

Prevalence of Hypertension and Obesity-related Hypertension in Urban School-aged Children in Rasht

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Introduction. Hypertension is a worldwide health concern. Complications of hypertension not only affect adult patients, but also involve children. Given the importance of assessing children with hypertension in order to decrease adulthood complications, we aimed to assess the prevalence of hypertension in urban school-aged children in Rasht, Iran.

Materials and Methods. This cross-sectional study was conducted on 2072 school-aged children in Rasht, Iran, from January 2013 to December 2015. Inclusion criteria were age between 7 and 17 years and residence and attending school in the urban area of Rasht.

Results. Overall, 205 (9.9%) and 144 (6.9%) of the participants were hypertensive and prehypertensive, respectively. The mean systolic blood pressure was 124.54 ± 11.86 mm Hg in the children. The prevalence of obesity in the children was 3.5%. Comparing the normal, prehypertensive, and hypertensive groups, there was a significantly increasing trend regarding age, height, weight, and body mass index associated with higher blood pressure categories.

Conclusions. This study showed a high rate of hypertension among school-aged children in Rasht. Hypertensive children tended to be have a higher body mass index than the prehypertensive and normal-weight participants. Case identification and early assessment of these children is recommended.

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INTRODUCTION

Hypertension is a worldwide health concern.¹ Recent Iranian childhood hypertension has been reported to be 11.4% of among the students.² The complications of hypertension not only occur in adult patients, but can involve children as well. Hypertension can induce organ damage including left ventricular hypertrophy and pathological vascular changes.^{3,4}

Children with hypertension can deal with significant reduction in cognitive function.⁵ Although, Clinicians suggest at least 1 annual blood

pressure monitoring as a health care principle in children from their 3rd year of age.^{6,7} Misdiagnosis and inappropriate treatment of hypertension can occur as a result of inaccurate measurement. Inappropriate cuff size and incorrect positioning can increase the risk of hypertension misdiagnosis.⁸ Childhood blood pressure should be calculated regarding age, sex, and height. Normal blood pressure can be identified by the 90th percentile for age, sex, and height, and blood pressure equal to or higher than the 95th percentile indicates childhood hypertension.⁶

Furthermore, obesity can increase the rate of mortality and morbidity and consequent cardiovascular diseases.⁹ Obesity can be associated with diverse complications such as type 1 and 2 diabetes mellitus, hypertension, asthma, increased insulin level, and osteoporosis.¹¹ There is a complex pathophysiology for obesity-related hypertension; multiple potential mechanisms contribute to the development of higher blood pressure in obese children. A previous investigation on school-aged children in south of Iran showed obesity and hypertension in 7% and 11.8% of them, respectively, and that hypertension and obesity were significantly related.¹² We aimed to assess the prevalence of hypertension in urban school-aged children in the large urban area of Rasht in north of Iran.

MATERIALS AND METHODS

A cross-sectional study was conducted on 2072 students in Rasht, Iran, during January 2013 to December 2015. The inclusion criteria were children aged 7 to 17 years attended in the primary and high schools in urban area of Rasht. Children with definite high blood pressure were excluded. The collected data included demographic characteristics (age, sex, parental educational level, height, and body weight), body mass index, duration of TV watching and exercise, eating fast foods, and family history. Systolic and diastolic blood pressure were measured by the appropriate mid-arm circumference cuff sizes in blood pressure aneroid devices. The mean systolic and diastolic blood pressure were noted. Prehypertensive and hypertensive patients were defined as blood pressure higher than the 90th and 95th percentiles for age, sex, and height. Height was measured in stand-up position with bare feet by a board portable stadiometer. Weight was assessed with light clothes by a calibrated scale. Body mass index was calculated as body weight divided by squared height (kg/m^2). Slim, normal, overweight, and obese children were determined as those with a body mass index less than $19.8 \text{ kg}/\text{m}^2$, less than $24.9 \text{ kg}/\text{m}^2$, between $25 \text{ kg}/\text{m}^2$ and $29.9 \text{ kg}/\text{m}^2$, and greater than $30 \text{ kg}/\text{m}^2$, respectively.

Participants with a measured first blood pressure greater than the 90th percentile for age, sex, and height underwent 2 more blood pressure measurement in 1 to 2 weeks' interval.

Data were reported using descriptive statistics,

including the mean \pm standard deviation and number (percentage). Comparisons were done using the 1-way analysis of variance, the independent *t* test, and the chi-square test. The analyses were done using the SPSS software (Statistical Package for the Social Sciences, version 19.0, SPSS Inc, Chicago, IL, USA). A *P* value less than .05 was considered of significance, and 95% confidence intervals were noted.

RESULTS

In this study, 2072 school-aged children and adolescents participated including 899 (44.4%) girls and 1153 boys (55.6%). Two hundred and five (9.9%) and 144 (6.9%) of the participants were hypertensive and prehypertensive, respectively. The mean systolic blood pressure was 124.54 ± 11.86 mm Hg in the children. The prevalence of obesity in the children was 3.5% (72 children). (Table 1).

Comparing normal, prehypertensive and hypertensive groups, there was a significant

Table 1. Characteristics of Participants*

Parameter	Value
Mean age, y	12.15 \pm 2.6
Mean height, cm	152.33 \pm 16.58
Mean weight, kg	48.45 \pm 18.25
Mean TV watching, h/d	2.91 \pm 2.02
Mean number of occasions eating fast food per week	1.42 \pm 1.43
Positive past medical history	241 (11.6)
Positive family history	431 (20.8)
Mean body mass index, kg/m^2	20.18 \pm 4.84
Body mass index, kg/m^2	
< 19.8	1110 (53.6)
19.8 to 24.9	583 (28.1)
25 to 29.9	276 (13.3)
> 29.9	72 (3.5)
Exercise	
< 3 hours	1007 (48.6)
3 to 6 hours	635 (30.6)
> 6 hours	421 (19.9)
High blood pressure	
No	1723 (83.1)
Prehypertension	144 (6.9)
Hypertension	205 (9.9)
Abnormal blood pressure	
Systolic	61 (17.8)
Diastolic	138 (40.2)
Both	144 (42.0)
Mean systolic blood pressure, mm Hg	124.54 \pm 11.86
Mean diastolic blood pressure, mm Hg	1.23 \pm 5.61

*Values are mean \pm standard deviation for continuous variables and frequency (percentage) for categorical variables.

Table 2. Characteristics of Children With Normal Blood Pressure Versus Prehypertensive and Hypertensive Children*

Parameter	Normal	Prehypertensive	Hypertensive	P
Mean age, y	12.05 ± 2.64	12.33 ± 2.48	13.29 ± 1.74	.001
Sex				
Female	889	15	14	
Male	898	123	130	.001
Mean height, cm	151.06 ± 16.67	157.66 ± 14.61	162.85 ± 12.09	.001
Mean weight, kg	46.65 ± 17.69	54.39 ± 16.97	64.95 ± 16.90	.004
Mean TV watching, h/d	2.92 ± 2.06	2.86 ± 1.83	2.75 ± 1.73	.59
Mean number of occasions eating fast food per week	1.42 ± 1.45	1.52 ± 1.34	1.43 ± 1.25	.70
Positive past medical history	207	14	20	.89
Positive family history	347	24	33	.71
Mean body mass index, kg/m ²	19.75 ± 4.71	21.48 ± 4.71	24.24 ± 4.57	< .001
Body mass index, kg/m ²				
< 19.8	1005	50	55	
19.8 to 24.9	469	46	68	
25 to 29.9	182	36	58	
> 29.9	40	10	22	> .05
Exercise				
< 3 hours	891	51	64	
3 to 6 hours	538	46	49	
> 6 hours	340	41	31	> .05

*Values are mean ± standard deviation for continuous variables and frequency for categorical variables.

difference between them regarding age, height, weight, and body mass index (Table 2); children with hypertension had higher mean age, height, weight, and body mass index. In addition, there was a significant relationship between the three groups regarding sex and duration of exercise. Among the obese children, 40 had a normal blood pressure, and 10 and 22 were prehypertensive and hypertensive, respectively (Table 2).

The prevalence of hypertension in the boys and girls with normal weight was 20.6% and 1.8%, respectively. In addition, 34.7% and 6.1% of the overweight and 51.5% and 12.5% of the obese boys and girls were hypertensive, respectively.

DISCUSSION

Childhood hypertension is a major health problem which can extend to adulthood hypertension and cardiovascular diseases. In this study, results showed that 9.9% of participants were hypertensive and that hypertensive children were more likely to have high body mass index as compared with the prehypertensive and normal weight participants. The prevalence of normal, prehypertension, and hypertension in these children were 83.1%, 6.9% and 9.9%, respectively.

The overall prevalence of hypertension was higher than that in the recently published study

by Wang and colleagues (6.1%).¹³ Kumar and colleagues showed that 7.2% of children were hypertensive (6.6% of the boys and 7.9% of the girls).¹⁴ However, Hung reported that 10.3% of children were hypertensive in their study population.¹⁵ Our results showed that 6.9% of children were prehypertensive (10.7% of boys and 2.3% of girls). Ostchega noted that 13.6% and 2.6% of boys and 5.7% and 34% of girls in the United States were hypertensive and prehypertensive, respectively.¹⁶

The prevalence of overweight and obesity in children were 13.3% and 3.5%, respectively. Investigations by Lu and colleagues and Andegiorgish and coworkers on Chinese children showed relatively lower incidence rates of overweight in school-aged children (11.3% and 12.5%, respectively). However, they mentioned a higher rate of obesity, as 13.53% and 15.7% of their participants were obese.^{17,18} Furthermore, 30.8% of Spanish and 25.6% of American school-aged children were reported to be obese elsewhere.¹⁹ These different findings may be as a result of different food intake and life style in different populations.

In this study, we reported higher rates of hypertension and prehypertension in the obese and overweight children, respectively; 21% and

30.1% of the overweight and obese children were hypertensive, respectively. Wang and coworkers reported consistent results.¹³ They showed that a higher risk of hypertension could be predicted by obesity and overweight in school-aged children, as they noted a higher incidence of hypertension among overweight (50.1%) and obese (70%) children,¹³ in their 4-year longitudinal study.

In addition, Flores and coworkers and Tu and colleagues suggested that the higher prevalence of chronic disease such as hypertension could be noted by the elevated risk of overweight and obesity.^{20,21} Our results showed lower rates of hypertension and prehypertension in slim and normal-weight school-aged children (hypertension in 5% and 11.7% and prehypertension in 4.5% and 7.9%, respectively) which was similar with previous investigation.²² Zhai and coworkers noted no significant difference between slim and normal-weight school-aged children regarding the occurrence of hypertension.²³

The prevalence of hypertension in normal-weight boys was 20.6% in our study population, which increased to 34.7% of the overweight and 51.5% of the obese boys. These results were similar with the figures reported by Zhai and coworkers that reported that the prevalence of hypertension in boys increased by increasing weight. Hypertension was noted in 17.2% of normal-weight, 26.1% of overweight, and 49.3% of obese boys.²³

CONCLUSIONS

This study showed a high rate of hypertension among school-aged children in Rasht. Hypertensive children tended to have a higher body mass index than the prehypertensive and normal-weight participants. Case identification and early assessment of these children is recommended.

CONFLICTS OF INTEREST

None declared.

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