive and normotensive patients for quantitative variables. For categorical variables, Pearson's chi-square test for independence was conducted. The Big Five personality factors and demographic and clinical features that were observed to be significantly different between the two groups were treated as independent variables to construct a binary logistic regression model in order to assess the predictive value of personality traits for hypertension, where hypertension and normotension serve as dichotomous dependent variables. Hosmer–Lemeshow and R^2 were calculated to test the model for goodness of fit. A *P*-value of 0.05 was considered as statistically significant.

Results

The current study invited 346 participants, and, from these, 164 of 188 (87.23%) hypertensive patients and 146 of 158 (92.40%) normotensive control patients fulfilled the criteria for the study. A total of 310 participants with valid protocol were included in the final analyses. Table 1 presents mean scores and SDs of the two groups of participants for the measures of the Big Five personality traits along with the independent *t*-test values. For different personality dimensions, significant differences were found for conscientiousness (t=-4.31, P<0.004) and neuroticism (t=11.13, P<0.001). Mean score clearly indicates that participants with hypertension have shown low score in conscientiousness (M=7.12, SD=1.39) in comparison to the participants without hypertension (M=7.26, SD=1.95). However, participants with hypertension reported high score in neuroticism trait of personality (M=8.24, SD=1.64) in comparison to the participants without hypertension (M=6.10, SD=1.79).

Table 1 Sociodemographic and Clinical Features of Participants

Variables	Normotensive Group (Control) *n*=146 *n* (%)	Hypertensive Group (Cases) *n*=164 *n* (%)	Chi-Square Test	*P* value
Gender			49.59	0.000
Male	83 (56.85%)	68 (41.46%)		
Female	63 (43.15%)	96 (58.54%)		
Marital status			42.06	0.002
Single	87 (59.59%)	46 (28.06%)		
Married	55 (37.67%)	83 (50.60%)		
Divorced	4 (2.74%)	35 (21.34%)		
Education			16.75	0.008
Elementary	6 (4.11%)	24 (16.63%)		
High school	53 (36.30%)	45 (27.43%)		
University	87 (59.59%)	95 (57.92%)		
Area of residence			6.34	0.063
Urban	131 (89.73%)	130 (79.27%)		
Rural	15 (10.27%)	34 (20.73%)		
Smoking status			3.14	0.002
Non-smoker	101 (69.18%)	125 (94.52%)		
Active smoker	45 (30.82%)	39 (23.78%)		
Exercise			23.01	0.000
>150 min/week	73 (50.00%)	36 (21.95%)		
<150 min/week	73 (50.00%)	128 (78.05%)		
Independent- sample *t*-test	Mean (SD)	Mean (SD)	*t*-test	
Age (years)	36.6 (7.12)	42.5 (7.98)		0.001
Big Five traits				
Extraversion	6.46 (1.64)	6.36 (1.33)	−0.58	0.556
Agreeableness	7.54 (1.69)	6.62 (1.77)	−0.98	0.320
Conscientiousness	7.26 (1.95)	7.12 (1.59)	−4.31	0.004
Neuroticism	6.10 (1.79)	8.24 (1.64)	11.13	0.001
Openness to experience	7.02 (1.86)	6.10 (1.84)	−0.71	0.473

In addition to personality dimensions, demographic and clinical features such as gender, marital status, educational qualification, smoking, physical activity, and age were found to have significant differences between mean scores of normotensive and hypertensive groups. These confounder variables are included together with the Big Five personality factors into a binary logistic regression model as independent variables. The Hosmer–Lemeshow statistic revealed no evidence of poor fit (P=0.089). The predictive values for each of the variables listed above are presented in Table 2.

Results of logistic regression analysis presented in Table 2 revealed that gender (OR=2.97; P=0.006), age (OR=4.94; P=0.001), and exercise (OR=3.09; P=0.004) were significantly associated with hypertension. Analysis shows that hypertension was about three times more likely in male patients and approximately five times more likely in older patients. For exercise, participants of the present study were categorized into two groups: those engaging in physical activity for more than 150 min/week, and for less than 150 min/week. Physical activity proved to be a statistically significant predictor, with less active participants being more than three times more likely to be hypertensive in comparison with active participants. However, there was no statistically significant relationship between hypertension and marital status, education, and smoking habits. In the present study it was hypothesized that the Big Five personality dimensions can predict hypertension. Results clearly indicated that conscientiousness and neuroticism were significantly

Table 2 Result of Binary Logistic Regression Model for Hypertension

Variables	OR	95% CI	*P* value
Gender (ref: female)			
Male	2.97	1.31–5.30	0.006
Age	4.94	1.87–10.72	0.001
Marital status (ref: single)			
Married	0.94	0.24–4.56	0.944
Divorced	1.05	0.03–2.93	0.968
Education (ref: Grade 10)			
High school	1.55	0.03–1.85	0.698
University	1.75	0.04–1.92	0.512
Exercise (ref: >150 min/week)			
<150 min/week	3.09	1.36–5.24	0.004
Smoking (ref: active smoking)			
Non-smoking	0.86	0.39–1.87	0.705
Personality traits			
Conscientiousness	1.09	0.92–1.29	0.003
Neuroticism	0.54	0.45–0.66	0.001

Abbreviation: OR, odds ratio.

related to hypertension even after adjusting for the important confounders like gender, age, marital status, education, smoking, and physical activity.

Discussion

The current study was conducted to investigate the differences in personality factors between hypertensive and normotensive patients. To our knowledge, this is the first study to examine the association of the Big Five personality traits and hypertension in Saudi Arabia. The results of the study reported a significant relationship between conscientiousness and neuroticism and the development of hypertension. The findings of the study reported that high neuroticism and low conscientiousness trait were the best predictors of hypertension. Direct comparison of this research with past findings exploring the association between personality traits and hypertension was not feasible due to the use of different personality assessment tools and sample characteristics, and studies focused on the relationship between personality dimensions are missing. The current study found that the high neuroticism trait was related to hypertension. This is in line with previous research that individuals who score highly in neuroticism may tend to perceive the world in a negative way. In addition, a person with neuroticism trait, experiencing negative emotions and being overreactive to stress, may have a greater chance to develop hypertension.[34,41–43] Previous research reported that negative emotions may have a direct physiologic effect on the development of coronary heart disease by activating the sympathetic nervous system and the hypothalamic-pituitary adrenocortical axis, as well as causing immune dysregulation and inflammation.[44–48] Moreover, negative emotions might indirectly influence coronary heart disease by motivating unhealthy behavior. For example, people who experience high levels of anxiety are more likely to smoke and less likely to engage in physical activity.[49–51] Both of these factors (biological and behavioral) have a potential to contribute to the development of hypertension and, as a result, the progression of cardiovascular disorders.

The findings of this research suggest that high conscientiousness is linked with lower risk of hypertension. Previous studies offered some clues about the mechanism underlying this trend of relationship.[29,50] People with high conscientiousness trait had approximately 40–50% lower cardiovascular-related mortality risk in comparison to people with low conscientiousness.[29] Conscientiousness has been linked to a variety of healthy behaviors and outcomes.[8,52,53] Conscientiousness proved to be the most important personality trait associated with all-cause mortality,[52] diabetes,[54]

and obesity[55] among other health outcomes. Individuals with high conscientiousness are capable of making long-term plans and sticking to them,[53] and conscientious people are also more likely to discover and follow health-related information.[56] The lower risk of cardiovascular mortality linked to conscientiousness is probably due to these cognitive-behavioral patterns and healthy behaviors.

Additionally, we assessed the relationship of demographic characteristics and hypertension. As a result of this analysis, gender, age, and physical activity were found to be significant predictors of hypertension. Our results indicate that female patients were significantly and substantially less likely to be hypertensive than male patients. Previous studies demonstrated an association between female gender and hypertension.[57–60] The observed gender differences in hypertension are caused by both biological and behavioral factors.[61–63] The biological factors such as hormones, chromosomal differences, and biological makeup are protective against hypertension in females. These biological factors start to appear in adolescence and continue into adulthood until a woman reaches menopause. High body mass index,[64,65] smoking,[66,67] and a lack of physical activity[64,68] are all behavioral risk factors for hypertension. However, further research is needed to examine other behavioral factors that may explain this disparity.

Regarding age, logistic regression analysis of this study suggested that hypertension occurred more frequently with increasing age which is similar to other studies,[69–71] indicating advanced age as an important non-modifiable risk factor for hypertension. The broad consensus is that blood pressure increases with age, although this correlation may be due to a variety of factors such as diet, environmental pollutants, and structural integrity of arteries. Lifestyle factors like physical inactivity were related with higher rates of hypertension in our study. These findings are consistent with earlier studies that examined the association between physical activity and hypertension.[72–75] Laboratory investigations and epidemiological researches have reported that more physical activity facilitates post-exercise hypotension, baroreceptor sensitivity, renin angiotensin regulation, endothelial nitric oxide production, and long-term cardiac remodeling.[76,77]

One of the important strengths of the current study is that the relationship between the Big Five personality factors and hypertension was examined for the first time in Saudi hypertensive patients. The second strength of this study is that the Saudi people are generally eager to participate in studies to advance this growing field in Saudi Arabia. They realize the importance of research and are willing to provide true and unbiased information. This fact has made our data collection journey easier and interesting, and has also increased the likelihood of obtaining valid and reliable data.

Despite the strengths of the present study, there are still some limitations. First, data of the present research were obtained from AlHasa Governorate of Saudi Arabia. Data collected in this region may be unique, and a replication of the study in others parts of the country may yield different outcomes. Second, the sample size of this study was relatively small as we did not find association between some personality traits like agreeableness and extraversion, and hypertension. However, prior findings support the relationship of these personality traits with health.[78–81] Nevertheless, this piece of research lays the foundation for longitudinal studies for further evaluation of this association. Third, results of the study would be limited in their generalizability as a convenience sampling technique was used. Finally, the current study focused on participants of Saudi nationality which may make it difficult to generalize the current findings to other nationalities. Further researches should examine populations from other nationalities.

Conclusion

The present study investigated the association between the Big Five personality factors and hypertension. This study found that hypertensive patients had higher neuroticism score and lower conscientiousness score than did normal controls. Several demographic (ie gender, age), physical activity, and personality dimensions were associated with hypertension. However, marital status, education, smoking, and some personality traits such as agreeableness, extraversion, and openness to experience were not found to be significant predictors of hypertension. The current study recommend that health professionals and clinicians should consider sociodemographic factors and personality traits as additional indicators of environmental vulnerability during routine chronic care for high-risk patient screening and improving outcome. A further exploration of these variables may be significant in designing intervention for patients at an early stage of hypertension.

Data Sharing Statement

The data that support our findings can be found through directly asking the corresponding author.

Institutional Review Board Statement

This study was conducted in accordance with the Declaration of Helsinki and approved by the Deanship of Scientific Research King Faisal University, Saudi Arabia (KFU-REC-2022-JAN-ETHICS449).

Informed Consent Statement

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

Author Contributions

All authors made a significant contribution to the work reported whether that is in conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; 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 conflicts of interest in this work.

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