# The prevalence of hypertension and its relationship with demographic factors, biochemical, and anthropometric indicators: A population-based study

**Mohammad Khajedaluee[(1)], Tahereh Hassannia[(2)], Abdolrahim Rezaee[(3)], Maryam Ziadi[(4)], Maliheh Dadgarmoghaddam[(5)]**

**Original Article**

## Abstract

**BACKGROUND:** Hypertension (HTN) is an important public health challenge worldwide. The prevalence of HTN varies across countries. It is necessary to obtain valid information about the prevalence of chronic condition like HTN and its predictors in different societies. Hence, this study was conducted to assess the prevalence of HTN and associated factors in Mashhad, Iran, 2015.

**METHODS:** This cross-sectional study was performed on 2974 adults residing in Mashhad in 2015. Multistage random sampling was used. A checklist was fulfilled for each subject, and a blood sample was taken for measuring fasting blood sugar, total cholesterol, triglycerides, hemoglobin, serum creatinine, high-density lipoproteins, and low-density lipoproteins. The height and weight of participants and their blood pressure were measured according to protocols.

**RESULTS:** The prevalence of HTN in this population was 22% (25.9% in male and 20% in female). Most interestingly, smoking and drug abuse were more prevalent in men (14.9% and 3.8%), but the sedentary behavior was more prevalent in women (51%). Interestingly, by increasing the age, the frequency of optimum, normal and high normal type was decreased and the frequency of HTN, specially sever form were increased. In binary logistic regression model, age [odds ratio (OR): 1.07, 95% confidence interval (CI): 1.06-1.09], gender (Ref:Female) (OR: 1.39, 95% CI: 1.05-1.83), and obesity (OR: 1.09, 95% CI: 1.06-1.12) were the predictors of HTN.

**CONCLUSION:** The prevalence of HTN among this population was found to be high; which indicates the need for HTN-screening programs, especially for the elderly, male and obese population. Given the close relationship between obesity and various diseases, including HTN, practical solutions, including lifestyle interventions, need to be developed.

**Keywords:** Hypertension, Prevalence, Adult, Anthropometric Indicators

***Date of submission:*** 05 Feb 2016, ***Date of acceptance:*** 19 Sep 2016

## Introduction

Hypertension (HTN) has become very common worldwide and can lead to major health outcomes, such as myocardial infarction, stroke, renal failure, and ultimately death. The prevalence of HTN is increasing in developing countries and is one of the leading causes of death and disability.[1] The prevalence of HTN increases with age.[2]

The results of descriptive studies showed that death from ischemic heart disease and stroke increased linearly in those with a systolic blood pressure (SBP) level as low as 115 mmHg and a diastolic BP (DBP) level of 75 mm Hg.[3,4] According to one study, the awareness of HTN among general population varied from 25.2% to 75%.[5] The World Health Organization reported that annually, complications of HTN accounted for 9.4 million deaths worldwide.[6]

Based on a systematic review in Iran, the estimated overall prevalence of HTN among those aged 30-55 years and older than 55 years was reported to be around 23% and 50%, respectively.[6] This prevalence was lower in men than in women and it increased by about 0.5% per each year of increase in the mean age of the subjects.[6] Other studies reported HTN prevalence rates of 21.2-41.8%. Among the Iranian

1- Professor, Department of Community Medicine, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran
2- Department of Internal Medicine, School of Medicine, Arash Hospital, Tehran University of Medical Sciences, Tehran, Iran
3- Assistant Professor, Inflammation and Inflammatory Diseases Research Center AND Department of Immunology, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran
4- State Health Center, Mashhad University of Medical Sciences, Mashhad, Iran
5- Assistant Professor, Department of Community Medicine, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran
Correspondence to: Maliheh Dadgarmoghaddam, Email: dadgarmm@mums.ac.ir

adult population, the prevalence of HTN was higher in females, older age groups, illiterate individuals, poor people, and urban residents.[7-12]

Information on the prevalence of chronic conditions, such as HTN, and its predictors in different societies are needed to aid disease management. This study was conducted to assess the prevalence of HTN and associated factors in Mashhad, Iran, in 2015.

## Materials and Methods

This was a cross-sectional study of the adult population (> 16 years) in Mashhad, a metropolitan area in the northeast of Iran in 2015. A sample size of 2700 was required, by considering all the assumption and a 30% attrition rate and finally multiplied by 3 for clustering design. Multi-stage cluster random sampling was used.

In the first stage of the study, the population was divided based on the population covered in each district (central health centers numbers 1, 2, 3 and 5). Then, five clusters (health centers) were selected randomly in each district. To allocate samples at the cluster level, the probability proportional to size (each district) method was used. In the second stage of the study, streets were selected randomly, and interviewers who had taken part in 2-day training workshop on data collection visited the homes of potential participants (they were masters in nursery or midwifery who were coworkers in this research). At each house, using a checklist, the interviewers obtained information on the demographic characteristics and socioeconomic status of the residents (maximum of two different genders from a family). The participants who agreed to take part in the study underwent a physical examination at their nearest health center by a general practitioner who had received training (three sessions) in how to minimize measurement and inter-observer bias.

The exclusion criteria were absent in any step of the study, passengers who are not resident in Mashhad.

In this study, sedentary behavior refers to any sitting or reclining posture and included television viewing, video game playing, computer use, driving automobiles and reading. If the respondent says yes to the question that they were spending more time in this activity daily, we considered them yes.

Obesity refers to a body mass index (BMI) ≥ 30.

Diabetes is defined as a fasting blood sugar (FBS) of > 126 mg/dl.[13]

A cigarette smoker refers to someone who smokes more than one cigarette per day or uses a hookah each day.

Drug abused was asked by a question "have you ever used illegal substances"?

In this study, the 3600 IR Rials was equal to 1 US dollar (exchange rate).

The seven blood pressure (BP) categories were defined as follows: "Optimal" SBP < 120 mmHg and DBP < 80 mmHg); "normal" (SBP 120-129 mmHg and/or DBP 80-84 mmHg); high normal (SBP 130-139 mmHg and/or 85-89 mmHg); Stage 1 HTN (mild) (SBP 140-159 and/or DBP 90-99 mmHg); Stage 2 HTN (moderate) (SBP 160-179 and/or DBP 100-109 mmHg); Stage 3 HTN (severe) (SBP 180-209 and/or DBP 110-119 mmHg); HTN Stage 4 (very severe) (SBP ≥ 210 and/or DBP ≥ 120).[14]

BP readings were obtained from the right arm of each subject, with the subject in a sitting period after a period of relaxation for 5 minutes using a standard mercury sphygmomanometer (Omron M6 Comfort, BP Monitors, Japan). Each subject's heart rate was also measured. The BMI was calculated based on the following formula: weight (kg) divided by the height ($m^2$). Body weight was measured using an analog scale, with the participants wearing single layer of clothing. Height was measured using a stadiometer. Blood samples were taken at health centers after 12 hours of fasting to determine the lipid profile, FBS, serum creatinine (Cr), and hemoglobin (Hb). All the samples were sent to a dedicated laboratory for analysis.

The study was conducted in accordance with the principles of the Declaration of Helsinki (1996 version) and good practice standard. All subjects signed informed consent forms.

Descriptive statistical measures, including measures of central tendency and dispersion, were used to describe the data. The continues variable presented by mean ± standard deviation (SD) and qualitative variable described by number (percent). The distribution of data was checked by one sample Kolmogorov–Smirnov test, and according to the result of this test, the appropriate test was selected.

Chi-square (nominal variable), Kruskal–Wallis, Mann–Whitney (for quantitative or ordinal variables), and binary logistic regression test is used to estimate the probability of HTN based on independent variables All reported P values are based on two-sided tests and compared to a significance level of 0.05. SPSS software for Windows (version 11.5, SPSS Inc., Chicago, IL, USA) was used for all the analyses.

**Table 1.** Blood pressure (BP) distribution in males and females

| BP | Sex n(%) | Age n(%) | | P | Sex n(%) | Age n(%) | | P | Total n(%) (n=2974) | P Total comparison in two gender |
|---|---|---|---|---|---|---|---|---|---|---|
| | Female (n=1930) | <65 1840 (95.4) | ≥65 88 (4.6) | | Male (n=1044) | <65 922 (88.6) | ≥65 119 (11.4) | | | |
| Optimal* | 1378 (71.4) | 1319 (73.6) | 22 (25.6) | <0.001 | 634 (60.7) | 581 (64.6) | 35 (29.9) | <0.001 | 2012 (67.7) | <0.001 |
| Normal | 152 (7.9) | 136 (7.6) | 12 (14.0) | | 132 (12.6) | 111 (12.3) | 17 (14.5) | | 284 (9.6) | |
| High normal | 14 (0.7) | 12 (0.7) | 1 (1.2) | | 8 (0.8) | 7 (0.8) | 1 (0.1) | | 22 (0.7) | |
| HTN | 386 (20.0) | 325 (18.0) | 51 (59.3) | | 270 (25.9) | 200 (22.2) | 65 (49.3) | | 656 (22.0) | |
| Mild | 222 (11.5) | 189 (10.5) | 26 (30.2) | | 171 (16.4) | 133 (14.8) | 35 (29.9) | | 393 (13.2) | |
| Moderate | 127 (6.6) | 103 (5.7) | 22 (25.6) | | 78 (7.5) | 55 (6.1) | 21 (17.9) | | 205 (6.9) | |
| Sever | 31 (1.6) | 29 (1.6) | 2 (2.3) | | 16 (1.5) | 8 (0.9) | 8 (0.6) | | 47 (1.6) | |
| Very sever | 6 (0.3) | 4 (0.2) | 1 (1.2) | | 5 (0.5) | 4 (0.4) | 1 (0.9) | | 11 (0.3) | |

* n (%). Based on chi-square test
HTN: Hypertension; BP: Blood pressure

## Results

The study consisted of 2974 participants (age ranged 16-90). The prevalence of HTN in the study population was 22% (25.9% in males and 20% in females). The overall average age of participants was 43.52 ± 14.69 years old; men had a significantly higher age in comparison with female [46.10 ± 15.75 and 42.12 ± 13.89 (P < 0.001), respectively].

Table 1 shows the BP distribution of males and females. The total distribution was statistically different in both genders (P < 0.001). Moreover, based on the American Heart Association writing committee,[15] elderly was defined as those ≥ 65 years of age and accordingly we compared the distribution of different BP categories in our elderly and non-elderly subjects in table 1, which showed that a significantly greater number of subjects in each gender was known to be < 65-year-old.

According to the new category that consisted of three major groups (optimal, normal and hypertensive), we compared the underlying factors in these groups. As demonstrated in table 2, the following factors were statistically different between the groups: Educational level (P < 0.001), job (P < 0.001), marital status (P < 0.001), drug abuse (P = 0.040), sedentary behavior (P = 0.010), and BMI (P < 0.001).

Table 3 shows the comparison of the mean lipid profile, FBS, serum Cr, urine Cr, and Hb in the three groups according to gender. As can be seen from the table, FBS, cholesterol, triglyceride (TG), low-density lipoprotein (LDL), and serum Cr were higher in the hypertensive group of women. FBS, cholesterol, TG, LDL and, surprisingly, high-density lipoprotein were higher in the hypertensive group of men.

In the binary logistic regression (enter model) of the predictors of HTN in this population, age, gender and obesity were meaningful predictors (Table 4).

The sensitivity of the model was 53%, and its specificity was 81%.

## Discussion

The prevalence of HTN in this population was 22% (25.9% in males and 20% in females). Interestingly, smoking and drug abuse were more prevalent in men (14.9% and 3.8%, respectively), but the sedentary behavior was more prevalent in women (51%). A total of 71.4% of women and 60.7% of men had optimal BP.

The urban HEART-2 study, which was conducted in 2011 in Tehran, Iran, reported a prevalence of self-reported HTN of 5.27% in the population (3.83% in men and 6.64% in women) (P < 0.001).[16] To some extent, the difference in the prevalence of HTN in that study compared to that of this study may be explained by the different years of the two studies that certainly affect the prevalence rate.

Furthermore, the findings of the Urban HEART-2 were based on self-report data, which are subject to reporting bias. Increased awareness by the public of their HTN status may also increase the likelihood of reporting.

The higher prevalence of HTN found in this study (25.9% in men and 20%% in women) is similar to that reported in most previous studies[8,17-19] although some discordance with previous reports was observed.[12,20-23] The discordance may be due to the self-report questionnaire design of the study and the fact that women are generally more likely than men to say they are unwell.

**Table 2.** Comparison of underlying factors in the three groups [optimal blood pressure (BP), normal BP and Hypertension (HTN)]

| Variables | Optimal (n = 2011) | Normal BP (n = 307) | HTN (n = 656) | P |
|---|---|---|---|---|
| Educational level | | | | |
| Illiterate | 172 (45.1) | 49 (13.0) | 160 (41.9) | < 0.001 |
| Elementary | 562 (59.7) | 106 (11.3) | 273 (29.0) | |
| Not completed high school | 400 (75.3) | 53 (10.0) | 78 (14.7) | |
| High school diploma | 568 (78.9) | 67 (9.4) | 85 (11.7) | |
| College diploma | 119 (76.0) | 12 (8.0) | 25 (16.0) | |
| License and higher degree | 190 (77.7) | 18 (7.4) | 37 (14.9) | |
| Job | | | | |
| Jobless | 100 (57.3) | 19 (10.8) | 56 (31.9) | < 0.001 |
| Employee | 177 (58.8) | 41 (13.5) | 83 (27.7) | |
| worker | 92 (64.4) | 20 (14.1) | 31 (21.5) | |
| Free lancer | 375 (66.5) | 69 (12.3) | 120 (21.2) | |
| Student | 121 (91.4) | 5 (3.9) | 6 (4.7) | |
| Housewife | 1151 (69.4) | 154 (9.3) | 354 (21.3) | |
| Marital status | | | | |
| Single | 249 (86.9) | 17 (5.8) | 21 (7.3) | < 0.001 |
| Married | 1686 (66.9) | 267 (10.6) | 567 (22.5) | |
| Widow | 71 (46.9) | 22 (14.3) | 58 (38.8) | |
| Divorced | 9 (58.8) | 2 (11.8) | 5 (29.4) | |
| Tobacco use | | | | |
| Yes | 158 (63.1) | 27 (10.8) | 66 (26.1) | 0.240 |
| No | 1852 (68.0) | 280 (10.3) | 591 (21.7) | |
| Drug abuse | | | | |
| Yes | 33 (60.4) | 2 (4.2) | 19 (35.4) | 0.040 |
| No | 1974 (67.6) | 307 (10.5) | 639 (21.9) | |
| Sedentary behavior | | | | |
| Yes | 909 (66.8) | 121 (8.9) | 331 (24.3) | 0.010 |
| No | 1097 (68.0) | 184 (11.4) | 332 (20.6) | |
| BMI | | | | |
| Low | 93 (91.7) | 1 (1.0) | 7 (7.3) | < 0.001 |
| Normal | 792 (76.8) | 88 (8.5) | 152 (14.7) | |
| Over weight | 768 (64.9) | 136 (11.5) | 279 (23.6) | |
| Obesity | 295 (58.7) | 58 (11.5) | 150 (29.8) | |
| Very obesity | 72 (46.6) | 20 (12.8) | 63 (40.6) | |
| Diabetes | | | | |
| Yes | 111 (44.9) | 38 (15.6) | 98 (39.5) | < 0.001 |
| No | 1869 (68.6) | 294 (10.8) | 561 (20.6) | |

Based on chi-square test. BMI: Body mass index; BP: Blood pressure; HTN: Hypertension

In accordance with other reports, this study showed a significant association between obesity and BP. In a previous study of 3423 adults aged 30-65 years in China, 1929 adults in the Philippines and 7957 adults in the U.S., a high BMI was correlated with increasing rates of HTN.[24] A study in Denmark of 13,577 adolescents aged 15-20 years demonstrated an association between fitness and BMIs with HTN.[25] Another study reported that obesity and being overweight could increase BP via physiological changes, including increased insulin resistance, elevated activity of the renin-angiotensin system in the kidney and increased pressure on peripheral vessels.[26] The results of this study, which showed that BP increased with age, are similar to those of other reports.[11,27] In a survey in the U.K., after adjustment for age, BMI, alcohol and social class, a significantly higher SBP was found in older men and in heavy and moderate smokers than in never smokers, whereas no such differences were seen in DBP.[28]

In the binary logistic regression after adjustment for other variables, smoking was not a meaningful predictor of HTN.

Furthermore, in this study, after adjustment for other variables, sedentary behavior was not a meaningful predictor of HTN. In a dynamic cohort study (SUN Study)[29] of 11,837 Spanish university graduates, with a mean age of 36 years, self-reported total sedentary behavior (i.e., interactive and noninteractive) was directly associated with a higher risk of HTN (hazard ratio: 1.48; 95% confidence interval: 1.01-2.18.[29] In a subtype analyses, the same study reported that interactive sedentary behavior (driving and computer use) but not noninteractive sedentary behavior (television viewing and sleeping) was associated with a higher risk of HTN.[29]

**Table 3.** Comparison of the lipid profile, fasting blood sugar (FBS), serum creatinine (Cr), urine Cr and hemoglobin (Hb) according to blood pressure (BP) and gender

| BP | Female (n = 1930) | | | | Male (n = 1044) | | | |
|---|---|---|---|---|---|---|---|---|
| | Optimal (n = 1378) | Normal (n = 166) | HTN (n = 386) | P | Optimal (n = 634) | Normal (n = 140) | HTN (n = 270) | P |
| FBS | 89.88 ± 23.87 | 99.50 ±33.40 | 104.03 ± 36.94 | < 0.001 | 97.97 ± 31.56 | 106.71 ± 45.54 | 107.42 ± 43.51 | 0.002 |
| Cholesterol | 175.63 ± 38.24 | 187.27 ± 39.46 | 193.52 ± 40.10 | < 0.001 | 176.53 ± 35.97 | 184.79 ± 40.57 | 190.41 ± 41.61 | < 0.001 |
| TG | 123.69 ± 100.51 | 142.14 ± 79.71 | 160.34 ± 74.92 | < 0.001 | 148.06 ± 85.10 | 171.05 ± 100.01 | 173.56 ± 92.76 | 0.002 |
| LDL | 107.43 ± 26.65 | 113.11 ± 26.48 | 114.78 ± 29.88 | < 0.001 | 104.79 ± 26.91 | 108.00 ± 26.53 | 110.22 ± 33.79 | 0.040 |
| HDL | 43.53 ± 10.47 | 47.04 ± 11.64 | 46.65 ± 12.25 | < 0.001 | 42.38 ± 9.99 | 44.66 ± 10.13 | 45.40 ± 13.01 | 0.001 |
| Serum Cr | 1.03 ± 0.21 | 1.07 ± 0.20 | 1.10 ± 137.00 | < 0.001 | 1.21 ± 0.22 | 1.27 ± 0.31 | 1.25 ± 0.28 | 0.400 |
| Urine Cr | 131.91 ± 71.10 | 114.81 ± 73.58 | 108.36 ± 56.07 | < 0.001 | 150.19 ± 75.83 | 134.37 ± 81.39 | 129.85 ± 65.28 | 0.010 |
| Hb | 13.32 ± 1.55 | 13.57 ± 1.57 | 13.38 ± 1.59 | 0.310 | 15.19 ± 1.86 | 14.79 ± 1.89 | 14.93 ± 1.55 | 0.370 |

Based on Kruskal–Wallis test; Hb: Hemoglobin; Cr: Creatinine; HDL: High-density lipoprotein; LDL: Low-density lipoprotein; BP: Blood pressure; HTN: Hypertension; FBS: Fasting blood sugar; TG: Triglyceride

**Table 4.** Binary logistic regression (enter model) of the predictors of hypertension (HTN) in this population

| Variables | B | SE | Wald | df | Significant | OR | 95% CI for OR | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lower | Upper |
| Gender (Ref: F) | 0.329 | 0.142 | 5.377 | 1 | 0.020 | 1.390 | 1.052 | 1.836 |
| Educational level (Ref:Illitrate) | | | 8.686 | 5 | 0.122 | | | |
| Elementary | −0.283 | 0.177 | 2.548 | 1 | 0.110 | 0.753 | 0.532 | 1.067 |
| Not completed high school | −0.614 | 0.232 | 7.038 | 1 | 0.008 | 0.541 | 0.344 | 0.852 |
| High school diploma | −0.566 | 0.234 | 5.828 | 1 | 0.016 | 0.568 | 0.359 | 0.899 |
| College diploma | −0.392 | 0.353 | 1.232 | 1 | 0.267 | 0.676 | 0.338 | 1.350 |
| License and higher degree | −0.459 | 0.334 | 1.882 | 1 | 0.170 | 0.632 | 0.328 | 1.217 |
| Marital status (Ref:Single) | | | 4.754 | 3 | 0.191 | | | |
| Married | −0.432 | 0.369 | 1.368 | 1 | 0.242 | 0.649 | 0.315 | 1.339 |
| Widow | −0.822 | 0.455 | 3.261 | 1 | 0.071 | 0.439 | 0.180 | 1.073 |
| Divorced | −1.818 | 1.307 | 1.933 | 1 | 0.164 | 0.162 | 0.013 | 2.105 |
| Ethnicity (Ref: Fars) | | | 5.599 | 6 | 0.470 | | | |
| TURK | 0.054 | 0.265 | 0.041 | 1 | 0.840 | 1.055 | 0.628 | 1.773 |
| Kurd | −0.793 | 0.484 | 2.682 | 1 | 0.101 | 0.452 | 0.175 | 1.169 |
| Baloch | −18.878 | 40192.970 | < 0.001 | 1 | 1.000 | < 0.001 | < 0.001 | < 0.001 |
| Lurs | 2.630 | 1.781 | 2.181 | 1 | 0.140 | 13.868 | 0.423 | 454.593 |
| Turkmens | −18.588 | 40192.970 | 0.000 | 1 | 1.000 | < 0.001 | < 0.001 | < 0.001 |
| Afghani | 0.243 | 0.311 | 0.609 | 1 | 0.435 | 1.275 | 0.693 | 2.348 |
| Family income | 0.000 | 0.000 | 0.028 | 1 | 0.866 | 1.000 | 1.000 | 1.000 |
| Smoking (Ref:No) | 0.071 | 0.215 | 0.109 | 1 | 0.741 | 1.074 | 0.705 | 1.635 |
| Drug abuse (Ref:No) | 0.630 | 0.401 | 2.470 | 1 | 0.116 | 1.877 | 0.856 | 4.116 |
| Sedantary behavior (Ref: No) | −0.197 | 0.128 | 2.383 | 1 | 0.123 | 0.821 | 0.640 | 1.055 |
| Obesity | 0.090 | 0.014 | 44.242 | 1 | < 0.001 | 1.095 | 1.066 | 1.124 |
| Age | 0.069 | 0.006 | 137.917 | 1 | < 0.001 | 1.071 | 1.059 | 1.084 |
| Constant | −6.278 | 0.566 | 122.851 | 1 | < 0.001 | 0.002 | | |

For doing binary logistic regression, we defined two groups; hypertensive (HTN mild, moderate, severe and very severe) and normal (optimal, normal, high normal). Hosmer and Leme show test: chi-square: 11.905, P = 0.15. HTN: Hypertension; Df: Degrees of freedom; 95% Cl: Confidence interval; SE: Standard error; OR: Odds ratio

The difference in the results of that study compared to the current one may be due to the different populations and dissimilar lifestyles in Iranian and Spanish culture and the differences in the age range of the participants in the studies.

Previous research indicated that the prevalence of HTN was strongly highly associated with social class, as measured by education, occupation or income.[30] However, in this study, neither educational level nor family income was a meaningful predictor of HTN. In common with the findings of the current study, a study conducted in China also found no association between education and BP.[31] In another study in Iran, it was found significant relationships between HTN and education.[32]

The results in this study should be interpreted with caution, as the study contains a number of limitations. First, the design of the study was cross-sectional, which could result in reverse causality. Second, the sample population consisted of urban citizens. Third, we did not assess health care access. Further studies should consider the roles of diet and health care access as risk factors for high BP and HTN.

## Conclusion

We hope that this study facilitates a better understanding of the relationship between anthropometric indicators and demographic factors and HTN. Continued and accelerating urbanization are likely to increase the prevalence of HTN.[33] Urgent preventive interventions on a national scale are needed to target HTN, which is highly prevalent. Given the close relationship between obesity and various diseases, including HTN, practical solutions, including lifestyle interventions, need to be developed.

## Acknowledgments

This study was supported by vice chancellor of Mashhad University of Medical Sciences. We would like to express our great thanks to deputy of health of Mashhad University of Medical Sciences and general physicians for their help and support.

## Conflict of Interests

Authors have no conflict of interests.

## References

1. Mohan S, Campbell N, Chockalingam A. Time to effectively address hypertension in India. Indian J Med Res 2013; 137(4): 627-31.
2. James PA, Oparil S, Carter BL, Cushman WC, Dennison-Himmelfarb C, Handler J, et al. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). JAMA 2014; 311(5): 507-20.
3. Lewington S, Clarke R, Qizilbash N, Peto R, Collins R. Age-specific relevance of usual blood pressure to vascular mortality: a meta-analysis of individual data for one million adults in 61 prospective studies. Lancet 2002; 360(9349): 1903-13.
4. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. JAMA 2003; 289(19): 2560-72.
5. Kearney PM, Whelton M, Reynolds K, Whelton PK, He J. Worldwide prevalence of hypertension: a systematic review. J Hypertens 2004; 22(1): 11-9.
6. Haghdoost AA, Sadeghirad B, Rezazadehkermani M. Epidemiology and heterogeneity of hypertension in Iran: a systematic review. Arch Iran Med 2008; 11(4): 444-52.
7. Veghari G, Sedaghat M, Maghsodlo S, Banihashem S, Moharloei P, Angizeh A, et al. Impact of Literacy on the Prevalence, Awareness, Treatment andControl of Hypertension in Iran. J Cardiovasc Thorac Res 2012; 4(2): 37-40.
8. Sahraki R, Mirshekari M, Sahraki H, Mohammadi AR, Sahraki M, Khazaei Feizabad E. Hypertension Among 30+ Year-Old People in Zahedan (Southeast of Iran). Shiraz E Med J 2011; 12(3): 129-34.
9. Namayandeh S, Sadr S, Rafiei M, Modares-Mosadegh M, Rajaefard M. Hypertension in Iranian urban population, epidemiology, awareness, treatment and control. Iran J Public Health 2011; 40(3): 63-70.
10. Azizi F, Esmaillzadeh A, Mirmiran P. Obesity and cardiovascular disease risk factors in Tehran adults: a population-based study. East Mediterr Health J 2004; 10(6): 887-97.
11. Peymani P, Heydari ST, Ahmadi SM, Lankarani KB. The prevalence of high blood pressure and its relationship with anthropometric indicators; a population based study in Fars Province, IR Iran. J Cardiovasc Thorac Res 2012; 6(2): 40-5.
12. Esteghamati A, Meysamie A, Khalilzadeh O, Rashidi A, Haghazali M, Asgari F, et al. Third national Surveillance of Risk Factors of Non-Communicable Diseases (SuRFNCD-2007) in Iran: methods and results on prevalence of diabetes, hypertension, obesity, central obesity, and dyslipidemia. BMC Public Health 2009; 9: 167.
13. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care

2008; 31(Suppl): S55-S60.
**14.** Taylor RB. Family medicine: principles and practice. 5th ed. Berline, Germany: Springer Science & Business Media; 2013.
**15.** Aronow WS, Fleg JL, Pepine CJ, Artinian NT, Bakris G, Brown AS, et al. ACCF/AHA 2011 expert consensus document on hypertension in the elderly: a report of the American College of Cardiology Foundation Task Force on Clinical Expert Consensus documents developed in collaboration with the American Academy of Neurology, American Geriatrics Society, American Society for Preventive Cardiology, American Society of Hypertension, American Society of Nephrology, Association of Black Cardiologists, and European Society of Hypertension. J Am Coll Cardiol 2011; 57(20): 2037-114.
**16.** Cheraghian B, Asadi-Lari M, Mansournia MA, Majdzadeh R, Mohammad K, Nedjat S, et al. Prevalence and associated factors of self-reported hypertension among Tehran adults in 2011: a population-based study (Urban HEART-2). Med J Islam Repub Iran 2014; 28: 105.
**17.** Sarry El-Din A, Erfan M, Kandeel W, Kamal S, El Banna R, Fouad W. Prevalence of pre-hypertension and hypertension in a sample of egyptian adults and its relation to obesity. Aust J Basic Appl Sci 2012; 6(13): 481-9.
**18.** Shapo L, Pomerleau J, McKee M. Epidemiology of hypertension and associated cardiovascular risk factors in a country in transition: a population based survey in Tirana City, Albania. J Epidemiol Community Health 2003; 57(9): 734-9.
**19.** Manandhar K, Koju R, Sinha NP, Humagain S. Prevalence and associated risk factors of hypertension among people aged 50 years and more in Banepa Municipality, Nepal. Kathmandu Univ Med J (KUMJ) 2012; 10(39): 35-8.
**20.** Azizi F, Ghanbarian A, Madjid M, Rahmani M. Distribution of blood pressure and prevalence of hypertension in Tehran adult population: Tehran Lipid and Glucose Study (TLGS), 1999-2000. J Hum Hypertens 2002; 16(5): 305-12.
**21.** Gupta R. Trends in hypertension epidemiology in India. J Hum Hypertens 2004; 18(2): 73-8.
**22.** Hatmi ZN, Tahvildari S, Gafarzadeh MA, Sabouri KA. Prevalence of coronary artery disease risk factors in Iran: a population based survey. BMC Cardiovasc Disord 2007; 7: 32.
**23.** Dogan N, Toprak D, Demir S. Hypertension prevalence and risk factors among adult population in Afyonkarahisar region: a cross-sectional research. Anadolu Kardiyol Derg 2012; 12(1): 47-52.
**24.** Colin BA, Adair LS, Popkin BM. Ethnic differences in the association between body mass index and hypertension. Am J Epidemiol 2002; 155(4): 346-53.
**25.** Nielsen GA, Andersen LB. The association between high blood pressure, physical fitness, and body mass index in adolescents. Prev Med 2003; 36(2): 229-34.
**26.** Guagnano MT, Ballone E, Pace-Palitti V, Vecchia RD, D'Orazio N, Manigrasso MR, et al. Risk factors for hypertension in obese women. The role of weight cycling. Eur J Clin Nutr 2000; 54(4): 356-60.
**27.** Amirkhizi F, Siassi F, Minaie S, Jalali M, Dorosty Motlagh A R, Chamari M. Assessment of blood pressure status and its relationship with anthropometric indices among women in rural areas of Kerman province, Iran. Yafteh 2009; 10(2): 31-8.
**28.** Primatesta P, Falaschetti E, Gupta S, Marmot MG, Poulter NR. Association between smoking and blood pressure: evidence from the health survey for England. Hypertension 2001; 37(2): 187-93.
**29.** Beunza JJ, Martinez-Gonzalez MA, Ebrahim S, Bes-Rastrollo M, Nunez J, Martinez JA, et al. Sedentary behaviors and the risk of incident hypertension: the SUN Cohort. Am J Hypertens 2007; 20(11): 1156-62.
**30.** Ordunez P, Munoz JL, Espinosa-Brito A, Silva LC, Cooper RS. Ethnicity, education, and blood pressure in Cuba. Am J Epidemiol 2005; 162(1): 49-56.
**31.** Xu X, Niu T, Christiani DC, Weiss ST, Zhou Y, Chen C, et al. Environmental and occupational determinants of blood pressure in rural communities in China. Ann Epidemiol 1997; 7(2): 95-106.
**32.** Gharipour M, Khosravi A, Sadeghi M, Roohafza H, Hashemi M, Sarrafzadegan N. Socioeconomic characteristics and controlled hypertension: Evidence from Isfahan Healthy Heart Program. ARYA Atheroscler 2013; 9(1): 77-81.
**33.** Dadgarmoghaddam M, Khajedaluee M, Khadem Rezaiyan M, Khodaee G. Risk factors for non-communicable disease: a population based study in Mashhad (Iran). Br J Med Med Res 2015; 7(6): 503-11.

**How to cite this article:** Khajedaluee M, Hassannia T, Rezaee A, Ziadi M, Dadgarmoghaddam M. **The prevalence of hypertension and its relationship with demographic factors, biochemical, and anthropometric indicators: A population-based study.** ARYA Atheroscler 2016; 12(6): 259-65.