

## Prehypertension; patient awareness and associated cardiovascular risk factors in an urban population in Iran

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### Abstract

**Background:** This study was to estimate the frequency of prehypertension and to characterize patient awareness and associated cardiovascular risk factors in an urban population in Iran.

**Methods:** During a hypertensive awareness program, a cross-sectional study was conducted on 2036 people. All participants completed a questionnaire about their demographic and anthropometric indices and were asked about symptoms, risk factors and preventive measures of hypertension. Data were compared between prehypertensive and non-hypertensive groups.

**Results:** Prehypertension was detected in 30% (n=611) of the subjects. Previous CHD, diabetes, and hyperlipidemia were more prevalent in low prehypertension group compared to high normal blood pressure. The male sex, increasing age and body weight were positively associated with the rate of prehypertension. Only 8% of participants with prehypertension were aware about the symptoms of hypertension, 12% correctly mentioned at least three risk factors of hypertension, and 48% explained appropriate preventive measures.

**Conclusion:** Prehypertension was prevalent in this population. Age, body weight, male sex, and previous CHD were the major determinants. Furthermore, hypertension awareness was alarmingly poor. Therefore, hypertension prevention programs focused on increasing public awareness are essential.

**Keywords:** Blood Pressure, Prehypertension, Awareness, Cardiovascular risks.

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### Introduction

Hypertension is one of the most important health problems worldwide (1). The Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7) defined prehypertension as systolic blood pressure of 120-139 mmHg or a diastolic blood pressure of 80-89 mmHg (2). People with prehypertension has been shown to increase the risk for development of hypertension (3). The lon-

gitudinal Framingham Heart study, showed that prehypertension preceded the diagnosis of hypertension in 90% of subjects aged  $\geq 55$  years (4). Furthermore, the risk for cardiovascular disease reported to be increased in this population (5).

The prevalence of prehypertension varies in different populations, and seems to be affected by age, sex, body weight, and clustering of other cardiovascular risk factors (6-10). Lack of awareness regarding the

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risk factors for developing hypertension and inadequate knowledge about appropriate preventive measures could lead to delay in diagnosis and inadequate control of blood pressure (11).

The aim of this study was to investigate the frequency of prehypertension among urban adults in Tehran, and to examine the associated cardiovascular risk factors as well as patient awareness in relation to the symptoms, risk factors, and preventive measures.

### Methods

This cross sectional study was performed on all adults ( $n=2036$ ) who participated in the hypertensive awareness program in Tehran in 2013. Blood pressure was measured after at least 5 minutes of rest in sitting position from right arm. A repeated measurement was done 5 minutes later, if the subject had a systolic blood pressure  $>120$  mmHg or a diastolic blood pressure  $>80$  mmHg.

The JNC7 report was used for classification of the blood pressure. Normal blood pressure was defined as a systolic blood pressure of  $<120$  mmHg and a diastolic blood pressure of  $<80$  mmHg. Prehypertension was defined as a systolic blood pressure of 120-139 mmHg or a diastolic blood pressure of 80-89 mmHg. Subjects were labeled to be hypertensive if they were taking antihypertensive medication or had a systolic blood pressure of  $\geq 140$  mmHg or a diastolic blood pressure of  $\geq 90$  mmHg. Furthermore, we evaluated the association of two components of prehypertension, i.e. low prehypertension (systolic blood pressure 120-129 mmHg and diastolic blood pressure 80-84 mmHg) and high normal blood pressure (systolic blood pressure 130-139 mmHg and diastolic blood pressure 85-89 mmHg), with cardiovascular risk factors.

The participants were asked to answer a questionnaire which included demographic variables, as well as questions about the symptoms, risk factors, and preventive mechanisms attributed to high blood pres-

sure. They were also asked to write down the most common symptoms of hypertension as well as the five most important risk factors of high blood pressure, and to mention preventive mechanisms for control of hypertension.

Body weight was measured to the nearest 100 grams, with light clothes and without shoes. Height was measured to the nearest 0.5 cm without shoes using a stadiometer (Seca 700, Germany). Body mass index (BMI) was calculated by dividing weight (kg) by height (squared meter).

Cigarette smoking status was asked and current smoking was considered as a risk factor.

Previous cardiovascular disease, diabetes, and hyperlipidemia, were recorded by the participants, if a doctor ever told them they have had such a problem or they were taking anti-hypertensive, oral glucose lowering drugs, or anti-hyperlipidemic medications.

The data were analyzed anonymously. Descriptive statistics (mean and SD and frequency) were used to describe key clinical and demographic characteristics. The data were compared between two groups via the Chi-square test. A  $p < 0.05$  was considered statistically significant. IBM SPSS for Windows Version 19 (IBM Corp., Armonk, NY, USA) was applied for the statistical analysis.

### Results

The data of 2036 people was used for the final analysis. Table 1 displays baseline characteristics of the participants. Prehypertension was determined in 30% ( $n=611$ ) of the subjects and it was most prevalent in the age group of 25-50.

Considering cardiovascular risk factors, previous CHD was significantly more prevalent in the prehypertensive group ( $p=0.01$ ). However, no statistically significant difference was observed in relation to previous diabetes, hyperlipidemia, family history of hypertension, and cigarette smoking.

We analyzed the association of the two

Table 1. Baseline Characteristics of the study population, Iran, 2013

	Total	Normal BP <sup>a</sup>	Prehypertension	Hypertension
	N=2036	N=696	N=608	N=726
Gender (Female %)	42%	61%	26%	35%
Age (years) Mean ± SD	53.4±12.86	48.3±11.74	51.7±12.32	59.7±11.96
25-50 (%)	56.2%	50.4%	61%	23.4%
51-64 (%)	31.1%	34%	28.7%	41.3%
>65 (%)	12.7%	15.6%	10.3%	35.2%
BMI <sup>c</sup> (Kg/m <sup>2</sup> )	27.5±4.11	26.9±4.18	27.6±3.72	27.9±4.31
Education				
Illiterate	1%	1%	1%	2%
Educated	66%	63%	64%	70%
Academic education	33%	36%	35%	28%

<sup>a</sup>BP: Blood Pressure<sup>c</sup>BMI: Body Mass Index

Table 2. Clustering of cardiovascular risk factors by blood pressure groups, Iran, 2013

Number of risk factors	Normal BP	Prehypertension	Total	p
	N=510	N=483	N=1538	
0	45 (8.8)*	10 (2.1)	57 (3.7)	0.001
1	123 (24.1)	62 (12.7)	208 (13.5)	0.001
2	157 (30.8)	153 (31.7)	439 (28.5)	0.007
3	100 (19.6)	135 (28.0)	429 (27.9)	0.001
>4	85 (16.7)	123 (25.5)	405 (26.4)	0.001
Total	510 (100.0)	483 (100.0)	1538 (100.0)	----

\* N (%)

<sup>a</sup>BP: Blood Pressure

components of prehypertension with cardiovascular risk factors. Previous CHD was 6 times more prevalent in the high normal blood pressure group compared to the non-hypertensive group ( $p=0.003$ ). In addition, previous diabetes and hyperlipidemia were more prevalent in the former group ( $p=0.01$ , and  $p=0.02$  respectively). Moreover, logistic regression analysis revealed that male sex increase the odds of prehypertension by 5 times and every single unit increase in BMI was associated with 8% ( $p<0.001$ ) increase in the risk of prehypertension. When we considered age as a continuous variable, every one year increase of age increased the rate of prehypertension by 2%.

Table 2 compares the percentage of subjects with 0, 1, 2, 3, 4 or more cardiovascular risk factors between prehypertension subjects and those with normal blood pressure. Twenty eight percent of subjects in the prehypertension group had at least 3 additional cardiovascular risk factors compared to 19.6% ( $n=100$ ) of normal blood pressure group ( $p<0.001$ ). Moreover, the prehypertension group exhibited  $\geq 4$  additional risk factors in 25.5% ( $n=123$ ), compared to 16.7% ( $n=85$ ) of those in normal

blood pressure group ( $p<0.001$ ).

Considering hypertension awareness, only 8% of people in prehypertension group were able to mention at least 3 symptoms attributed to high blood pressure. In addition, 12% recorded at least 3 risk factors for development of hypertension. On the other hand, 48% respond correctly to the preventive measures for better control of high blood pressure. In relation to the level of formal education, higher education was not associated with better awareness of symptoms (14% vs. 10.5%,  $p=0.21$ ) and risk factors for hypertension (8% vs. 5.9%,  $p=0.34$ ). However, people with higher level of education were more aware about preventive measures (50.9% vs. 40.2%,  $p<0.001$ ).

## Discussion

We found that prehypertension is prevalent in this urban population in Iran, especially in the middle-age group. The study also revealed that age, body weight, and male gender are associated with increased risk of prehypertension. Furthermore, previous CHD, diabetes, and hyperlipidemia were considerably more prevalent among the participants in the upper half of the pre-

hypertension range. Moreover, hypertension awareness was poor in this population.

The National Health and Nutrition Examination Survey (NHANES) reported that the overall prevalence of prehypertension in disease free adults from 1999 to 2006 was 36.3% (12). Nearly similar rates have been reported from Japan (10), Korea (13), Jamaica (6), and Taiwan (8). In a previous study, the prevalence of prehypertension was reported to be 33.7% in an adult population in south of Iran (14), a finding that is similar to the rate of prehypertension detected in our study. In addition, we found that prehypertension is more prevalent among the middle-age group. This finding is in line with the data from Korea (13), Japan (10), China (7), and Iran (14).

Many studies demonstrated that the prehypertensive subjects had higher BMI and higher levels of total cholesterol, blood glucose, and triglycerides (9,15). BMI is a strong predictor of prehypertension (10). We also found that higher BMI is a major risk factor for prehypertension. Similar findings were also reported from Thailand, China, and Japan (7,10,16).

According NHANES 1999-2000, most people with prehypertension have at least one other cardiovascular risk factor (5). Our findings revealed clustering of cardiovascular risk factors in one-fourth to one-third of the subjects with prehypertension. This is a very important issue in determining risk of cardiovascular events (17). Lifestyle modification could have a favorable impact on these risk factors and prevent subsequent morbidity from cardiovascular events (18). The importance of the lifestyle modification on prevention of hypertension and subsequent CHD is highly considerable as the majority of people with prehypertension in this study were middle-aged men in their most productive working years. Lifestyle is an important determinant of physical health and healthier life-style is an effective tool for prevention and control of hypertension (11,18).

It was particularly unfortunate that a reasonable number of our respondents were

unaware of the symptoms and risk factors of hypertension, a finding that was not affected by the level of formal education. This suggests that specific knowledge about hypertension is needed and formal education alone may not suffice.

Considering preventive measures, although the level of awareness was better, it was still below the acceptable limits for the community in an urban setting. Prevention programs relying on diffusion of health messages through the mass media could be effective to transfer specific knowledge about healthy lifestyles. Moreover, development of relevant public policies, including appropriate facilities for public engagement in leisure physical activities promotes healthy lifestyle in population.

Our study had some limitations. We did not measure blood glucose and lipid profile of the participants. This could underestimate the frequency of diabetes and hyperlipidemia. In addition, special aspects of hypertension awareness were explored. Lack of data on habitual physical activity and dietary pattern are the other potential limitations.

In conclusion, the data suggest that prehypertension is prevalent in adult urban population in Iran. However, the awareness is alarming poor. Public health education focused on more specific health education programs, policy for annual blood pressure measurement in adults, and promoting healthier life style behavior are necessary in order to improve public health outcomes.

#### *Conflict of interest*

The authors have no conflicts of interest.

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