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Hypertension and Its Risk Factors in the Population Covered by Mashhad University of Medical Sciences

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ABSTRACT

Introduction: Hypertension is recognized as one of the major causes of cardiovascular disease. The present study aimed to assess the relationship between hypertension and its risk factors in the population referring to comprehensive health care centers affiliated to Mashhad University of Medical Sciences.

Materials and Methods: This case-control study was performed on the health assessment data of the population aged 30 years and above registered in the SINA system in 2017-2018. The present case-control study was conducted on 1500 cases who were selected by systematic random sampling and assigned to the case group (500 hypertensive patients) and control group (1000 subjects without a history of hypertension). Data were analyzed using SPSS software (version 22). A p-value less than 0.05 was considered statistically significant.

Results: Based on the results, the risk factors for hypertension included settlement in urban areas (OR=2.914), body mass index≥ 25 (OR = 2.522), waist circumference>90 (OR=2.409), sedentary lifestyle (OR=2.373), consumption of solid oil (OR=1.581), triglyceride level of >150 (OR=566), use of table salt (OR=1.547). On the other hand, the following were identified as protective factors against hypertension: hard labor jobs (OR=0.292), optimal physical activity (OR=0.421), and regular consumption of vitamin D (OR=0.625) (P<0.05).

Conclusion: The results will not only provide a solid foundation on potency of risk factors and protective factors for hypertension but will also give an invaluable insight to the health planning programs. The reduced prevalence of hypertension can be planned for with the identification of related risk and protective factors.

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Introduction

Hypertension is recognized as an underlying cause of cardiovascular disease, affecting more than one billion people worldwide. Moreover, as a contributor to premature death, this disease is responsible for 9.4 million deaths annually (1).around 92millionDALYs(disability-adjusted life year)worldwide were attributed to high blood *pressure* in 2001 (2). It is expected that the prevalence of hypertension and the number of affected people increase over the coming decade (1). Furthermore, it is noteworthy that high blood pressure has been mostly tracked in developing countries(3).

Hypertension, if left untreated, is an independent predisposing factor for non-communicable diseases (NCDs) including stroke, heart failure, kidney disease, ischemic heart disease, and peripheral artery disease. The major complications of hypertension include cardiac, cerebrovascular, renal, and peripheral vascular complications(2). On a global scale, non-optimal blood pressure is responsible for two-thirds of stroke cases and half of ischemic heart diseases incidences (3). There is a direct relationship between hypertension and the risk of cardiovascular events; moreover, the risk of kidney failure, stroke, heart attack, and heart failure and goes hand in hand with an increase in blood pressure (4).

Environmental and genetic factors may contribute to differences in racial and regional prevalence. Hypertension is primarily related to environmental factors and lifestyle, rather than racial and genetic differences (5). Some of the major environmental risk factors that predict hypertension include obesity (about an increase of 1 mm Hg in blood pressure per one kilogram of weight gain), excess sodium intake (more than 1.5 to 2.5 grams per day), alcohol consumption (more than 10-20 grams per day), lack of exercise, concomitant use of several over-the-counter medications, use of antihypertensive drugs (e.g., stimulants, anticonvulsants, contraceptives, and nonsteroidal anti-inflammatory drugs).

The effect of these risk factors on hypertension depends on one's genetic background. Although single-gene disorders (mainly affecting the kidneys and sodium transport system) also contribute to the development of hypertension, most cases of primary hypertension are associated with multigene disorders (1). The effect of heredity on hypertension is 15- 35%, and this disease is 3.5 times higher in people with a positive family history before the age of 55. Therefore, a history of hypertension in first-degree family members doubles the risk of developing this disease (2).

Obesity and overweight are independent and strong risk factors for hypertension. It is estimated that about 60% of hypertensive patients are>20% overweight. Various studies have linked hypertension to obesity and overweight (6-14). Furthermore, the prevalence of hypertension is related to the amount of sodium chloride intake, and age-related increases in blood pressure may be exacerbated by the excessive consumption of salt. Inadequate levels of calcium and potassium intake may also contribute to an increased risk of hypertension. Alcohol consumption, psychological stress, and insufficient physical activity also contribute to hypertension .A better understanding of these risk factors could guide efforts to prevent hypertension and reduce mortality (13).

Despite different risk factors for hypertension in various regions, the population under the auspicious of Mashhad University of Medical Sciences do not have much awareness of the prevalence and risk factors of this disease. Moreover, no study has been conducted on large populations (such as the up-to-date database of SINA Electronic Health Record System). The aforementioned issues prompted us to carry out a study in this filed since we can make a purposeful effort to prevent and reduce mortality and complications of this disease among this population with a better understanding of these risk factors.

Materials and Methods

The present case-controlstudy assessed the health assessment data of the population aged 30 and above referring to the comprehensive health service centres affiliated to Mashhad University of Medical Sciences and registered in the SINA Electronic Health Record System. The research was approved by the Ethics

Committee of Mashhad University of Medical Sciences (IR.MUMS.MEDICAL.REC. 1397.346). The process of data collection was as follows: the individuals aged 30 and above covered by Mashhad University of Medical Sciencesin 2017 were identified by trained caregivers in comprehensive healthcare centres. Thereafter, their health was assessed using the learned training and skills. Finally, the results were collected in health assessment forms for the middle-aged (30- 59 years) and the elderly (over 60 years) and recorded in the SINA system.

Blood pressure (BP) test as the general evaluation was performed at least twice on each visit in five-minute intervals. When systolic blood pressure (SBP) was ≥140 and/or diastolic blood pressure (DBP) was ≥90 mmHg, or the patients received antihypertensive medications, they were diagnosed with hypertension (15). Moreover, risk factors for hypertension, including smoking, physical activity, age, waist circumference, body mass index, alcohol consumption, and nutritional status, were assessed and recorded by health care providers.

Inclusion and exclusion criteria

The inclusion criteria entailed: 1) 30 years of age and above, 2) coverage by Mashhad University of Medical Sciences, 3) absence of physical illness or acute mental and emotional disorders, and 4) ability to standandwalk. On the other hand, the exclusion criteria entailed: 1) incomplete information, 2) major metabolic diseases, 3) the use of specific medications, such as immunosuppressive drugs, and 4) non-reference to comprehensive health service centers.

Statistical methods and sample size

Based on previous studies (16) , we applied following formula to calculate the size of the studied population. Accordingly, we estimated the sample size to be 1500 cases for this study. Using a systematic random sampling, we selected 500 hypertension patients from a total of 246904 patients who were registered in the SINA electronic health record system of the Mashhad University of Medical sciences. The control group was chosen to be double in size compared to the case group and were randomly selected from patients who are 30 years old and above without history of hypertension.

$$n=\frac{(z_{1-\alpha/2}+z_{1-\beta})^2(p_1(1-p_1)+p_2(1-p_2))}{(p_1-p_2)^2}$$

In addition, ethical considerations, including coordination and obtaining permission from relevant institutions, as well as patient information confidentiality was fully observed.

Statistical analysis

The result was analysed using SPSS software (version 22)data analysis package. Firstly, descriptive statistics indices (dispersion and central indices) were calculated. For analytical statistics, after examining the normality of the data, T-test and Mann-Whitney U tests were utilized to investigate the relationship between factors and blood pressure. Moreover, the logistic regression model was also used to control the confounding variables to determine the relationship between the independent variable and the dependent variables. Furthermore, the odds ratio was calculated to determine effect size of the related factors. A p-value less than 0.05 was considered statistically significant.

Results

The current study was performed on a total of 1,500 cases aged over 30 years old (49.7±2.02). Table 1 presents participants' demographic information, including age,gender, history of diabetes or cardiovascular disease, BMI, and waist circumference.

City-dwelling, body mass index of ≥25, the waist circumference of > 90 cm, sedentary lifestyle, diabetes, consumption of solid oil, triglyceride level of>150, use of table salt, day and female gender were identified as the risk factors for hypertension with a significant p-value (P<0.05). On the other hand, hard labor jobs, optimal physical activity, Mere consume of liquid oil, regular intake of vitamin D, even consumption of less than two servings of fruit every day and consumption of less than three servings of vegetable every were recognized as the protective factors against hypertension with a significant p-value (P<0.05).

Table 1. Demographic characteristics of participants and its relation with hypertension

Parameter	Classification	Case		Control		P- value
		mean±SD	Frequency	mean±SD	Frequency	
Age		58.9±15.6		59.23±16.27		P=0.122
Blood pressure	Systolic	127.12±24.58		112.13±26.15		P<0.0001
	Diastolic	76.7±83.69		68.8±71.73		
Sex	Male		320(32%)		202(40.3%)	P=0.004
	Female		674(67.4%)		299(59.7%)	
Diabetes			380(38%)		115(23%)	P<0.0001
Cardiovascular disease			116(11.65%)		22(4.4%)	P<0.0001
BMI	BMI<18.5		8(0.8%)		10(1.9%)	
	BMI 18.5-25		280(28%)		243(48.6%)	
	BMI>25		398(39.8%)		180(36%)	P<0.0001
	BMI>30		314(31.4%)		118(13.5%)	P<0.0001
Waist size>90 cm			588(58.8%)		186(32.7%)	P<0.0001

Table 2. Relationship between the study variables and the risk of hypertension

Variable	Unadjusted OR (95% CI)	p-value	Adjusted Odds ratio	p-value
Female gender	1.396(1.114-1.749)	P=0.004	0.61(0.31-1.176)	P=0.204
Age of >60 years	1.186 (0.956-1.472)	P=0.122	3.14(1.96-5.04)	
Literate	0.922 (0.738-1.152)	P=0.437		
Urban residence	2.914 (2.334-3.638)	P<0.0001	0.15(0.07-0.33)	P<0.0001
Diabetes	2.0.52 (1.625-2.59)	P<0.0001	2.33(1.18-4.63)	P=0.027
Cardiovascular disease	2.851 (1.894-4.286)	P<0.0001	3.01(0.67-13.4)	P=0.201
Overweight (body mass index ≥ 25)	2.522 (2.004-3.174)	P<0.0001	2.49(1.09-5.67)	P=0.045
Obesity (Body Mass Index ≥ 30)	2.933 (2.257-3.811)	P<0.0001	2.16(0.93-5.01)	P=0.208
Abdominal obesity (waist circumference>90)	2.409 (1.935-3.001)	P<0.0001	0.54(0.22-1.30)	P=0.476
Smoking	1.329 (0.772-2.275)	P=0.299		
Opioid use	1.431 (0.762-2.690)	P=0.265		
Alcohol consumption	0	p>0.99		
Optimal physical activity	0.421 (0.348-0.535)	P<0.0001	0.73(0.37-1.43)	P=0.326
Walking	0.891 (0.716-1.108)	P=0.298		
Hard labor job	0.292 (0.229-0.372)	P<0.0001	0.39(0.19-0.76)	P=0.003
Sport and recreational activity	0.662 (0.431-1.016)	P=0.059	0.90(0.21-3.83)	P=0.569
Sedentary lifestyle	2.373 (1.905-2.955)	P<0.0001	2.12(1.82-2.88)	P=0.045
Consumption of less than two servings of fruit every day	0.247 (0.074-0.824)	P=0.023	0.12(0.06-0.83)	P<0.001
Consumption of less than three servings of vegetable every day	0.492 (0.074-0.926)	P=0.029	0.78(0.89-6.96)	P=0.401
Consumption of less than two servings of dairy every day	0.497 (0.159-1.549)	P=0.228		

Table 2. (Continued)

Consumption of only solid-semi-solid-animal oils	1.581 (1.274-1.963)	P<0.0001	0.49(0.20-1.19)	P=0.076
Mere consume of liquid oil	0.733 (0.548-0.981)	P=0.037	1.40(0.66-2.98)	P=0.061
Continuous use of table salt	1.547 (1.174-2.38)	P=0.002	0.72(0.18-2.79)	P=0.878
Consumption of ready-made meals more than twice a week	0.689 (0.445-1.068)	P=0.096		
Regular intake of vitamin D	0.625 (0.46-0.849)	P=0.003	0.76(0.39-1.45)	P=0.681
High cholesterol	1.169 (0.895-1.527)	P=0.252		
High triglyceride	1.566 (1.164-2.106)	P=0.003	1.46(0.73-2.91)	P=0.203
Low HDL	0.858 (0.642-1.148)	P=0.304		

The results of multiple regression analysis also confirmed that age, diabetes, cardiovascular disease, overweight, obesity, sedentary lifestyle and high triglycerides are effective factors in prediction of the risk of hypertension.

Discussion

The relative frequency of hypertension and its risk factors vary across different societies. In this regard, the determination of the relative frequency and risk factors of this disease in the target population according to the demographic characteristics of that region would be of great help to plan for the prevention and control of this disease. Similar to other developing countries, Iran is experiencing severe demographic and epidemiological changes. The increasing trend towards Western and sedentary lifestyles gives rise to the prevalence of non-communicable diseases, such as cardiovascular disease.

Numerous studies have been performed to determine the relative frequency and risk factors of hypertension in Iran and other parts of the world. These studies have yielded contradictory results regarding the prevalence and risk factors for hypertension. These findings are summarized in Table 3. The existing discrepancies between the results of the present research and other similar studies around the world can be attributed to different ethnicity, geographical factors, lifestyles, physical activity, and dietary habits (6-9, 11, 12, 17).

In several studies, the prevalence of hypertension was higher in men, and the male gender was considered a risk factor for hypertension (18, 19) . Even in one study,female gender was mentioned as a protective factor (20). Nonetheless, in the present study, the risk of hypertension in women was higher (P=0.004). In line with the findings of the present research, other studies have been conducted in studies in Iran and various countries (7). The assessment and comparison of the risk factors for hypertension by gender pointed to the conclusion that the relative frequency of risk factors for hypertension, such as overweight, excess salt intake, high triglycerides, waist circumference, sedentary lifestyle, and obesity is significantly higher in women (P<0.05).

Moreover, the relative frequency of protective factors against hypertension, including optimal physical activity and hard labor jobs is significantly lower in women (P<0.05). The aforementioned issues can justify the higher frequency of hypertension in women. Contrary to the findings reported by DO et al. (7), the results of the present study showed that the risk of hypertension in urban residents is higher, compared to those residing in rural areas (P<0.0001).

The assessment and comparison of the risk factors for hypertension by place of residence (rural/urban) pointed to the conclusion that the prevalence of risk factors for hypertension, namely diabetes, sedentary lifestyle, overweight, salt intake, consumption of solid, semi-solid, and animal oil, abdominal obesity, obesity, and high triglycerides, was significantly higher in urban residents (P<0.05).

Table 3. Role of factors affecting hypertension in different studies

Author	Age	Diabetes	Desirable Avtivity	Low activity	Overweight	Obesity	waist circumference>90 above 90	Salt	Female gender	City residence	Solid oil	Liquid oil	Vitamin D	Hard job	Fruit consumption	Vegetable consumption consumption	Dairy consumption	High TG	High Cholestrol	Smoking	Alcohol consumption	Convenience food	Literacy & education
Ingale(23)		–	–		–	–		✓												–	–		
Lioyd(12)				✓	✓	✓			✓												✓		
Liu(11)					✓	✓													✓	✓			
Ahmed(16)	✓	–	–		–	–		✓								–				–			
Li(17)			◯		✓	✓									◯	◯				✓			
Chenata(22)	✓		–					✓												✓	✓		
Jolly(8)	✓	–				✓			–									✓		–			
Do(7)	✓		◯		✓				–	◯											✓		◯
Pinto(13)	✓			✓		✓		✓	✓											✓	✓		◯
Yang(24)	✓				✓	✓	✓		–	◯											✓		◯
Joshi(9)	✓					✓	✓																
Ahmadi(16)	✓			✓		✓						◯											◯
Kazemi(20)					✓	✓														◯			
Ghorbani(25)	✓	✓					✓		◯									✓	✓				
Gholizade(21)	✓	✓	◯						◯	◯					✓	✓		✓	✓	✓			
This article	–	✓	◯	✓	✓	✓	✓	✓	✓	✓	✓	◯	◯	◯	✓	✓	–	✓	–	–	–	–	–

Table cells with a dash sign (–) indicate that there is no significant relationship, cells with a circle sign show protective factors and empty cells show no study has been done on that variable. Table cells with a check mark (✓) depict that there is a significant relationship.

studies. Similar to previously conducted studies, (7, 13, 16, 17, 21), the results of our study indicated that the risk of hypertension is higher in people living a sedentary lifestyle, compared to those without sedentary lifestyle (P<0.0001).Optimal physical activity, Hard labor job as well as sport and recreational were identified as protective factors against hypertension. However, the association between hypertension and physical activity was not significant in all studies (6, 22, 23).

In a study on the population of the region, similar to other studies in other parts of the world, other risk factors for hypertension were as follows: abdominal obesity (9, 24, 25) , overweight (body mass index > 25; (7, 11, 12, 16, 17, 24) ,and obesity (body mass index≥ 30) (6, 9, 11-13, 17, 20) .

The discrepancy between previously conducted studies and the present research lies in the fact that it was the first community-associated factors.

The findings of the current study regarding specific laboratory criteria, such as triglyceride level of >150, were similar to studies performed in these areas: (P=0.003) (8, 25). Furthermore, consistent with studies in other regions, in the present study, the risk of hypertension in diabetic patients was obtained at OR=2.05 (1.625-2.59) (21, 25-28). Nonetheless, these findings have not been confirmed by other studies (6, 8, 16, 23).

Limitations, strengths, and weaknesses of the present study

The strength of the present study is the large sample size which increases the generalizability of the results and provides a broader and more comprehensive view in this field. On the other hand, one of the limitations of the present study is non-referral of some covered people, as well as the incomplete or incorrect completion of health information in some cases due to inactive collection of information by

physicians and health care providers. The lack of full coverage of the urban population in the system is another notable limitation imposed on the current study.

Based on the results of the present study, the major risk factors for hypertension pressure in our society include obesity, urbanization, and a sedentary lifestyle. Due to the high relative frequency of risk factors for hypertension in the community, it is recommended to inform the people about the risk and protective factors for this disease and control blood pressure from an early age.

Conclusion

It is of paramount importance to have access to updated information about hypertension since the frequency and risk factorsof this disease vary among different regions of Iran, as well as the world. The provision of new insightinto the risk factors of hypertension will enable health authorities to prioritize the needs and develop better planning to reduce the complications of hypertension. It is recommended that future studies identifythe type and target group of interventions in thecommunity in an effort to properly allocate the limited resources in the healthcare system.

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Conflicts of interest

The authors have no competing interest.

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