Original Article

Prevalence and Predictors of Hypertension in Primary School Students: A population based study in Aydin, Turkey

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Abstract

Background and aim: The presence of cardiovascular risk factors in childhood and adolescence may lead to cardiovascular disease in adulthood. The aim of this study was to determine the prevalence and predicting factors of hypertension in primary school students of a Western city, Aydin.

Study Design and Methods: A total of 1348 primary school students (1^{st}-8^{th} grade) between 6-15 years old were randomly included in the study. Blood pressure measurements were obtained and hypertension was diagnosed using the tables provided by the Task Force Report on high blood pressure- specific to gender, age and height percentile- in children and adolescents. Weight and height were measured using standard procedure.

Results: The prevalence of hypertension in primary school students was 13.4%. Hypertension, overweight and obesity were significantly higher in children with higher socioeconomic status ($p<0.001$). There was a significant increase in systolic and diastolic blood pressure (SBP and DBP, respectively) with increase in BMI percentile ($p<0.001$, for both). Of students, 1123 (83.3%) stated they did not have any blood pressure measurement before.

Conclusion: Childhood hypertension remains as an important child health problem and it is associated with overweight. Early identification of children with hypertension is possible by routine blood pressure monitoring during well-child visits.

Key words: Adolescent, children, hypertension, obesity, overweight, prevalence.

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Introduction

Cardiovascular diseases are one of the most common health problems and one of the leading causes of death in adults. The presence of cardiovascular risk factors in childhood and adolescence may lead to long term burden on cardiovascular system which ultimately results in cardiovascular disease and mortality in adulthood.[1]

Obesity which is related to cardiovascular diseases reached epidemic levels in many countries.[2] It is remarkable that the prevalence of childhood obesity has also increased over the last decades.[3]

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Hypertension in childhood may become more prevalent than previously reported and an epidemiologic shift may be seen from secondary hypertension to primary hypertension in relation to increasing prevalence of childhood obesity.[3,4] Many studies have investigated the interaction between overweight, hypertension and ethnicity.[3,5] The prevalence of overweight and hypertension in childhood has increased among ethnic minorities such as Turkish children living in Netherlands.[3,6] There is a recent study conducted in older children in central Anatolia.[7] However there is no population based study about childhood hypertension in Western Anatolia where Mediterranean life style is more predominant.

The aim of this study is to determine the prevalence and predicting factors of hypertension in primary school students of a Western city, Aydin. .

Material and Methods

This cross-sectional, descriptive, population-based study was implemented between January-November 2005. The study was approved by Turkish Ministry of Education and Local Ethics Committee. Informed parental consent was obtained.

Study Design and Population

The sample size was calculated as 1350 children on prevalence of 5%, d=0.05 at a confidence level of 95%. A design effect of 2 was used to allow for multistage sampling.[8]

A three stage probability design was used to select a representative sample of primary school children in Aydin between 1st and 8th grades. Stage one involved to stratify schools by socioeconomic status (low, medium, high). Total population of schools in each socioeconomic status (SES) was calculated to have a balanced distribution for SES and gender. In the second stage, a stratified random selection was performed for total of seven schools from each SES. In the third stage, one in three students was randomly selected from each classroom. A questionnaire including demographic information was filled out for each student. Information was obtained from school records and from children themselves.

Blood pressure, weight and height measurements

Mercury sphygmomanometer was used to measure arterial blood pressure. Bladder with its width covering at least two thirds of the upper arm and length exceeding 80% of the biceps circumference was selected for each student. After 10 minute of rest in a quiet room, three blood pressure and heart rate measurements were taken at 15 minute intervals while student was seated. The average of three measurements was used in subsequent analysis.

Students with elevated blood pressure (≥95th percentile) were determined using the tables provided by the Task Force Report on high blood pressure-specific for gender, age and height percentile-in children and adolescents.[9] Children with an average of three measurements over 95th systolic blood pressure (SBP) and/or diastolic blood pressure (DBP) percentile considered as hypertensive.

Weight was measured in light clothing using a beam balance and height with a stadiometer. Body mass index (BMI) was calculated as weight (kg)/height (m)². Determination of overweight and obesity was obtained by the 85th and 95th percentiles of BMI for age, respectively, as proposed by Centres for Disease Control (CDC) in 2000.[10] Growth curves for healthy Turkish children were used to find the age-specific height and weight percentile for each student.[11]

Table 1: Demographic characteristics of students (n=1348)

Demographic characteristics	n (%)
Gender	
Girls	683 (50.7%)
Boys	665 (49.3%)
Parental education	
Mother	
Illiterate	146 (10.8%)
Basic reading-writing skills	174 (12.9%)
Primary school	516 (38.3%)
Secondary school	98 (7.3%)
High school	330 (24.4%)
University	84 (6.2%)
Father	
Illiterate	35 (2.6%)
Basic reading-writing skills	156 (11.6%)
Primary school	477 (35.4%)
Secondary school	131 (9.7%)
High school	387 (23.7%)
University	162 (12.0%)
Occupation	
Mother	
Housewife	1065 (80.4%)
Labourer (unqualified)	63 (4.7%)
Teacher	47 (3.5%)
Government officer	33 (2.4%)
Retired	13 (1.0%)
Physician	10 (0.7%)
Other (housekeeper, tailor, etc.)	117 (8.9%)
Father	
Labourer (unqualified)	304 (22.6%)
Tradesman	204 (15.1%)
Government officer	83 (6.2%)
Unemployed	81 (6.1%)
Security officer	69 (5.1%)
Retired	61 (4.5%)
Teacher	46 (3.4%)
Farmer	30 (2.2%)
Engineer	26 (1.9%)
Deceased	20 (1.5%)
Other (shepherd, hawker, mechanic, etc.)	424 (32.3%)
Body mass index	
< 85th percentile	1127 (83.6%)
85th -94th percentile	140 (10.4%)
≥ 95th percentile	81 (6.0%)
Socioeconomic status	
Low	289 (21.4%)
Medium	795 (59.0%)
High	264 (19.6%)

Statistical Analysis

Descriptive statistics are presented as percentages, means and standard deviations. χ^2 analyzes was used to define associated factors with hypertension and multiple logistic regression analysis was used to assess the possible influence of variables as confounding factors in determining hypertension. Correlation between blood pressure and BMI percentile values were analyzed by Spearman's rank correlation coefficient. One way ANOVA was performed for between-group comparisons of categorical and continuous variables. P value <0.05 was used to indicate statistical significance. Data were analyzed using the Statistical Package for the Social Sciences program version 13.0 (SPSS 13.0).

Results

A total of 1408 primary school students were screened for hypertension. Sixty children were excluded from the study as four students had heart disease and 56 children had incomplete data. A total of 1348 primary school students were included in the study.

Mean age was 10.5±2.4 years. The majority of students were from middle socioeconomic status. In pre-school period, 1142 (85.2%) children were taken care of by their mothers and the majority of mothers were housewives. Other care sources were day-care, grandmother, father and baby-sitter. Demographic characteristics of children are shown in Table 1.

It was remarkable that 1123 (83.3%) students did not ever have their blood pressure measured before.

Mean BMI percentile was 48.56%±29.79 and mean BMI was 17.78kg/m^2±3.32. Two hundred and twenty one (16.4%) students had BMI≥85^{th} percentile. Among this group 81 (6.0%) students had BMI≥95^{th} percentile.

Mean SBP increased by age (p=0.03) whereas there was no significant change in DBP by age (p>0.05). There was significant increase in both SBP (r=0.323, p<0.001) and DBP (r=0.110, p<0.001) with increase in BMI percentile. Mean SBP and DBP for each BMI percentile was shown in Figure 1.

One hundred and eighty one children had high blood pressure and the prevalence of hypertension in primary school students was 13.4%. Details of hypertensive and normal children with regard to gender and socioeconomic status were shown in Table 2. There was no significant relationship between hypertension and gender. Results of logistic regression analysis showed that, obese and high SES students (p< 0.001, p< 0.001, respectively) had higher rates of hypertension. Forty-five (24.8%) of the total 181 hypertensive children were either overweight or obese.

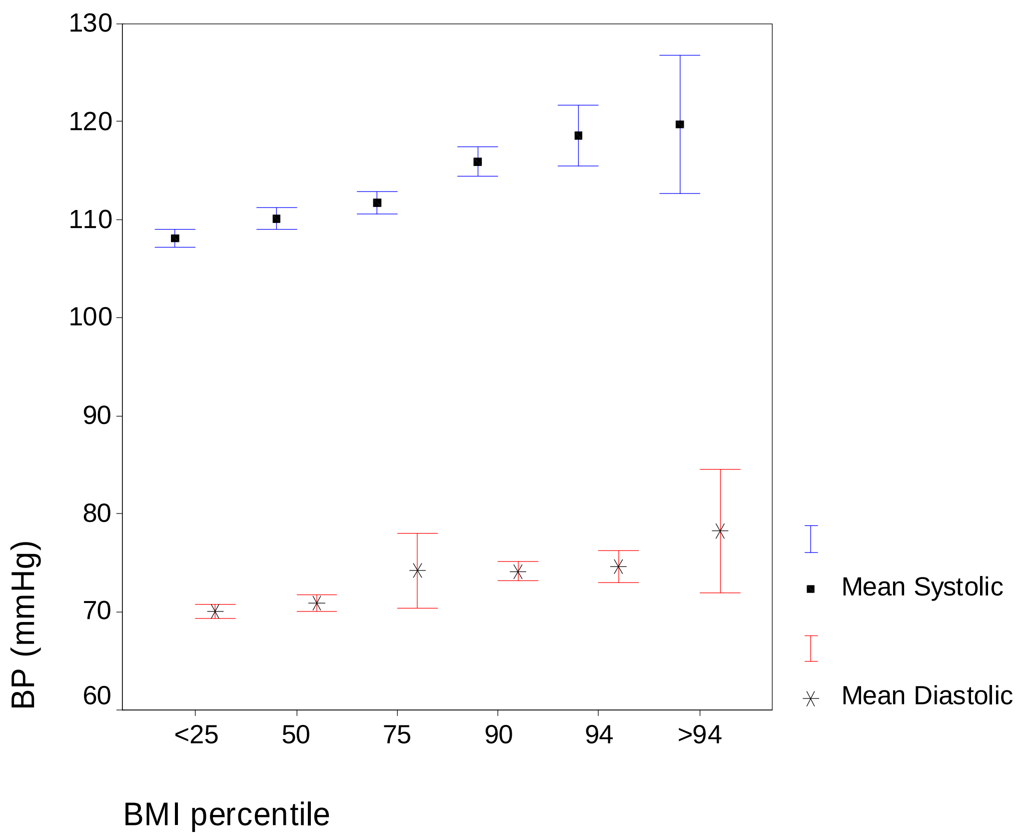

Figure 1: Mean systolic and diastolic blood pressures for each Body Mass Index (BMI) percentile.

Table 2: Blood pressure groups, gender and socioeconomic status of students (n=1348)

	High Blood Pressure n(%)	Normal n(%)	p value
Gender			
Girls	104 (15.2)	579 (84.8)	0.06
Boys	77 (11.6)	588 (88.4)	
Socioeconomic Status			<0.001
Low	37 (13.0)	253 (87.0)	
Medium	73 (9.2)	721 (90.8)	
High	71 (26.9)	193 (73.1)	
Total	181 (13.4)	1045 (86.6)	

Hypertension and overweight and obesity were significantly high in children from high SES. Table 3 shows mean values for BMI and blood pressures and proportion of overweight or obese according to SES.

Discussion

Since clusters of multiple cardiovascular risk factors persist strongly from childhood to adulthood, screening children has vital importance in detecting the risk factors. Obesity is associated with higher blood pressure levels, various adverse biochemical, physiological, and psychological effects, many of which have the possibility of tracking into chronic disease risk factors in adulthood.[12] Studies have shown cardiac hypertrophy and increased left ventricular mass to be associated with higher levels of blood pressure, which is an independent risk factor for future cardiovascular events in adulthood.[1]

Even though age remains a major determinant of vascular changes, the data from Bogalusa Heart Study showed that approximately 60% of overweight 5-10 years old children had one cardiovascular risk factor, such as high blood pressure.[1, 13]

Hypertension prevalence in screening studies of children and adolescents in various age groups have been recently reported in a range between 4.5% to 23.9%.[3,7,14-16] As an important predictor of childhood hypertension, obesity in children cannot be classified as a Western problem as it is shared by many industrialized areas and many developing countries.[12,17-20] Rapidly increasing prevalence of overweight and obesity even among pre-school children had been reported from developing countries.[21] Overweight and obese children have significantly higher blood pressure values than normal weight children. Additionally in overweight and obese subjects the number of patients with blood pressure values below the 50th percentile was found to be lower.[22] Atabek et. al. reported in a hospital-based study that hypertension prevalence in obese Turkish children was 37.0%.[23] Likewise, Sorof et. al. reported that even though the unadjusted relative risk of hypertension was higher in some ethnic groups, after adjustment for overweight, ethnicity was no longer predisposing factor for hypertension. Overweight was the strongest predictor of hypertension in children.[3] Our findings were consistent with the literature.

Girls have been affected from overweight and obesity more than boys, and girls at the 85th percentile of BMI have begun to show a marked increase of obesity after 9 years of age.[1] Unlike to overweight and obesity, gender was not found to be related to blood pressure level in children.[24] We did not find any gender difference with hypertension and overweight and obesity.

Socioeconomic status is another interest of point for childhood hypertension. Conflicting data exists on the relationship between obesity, hypertension and socioeconomic status. Lower socioeconomic status was reported as an important predictor for increased prevalence of overweight and hypertension in children in developed countries.[19,25] However, contrary was reported from developing countries.[17] Likewise, high SES was associated with hypertension, overweight and obesity in our study.

Table 3: Mean±SD for Body Mass Index (BMI), BMI percentile, blood pressures and overweight or obese according to socioeconomic status (SES)

SES Category	n (%)	BMI (kg/m^2)	BMI Percentile (%)	Overweight or obese n (%)	Systolic Blood Pressure (mmHg)	Diastolic Blood Pressure (mmHg)
Low	289 (21%)	17±3	47±28	37 (13%)	112±9	72±7
Medium	795 (59%)	17±3	46±29	110 (14%)	110±10	72±7
High	264 (20%)	18±3*	58±29*	74 (28%)*	116±11*	74±7**

* p< 0.001 **p<0.01

Early identification of children who are at risk of hypertension is important in preventing adult hypertension. Childhood hypertension can be identified easily by yearly measurements of blood pressure in all children over 3 years old in a routine paediatric well-child visit as recommended by Task Force on Blood Pressure Control in Children.[9] Primary care centres are easily accessible and widely used facilities for routine paediatric well-child visits. However, it is unfortunate that primary care physicians are not sufficiently detecting, monitoring and managing hypertension in children.[1] Furthermore, with regard to obesity, an important predictor of hypertension, although the majority of nurse practitioners were aware of childhood obesity prevention guidelines, most were not consistently using BMI for age or monitoring children at increased risk for obesity.[26] In our study, it is remarkable that, %83.3 of children between 6-15 years old did not have any previous blood pressure measurement. New strategies should be developed in primary care settings and school health centres to prevent childhood hypertension.

Prevention of disease in childhood is one of the most important goals of primary care, and success in prevention ultimately will result in reduction of diseases in adulthood. Primary care physicians and school health workers should play an important role in childhood obesity and hypertension. They should join forces between disciplines to mount an effective public health campaign in the prevention and treatment of these two important public health priorities.

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