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Prevalence of hypertension and associated factors: a cross-sectional study in Riyadh, Saudi Arabia

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Abstract

Background Hypertension is a chronic condition that represents a global burden across the world. The burden of hypertension is found to be particularly high in Middle Eastern countries such as Saudi Arabia. This study was undertaken to measure the prevalence of hypertension and its associated factors. An assessment of the impact of hypertension is required to alleviate/reduce the comorbidities and complications associated with hypertension in Saudi Arabia.

Materials and methods A cross-sectional survey was conducted among 14,239 individuals in Saudi Arabia. A valid and reliable questionnaire was administered after randomly selecting study participants from 48 primary healthcare centers. Univariate analysis was performed to investigate the relationship between independent variables and hypertension. P-values less than 0.05 were considered significant. Multivariate logistic regression was used to establish the major associated factors of hypertension among Saudi citizens. A 95% confidence interval (CI) was presented for each of the adjusted odds ratios (AORs).

Results It was found that 11.1% of research participants reported having hypertension. Compared to younger participants of < 50 years, those who are 50 to 75 years old are two times more likely to be hypertensive (AOR: 2.05; 95% CI: 1.68, 2.50). Compared to employed Saudi residents, unemployed residents were 1.43 times more likely to be hypertensive (AOR: 1.43; 95% CI: 1.25, 1.65). The odds of hypertension were higher by 1.73 times among obese than non-obese individuals (95% CI: 1.33, 2.25). Individuals with heart disease were 3.72 times more likely to suffer from hypertension than individuals without heart disease (95% CI: 2.84, 4.88). Similarly, those with high cholesterol levels were 8.37 times more likely to have hypertension than those with low cholesterol levels (95% CI: 6.94, 10.09). Diabetic individuals were 10.45 times more likely to develop hypertension than non-diabetic individuals (95% CI: 8.87, 12.30).

Conclusion The prevalence of hypertension found in the current study was 11.1%. Older age, unemployment, insurance coverage, obesity, diabetes, heart disease, and high blood cholesterol were associated with high blood

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pressure in this study. The findings of this study suggest that researchers and policymakers should target modifiable risk factors to reduce the burden of hypertension among Saudi residents.

Keywords Hypertension, Prevalence, Associated factors, Saudi Arabia

Introduction

Hypertension is a significant public health problem, and more than one-third of individuals are affected by hypertension across the world [1, 2]. The results of the National Health and Nutrition Examination Survey (2012–2013) indicate that about a third of American adults suffer from hypertension [3]. High blood pressure is considered to be a major contributor, as well as a leading cause of cardiovascular disease and cerebrovascular accidents [4, 5]. Besides, hypertension can also lead to musculoskeletal diseases such as osteoarthritis [6]. High blood pressure, if not diagnosed and treated on time, can lead to various adverse outcomes such as kidney and heart failure, stroke, and even mortality [4, 5]. Like other diseases, hypertension is multifactorial in etiology, meaning that various causes, such as sole intake of sodium, inadequate intake of fruits and leafy vegetables, smoking, poor physical activity, and obesity can lead to high blood pressure [7–10]. Countries such as Saudi Arabia are currently going through the process of nutrition transition, where people are adopting the Western lifestyle by replacing their traditional diet with fast food [9, 11]. Moreover, individuals are becoming less active day by day, and this shift in diet and lifestyle has been related to increased rates of obesity, hypertension, type 2 diabetes, and other comorbidities [11, 12].

In 2013, it was reported that about half of non-communicable diseases were attributable to cardiovascular diseases in Saudi Arabia (<https://www.moh.gov.sa/en/Ministry/MediaCenter/News/Pages/News-2013-10-30-002.aspx>). Given this, the Saudi Vision 2030 strategic framework has set up several goals aimed at improving preventive healthcare services, and the healthcare system in Saudi Arabia. To achieve these targets and goals, it is crucial to identify the population's needs by estimating the burden of the problem and its determinants. While some national studies have attempted to estimate the prevalence of hypertension in Saudi Arabia, the prior studies present certain limitations. For example, other studies have either focused on specific regions or genders or were conducted about two decades earlier [13, 14]. Therefore, there is a lack of up-to-date scientific data that provides insights into the true burden of hypertension among all genders and its associated factors. To address this knowledge gap, the aim of the current study is to measure the prevalence of hypertension and its associated sociodemographic and behavioural factors along with the consequent comorbid conditions. The findings of the study will provide a framework for the researchers

and policymakers to develop targeted and tailored interventions to reduce the burden of hypertension among the Saudi population.

Materials and methods

Study design and sampling methods

In Riyadh, Saudi Arabia, a cross-sectional survey was conducted from March to July 2023. Patients who visited Riyadh, Saudi Arabia's primary healthcare facilities were the participants of this study. Using multistage cluster sampling, 48 primary healthcare facilities were chosen randomly from a list of 103 primary healthcare facilities in Riyadh, during the first stage. The second stage of sampling involved randomly selecting patients from the 48 selected primary healthcare centres.

Eligibility criteria and study sample

The inclusion criteria were anyone 18 years of age or older who attended the health facility, and the only exclusion were staff or medical professionals at the centre. At various intervals throughout the day, data collectors addressed all patients and their family members who were 18 years of age or older in the primary health care centre's visiting area. The total number of study participants who fit the eligibility criteria was 14,239 people -- which was the sample size used for the current study.

Study questionnaire validation

A separate questionnaire has been prepared for the needs assessment survey by the research authors (Supplemental File). A pilot test of an electronic questionnaire was created and executed in Hail, a region of Saudi Arabia where the survey was not carried out. The questions were first translated into Arabic, and then back into English since the questions were selected from English-language sources. A pilot test of the electronic questionnaire was conducted on 100 patients in the Hail area before its implementation on the actual analytical sample of 14,239 patients. Pilot testing was used to determine the comprehensiveness and degree of difficulty of the questions, before they were modified and corrected as needed. Following the pilot testing, a focus group meeting was scheduled with 20 important Hail informants, who assisted in revising and modifying the questionnaire before it was given to the study participants in 48 centres. The questionnaire was re-administered to 100 patients after the questions were changed to evaluate the test-retest reliability, which was discovered to be 0.83.

In a similar vein, the questionnaire's face validity was accepted and deemed to be reasonable.

Data collection and questionnaire administration

A total of 14,239 patients were given the questionnaire via an electronic survey while a data collector was present. Data collectors have study specific electronic devices for data collection (tablet or smart phones) -- for filling each questionnaire. The questionnaire was divided into several sections. One section asked about the patient's age, gender, marital status, degree of education, employment status, and health. Data on behavioural characteristics such as daily physical activity, alcohol intake, cigarette smoking habits, and fast-food consumption, was gathered in the second section. Data on comorbid conditions such as diabetes, obesity, hypertension, cardiovascular disease, and chronic obstructive pulmonary disease were gathered during the third segment of the questionnaire. Diseases were ascertained based on self-reported diagnoses, confirmation of medical visits, or the use of prescribed medications. Hypertension was defined via self-reported, physician-diagnosed, or treated with antihypertensive medications. Before gathering information from eligible patients, data collectors informed patients about the aim of the study. Informed consent was obtained from all participants who qualified for the study. Participants were asked to respond to a series of questions; however, participation was entirely voluntary.

Statistical analysis

The statistical program of social sciences (SPSS version 26.0 for Windows) was used to analyze the data. Categorical variables were presented as frequency and proportions while continuous variables were presented as means and standard deviation (SD). After evaluating the normality of continuous variables using histograms, the means, and standard deviations were calculated. To evaluate the relationship between independent variables and the binary outcome variable (hypertension: yes/no), a univariate analysis was carried out. P-values less than 0.05 were regarded as significant. Multivariate logistic regression was used to assess major associated factors of hypertension among Saudi residents, presenting 95% confidence intervals (CIs) for adjusted odds ratios (AORs). The model was constructed using forward selection method to identify the determinants of hypertension. This method involved the sequential addition of variables based on their statistical significance (using a threshold of $p < 0.05$) and clinical relevance. The decision to include variables was further guided by clinical evidence from previous studies, to ensure that the model captured established associated factors while allowing for the identification of novel associations. For example, we kept smoking in the model as clinically important

variable despite it was not strongly associated with the outcome in the univariate analysis. There was no missing data for any of the variables included in the multivariate logistic regression model. Complete case analysis was performed, ensuring that all participants with available data were included in the model construction. This approach eliminated the need for data imputation and maintained the integrity of the statistical analysis. Since there was no clarity on what "Others" specifically represented for "Education" variable, it was deemed inappropriate and potentially misleading to include this category in the analysis. Hence, we excluded the "Others" category from the multiple regression analysis and focused on the remaining sample of 11,845 participants for whom education levels were clearly defined.

Study results

Sociodemographic characteristics of study participants

The sociodemographic data of the Saudi Arabian study participants is displayed in Table 1. Men represented 43.3% of research participants, while 48.8% of individuals were between the ages of 50 and 75 years. The proportion of those surveyed that stated that they had gone to college or university was 51.5%. Further, 34.7% of the research participants were single, while 51.4% of adults were employed. About a quarter (24.3%) of the study participants had insurance, and 27.7% of them were smokers. Table 1 reveals that although close to two-thirds (60.7%) of the sample reported being physically active, 5.2% of them were found to be obese. Only 11.1% and 12% of research participants reported having hypertension and diabetes, respectively as shown in Table 1.

Sociodemographic factors associated with hypertension among Saudi residents at primary healthcare settings in Riyadh

Table 2 shows the demographic and behavioural factors of hypertension among Saudi residents in primary healthcare settings in Riyadh. There was a close relationship between age and association of hypertension, as illustrated in Table 2. It was found that in comparison to younger participants aged < 50 years, those who were 50 to 75 years old were twice as likely to be hypertensive (AOR: 2.05; 95% CI: 1.68, 2.50). Education was also found to be a strong protective factor of hypertension and those with higher education were about 60% less likely to develop hypertension than those with a lower education attainment profile. Married participants were not found to have a statistically significant risk of hypertension (AOR: 1.05; 95% CI: 0.87, 1.24). Compared to employed Saudi residents, unemployed residents were 1.43 times more likely to be hypertensive (AOR: 1.43; 95% CI: 1.25, 1.65) as shown in Table 2.

Table 1 Sociodemographic characteristics of study participants (n = 14,239)

	Frequency	Percentage
Age		
< 50 years	4848	34.0
50 to 75 years	6945	48.8
> 75 years	2446	17.2
Gender		
Female	8062	56.6
Male	6177	43.4
Marital status		
Not married	4939	34.7
Married	9300	65.3
Education		
Primary	572	4.00
Up to High School	3937	27.6
College/University	7336	51.5
Others ^a	2394	16.8
Employment status		
Employed	7317	51.4
Unemployed	6922	48.6
Health status		
Excellent	4798	33.7
Very good	5076	35.6
Good	2815	19.8
Fair	1256	8.80
Poor	294	2.10
Insurance coverage		
Yes	3457	24.3
No	10,782	75.7
Physical activity		
No	5598	39.3
Yes	8641	60.7
Smoking		
No	10,297	72.3
Yes	3942	27.7
Hypertension		
No	12,659	88.9
Yes	1580	11.1
Obesity		
No	13,502	94.8
Yes	737	5.20
Diabetes		
No	12,474	87.6
Yes	1765	12.4

^aWe excluded others from the multiple regression analysis (See Table 2)

Behavioural factors and co-morbidities associated with hypertension among Saudi residents at primary healthcare settings in Riyadh

Table 3 shows univariate analysis of the behavioural factors and co-morbidities associated with hypertension among Saudi residents in primary healthcare settings in Riyadh.

Table 2 Sociodemographic factors associated with hypertension among Saudi residents at primary healthcare settings in Riyadh (11,845)

Associated Factors	Univariate analysis		Multivariate Analysis	
	OR	95% CI	AOR	95% CI
Age				
< 50 years	1		1	
50 to 75 years	2.10	1.81–2.44	2.05	1.68–2.50
> 75 years	6.29	5.37–7.35	5.14	4.16–6.37
Education				
Primary	1		1	
Up to High School	0.32	0.26–0.39	0.46	0.37–0.57
College/University	0.25	0.20–0.31	0.40	0.32–0.50
Gender				
Female	1		1	
Male	0.96	0.86–1.07	1.04	0.92–1.19
Marital status				
Single	1		1	
Married	1.61	1.45–1.79	1.05	0.87–1.24
Employment status				
Employed	1		1	
Unemployed	1.49	1.34–1.64	1.43	1.25–1.65

OR represent the estimated odds ratio from univariate analysis, unadjusted results

AOR represent the adjusted odds ratio obtained after mutually adjusting for age, education, gender, marital status, and employment status

The findings of the multivariate analysis revealed that insurance coverage, obesity, heart disease, high cholesterol, and diabetes were found to be significantly associated with hypertension. More specifically, individuals with insurance coverage were 1.21 times (95% CI: 1.02, 1.44) more likely to develop hypertension than those without insurance coverage. The odds of hypertension were higher by 1.73 (95% CI: 1.33, 2.25) times among obese than non-obese individuals. Individuals with heart disease were 3.72 times (95% CI: 2.84, 4.88) more likely to suffer from hypertension than individuals without heart disease. Similarly, those with high cholesterol levels were 8.37 times (95% CI: 6.94, 10.09) more likely to develop hypertension than those with low cholesterol levels. Diabetic individuals were 10.45 (95% CI: 8.87, 12.30) times more likely to develop hypertension than non-diabetic individuals as shown in Table 4 below.

Discussion

This cross-sectional survey was undertaken to assess the prevalence of hypertension and its associated factors. The study results showed that 11% of the patients who attended the health facilities in Riyadh were found to be hypertensive. The factors associated with high blood pressure included older age, unemployment, insurance coverage, obesity, high cholesterol levels, heart disease,

Table 3 Univariate analysis of behavioural factors and co-morbidities associated with hypertension among Saudi residents at primary healthcare settings in Riyadh (11,845)

Associated Factors	Model 1: Univariate Analysis	
	OR	95% CI
Insurance coverage		
No	1	
Yes	1.36	1.21–1.53
Smoking		
No	1	
Yes	1.14	1.01–1.27
Fast food consumption		
No	1	
Yes	0.92	0.81–1.06
Physical activity		
No	1	
Yes	1.001	0.89–1.11
Obesity		
No	1	
Yes	6.35	5.42–7.43
Heart Disease		
No	1	
Yes	15.14	12.55–18.27
High Cholesterol		
No	1	
Yes	24.24	20.94–28.05
Type 2 diabetes		
No	1	
Yes	21.83	18.99–25.08

Model 1: Univariate analysis, unadjusted results

and type 2 diabetes. However, in the current study, higher education was associated with a lower prevalence of hypertension.

Overall, the prevalence of hypertension in this study is similar to what has been found in previous national surveys conducted in Saudi Arabia. Another study suggests that about 11.5% of individuals 15 to 64 years of age were found to be hypertensive -- results very similar to the findings from the current study [10]. However, a national survey reported that about 15% of the adults were hypertensive in Saudi Arabia -- findings very similar to the burden of hypertension in the current study [13]. A recent systematic review indicated that the prevalence of hypertension in MENA region was 26.2% (95% CI: 24.6, 27.9%; I²=99.8%) [15]. In the Arab countries, the estimated overall prevalence of hypertension among adolescents was 12.6% (95% CI: 0.083–0.176) [16]. Whereas in the Middle East region, the prevalence was 24.36% in adults [17]. These estimates suggested that in Arab and MENA regions the prevalence of hypertension is increasing and there is a need to prioritize preventive and screening measures to control the burden of hypertension.

In regards to the associated factors, it was found that marital status was not associated with hypertension,

Table 4 Multivariate analysis of behavioural factors and co-morbidities associated with hypertension among Saudi residents at primary healthcare settings in Riyadh (11,845)

Associated Factors	Model 2		Model 3	
	AOR	95% CI	AOR	95% CI
Insurance coverage				
No	1		1	
Yes	1.47	1.29–1.68	1.21	1.02–1.44
Smoking				
No	1		1	
Yes	1.35	1.18–1.54	0.96	0.81–1.15
Obesity				
No	1		1	
Yes	7.48	6.24–8.97	1.73	1.33–2.25
Heart Disease				
No	1		1	
Yes	17.58	14.39–21.46	3.72	2.84–4.88
High Cholesterol				
No	1		1	
Yes	22.63	19.44–26.35	8.37	6.94–10.09
Type 2 diabetes				
No	1		1	
Yes	18.46	16.01–21.30	10.45	8.87–12.30

Model 2: Adjusted for age and sex

Model 3: Mutually adjusted for other factors in the model

which is also similar to the prior national survey [13]. However, this study's findings contradict previous studies that reported a significant association between marital status (married and divorced) and hypertension [18–20]. Given the mixed findings, the evidence regarding the association between marital status and hypertension is not conclusive so far. Similarly, while a significant association between sex and hypertension was not found, the evidence suggests that males are more likely to develop hypertension than females [21, 22]. This is further supported by the direction of the odds ratio in our study, suggesting that males are at higher risk of developing hypertension than females. However, a meta-analysis concludes that global studies suggest no difference in hypertension by sex, where its findings are aligned with the current study [23]. These mixed findings provide an opportunity for researchers to think about the inconsistent findings across the studies.

Aging is a universal phenomenon, and increased age incurs a variety of associated factors that can lead to high blood pressure. The association between increased age and high blood pressure is also suggested by studies conducted in developed and developing countries, suggesting that increased age and its relationship with high blood pressure overrides cultures or geographic regions with diverse populations [24–26]. Similarly, the study concludes that higher education was found to be a protective factor against hypertension, meaning that less educated individuals were at higher risk of developing

hypertension. These findings are consistent with studies from China and Saudi Arabia [27, 28]. According to the World Health Organization (WHO), social determinants such as education do influence behavioural risk factors and thereby non-communicable diseases [29]. Furthermore, higher education may aid awareness and knowledge about the value of living a healthy lifestyle, eating a healthy diet performing physical activity, and also pursuing regular health checkups, which in turn may lower the risk of developing hypertension.

Lastly, obesity and high blood cholesterol levels were found to be associated with hypertension. These findings are consistent with prior studies. Obesity is considered a modifiable associated factor for hypertension, typically co-existing as a chronic condition with high blood pressure and other cardiovascular diseases [30–32]. Hence, weight control measures should be prioritized by the people of Saudi Arabia by performing daily exercise and regular physical activities. Along with that, a study conducted in China reported that high levels of blood cholesterol and triglycerides were associated with hypertension, corroborating the current study findings [30, 31, 33].

Strengths and limitations

The study's findings provide useful insights into the prevalence of hypertension and its associated factors. The study sample was drawn randomly from the population using multistage stratified sampling. Therefore, the findings can be generalized to other population study settings with similar sociodemographic profiles. A validated and reliable questionnaire was used and pretested on a random sample of individuals before administering the questionnaire. The questionnaire was also modified based on the feedback from local people, increasing the face validity of the questionnaire. However, the findings should be interpreted with caution. First, blood pressure of the study participants was not objectively measured -- it was based on self-reporting, which partly explains the underestimation of the prevalence of hypertension. Self-reporting of the data also introduces social desirability bias that may affect the results. Similarly, the data on other variables such as obesity and diabetes were also based on self-reporting. Second, data was collected on independent variables and outcome variables simultaneously, hence, the temporal relationship between associated factors and hypertension cannot be established due to the cross-sectional nature of this survey study.

Conclusion

The prevalence of hypertension among individuals attending health facilities in Riyadh was considerable, at 11%. Older age, unemployment, insurance coverage, obesity, type 2 diabetes, heart disease, and high blood cholesterol were associated with high blood pressure in

the current study. These findings suggest that researchers and policymakers should target modifiable associated factors to reduce the burden of hypertension among the Saudi population. Since higher education was found to be a protective factor against high blood pressure, it is recommended to raise awareness among individuals about the associated factors and outcomes associated with hypertension.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12913-025-12481-7>.

Supplementary Material 1

Supplementary Material 2

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Authors' contributions

SMN, AEM, BA, FF, and MMS: Conceptualization; FF, KA, BA, AIA, SJ, NA and SA: Methodology. AA, NB, and KA participated in data collection and investigation. MMS conducted the statistical analysis and reporting of Results and proof-read/edited the final version of the manuscript before submission. BA, KA, NA, AIA, SMN, FF, AA, SA and SJ wrote the manuscript. All authors have participated in the final revision. AEM, FF and MMS reviewed and edited the manuscript. All the authors have read and approved the final manuscript.

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Data availability

The dataset(s) supporting the conclusions of this article is included within the article.

Declarations

Ethics approval and consent to participate

The ethical approval for the current study was taken from Intuitional Review Board of King Fahad medical city (approval # 22-397E). The study was conducted in accordance with the Declaration of Helsinki. The informed consent to participate were taken from all participants before the data collection process. Participant confidentiality was ensured in all stages of the data analysis and reporting of results. The analysis was done on aggregate data (no identifiers such as participant's name, age, or gender), and anonymous data have been shared with statisticians and the authors.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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