Prevalence of Childhood Obesity and Hypertension in South of Iran

Mitra Basiratnia,[1] Dorna Derakhshan,[2] Sara Ajdari,[3] Forough Saki[4]

[1]Division of Pediatric Nephrology, Shiraz University of Medical Sciences, Shiraz, Iran
[2]Department of Pediatrics, Shiraz University of Medical Sciences, Shiraz, Iran
[3]Faculty of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran
[4]Division of Pediatric Endocrinology and Student Research Center, Shiraz University of Medical Sciences, Shiraz, Iran

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Introduction. Obesity is a growing problem worldwide and is likely a major cause of the increased prevalence of high blood pressure in children. The aim of this study was to investigate the frequency of pediatric obesity and its association with hypertension in a sample of children and adolescents in Fars province (south of Iran).
Materials and Methods. This cross-sectional study was carried out in Shiraz during a period from 2010 to 2011. A total of 2000 healthy students aged 11 to 17 years were included. Data on weight, height, systolic and diastolic blood pressure (measured 3 times with 5-minute intervals), and parental history of hypertension and educational level were obtained. The 95th percentile body mass index for age and sex was considered obesity.
Results. Overall, 7% and 11.8% of the students were obese and hypertensive, respectively. Blood pressure was associated with body mass index. Maternal education level was not associated with hypertension in the child.
Conclusions. In this study, obesity was an important risk factor for hypertension. Our data showed that prevalence of obesity has not been changed in the recent 5 years in Iran, but that of hypertension has risen significantly. The high prevalence of hypertension in overweight and obese children emphasizes the need for prevention and control of childhood obesity and hypertension in early stages.

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INTRODUCTION

Childhood obesity has become a major global health concern in the recent decades.[1]. The prevalence of obesity among children appears to be raising rapidly in developing countries, including our country, Iran, which could be attributed to changes in the lifestyle.[2] The recent data have demonstrated a dramatic increase of overweight children and adolescents during the past 2 decades. Overnutrition and insufficient physical activity associated with obesity have been estimated to account for at least 300 000 deaths and about US $ 99 billion costs per year in the United States. Like many other countries, the prevalence of obesity among Iranian students has doubled during the period from 1993 to 1999.[2,3]

Even during childhood, obesity is the risk factor for future cardiovascular disease, including hypertension and dyslipidemia. These risk factors have been proved to accelerate progression of atherosclerotic lesions in the coronary arteries of young people.[4] Obese children are at an increased risk for adult mortality and morbidity particularly from cardiovascular disease.[5] Hypertension and cardiovascular disease are also the major causes of morbidity and mortality in the general population. Blood pressure screening is an important part of pediatric routine examinations.[6] The idea that hypertension in children is rare, being mostly secondary to kidney disease, has been contested in epidemiological studies, which have shown an increase in the prevalence of essential hypertension in the pediatric population.[7]

There is a lack of data about prevalence of obesity and hypertension in South of Iran. Due to changes in obesity prevalence year by year, lack of data about prevalence of obesity in children in the south of Iran after 1990, and importance of obesity as a common preventable cause of mortality and morbidity, this large-scale study was done to determine the prevalence of obesity and hypertension and association of these two factors in Iranian children and adolescents.

MATERIALS AND METHODS

This cross-sectional study was conducted from November 2010 to March 2011 in Shiraz. We screened 2000 students aged 11 to 17 years, of 20 middle (*guidance*) schools and high schools of this area, to which 314 017 students were assigned. These students were included only if they were healthy, had no history of disease known to affect blood pressure (secondary causes), and were not taking blood pressure-affecting medications (eg, prednisolone and methylphernylate). This study was conducted in accordance with the principles of the local Ethics Committee of Shiraz University of Medical Sciences and Helsinki protocol. All the participants signed a written informed consent after description of the aims and methods of the study in detail.

Body weight was recorded to the nearest 0.1 kg, using a standard digital scale with the participant's bare foot and wearing a light cloth. Body height was recorded to the nearest 0.5 centimeters according to the following protocols: no shoes, heels together, and head touching the ruler with line of aligned horizontally. Body mass index (BMI) was calculated as the ratio of body weight (kg) to body height (in meters) squared. Growth charts published in 2000 from the Centers for Disease Control and Prevention were used to plot BMI against age in both sexes. Body mass index percentile and BMI Z score were estimated according to these charts. A BMI value of 95th percentile and greater was defined as obesity and a value between the 85th and 95th percentile for age and sex was considered overweight.

Blood pressure was measured in the seated position by the use of an ALPK2 sphygmomanometer (Zhejiang, China) with the appropriate cuff using the standard method.[8,9] Three readings were recorded at 5-minute intervals with complete deflation of the cuff between each reading. The average of the three readings was calculated. The definition of hypertension in children and adolescents requires a systolic and/or diastolic blood pressure value greater than the 95th percentile at the standard age-sex-height percentile specific blood pressure tables. If a student had an average blood pressure higher than the 95th percentile for age and height, blood pressure was again rechecked 3 times with 1-week intervals. The students were considered to be hypertensive if they had 3 episodes of high blood pressure (> 95th percentile).

Information about the mother's education and occupation was obtained from children and data about parental hypertension was collected by calling the mothers. Data were rechecked and missing data were completed in 3 visits to the schools.

The data were analyzed using the SPSS version 15 and a P value less than .05 was set as the level of statistical significance. Comparison of proportions was done by the chi-square test. We used multivariable regression analysis to assess the relative importance of age, sex, BMI, BMI Z score, and parental hypertension on systolic and diastolic blood pressure values of the students.

RESULTS

A total of 2000 guidance and high school students aged between 11 to 17 years were evaluated in our study. The sample consisted of 953 males and 1047 females. The mean age of the students was 13.85 ± 1.69 years.

Table 1 shows the distribution of normal, overweight, and obese children by age and sex. Overall, 80% of the children had normal BMI values (81.3% of boys and 78.8% of girls), 13% were overweight (10.8% of boys and 15.0% of girls) and 7.0% were obese children (6.2% of boys and 7.9% of girls). Table 2 provides the height, weight, BMI, and systolic and diastolic blood pressure in each age and sex group. An increase was observed in the mean systolic and diastolic blood pressure with age. Overall, the prevalence of obesity was higher in boys (P= .05). The girls in the age group of 11 years old were most likely to be obese and obesity was the least frequent of all in girls aged 15 years.

The distribution of systolic and diastolic blood

Table 1. Normal, Overweight, and Obese Children by Age and Sex*

Age and Sex	Body Mass Index Percentile < 85% (Normal)	85% to 95% (Overweight)	> 95% (Obese)
11			
Female	51 (67.1)	13 (17.1)	12 (15.8)
Male	60 (71.4)	10 (11.9)	14 (16.7)
12			
Female	141 (73.4)	37 (19.3)	14 (7.3)
Male	113 (76.9)	20 (13.6)	14 (9.5)
13			
Female	185 (78.4)	35(14.8)	16 (6.8)
Male	127 (79.9)	17 (10.7)	15 (9.4)
14			
Female	125 (72.2)	37 (21.4)	11(6.4)
Male	155 (80.7)	23 (12.0)	14 (7.3)
15			
Female	149 (88.2)	15 (8.9)	5 (2.9)
Male	159 (85.0)	18 (9.6)	10 (5.3)
16			
Female	103 (85.9)	13 (10.8)	4 (3.3)
Male	119 (88.8)	9 (6.7)	6 (4.5)
17			
Female	71 (87.7)	7 (8.6)	3 (3.7)
Male	42 (84.0)	6 (12.0)	2 (4.0)
Total			
Female	825 (78.8)	157 (15.0)	65 (6.2)
Male	775 (81.3)	103 (10.8)	75 (7.9)

*Values are absolute numbers (percent).

pressure is shown by age and sex groups in Table 3. They were classified into 3 categories according to the severity: systolic and diastolic blood pressure less than 90% percentile for age and height percentile was considered normal. Those with systolic and diastolic blood pressure more than 95% percentile for their age and height were regarded hypertensive. The values between 90th and 95th percentiles (prehypertension) for age and height were the children at risk for hypertension. Overall, 84.9% and 85.9% of the students had normal systolic and diastolic blood pressure, respectively, and 4.5% and 7.4% of them were at risk of systolic and diastolic hypertension, respectively. Systolic hypertension was found in 10.7% of all these students, and 6.8% had diastolic hypertension. Systolic and diastolic blood pressure measurements were both high in 5.5% of the students. The prevalence of hypertension in the study population was 11.8% (13% in the girls and 10.4% in the boys; $P = .08$).

The mean systolic and diastolic blood pressure values for each BMI and age and sex group are displayed in Tables 3 and 4. There was a significant increase in both systolic ($P < .001$) and diastolic blood pressure ($P < .001$) that correlated with increasing BMI. Obese students had significantly higher systolic and diastolic blood pressure values

Table 2. Mean Height, Weight, Body Mass Index (BMI), and Systolic and Diastolic Blood Pressure (BP) by Age and Sex

Age and Sex	Number of Students	Height, cm	Weight, kg	BMI, kg/m^2	Systolic BP, mm Hg	Diastolic BP, mm Hg
11						
Female	76	151.01 ± 7.53	44.44 ± 11.07	19.27 ± 3.79	110.00 ± 10.53	70.65 ± 6.23
Male	84	146.61 ± 13.81	42.30 ± 16.38	18.57 ± 3.81	107.85 ± 10.73	69.58 ± 6.73
12						
Female	192	153.97 ± 12.59	47.27 ± 11.57	19.49 ± 3.78	112.65 ± 12.29	73.20 ± 7.89
Male	147	149.63 ± 7.27	42.56 ± 12.03	19.62 ± 11.32	107.23 ± 9.98	68.19 ± 7.37
13						
Female	236	158.27 ± 6.03	50.59 ± 10.11	20.06 ± 3.53	113.94 ± 12.81	74.27 ± 8.10
Male	159	160.55 ± 9.29	50 ± 12.6	19.23 ± 3.74	107.88 ± 9.87	68.58 ± 6.67
14						
Female	173	160.13 ± 6.80	54.45 ± 10.00	21.23 ± 3.62	112.49 ± 12.75	75.51 ± 7.84
Male	192	165.56 ± 8.73	54.18 ± 12.50	19.60 ± 3.71	111.82 ± 9.99	71.45 ± 6.30
15						
Female	169	160.41 ± 6.36	53.14 ± 8.14	20.58 ± 3.10	111.77 ± 11.34	72.63 ± 7.07
Male	187	171.13 ± 8.45	58.00 ± 12.12	19.69 ± 3.53	117.24 ± 12.22	74.25 ± 7.51
16						
Female	120	160.05 ± 6.68	54.31 ± 9.45	21.05 ± 3.35	111.91 ± 10.49	72.66 ± 7.18
Male	134	173.67 ± 7.53	60.73 ± 11.52	20.18 ± 3.38	120.26 ± 13.32	76.6 ± 7.39
17						
Female	81	162.67 ± 7.76	55.38 ± 11.62	20.80 ± 3.68	113.65 ± 12.35	74.25 ± 6.75
Male	50	171.40 ± 9.75	63.68 ± 12.45	21.58 ± 3.69	117.80 ± 14.29	75.90 ± 8.37

Table 3. Frequencies of Systolic and Diastolic Blood Pressure Percentiles by Age and Sex

	Blood Pressure					
	< 90th Percentile		90th to 95th Percentile		> 95th Percentile	
Age and Sex	Systolic	Diastolic	Systolic	Diastolic	Systolic	Diastolic
11						
Female	66 (86.7)	68 (89.3)	4 (5.3)	3 (4.0)	6 (8.0)	5 (6.7)
Male	74 (88.1)	76 (90.5)	2 (2.4)	4 (4.8)	8 (9.5)	4 (4.8)
12						
Female	142 (74.0)	145 (75.5)	16 (8.3)	25 (13)	34 (17.7)	22 (11.5)
Male	135 (91.8)	136 (92.5)	2 (1.4)	5 (3.4)	10 (6.8)	6 (4.1)
13						
Female	182 (77.1)	180 (76.3)	13 (5.5)	42 (17.6)	41 (17.4)	14 (5.9)
Male	149 (93.7)	149 (93.7)	3 (1.9)	5 (3.1)	7 (4.4)	5 (3.1)
14						
Female	143 (82.7)	143 (82.7)	8 (4.6)	18 (10.4)	22 (12.7)	12 (6.9)
Male	174 (90.6)	176 (91.7)	9 (4.7)	6 (3.1)	9 (4.7)	10 (5.2)
15						
Female	151 (89.3)	153 (90.5)	5 (3)	11 (6.5)	13 (7.7)	5 (3)
Male	154 (82.4)	161 (86.1)	14 (7.5)	6 (3.2)	19 (10.2)	20 (10.7)
16						
Female	107 (89.2)	110 (91.7)	2 (1.7)	6 (5)	11 (9.2)	4 (3.3)
Male	111 (82.8)	105 (78.4)	3 (2.2)	12 (9)	20 (14.9)	17 (12.7)
17						
Female	66 (81.5)	73 (90.1)	9 (11.1)	5 (6.2)	6 (7.4)	3 (3.7)
Male	43 (86.0)	42 (84.0)	0	0	7 (14)	8 (16)
Total						
Female	857 (81.8)	872 (83.2)	57 (5.5)	110 (10.5)	133 (12.7)	65 (6.2)
Male	841 (88.3)	845 (88.7)	33 (3.5)	38 (4)	79 (8.2)	69 (7.3)

Table 4. Mean Systolic and Diastolic Blood Pressure (BP) Values by Body Mass Index (BMI) and Age in Female Students

	Body Mass Index Percentile		
Age and Sex	< 85% (Normal)	85% to 95% (Overweight)	> 95% (Obese)
11			
Systolic BP	107.96 ± 10.3	114.5 ± 9.5	116.6 ± 9.12
Diastolic BP	69.8 ± 6	71 ± 7.37	74.1 ± 5.14
12			
Systolic BP	111.2 ± 12	117.8 ± 11.5	118.6 ± 14.6
Diastolic BP	72.4 ± 7.59	75.4 ± 8.2	77.2 ± 9.25
13			
Systolic BP	112.3 ± 12.2	118.5 ± 12.7	124 ± 13.78
Diastolic BP	73.4 ± 7.7	76.4 ± 8.1	80 ± 9.2
14			
Systolic BP	110.4 ± 7.2	117 ± 11.1	122.5 ± 19.8
Diastolic BP	71.5 ± 7.2	74.6 ± 8.2	76 ± 10.7
15			
Systolic BP	111.2 ± 11	117.5 ± 12.2	108.7 ± 14.3
Diastolic BP	72.3 ± 7	75.6 ± 7.04	72.5 ± 5
16			
Systolic BP	111.53 ± 10	115.9 ± 12.1	113.7 ± 17
Diastolic BP	72.4 ± 7.3	74.1 ± 6.6	75 ± 5.7
17			
Systolic BP	113.3 ± 12	114.1 ± 14.4	116.6 ± 20.8
Diastolic BP	74 ± 6.5	75.7 ± 7.86	76.6 ± 11.5

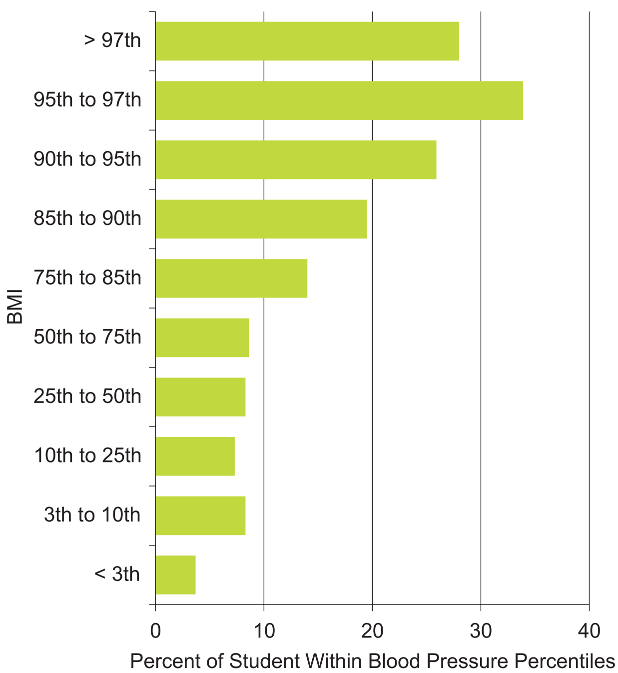
Table 4. Mean Systolic and Diastolic Blood Pressure (BP) Values by Body Mass Index (BMI) and Age in Male Students

	Body Mass Index Percentile		
Age and Sex	< 85% (Normal)	85% to 95% (Overweight)	> 95% (Obese)
11			
Systolic BP	106.0 ± 9.6	110.7 ± 11.4	116.1 ± 13.1
Diastolic BP	68.7 ± 6.5	72.7 ± 6.0	71.8 ± 8.6
12			
Systolic BP	105.6 ± 9.07	109.0 ± 10.0	119.2 ± 10.0
Diastolic BP	67.0 ± 6.7	70.0 ± 6.6	75.6 ± 8.4
13			
Systolic BP	106.1 ± 8.4	113.4 ± 13.3	118.6 ± 9.5
Diastolic BP	67.5 ± 5.8	73.6 ± 8.4	72.7 ± 8.1
14			
Systolic BP	110.2 ± 8.6	117.8 ± 13.0	119.6 ± 8.1
Diastolic BP	70.2 ± 5.1	77.0 ± 8.1	76.2 ± 8.1
15			
Systolic BP	116.2 ± 11.2	122.1 ± 17.2	125.0 ± 13.8
Diastolic BP	73.5 ± 6.8	78.4 ± 11.0	80.0 ± 6.6
16			
Systolic BP	118.6 ± 11.8	127.2 ± 14.6	141.6 ± 19.9
Diastolic BP	76.0 ± 7.0	81.8 ± 10.1	83 ± 6.1
17			
Systolic BP	117.0 ± 14.2	128.0 ± 13.7	112.5 ± 17.6
Diastolic BP	75.3 ± 8.3	79.1 ± 9.1	77.5 ± 10.6

than the overweight and normal-weight group ($P = .04$). The overall prevalence of hypertension increased in both groups of boys and girls with a rise in BMI.

The prevalence of hypertension was 30.7% and 8.4% in obese and normal-weight children. There was a strong association between obesity and hypertension ($P < .001$). The relative risk of hypertension was 3.1 (95% confidence interval [CI], 2.45 to 3.93) for a BMI percentile of 85% to 95% and 3.7 (95% CI, 2.75 to 4.95) for a BMI percentile greater than 95%. These relative risks were 2.74 (95% CI, 2.07 to 3.60) in and 2.92 (95% CI, 1.92 to 4.41), respectively, in the girls and 3.22(95% CI, 2.02 to 5.15) and 4.64 (95% CI, 2.98 to 7.20) in the boys. With the increase in the BMI, there was a significant increase in the frequency of hypertensive children (Figure).

Systolic blood pressure correlated with age ($P < .001$), sex ($P < .001$), BMI ($P = .03$), and BMI Z score ($P = .02$), but not with parental history of hypertension ($P = .37$). Diastolic blood pressure correlated with age ($P < .001$), sex ($P < .001$), BMI ($P = .01$), and BMI Z score ($P = .01$), but not with parental history of hypertension ($P = .17$). Data showed that female sex was protective against hypertension in children and adolescents. For each 1 kg/m^2 rise in BMI, there was a 0.16 mm Hg



The increasing pattern of the frequency of hypertension with the increase in body mass index (BMI) percentile

and 0.11 mm Hg increase in systolic and diastolic blood pressure values, respectively.

The prevalence of maternal and paternal and both parents' hypertension in the students was 7.0%, 5.7%, and 1.2%, respectively. Of all 11.8% hypertensive students, 39.0% had a history of maternal hypertension and 7.9% had a history of paternal hypertension. There was no correlation between child and parental hypertension.

Distribution of obesity and hypertension in the students was assessed considering their mother's education. Overall, 85.1% of the students had mothers with primary education level. Of all 11.8% of the hypertensive children, 5.8% had mothers with primary education level and 6% had mothers with advanced education levels. Of the 7% of the obese children, 3% had primary and 4% had highly educated mothers. Neither obesity ($P = .17$) nor hypertension ($P = .09$) in students had a significant correlation with maternal education.

DISCUSSION

We studied 2000 students aged 11 to 17 years from November 2010 to March 2011 in Shiraz (south of Iran). This study population consisted of 953 boys and 1047 girls. Overall, 80% of the children had normal BMI values (boys, 81.3%; girls, 78.8%), 13% were overweight (boys, 10.8%; girls, 15%), and 7% were obese (boys, 6.2%; girls, 7.9%). We found that girls aged 11 years old were most likely to be obese. Puberty changes in this age group might be a cause. Our study showed that there is no significant difference in the prevalence of obesity between boys and girls. Also, we demonstrated that there was a significant increase in both systolic and diastolic blood pressure that corresponds with an increase in BMI, and the prevalence of systolic hypertension was 30.7% and 8.4% in children with obesity and normal BMI, respectively. The relative risk of hypertension was 3.1 (95% CI, 2.45 to 3.93) for a BMI percentile of 85% to 95% and 3.7 (95% CI, 2.75 to 4.95) for a BMI percentile of 95%. According to these findings, we concluded that obesity was an important risk factor for hypertension and this risk was more in boys than the girls.

Systolic and diastolic blood pressure had a correlation with patient age, sex, BMI and BMI Z score, but it did not have any correlation with parental history of hypertension and level of maternal education. It demonstrates that in the south of Iran, media, culture, and ethnic factors might be more important than education of mothers in changing lifestyle and eating habits to prevent hypertension in children. Furthermore, we showed that for each 1-kg/m^2 rise in BMI, there were 0.16-mm Hg and 0.11-mm Hg increases in systolic and diastolic blood pressure, respectively. Also, there was a 0.55-mm Hg rise in systolic and a 0.36-mmHg rise in diastolic blood pressure with each 1 unit increase in BMI Z score.

Childhood and adolescent obesity has become a global health problem and is no longer limited to industrially developed countries; the implementation of western lifestyles, especially the intake of attractive energy-dense food with undesirable composition, increased consumption of animal fats and sugars and reduced consumption of dietary fiber, along with a lack of sufficient physical activity has resulted in an increasing prevalence of obesity in many countries.[2] The Middle East region has the highest dietary energy surplus among developing countries, and there is evidence of a rapid rise in noncommunicable disease risk factors, including obesity.[10] The largest number of studies on the epidemiology of obesity among children and adolescents were from Saudi Arabia and Iran, followed by Kuwait.[11-24] The highest prevalence of overweight was reported from Bahrain (38.5%),[11] followed by Kuwait with a rate of 31.8% among girls.[17] The lowest prevalence of obesity was reported from Iran (2% to 3%),[18] followed by Lebanon (3.2% among 3- to 19-year-old girls).[19] In 2002, Dorosty and colleagues studied 4315 children in Guilan (North of Iran) aged 2 to 5 years old and showed that the prevalence of obesity among female toddlers was 10% and among boys was 9%. Also, the prevalence of overweight was 22.3% among female toddlers and 20.4% in male toddlers.[20]

In 2006, Moayeri and coworkers demonstrated the prevalence of obesity in 2900 student aged 11 to 17 years in Tehran (North of Iran) during a period of 2004 to 2005. They showed that the prevalence of obesity and overweight was 7.1% and 17.9%, respectively.[21] Also, in 2006 Esmaillzadeh and colleagues showed that the mean prevalence of obesity and overweight was 5.1% and 12.1% in girls, respectively, and 7% and 10.1% in boys. They studied 6565 children aged 10 to 19 years in Tehran.[22] In 2007, Kelishadi and colleagues published an article that investigated the prevalence of obesity among 21 111 students aged 6 to 18 years in 2 province of Iran (Tehran and Isfahan) in the north and center of Iran in 2004 to 2005, showing that the prevalence of obesity and overweight was 1.3% and 5.9% among girls and 1.6% and 5.4% in boys, respectively.[18] Studies in the Middle East indicated a steady increase in the prevalence of overweight and obesity with increasing growth and stage of puberty and in a comparison of rates of overweight in 4 Asian and 5 European countries it was reported that the crude number of cases was highest among 10 year-old-children.[12] According to these data, it seems that the prevalence of obesity was similar in the south and north of Iran in children and adolescents, but in the south of Iran, the prevalence of obesity in girls was more than that in the north of Iran.

The comparison between our data and previous studies[20-22] showed that the prevalence of obesity during years 2006 to 2011 did not change significantly, and it was steadily about 7.9% in female children and adolescents and 6.2% in male children and adolescents. This shows that population-wide interventions to prevent childhood overweight in Media and school were successful in controlling obesity, but more extensive monitoring and preventing programs need to lower the prevalence of obesity in childhood. Like other studies in Iran, our study showed that the prevalence of obesity in boys in the south of Iran is more than girls, but it is not significant. International comparisons[20] also report that the prevalence of obesity is higher among boys than girls in developing countries. Such differences might reflect different cultural habits and attitudes towards nutrition and physical activity.[11,12]

Obesity is the principal risk factor for arterial hypertension. In 1978, the *New England Journal of Medicine* published an important paper which showed that weight loss alone (without salt restriction) reduced the blood pressure of overweight hypertensive patients.[3] The most comprehensive study by Rosner and colleagues pooled data from 8 large United States epidemiological studies involving over 47 000 children to describe blood pressure difference between black and white children in relation to body size. Irrespective of race, sex, or age, the risk of elevated blood pressure was significantly higher for children in the upper compared with the lower deciles of BMI, with an odds ratio of systolic hypertension ranging from 2.5 to 3.7.[13] Hamidi and colleagues investigated obesity and associated cardiovascular risk factors in Iranian children and concluded that high prevalence of cardiovascular risk factors in overweight and obese children and positive correlation of these factors with severity of obesity emphasize the need for prevention and control of childhood obesity from early stages.[3] Sorof and coworkers recently reported a high prevalence of hypertension in obese compared with nonobese adolescents in a school-based hypertension and obesity screening study. In this study, 33% of the obese children were hypertensive compared with 11% of lean children.[15]

In 2006, Kelishadi and coworkers performed a study to determine the prevalence of hypertension and its influencing factors among 21 111 children in Iran. The overall prevalence of systolic, diastolic, and systolic or diastolic hypertension according to the second task force study 95th percentile cutoff points were 4.2%, 5.4%, and 7.7%, respectively, without a significant sex difference. They concluded that male sex, large waist, and low education of the mother were the risk factors of systolic hypertension, whereas the risk of diastolic hypertension rose with living in an urban area, attending public school, low physical activity level, having a housewife mother, and a positive family history of obesity, especially in the parents.[18] Mohkam and colleagues showed hypertension in 24.2% of the children sampled from primary schools of Tehran (aged 7 to 11 years old). Overweight was determined in 12% of them. They also detected a significant difference in the prevalence of hypertension and overweight between the children of different geographic parts of this city in the north of Tehran. They showed that childhood hypertension is on the rise; they reported that this prevalence was similar to those recently reported in other countries.[24]

In Kamath and colleagues' cross-sectional study, a total of 2067 students aged 5 to 16 years in India were studied, and total prevalence of hypertension was 2.2% (2.4% in females and 2.1% in males). In the study, the prevalence of hypertension was increased with an increase in BMI.[23] In the present study, 84.9% and 85.9% of the students had normal systolic and diastolic blood pressure, respectively. About 4.5% and 7.4% of them were at risk of systolic and diastolic hypertension, respectively. In addition, 10.7% of all the students had systolic hypertension and 6.8% of them had diastolic hypertension. According to their ages and height percentile, 5.5% had both systolic and diastolic hypertension. It means that the prevalence of hypertension in 2010-2011 was greater than that in the past years in Iran,[13-16] and it may be due to eating habits (increasing fast food ingestion), decreased exercise, sedentary life, and increase in the environmental tensions.

A limitation of our study was the use of questionnaire data to determine the hypertension status of parents and we did not measure their blood pressure. Usually, 25% to 30% of the adults are unaware of being hypertensive, so we might have included some parents with undetected hypertension as nonhypertensive parents.

CONCLUSIONS

Our study highlights the prevalence of obesity and hypertension in Iran. It showed that the slope of prevalence of obesity was flat in the recent 5 years in Iran, but the prevalence of hypertension was significantly higher than that in the years before. It stresses the role of pediatrician and family physicians in monitoring blood pressure in children as a routine practice for early detection of hypertension and its definite causative factors such as obesity. Undoubtedly, this may prevent future cardiovascular events.

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CONFLICT OF INTEREST

None declared.

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Correspondence to:
Forough Saki, MD
Division of Pediatric Endocrinology and Student Research Center, Shiraz University of Medical Sciences, Shiraz, Iran
E-mail: forughs@yahoo.com

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