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### Original Article

# Prevalence of hypertension and prehypertension in adolescence in Ahvaz, Iran

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#### ABSTRACT

**Background:** High blood pressure is a risk factor for some disease like stroke, coronary heart disease, and renal failure. High blood pressure in children is an increasing health problem.

**Objectives:** The aim of this study was to determine prevalence of hypertension and pre-hypertension age between 10 to 17 years old.

**Patients and methods:** This descriptive analytic study was conducted using multiphase sampling method in Ahvaz (Southwest of Iran). A questionnaire include: height, weight, and body mass index, systolic and diastolic blood pressures filled for each participant. Blood pressure was measured twice for each person. For the diagnosis of hypertension, the fourth report of the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents of the National Health Institute of United States was used. **Results:** Total participants of the study were 1707 children and adolescents including 922 boys (54%) and 785 girls (46%). The prevalence of high blood pressure was 1.7% (2.5% in boys and 0.8%). The prevalence of pre-hypertension was 9% (7.6% in boys, 10.6% in girls). The mean systolic and diastolic blood pressures increased with increasing body mass index.

**Conclusions:** The prevalence of high blood pressure was found to be lower than other studies in our country. The prevalence of the high blood pressure in boys was significantly higher than girls. This study, like other studies showed high correlation between being overweight and an increase in systolic and diastolic blood pressure.

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### Implication for health policy/practice/research/medical education

High blood pressure in children is an increasing health problem. So this study was conducted to determine prevalence of hypertension and pre-hypertension between children and adolescence in Ahvaz. Prevalence of hypertension and pre-hypertension was 1.7% (2.5% in boys and 0.8% in girls) and 9% (7.6% in boys and 10.6% in girls) respectively.

#### 1. Introduction

Hypertension is a physiological parameter that can be a significant risk factor for atherosclerosis and its consequences in the coronary vessels, kidney and the brain vessels. In adults,

hypertension can often be a preliminary phase to some dangerous diseases like stroke, coronary heart disease (CHD), congestive heart failure (CHF), Renal failure (RF). There is a possibility that a major proportion of high blood pressure in adults could be a result of high blood pressure in their childhood [1,2]. Hypertension is responsible for 7 million deaths annually around the world [3]. Hypertension in children is an increasing health problem [4] and high secondary blood pressure is more prevalent in children than in adults [5]. Overweight and obesity are highly correlated with hypertension in children [6–8]. Having a family history of hypertension or coronary heart disease, being male, and smoking during pregnancy are other risk factors [9–11]. Moreover, children who are breast fed have lower risk for hypertension. Children with hypertension have shown evidences of disorder in the target organs including hypertrophy of the left ventricle, and pathology of blood vessel changes [12,13]. Primary hypertension in childhood is also related to other risk factors like hyperlipidemia, and diabetes mellitus for coronary and heart diseases [14,15]. Research conducted on different ethnicities shows differences in prevalence of

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hypertension across these ethnicity groups [16,17]. Based on the results of different studies, the prevalence of hypertension in children was between 1.4 to 11% [3,18,19].

## 2. Objectives

Considering the changes in the levels of blood pressure from one population to another, this study was conducted to assess prevalence of hypertension and pre-hypertension on the children and adolescents of Ahvaz age range 10 – 17 years old.

## 3. Patients and methods

In this descriptive-analytic study, using multistage cluster sampling, from 25 health centers in Ahvaz (capital city of Khuzestan province, South West of Iran), four centers from East and two centers from West were chosen.

For each health center, several families were randomly selected as the head of cluster and in each cluster, 50 subjects in age 10 to 17 years old were chosen.

Necessary information was given to the subjects and their parents. In each center, health workers who were properly trained to help in this research project. A questionnaire filled up for each participant included: age, gender, education level, parents' job, daily activity, smoking, maternal history, birth weight, parent medical history. The height was measured by standard instrument. Waist circumference (WC) was measured with a non-elastic tape at a point midway between the lower border of the ribcage and the iliac crest at the end of normal expiration. Their weight was measured using Seca weighing scales with standard method. Obesity in children was defined by body mass index (BMI), calculated as weight in kilograms (kg) divided by the square of height in meters (m<sup>2</sup>).

BMI above 85 percentile for age and gender were considered overweight and above 95 were considered obese [20].

Systolic and diastolic blood pressure were taken from the right arm at least after 5 minutes of rest in two occasions with a 30 seconds interval in sitting position using a (mechanical) sphygmomanometer and placing the stethoscope under the cuffs specially suited for the children. During the interval, the arms of the children were in the resting position. The average of the result of the measurement was recorded as the blood pressure of the individual. For the recording of the blood pressure, the sounds of korotkoff in the first and fifth phase was listened to preferably by the bell part of the stethoscope and the values of the blood pressure in korotkoff's first phase was recorded in the form as the systolic blood pressure and the fifth phase as the diastolic blood pressure. In children and adolescents, the normal blood pressure varies according to the size of the body and the age. As a result, the standards based on gender, age and height provide a better criterion of the classification of blood pressure in proportion to the body size. In this study the fourth report of the National Health institute of the United States on the Diagnosis, Evaluation, and

Treatment of High blood Pressure in Children and Adolescents was used as the criterion [21].

### 3.1. Ethical issues

Since all participants were under 18 years old, written informed consent was obtained from their parents. This study was conducted in accordance with the principles laid down in the declaration of Helsinki. The research was approved by the ethical committee of Ahvaz Jundishapur University of Medical Sciences.

### 3.2. Data analysis

Data were analyzed using the SPSS software (Statistical Package for the Social Sciences, version 18.0, SPSS Inc, Chicago, Ill, USA). We used *t*-test and analysis of variance (ANOVA) for comparison of means, chi-square for variables relation and Binary logistic for compute odds ratio (O.R). P- Value less than 0.05 was considered significant.

## 4. Results

In this study, 1707 children and adolescents age from 10 to 17 years old evaluated. They lived in Ahvaz and included 922 boys (54%) and 785 girls (46%).

8. 7% [95%C.I. (7.4–10)] of the adolescents were overweight and 3.6% [95%C.I. (2.8–4.4)] of them were obese. Gender-wise, 7% of the boys and 10.7% of the girls were overweight. 2.3% of boys and 5.2% of girls were obese.

Table 1 shows mean of BMI, systolic and diastolic blood pressure according to age and sex. Mean BMI in girls is higher than boys significantly ( $P \leq 0.002$ ).

Mean systolic and diastolic blood pressure in varying weight group shows that there is significant different between them ( $P = 0.0001$ ) (Table 2).

Table 3 shows comparison of hypertension and pre-hypertension between to genders.

According to Table 4, Model 1 shows being male increased risk of hypertension 3.5 times more than female. Also, being overweight increased risk of hypertension 2.8 times more than normal people. In model 2 increasing height, decreases the risk of having hypertension, while the risk of hypertension in male was 4.8 times more than female.

## 5. Discussion

This study was conducted on 1707 children and adolescents 10 to 17 years of age in Ahvaz. 1.7% of participants were diagnosed with hypertension and 9% with prehypertension. In a study carried out by Kelishadi and et al. on a representative sample of 23 provinces in Iran, with age group 6 to 18 years, prevalence of hypertension was 4.2% [22] and in another study by Ataei and et al. On Tehran adolescents aged 13 to 18 years, was reported 4.7% (2.9%

**Table 1**

The comparison of mean systolic and diastolic blood pressures and BMI with age and sex.

Age	Sex	n (%)	BMI Mean $\pm$ SD	DBP(mm/hg) Mean $\pm$ SD	SBP (mm/hg) Mean $\pm$ SD
10–14	Boys	505(54.2)	18.34 $\pm$ 3.3	62.2 $\pm$ 9.5	103.3 $\pm$ 10
	Girls	426(45.8)	19.1 $\pm$ 3.9	63.2 $\pm$ 9.1	103.4 $\pm$ 10.2
P Value			0.001	0.11	0.95
15–17	Boys	417(53.7)	20.86 $\pm$ 5.2	66.2 $\pm$ 9.7	109.2 $\pm$ 11
	Girls	359(46.3)	21.7 $\pm$ 3.9	65.7 $\pm$ 8.9	108 $\pm$ 9.6
P Value			0.002	0.47	0.42
10–17	Total	1707(100)	19.8 $\pm$ 4.3	64.1 $\pm$ 9.5	106 $\pm$ 10.8

DBP: Diastolic blood pressure (mm/hg) SBP: Systolic blood pressure(mm/hg).

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