



Prevalence of Pre-hypertension and Risk Factors in an Iranian Population: East of Iran

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ABSTRACT

Background: Pre-hypertension is known as the precursor of hypertension. We could prevent or delay hypertension by controlling pre-hypertension.

Objectives: In this study, we investigated the prevalence of pre-hypertension and its risk factors in an Iranian population, East of Iran, in 2014.

Patients and Methods: This cross-sectional study was conducted on 1280 subjects living in Birjand, East of Iran in 2014. After explaining about the project, a questionnaire containing demographic characteristics and clinical backgrounds was filled out by all subjects. Participants were classified as pre-hypertension (PHTN) if systolic blood pressure was 120 - 139 mmHg or if diastolic blood pressure was 80 - 89 mmHg. Data were analyzed by chi-square test and multiple logistic regression using SPSS (version 22). $P < 0.05$ was considered as statistically significant.

Results: Among 1286 participants, 21.4% had pre-hypertension. Results showed that pre-hypertension, diabetes mellitus (DM) and smoking were more prevalent among men than women ($P < 0.001$), while prevalence of dyslipidemia was more observed in women ($P < 0.001$). In addition, the risk of pre-hypertension was more in men (OR = 2.9), overweight (OR = 3.7), and obese (OR = 5.6) subjects. Smoking cigarette showed a protective effect (OR = 0.4).

Conclusions: Pre-hypertension was more prevalent among men and obese subjects. Since pre-hypertension progresses to hypertension and increases the risk of cardiovascular disease, it needs more attention by public health policy makers to change people's lifestyle.

1. Background

Hypertension has been known as the risk factor of cardiovascular disease (CVD). In 2003, a new category termed pre-hypertension was defined for patients with systolic BP of 120 to 139 mm Hg or diastolic BP of 80 to 89 mm Hg by the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure designated (1).

Pre-hypertension is known as the precursor of hypertension. If pre-hypertension is controlled, it will prevent or delay hypertension (2). Recent studies have shown that hypertension is associated with the risk of DM and CVDs (3). A chance to prevent hypertension lets us to decrease the risk of diabetes mellitus (DM), stroke

and CVDs (4). Therefore, it is important to control and manage the public health by policy makers. To improve the strategies of controlling pre-hypertension, it is necessary to identify the risk factors associated with hypertension. In addition, some studies have shown that hypertension and pre-hypertension were associated with age and sex among Iranian population (2).

In Iran, there are few studies about the prevalence of pre-hypertension and predictive risk factors (5, 6). All studies have included the people from other provinces, but no study has evaluated this prevalence and the association of cardio-metabolic risk factors with pre-hypertension in the east of Iran. Ebrahimi et al. have shown that the prevalence of pre-hypertension was 12% among 9762 participants in Mashhad, Iran (7). Rohani et al. indicated that the prevalence of pre-hypertension was 25.8% in children with type 1 DM (8). In this regard, Guo et al. have indicated that the overall pooled prevalence of pre-hypertension was 38% worldwide (9).

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Also, Kim et al. indicated that overall prevalence was 36.8% and higher in men than women in Korea (10).

2. Objectives

The necessity of this study is that the prevalence of hypertension, CVD risk factors and DM has been shown to be high; we investigated the prevalence of pre-hypertension and risk factors in an Iranian population in Birjand, the south of Khorasan in 2014.

3. Patients and Methods

This cross-sectional study was conducted on 1280 subjects aged 15 - 70 years in Birjand in urban area in 2013 - 2014. The population of Birjand is 259,506 including 132,247 men, 127,259 women, and 71,384 families. We used multistage cluster sampling, holding 250 cluster heads and 20 samples from each cluster. Details are presented in our previous study (11). The inclusion criteria were age above 15 yr, the ability to respond to the interviewer, willingness to take part in the study, and having national identification documents. The exclusion criterion was non-Iranian nationality. After explaining about the project, a questionnaire containing demographic, characteristics and clinical backgrounds was completed by all subjects. The clinical examination included height, weight, waist circumference and blood pressure, all taken by standard methods. Blood Pressure (BP) was measured with mercury sphygmomanometer (ALPK2, Germany) from the right arm in sitting position. The average of at least two measurements was recorded.

Lipid profile and fasting blood glucose were measured by the standard enzymatic method (Pars Azmon Kit,

Iran) after 12 hours of fasting. According to WHO criteria diabetes, mellitus (DM) was defined as FBS 126 mg/dL (12). Dyslipidemia (DLP) was defined as having at least one criteria such as high cholesterol (> 240) or high triglyceride (> 200) or high LDL (> 130) or Low HDL (< 40 for men and < 50 for women (13). Based on the values of BMI, participants were classified as underweight (BMI < 18.5 kg/m²), normal (BMI 18.5 - 24.9kg/m²), overweight (BMI 25 - 29.9 kg/m²), and obese (BMI ≥ 30 kg/m²) (14). As defined in 2003, participants were classified as pre-hypertension (PHTN) if SBP = 120 - 139 mmHg or DBP = 80 - 89 mmHg (1).

The data were analyzed using SPSS software for Windows, version 22.0 (SPSS, Chicago, IL, USA); in all analyses, statistical significance was considered 0.05 (2-tailed). Descriptive analysis was used to determine the frequencies and percentage of the patients' clinical and characteristics variables. Moreover, multiple logistic regression was used to determine the important factors that had an impact on pre-hypertension. P < 0.05 was considered significant.

4. Results

Among 1280 participants, 627 subjects were men (48.8%), and based on BMI 231 subjects (%18.9) were obese. The prevalence of pre-hypertension was 21.4% (Table 1). Mean age was 43.5 ± 0.3 (43.7 ± 0.5 in men and 43.2 ± 0.5 in women), means of BMI, HDL, TG, TC, LDL and FBS were 28.9 ± 2.1, 39.1 ± 0.2, 157.1 ± 2.5, 188.6 ± 1.0, 121.3 ± 0.9 and 97.4 ± 0.7, respectively. Results showed that the prevalence of pre-hypertension (P < 0.001), DM and smoking (P < 0.001) was more in men than women. However, the prevalence of DLP was more in women (P < 0.001).

Table 1. Demographic Features of the Subjects

Variables	Groups	Male, N (%)	Female, N (%)	Total, N (%)	P value, (χ ²)
BMI	Underweight	36(5.7%)	48(7.3%)	84(6.9%)	< 0.001* (86.5)
	Normal	249 (39.7%)	204 (31.0%)	450 (37.0%)	
	Overweight	228 (36.4%)	225 (34.1%)	450 (37%)	
	Obese	88 (14.0%)	143 (21.7%)	231 (19%)	
DM	Yes	37 (5.9%)	37 (5.6%)	74 (5.8%)	0.814 (0.05)
Smoking	Yes	64 (10.2%)	6 (0.9%)	70 (5.4%)	< 0.001* (54.9)
DLP	Yes	532 (85.0%)	610 (92.7%)	1142 (88.9%)	< 0.001* (19.4)
Pre-hypertension	Yes	180 (28.8%)	95 (14.5%)	275 (21.4%)	< 0.001* (38.5)

Abbreviations: BMI, Body Mass Index; DM, Diabetes Mellitus; DLP, Dyslipidemia

* Significantly normal at 0.05

Table 2. Multiple Logistic Regression Results for Pre-hypertension

Variables	Groups	OR	95% CI for OR	Wald Statistics	P
Sex	Female	1.00	-	-	-
	Male	2.9	2.2-4.0	49.55	< 0.001*
BMI	Underweight	1.00	-	-	-
	Normal	2.3	0.9 - 5.6	3.71	0.054
	Overweight	3.7	1.5 - 8.9	8.88	0.003*
	Obese	5.6	2.2 - 13.6	14.31	< 0.001*
DM	No	1.00	-	-	-
	Yes	1.2	0.7 - 2.2	0.68	0.408
Smoking	No	1.00	-	-	-
	Yes	0.4	0.2 - 0.9	4.82	0.028*
DLP	No	1.00	-	-	-
	Yes	1.4	0.8-2.3	2.08	0.149

Abbreviations: BMI, Body Mass Index; DM, Diabetes Mellitus; DLP, Dyslipidemia

* Significantly normal at 0.05

As shown in Table 2, multiple logistic regression results showed that the risk of pre-hypertension for men was 2.9 times more in comparison with women (95% CI: 2.2 - 4.0, $P < 0.001$). Also, the risk of pre-hypertension for overweight and obese subjects was 3.7 (95% CI: 1.5 - 8.9, $P = 0.003$) and 5.6 (95% CI: 2.2 - 13.6, $P < 0.001$) times more in comparison with underweight subjects. Smoking cigarette showed a protective effect in males for pre-hypertension (OR = 0.4, 95% CI: 0.2 - 0.9, $P = 0.033$).

5. Discussion

The overall aim of this study was to evaluate the prevalence of pre-hypertension and its risk factors in Iranian population. Prevalence of pre-hypertension was 21.4% in our study. Ebrahimi et al. (7) showed that the prevalence of pre-hypertension among participants in Mashhad (12%) was lower than Birjand. However, Koreans pre-hypertension (36.8%) and the overall pooled worldwide prevalence (38%) of pre-hypertension were higher (15). Also, the prevalence of pre-hypertension was 57.7% in India, and 59.8% among Chinese people (13). Khosravi et al. showed that the prevalence of pre-hypertension was 37.2% in men and 30.9% in women in an Iranian urban population, which was higher than the results of our study (6). Since pre-hypertension progresses to hypertension and increases the risk of cardiovascular disease (13), it needs more attention by public health policy makers.

Results showed that pre-hypertension, DM and smoking were more prevalent in men than women. Other similar studies support our results (3, 16). Guo et al. showed that the prevalence of pre-hypertension was high worldwide, especially in men (9). Parthaje et al. showed that pre-hypertension was more prevalent in men than women in India (17).

Risk of pre-hypertension was more in overweight and obese subjects. Chiang et al. (18) indicated that the risk of pre-hypertension was high for overweight and obese subjects among the Chinese (OR = 1.86) and Indians (OR = 1.68). Kim et al. revealed that BMI was associated with pre-hypertension (10). Meng et al. indicated that the risk of pre-hypertension was more for men and overweight/obese subjects in the northeast of China (19). Some studies in Iran revealed that being a men, having high BMI, and having DM were associated with pre-hypertension (6).

Smoking cigarette showed a protective effect in males (OR = 0.4) for pre-hypertension. In this regard, in a Korean study conducted by Kim et al. (10) smoking cigarette had a protective effect (OR = 0.55) on pre-hypertension (19). Also, Meng et al. indicated that smoking cigarette had protective effects on pre-hypertension. These unexpected results in our study need more attention in future studies and may happen because of low samples of smokers in comparison with non-smokers (70 vs. 1207) and differences in gender.

5.1. Conclusion

Results showed that the prevalence of pre-hypertension was observed 21.4% in Birjand population, the east of Iran. Also, pre-hypertension was more prevalent in men and obese subjects. Since pre-hypertension progresses to hypertension and increases the risk of cardiovascular

disease, it needs more attention by public health policy makers to change the people's lifestyle.

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Authors' Contribution

Toba Kazemi and Elahe Yari contributed in the conception of design of the work, revising the draft. Tahmine Tavakoli contributed in the drafting the work. Morteza Hajhosseini contributed in the analysis of the data and drafting the work. All authors approved the final version of the manuscript.

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References

- 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.
- Gupta AK, McGlone M, Greenway FL, Johnson WD. Prehypertension in disease-free adults: a marker for an adverse cardiometabolic risk profile. *Hypertension research : official journal of the Japanese Society of Hypertension*. 2010;**33**(9):905-10.
- Youngbum K, Seunghee L. Prevalence and Risk Factors Associated with Prehypertension by Gender and Age in a Korean Population in the KNHANES 2010–2012. *Iranian journal of public health*. 2015;**44**(12):1594.
- Mulligan DR, Lorenzo C, Haffner SM. Is prehypertension a risk factor for the development of type 2 diabetes? *Diabetes care*. 2009;**32**(10):1870-2.
- Hadaegh F, Hashemina M, Abdi H, Khalili D, Bozorgmanesh M, Arshi B, et al. Prehypertension Tsunami: A Decade Follow-Up of an Iranian Adult Population. *PloS one*. 2015;**10**(10):e0139412.
- Khosravi A, Emamian MH, Shariati M, Hashemi H, Fotouhi A. The prevalence of pre-hypertension and hypertension in an Iranian urban population. *High blood pressure & cardiovascular prevention: the official journal of the Italian Society of Hypertension*. 2014;**21**(2):127-35.
- Ebrahimi M, Heidari-Bakavoli AR, Mazidi M, Moohebaty M, Azarpazhooh MR, Nematy M, et al. Prevalence of hypertension, pre-hypertension and undetected hypertension in Mashhad, Iran. *Mediterranean Journal of Nutrition and Metabolism*. 2016;**9**(3):213-23.
- Rohani F, Hooman N, Moradi S, Mobarra M, Najafzadeh M, Tatarpoor P. The Prevalence of Pre-hypertension in Children with Type 1 Diabetes Mellitus. *International journal of preventive medicine*. 2014;**5**(Suppl 1):S44-9.
- Guo X, Li Y, Sun G, Yang Y, Zheng L, Xingang Z, et al. Prehypertension in children and adolescents: association with body weight and neck circumference. *Internal Medicine*. 2012;**51**(1):23-7.
- Kim Y, Lee S. Prevalence and Risk Factors Associated with Prehypertension by Gender and Age in a Korean Population in the KNHANES 2010-2012. *Iran J Public Health*. 2015;**44**(12):1594-602.
- Kazemi T, Hajhosseini M, Mashreghimoghdam H, Azdaki N, Ziaee M. Prevalence and Determinants of Hypertension among Iranian Adults, Birjand, Iran. *International journal of preventive medicine*. 2017;**8**:36.
- World Health Organization. Definition and diagnosis of diabetes mellitus and intermediate hyperglycemia: report of a WHO/IDF consultation. *World Health Org*. 2006.
- Rodriguez CJ, Daviglius ML, Swett K, Gonzalez HM, Gallo LC, Wassertheil-Smoller S, et al. Dyslipidemia patterns among Hispanics/Latinos of diverse background in the United States. *The*

- American journal of medicine*. 2014;**127**(12):1186-94 e1.
14. World Health Organization. Global database on Body Mass Index: BMI Classification. 2006. *World Health Organization Retrieved*. 2016;**16**.
 15. Shen L, Ma H, Xiang MX, Wang JA. Meta-analysis of cohort studies of baseline prehypertension and risk of coronary heart disease. *The American journal of cardiology*. 2013;**112**(2):266-71.
 16. Do HT, Geleijnse JM, Le MB, Kok FJ, Feskens EJ. National prevalence and associated risk factors of hypertension and prehypertension among Vietnamese adults. *American journal of hypertension*. 2015;**28**(1):89-97.
 17. Parthaje PM, Unnikrishnan B, Thankappan KR, Thapar R, Fatt QK, Oldenburg B. Prevalence and Correlates of Prehypertension Among Adults in Urban South India. *Asia-Pacific journal of public health*. 2016;**28**(1 Suppl):93S-101S.
 18. Chiang PP, Lamoureux EL, Shankar A, Tai ES, Wong TY, Sabanayagam C. Cardio-metabolic risk factors and prehypertension in persons without diabetes, hypertension, and cardiovascular disease. *BMC public health*. 2013;**13**:730.
 19. Meng XJ, Dong GH, Wang D, Liu MM, Liu YQ, Zhao Y, et al. Epidemiology of prehypertension and associated risk factors in urban adults from 33 communities in China--the CHPSNE study. *Circulation journal : official journal of the Japanese Circulation Society*. 2012;**76**(4):900-6.