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Undiagnosed Hypertension among Youth (18-24 Years) Referred to the Nutrition Clinic in Ardabil City, North West of Iran, from 2016 to 2018

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ABSTRACT

Introduction: Blood pressure among youth is associated with increased risk of future cardiovascular disease occurrence. The studies done on hypertension prevalence among young population are still insufficient. The purpose of this study was to determine undiagnosed hypertension, based on the Seventh Report of the Joint National Committee (JNC7) on Prevention, Detection, Evaluation and Treatment of High Blood Pressure updated guidelines among the apparently healthy young group of Iranian population.

Methods: In this cross-sectional study, 901 volunteers, without previous hypertension history, in the age group of 18-24 years old (body mass index< 40 kg/m^2) were assessed in Ardabil city from September 2016 to March 2008.They were apparently healthy youth and reported that their body weight had been stable for at least the last 3 months. Blood pressure was measured by standardized protocols based on American Heart Association guidelines, and the final value was obtained using the mean of the two careful readings of office blood pressure monitoring. Data were analyzed using Statistical Package for Social Sciences version 21.0. One-way analysis of variance was applied to determine the differences among hypertension groups, and p values <0.05 were considered statistically significant.

Results: The mean of age, weight and body mass index was 19.48±1.64 (years), 60.54±11.45 (kg) and 21.39±3.17 (kg/m^2), respectively. According to the JNC7 updated guidelines (2017), 17.4% subjects fell into elevated blood pressure whereas 2.1% and 1.7% into stage I and II hypertension category, respectively. Males were significantly more likely to have elevated blood pressure and stage I and stage II hypertension than females (p<0.001).

Conclusion: According to the JNC7 updated guidelines, there is a significant prevalence of undiagnosed elevated blood pressure and hypertension (21.1%) among Iranian youth population. These results emphasize the need for careful monitoring of the blood pressure even among apparently healthy young adults.

Keywords: Hypertension, Young adults, Iran

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Introduction

Hypertension is known as a serious global health problem, demanding a great proportion of health care resources directly and indirectly (1).The World Health Organization (WHO) has assessed that high blood pressure is responsible for approximately 7.5 million premature deaths annually which counts as 12.8% of the universal mortality (2). Based on the WHO estimation, hypertension is directly responsible for about 62% of the stroke and 49% of the coronary artery disease worldwide (3). In 2000, it is estimated that 26.4% of adults had hypertension, which will increase to 29.2% by 2025 (4).

To better control the National High Blood Pressure Education Program, Coordinating Committee of the National Heart, Lung, and Blood Institute published the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7) in 2003(5). Based on the JNC7 report, the risk of cardiovascular disease doubles with each 20 mmHg increase in systolic blood pressure or 10 mmHg increase in diastolic blood pressure over a SBP/DBP of 115/75 mmHg (6). Also, individuals with pre-hypertension are prone to developing hypertension in the later years of life (7). It is estimated that almost 40% of these people will progress to hypertension within 2 years (8). Hypertension is a leading cause of cardiovascular disease, end-stage renal disease and dementia (9). Young adults with elevated blood pressure, stage 1 hypertension, and stage 2 hypertension before the age 40, have significantly higher risk for future cardiovascular disease occurrence compared to those with normal blood pressure before the age of 40 (10, 11). The prevalence of hypertension and borderline blood pressure has been reported 7.3% and 26.9% among U.S. youths, respectively (12). Based on systematic review and meta-analysis, the prevalence of hypertension was 17% in Iran (13). However, the epidemiological studies have shown the fact that early identification of hypertension can prevent or delay the morbid events associated with it (14).

In recent years, the epidemiology of hypertension in older subjects has been extensively studied worldwide; such studies are still insufficient among young population. The purpose of this study was to assess the blood pressure and determine the prevalence of undiagnosed hypertension, according to the 2017 American College of Cardiology/American Heart Association (ACC/AHA) High Blood Pressure Clinical Practice Guidelines (15) among the younger age group in Iranian population.

Methods

Target population

The target population of this study was apparently healthy people in the age group of 18-24 years old who were referred to a nutrition clinic to receive a proper diet.

Study subjects

In this cross-sectional study, the sample size was estimated using this formula, $n \geq Z\ (1-\alpha/2)^2 pq/d^2$; where α was taken at 5% level of significance; z=1.96; p = prevalence of hypertension = 17.3%(13); q = 100-p = 82.7%; and d = margin of error = 4%. Therefore, the minimum sample size obtained was 394. The study was carried out among 901 volunteers who participated in the study between September 2016 and March 2018 in Ardabil city, the northwest of Iran to ensure the accuracy of the study. All subjects were selected using the convenience sampling, and they were apparently healthy youth. It is reported that their body weight had been stable for at least last 3 months. Exclusion criteria included subjects with acute pain, emotional or respiratory distress and existing conditions such as any infection and fever, diabetes, hypertension, and chronic kidney disease, current antihypertensive medications and smoking, and women who were pregnant.The study was ethically approved under the code number IR.ARUMS.REC.1396.97, and the informed consent was obtained from each subject.

Anthropometric measurements

Participants' body weight and height were measured using a balanced scale (Omron BF511)

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and a wall-mounted stadiometer, respectively. The body mass index (BMI) was calculated as weight (kg) divided by squared height (m^2) of each participant. The BMI was categorized as follows: underweight < 20 kg/m^2; normal weight: 20-24.9kg/m^2; overweight 25-30 kg/m^2 and obese≥30 kg/m^2 (16).

Blood pressure measurements

Blood pressure was measured by standardized protocols based on American Heart Association guidelines (17). By experienced nurse, each subject's blood pressure was measured in the right arm at sitting position using the standardized mercury column sphygmomanometer (Reister: nova-presameter® desk – model, Germany) with an appropriate sized cuff.

Before the measurements, the subjects rested for at least 10 minutes in a seated position with their arm supported at the level of the heart. All subjects wore light clothing without tight clothing constricting the arm and were in optimal room conditions. No stimulant drink, such as tea, coffee and caffeinated beverages were allowed within 30 minutes before blood pressure was taken. The people should not have moderate or intense physical activity during the previous 30 minutes.

The Korotkoff phase I (appearance) and phase V (disappearance) were recorded for the systolic blood pressure (SBP) and diastolic blood pressure (DBP), respectively. An appropriate blood pressure measurement is the essential stage in the assessment and diagnosis of hypertension (18, 19). According to JNC7, the diagnosis should be based on the average of two or more properly measured seated blood pressure readings on two or more office visits (5, 18). Therefore, each individual's blood pressure was measured two times with five-minute interval between each measurement on the same day. And, the average of two careful readings office blood pressure monitoring (OBPM) was considered as the final data of SBP and DBP. Subjects with a high blood pressure measurement had again measurement after one week using the same protocol and the average blood pressure on the second visit was used as the final value for the classification of hypertension.

Blood pressure was categorized based on the 2017 American College of Cardiology/American Heart Association (ACC/AHA) guidelines. The categories were as follows:

- Normal blood pressure: SBP< 120 and DBP< 80 mmHg;
- Elevated blood pressure: SBP: 120–129 and DBP< 80 mmHg;
- Hypertension Stage 1: SBP: 130–139 or DBP: 80–89 mmHg;
- Hypertension Stage 2: SBP≥ 140 or DBP≥ 90 mmHg (15).

In this study, undiagnosed hypertension was defined as having high blood pressure and never having been told that they had hypertension or elevated blood pressure.

Statistical analysis

Before any statistical analysis, normal distribution and homogeneity of the variances were tested using Kolmogorov-Smirnov test respectively. Continuous variables were presented as the mean values and standard deviation. Categorical variables were expressed as absolute and relative frequencies (%). The independent sample T-test was used for gender differences. One-way analysis of variance was applied to determine the differences among hypertension groups (normal, elevated blood pressure and hypertension). Comparisons among sex groups for blood pressure classification were done with the χ^2 test. All statistical tests were two tailed and p-values<0.05 were considered statistically significant. Data were analyzed using Statistical Package for Social Sciences (SPSS version 21.0 for Windows).

Results

A total of 901 subjects, 52.8% (n=476) were female. For all subjects, the mean of age, weight and body mass index were 19.48±1.64 (years), 60.54±11.45 (kg) and 21.39±3.17 (kg/m^2), respectively. The participants had body mass index of less than 40 kg/m^2. Based on BMI classification, only 12.1% (n=109) of subjects were overweight

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or obese (BMI≥25 kg/m^2) and72.7% (n=655) had normal weight (BMI: 20- 24.9kg/m^2).

Overall, the mean of systolic blood pressure, and diastolic blood pressure were 104.68±14.17 (mmHgand64.91±11.19 (mmHg), 39.74±11.87 (mmHg), respectively. Gender significantly influenced the results (p<0.001). The characteristics of participants by gender were presented in table 1.

Table 1. The characteristics of participants by gender

Variable	Male	Female	p-value
Age (years)	19.52±1.71	19.44±1.59	0.46
Weight (kg)	67.76±10.85	54.87±.84	<0.001
Body mass index (kg/m^2)	21.64±3.21	21.23±3.24	0.05
Systolic blood pressure (mmHg)	110.31±13.46	99.66±12.68	<0.001
Diastolic blood pressure (mmHg)	67.47±10.89	62.22±10.97	<0.001

Tested by the Independent Samples t-test

According to the 2017 JNC7 criteria, 17.4% of the subjects fell into elevated blood pressure whereas 2.1% and 1.7% of the subjects fell into stage I and II hypertension category, respectively. The distribution of blood pressure by gender was depicted in table 2. Based on the results, the prevalence of elevated blood pressure and stage I and stage II hypertension among male was higher compared to female (p<0.001). There was a significant difference among hypertension groups in SBP (p<0.001) and DBP (p<0.01). As shown in Table 3, the mean body mass index was low among the normotensives as compared to elevated blood pressure and hypertensive category.Also, based on these results, increasing levels of BMI even in the normal range is associated with an increase in blood pressure level among young people.

Table 2 . The distribution of blood pressure by gender

Blood pressure category	Total n(%)	Male n(%)	Female n(%)
Normal blood pressure	710(78.8%)	283(66.6%)	427(89.7%)
Elevated blood pressure	157(17.4%)	112(26.4%)	45(9.5%)
Stage I hypertension	19(2.1%)	17(4.0%)	2(0.4%)
Stage II hypertension	15(1.7%)	13(3.1%)	2(0.4%)

Tested by the χ^2 test, p<0.001

Table 3 . The mean body mass index according to blood pressure category

Blood pressure category	N	Mean ±SD (kg/m^2)	P value
Normal blood pressure	710	21.12±2.97	<0.001*
Elevated blood pressure	157	22.36±3.74	
Stage I hypertension	19	22.61±2.73	
Stage II hypertension	15	24.42±5.49	

* Differences tested by One-way ANOVA

Normal blood pressure Vs Elevated blood pressure: p<0.001

Normal blood pressure Vs Stage I hypertension: p=0.04

Normal blood pressure Vs Stage II hypertension: p=0.001

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Discussion

Based on the 2017 ACC/AHA hypertension guidelines, there is a significant prevalence of undiagnosed elevated blood pressure and hypertension (21.1%) among participants .Males were significantly more likely to suffer from elevated blood pressure and stage I and stage II hypertension comparing to females. Hypertension may exist for prolonged periods without symptoms and may manifest only after causing serious irreversible complications (20).

In our study, the mean systolic and diastolic blood pressure was approximately similar to other studies (21, 22). In this paper, elevated blood pressure and hypertension prevalence was 17.4% and 3.8%, respectively. The prevalence of normotension, pre-hypertension and hypertension were 86.8%, 9.2% and 4%, respectively in persons aged 15-29 years old in other study conducted in Iran (23). Based on JNC-VI classification (systole blood pressure>140mmHg and diastole blood pressure>90mmHg) (24), the prevalence of hypertension has been reported 0.7% among young adults (18-29 years) in Zabol (25). These differences may be due to used blood pressure classification and different cut-off points in determining the level of hypertension. Based on JNC7 hypertension guidelines, a hypertension prevalence of 3.0 % (aged between 20-30 years old), 22.9% (aged≥ 20 years), and 7.0% (aged 18-29 years) was reported in India (26), Korea (27) and Japan (28), respectively. This diversity results from used methodology, ethnicity or local factors such as climate, different dietary and behavioral lifestyles and the age span, but it should be noted that hypertension guideline changes from the JNC7 to American College of Cardiology/ American Heart Association (ACC/AHA) will be resulted in a significant increase in the prevalence of hypertension (29).

The results showed that the prevalence of elevated blood pressure or hypertension among men was higher compared to women. The interaction between sex and the prevalence of hypertension has been reported in previous studies (29-32). The reason can be related to higher prevalence of risk factors and the known hormonal differences in men (32, 33). Undiagnosed hypertension is considered as a major public health issue worldwide, even in western countries (34). Because of inadequate screening in young adults, this situation cannot be detected in this age group (35). The screening strategies need to be designed to appeal to young people, and based on the findings, more attention need to be paid to the male group.

Individuals with elevated blood pressure are at high risk of developing hypertension in their life (36). An association exist between pre hypertension and increased risk of cardiovascular, cerebrovascular (37, 38) and chronic kidney diseases (39). It has been shown that elevated blood pressure generally coexists with other risk factors such as the body mass index (40, 41), waist circumference (42), usingrefined cooking oil (26), high soft drink (39) and dietary salt consumption (26), low fruit intake (39), male sex (39), tobacco and alcohol use (43), inadequate physical activity (43), increasing age (40), low social-economic status (39) and family history of hypertension (22).. Some of these factors are modifiable. In this study, the body mass index indicated a significant association with elevated blood pressure and hypertension. Therefore, planning preventive interventions are essential in this regard.

Conclusion

This study had some limitations, and the primary limitation refers to the generalizability of the study results. The sample consisted of individuals were referred to the nutrition clinic. The subjects were selected using the available sampling method. Also, the information on diseases history or not smoking was self-reported, which might have compromised the validity of study. There were strengths in this study. The accuracy of findings was supported by the use of a standardized protocol and large sample size. However, according to the 2017 JNC7, a significant prevalence of undiagnosed hypertension among Iranian youth who were

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referred to the nutrition clinic is a matter of concern. On the other hand, increasing levels of BMI, even in the normal range is associated with an increase in blood pressure level. These results emphasize the need of community based screening of this problem among young populations.

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Conflict of interest

There is no conflict of interest.

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