

## Evaluation of the Measurements of Blood Pressure of a Primary School Students

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**Abstract:** The prevalence of hypertension is 1-3% in childhood population and it may cause high morbidity and mortality due to the complications. Therefore, the early diagnosis of hypertension is important. This study was performed to determine the frequency of the hypertension by interpreting of the blood pressure measurements of a primary school student. This project was conducted on 610 students, aged from 6-17 years who are studying in a primary school located in a district that has a low socio-economical status in the city center of Kayseri, Turkey between May-June 2004. The blood pressure measurements were interpreted according to the National High Blood Pressure Education Programme Working. 46.3% of the students were between 6-9 years old and 50.7% of them were girl. The overall rate of the hypertension was 2.44%. There was a positive correlation between age, height, weight, Body Mass Index (BMI,  $\text{kg m}^{-2}$ ), the mother's age and blood pressure. In boys, a negative relationship was found between the educational level of the parents and blood pressure while a positive correlation existed between income level and blood pressure ( $p < 0.05$ ). A positive correlation was determined between the blood pressure and age, height, weight and BMI of students in both gender. A negative correlation was found between blood pressure and educational level of parents and a positive correlation was found between income level of family and blood pressure of boys. The overall prevalence of hypertension was 2.44%.

**Key words:** Blood pressure, students, screening, primary school student, BMI

### INTRODUCTION

Hypertension, which is included in the "Significant Health Problems" by World Health Organisation, is widespread and it has a high prevalence as well as the high morbidity and mortality rates due to the complications, therefore the early diagnosis of hypertension is of importance. The prevalence of chronic hypertension in children was reported as 1-3% (Bakkaloğlu, 2003; Özaltın and Bakkaloğlu, 2000; Sever, 1997; Yalçinkaya, 2003). In a study conducted on 8820 children in Turkey, the prevalence of hypertension was determined to be 0.6% (Paç *et al.*, 2001). However, high systolic and diastolic blood pressures were found in ¼ of the first grade students in a primary school (Kubilay *et al.*, 2004). The detection of the children who are under the risk for essential hypertension by health screening and taking the preventive precaution are very important (Bakkaloğlu, 2003; Bayik, 1991).

This study was performed to determine the prevalence of hypertension in a primary school students by the interpretation of the blood pressure measurements and to canalise the students to a health institution.

### MATERIALS AND METHODS

This study was performed in a primary school located in a district with a low socio-economical status in the city centre of Kayseri, Turkey between May-June 2004. The permission was taken from Government National Education Administration Office and school management before the study. In the study, all of the students present in the school during the study were included ( $n = 610$ ) into the study instead of randomised sampling. The students participated in the study were taken to a interview room individually and informed about the study and blood pressure of them was measured following a 10 min rest. Children with high blood pressure in the first measurement were undergone a second measurement one day later and the second measurements were considered. The results of the measurements of blood pressure were evaluated according to the criteria of National High Blood Pressure Education Programme Working (National High Blood Pressure Education Programme Working, 2004) which is also applicable in Turkey (Neyzi and Ertuğrul, 2002).

The information about the children and their family was collected with questionnaire form and evaluated by computer. Data were analysed by percentage, means, Student's t test, Pearson's correlation and Prevalence test.

**RESULTS**

It was determined that 46.3, 32.6 and 20.8% of the students included in the study were 6-9, 10-12 and 13-17 years old, respectively and 50.7% of them were girl and 49.3% of them were boy. Sixty nine percent of the mothers of the students were primary school graduate, 98.5% of them were housewife and 54.4% of them were aged between 31- 40 years; 67.3% of the fathers of the students were primary school graduate, 57.6% of them aged between 35-44 years; 33.7% of the fathers did not have a regular job and 31.5% of them did not have regular income.

The systolic hypertension rate was 3.8% for girls and 3.1% for boys, while diastolic hypertension rate was 3.2% and 1.9% for girls and boys, respectively; the prevalence of overall hypertension was 2.9% in girls and 1.9% in boys (Table 1). Overall hypertension rate in all students was found to be 2.44%.

Distribution of the values of blood pressure according to the gender and age of the students were presented in Table 2. The blood pressure values were increased with the increasing age of the students.

Especially the blood pressure of the girls between 6 and 13 years old was higher than the boys, while blood pressure of the boys over 14 years old was higher than the same aged girls. Moreover, the blood pressure of 11 year old girls was higher than the boys and the difference was found statistically significant ( $t = 2.170$ ,  $p = 0.034$ ).

In this study, the relationship between the Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) of the girls and their height, weight, BMI, age and the age of their mothers and the educational levels of their parents were investigated and it was found that the blood pressure values increased with the increasing of the children's age, height, weight, BMI and age of the mothers and a positive correlation was determined (for SBP  $r = 0.449$ ,  $r = 0.442$ ,  $r = 0.316$ ,  $r = 0.364$ ,  $r = 0.246$ ,  $p = 0.000$ ; for DBP  $r = 0.324$ ,  $r = 0.355$ ,  $r = 0.298$ ,  $r = 0.284$ ,  $r = 0.254$ ,  $p = 0.000$ , respectively). The educational level of the parents had no effect on systolic and diastolic blood pressure of girls (Table 3).

There were an increase systolic and diastolic blood pressure values of the boys with the increasing

Table 1: The prevalence of hypertension of the students included in the study

Gender	Prevalence of hypertension		
	Systolic (%)	Diastolic (%)	General (%)
Girl	3.8	3.2	2.9
Boy	3.1	1.9	1.9

Table 2: The distribution of students' blood pressure values with regard to age and gender

Age	Gender	n	Left arm			
			Systolic mean (SD)	Diastolic mean (SD)	Max	Min
6	F	24	98.12 (± 9.41)	59.16 (±7.17)	110/70	80/50
	M	28	96.25 (± 9.29)	57.14 (±6.58)	120/70	80/50
7	F	43	99.30 (±12.32)	61.51 (±9.91)	140/100	80/50
	M	29	97.93 (±7.73)	59.65 (±5.16)	110/70	80/50
8	F	39	99.87 (±10.03)	62.82 (±8.17)	120/90	80/50
	M	37	99.73 (±10.06)	61.71 (±7.64)	120/80	80/50
9	F	50	102.10 (±10.40)	63.50 (±7.70)	130/80	80/50
	M	34	101.47 (±8.48)	65.29 (±5.65)	120/75	80/50
10	F	35	103.14 (±12.31)	62.71 (±6.45)	130/80	80/50
	M	42	103.33 (±9.79)	63.09 (±6.14)	130/80	80/50
11	F	33	109.09 (±11.88)	65.30 (±7.38)	130/80	80/50
	M	28	102.50 (±11.74)	64.82 (±9.37)	120/90	80/50
12	F	30	108.00 (±9.52)	64.16 (±6.95)	140/80	90/50
	M	31	107.25 (±11.82)	65.16 (±7.12)	140/80	90/55
13	F	35	111.80 (±13.17)	67.91 (±7.68)	130/80	80/50
	M	38	109.07 (±11.67)	67.23 (±8.02)	140/100	90/60
14	F	15	107.33 (±9.61)	67.33 (±5.93)	130/80	90/60
	M	25	114.20 (±13.04)	70.40 (±9.88)	130/95	90/50
15	F	5	114.00 (±20.7)	70.00 (±14.14)	130/90	100/60
	M	3	120.00 (±10.0)	76.66 (±5.77)	130/80	110/70
16	F	-	-	-	-	-
	M	4	120.00 (±8.16)	80.00 (±0.00)	130/80	110/80
17	F	-	-	-	-	-
	M	2	125.00 (±7.07)	75.00 (±7.07)	130/80	120/70

Table 3: The correlation between blood pressure and anthropometric measurements and families' characteristic in girls

Features	Systolic blood pressure		Diastolic blood pressure	
	r	P	r	P
Height	0.449	0.000	0.324	0.000
Weight	0.442	0.000	0.355	0.000
BMI	0.316	0.000	0.298	0.000
Age	0.364	0.000	0.284	0.000
Mother's age	0.246	0.000	0.254	0.000
Mother's education	-0.070	0.241	-0.102	0.087
Father's education	-0.068	0.269	-0.015	0.810
Income	0.030	0.660	0.036	0.595

Table 4: The correlation between blood pressure and anthropometric measurements and families' characteristic in boys

Features	Systolic blood pressure		Diastolic blood pressure	
	r	P	r	P
Height	0.494	0.000	0.480	0.000
Weight	0.500	0.000	0.489	0.000
BMI	0.362	0.000	0.368	0.000
Age	0.478	0.000	0.472	0.000
Mother's age	0.246	0.000	0.299	0.000
Mother's education	-0.155	0.015	-0.217	0.001
Father's education	-0.144	0.028	-0.138	0.034
Income	0.168	0.020	0.215	0.003

their height, weight, BMI, age and age of their mothers and a positive correlation was determined (for SBP  $r = 0.494$ ,  $r = 0.500$ ,  $r = 0.362$ ,  $r = 0.478$ ,  $r = 0.246$ ,  $p = 0.000$ ; for DBP  $r = 0.480$ ,  $r = 0.489$ ,  $r = 0.368$ ,  $r = 0.472$ ,  $r = 0.299$ ,  $p = 0.000$ , respectively). However, blood pressure values were increased with the decreasing educational level of the parents, thus a negative correlation was determined (in mothers SBP  $r = -0.155$   $p = 0.015$ , DBP  $r = -0.217$   $p = 0.001$ ; in fathers SBP  $r = -0.144$   $p = 0.028$ , DBP  $r = -0.138$   $p = 0.034$ , respectively) (Table 4).

There was no relationship between income level and the systolic and diastolic blood pressure values of the girls while a positive correlation was determined between the systolic and diastolic blood pressure and income level of the family of the boys (for SBP  $r = 0.168$ ,  $p = 0.020$ ; for DBP  $r = 0.215$ ,  $p = 0.003$ , respectively).

## DISCUSSION

In this study, the systolic hypertension rates were 3.8% for girls and 3.1% for boys; the diastolic hypertension rate were 3.2% for girls and 1.9% for boys; in general, the rate of hypertension was found 2.9% and 1.9% for girls and boys, respectively. In a study of Eksen *et al.* (2004) prevalence of systolic hypertension was reported as 3.5% for girls and 1.5% for boys and diastolic hypertension was 6.3% for girls and 5.2% for boys. Androque found the prevalence of systolic hypertension is 2.8% for girls and 2.7% for boys. The prevalence of diastolic hypertension was found 2.7% for girls and 1.3% for boys by the same authors

(Androque and Sinakio, 2001). In the present study, overall hypertension rate was found as 2.44%. In a study conducted on the school children between 13-19 years old, hypertension rate was found 4.5% (Sorof *et al.*, 2004). In a previous study conducted in Turkey on 8820 children, the prevalence of hypertension was found as 0.6% (Paç *et al.*, 2001).

It is known that the blood pressure of children changes with the age, gender, height and weight (Özaltın and Bakkaloğlu, 2000; Sever, 1997). In a study, conducted on the school children between 12-16 years old, the blood pressure values of the children in both gender increased with the increasing age (Chu *et al.*, 2001). Guerra *et al.* (2002) also found the increased systolic and diastolic blood pressure with the increasing age in both gender. In another study conducted in our country on 1024 children, a positive relation was determined with the age and blood pressure (Soylu *et al.*, 2000). Similarly, in this study, a positive correlation was found between the age and blood pressure of the students, so the blood pressure values increased with increasing age (for girls, SBP  $r = 0.364$ ,  $p = 0.000$ ; DBP  $r = 0.284$ ,  $p = 0.000$ ; for boys, SBP  $r = 0.478$ ,  $p = 0.000$ ; DBP  $r = 0.472$ ,  $p = 0.000$ ).

Among the children between 6 and 13 years old, the girls had higher blood pressure than the boys, while the blood pressure of the boys over 14 years old was higher than the girls but the difference was not statistically significant ( $t = -1.907$ ,  $p = 0.064$ ). The higher blood pressure rate in the boys over 14 years old may be due to becoming adolescent in this period; the increases in height and weight may cause the high blood pressure. In this study, the blood pressure of 11 years old girls was higher than the boys and the difference was found significant as statistically ( $t = 2.170$ ,  $p = 0.034$ ). The higher blood pressure determined at this age in the girls may be due to the entering of the girls to puberty earlier than the boys.

It was suggested that obese children have higher blood pressure values than the no obese children at the same age and the increase in weight is a risk factor for hypertension (Bakkaloğlu, 2003; Sever, 1997; Sorof and Daniels, 2002; Yalçinkaya, 2003). Lurbe *et al.* (1998) conducted a study on the school children aged between 6 and 16 years and they found obese children had higher blood pressure values than no obese ones and blood pressure was positively correlated with their height and weight. In another study, a three fold higher hypertension rate was observed in obese children than normal children (Sorof *et al.*, 2002). A positive relationship was found between blood pressure and height and weight of the children included in the study of Eksen *et al.* (2004). In the present study, a positive relation between the blood

pressure and height and weight of the students was found. Also it was found consistent with the results of the previous studies indicating higher blood pressure is associated with the higher height and weight values (for girls, SBP  $r = 0.449$ ,  $p = 0.000$ , DBP  $r = 0.324$ ,  $p = 0.000$ ; for boys, SBP  $r = 0.494$ ,  $p = 0.000$ ; DBP  $r = 0.480$ ,  $p = 0.000$ , respectively; for girls, SBP  $r = 0.442$ ,  $p = 0.000$ , DBP  $r = 0.355$ ,  $p = 0.000$ ; for boys, SBP  $r = 0.500$ ,  $p = 0.000$ ; DBP  $r = 0.489$ ,  $p = 0.000$ , respectively).

Higher BMI than normal with the increasing height and weight brings the risk of hypertension together (Sorof and Daniels, 2002). In several previous studies, the rate of hypertension was high in the population of children with high BMI (Barker *et al.*, 2002; Chu *et al.*, 2001; Eksen *et al.*, 2004; Giampietro *et al.*, 2002; Paç *et al.*, 2001; Soyly *et al.*, 2000; Sorof *et al.*, 2004). In a study conducted on school children by Sorof *et al.* (2004) an increase was observed in the prevalence of hypertension with the increasing value of BMI and a positive correlation was found especially between systolic blood pressure and BMI. In this study, when the relationship between the BMI and systolic and diastolic blood pressure of girls and boys was examined; blood pressure values of all students increased with the increasing BMI values and this values were positively correlated. It was observed that increased BMI affected especially systolic blood pressure values (for girls, SBP  $r = 0.316$ ,  $p = 0.000$ , DBP  $r = 0.298$ ,  $p = 0.000$ ; for boys, SBP  $r = 0.362$ ,  $p = 0.000$ ; DBP  $r = 0.368$ ,  $p = 0.000$ ).

In the present study, in boys, a negative relationship was found between blood pressure and educational level of their parents. The blood pressure values of boys increased with decreasing in the educational levels of their mothers (SBP,  $r = -0.155$ ,  $p = 0.015$ ; DBP  $r = -0.217$ ,  $p = 0.001$ ) and fathers (SBP,  $r = -0.144$ ,  $p = 0.028$ ; DBP  $r = -0.138$ ,  $p = 0.034$ ) while the educational level of parents had no effect on the blood pressure of girls. However, in both gender, a positive correlation was found between the age of the mother and blood pressure of the children and blood pressure values of the students increased with the increasing age of their mothers (for girls, SBP  $r = 0.246$ ,  $p = 0.000$ , DBP  $r = 0.254$ ,  $p = 0.000$ ; and for boys, SBP  $r = 0.246$ ,  $p = 0.000$ ; DBP  $r = 0.299$ ,  $p = 0.000$ ). According to the results of this study, it may be speculated that because of the older aged mothers (69.0% of the mothers was between 31-40 years old and 22.3% of the mothers was over 40 years old) have low educational level (23.3% of the mothers was illiterate and 49.9% of them was primary school graduate) affect the relationship between the age of the mothers and blood pressure values of the children.

When the blood pressure values and income levels of the family of the students in both gender was examined,

no relationship was observed between income level and blood pressure in girls, but the blood pressure values of boys increased with the increasing income level, thus a positive correlation was found in boys statistically (SBP,  $r = 0.168$ ,  $p = 0.020$ ; DBP  $r = 0.215$ ,  $p = 0.003$ ). Soyly *et al.* (2000) reported a lower blood pressure level in the children with a low income level. It can be speculated that the obesity due to unbalanced nutrition of the children belonging to wealthy families may brings the hypertension risk together.

## CONCLUSION

In this study, a positive correlation was found between the blood pressure values and age, height, weight and BMI of children in both gender. A negative correlation was determined only in boys between blood pressure and educational level of their parents and a positive correlation was found between blood pressure and income level. The prevalence of hypertension was 2.9% in girls and 1.9% in boys; however, the difference between girls and boys with regard to the hypertension rate was not significant. Overall rate of hypertension in the students was found as 2.44%.

The teachers and the family of the students with high blood pressure were informed and canalized to health institutions.

The results of this study has shown that the school children are under the risk of hypertension, therefore, it can be recommended that health services for the schools should be disseminated, the risk should be accepted and for early diagnosis of hypertension, screening of the blood pressure should be included in the school health services.

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