Prevalence of hypertension among schoolchildren aged 13–18 years in Gemlik, Turkey

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Arterial hypertension is the permanent elevation of blood pressure (BP). Previous studies have documented that hypertension may begin in adolescence, perhaps even in childhood. The purpose of this study was to determine the prevalence of hypertension among adolescents in the Gemlik Research and Training Area, Turkey. Between January and March 1994, all secondary and high school students aged 13–18 years were included in this study. An elevated BP was defined according to the Report of the Second Task Force on Blood Pressure Control in Children. Of the 3,641 students screened, 262 (7.2%) had elevated systolic and/or diastolic BP, 161 (4.4%) students had significant hypertension and 101 (2.8%) students had severe hypertension. We found that systolic and diastolic BP increased with age, height and weight. BP measurements should be included in physical examinations as part of the continuing care of the child.

Key words: hypertension, prevalence, schoolchildren

Arterial hypertension is the permanent elevation of blood pressure (BP). The prevalence of hypertension is reported as being 1–30% among adults in different age groups. It has been recognized since the 1950s that hypertension is a major risk factor for cardiovascular morbidity and mortality.[1] Previous studies have documented that hypertension may begin in adolescence, perhaps even in childhood.[2–5] Early diagnosis, treatment, follow-up of the hypertensive cases and preventive methods such as decreasing weight to the ideal, increasing physical activity and changing eating habits may decrease future hypertension morbidity and mortality.[6]

Early diagnosis of hypertensive cases in adolescence can be a problem because subjects in this age group are generally healthy and see a physician only when they are acutely ill. For this reason, BP should be measured routinely in children aged three years and older during well-child examinations.[7,8] High school screening assessments can be an effective way of finding adolescents with elevated BP, particularly those who are being missed by traditional health care delivery. In addition, in a previous study among adults in Gemlik, the prevalence of hypertension was higher than in the other studies carried out in Turkey.[9] In Turkey, there has been no population study among adolescents. Previous studies were conducted in clinics so the results were not representative of the whole population.

In order to make up for this lack of knowledge, we conducted a population study among adolescents in the Gemlik Research and Training Area, Turkey.

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MATERIALS AND METHODS

The study was conducted between January and March 1994. All secondary and high school students aged 13–18 years were included in this study. Our target population was 3,681 students and we managed to contact 3,641 (98.9%) of them. One medical doctor, one nurse and one health worker received training in BP measurement at the Department of Nephrology in Uludag University Medical School. Standard adult sphygmomanometers (Erkameter; width 13 cm and length 23 cm) were used. The screening team explained to the students the purpose of the study and how BP is measured before the measurements were carried out. When a student was absent, the team went to the school for a second time. The students rested for at least 15 minutes before the measurement was taken. The BP measurements were done in a separate and silent room, in a comfortable sitting position, with the right arm fully exposed and resting on a table at heart level. The onset of the tapping sound (Korotkoff I = phase I) corresponds to the systolic BP. The diastolic BP is characterized by the disappearance of all sounds (Korotkoff V = phase V) for adolescents 13–18 years of age.[7] The data collected included name, age, sex, height and weight. An elevated BP was defined according to the Report of the Second Task Force on Blood Pressure Control in Children–1987.[7] According to this report, for adolescents aged 13–15 years the significant hypertension limits are systolic BP ≥136 mmHg and diastolic BP ≥86 mmHg and the severe hypertension limits are systolic BP ≥144 mmHg and diastolic BP ≥92 mmHg. For older adolescents (aged 16–18 years), these limits are systolic BP ≥142 mmHg and diastolic BP ≥92 mmHg and systolic BP ≥150 mmHg and diastolic BP ≥98 mmHg respectively.[7]

If the systolic and/or diastolic BPs were elevated, the measurements were repeated after 15 min (second meas-

urement). Students in whom both BPs (first and second measurements) were high, were measured for a third time one month later. The students whose second and third measurements were evaluated as normal, were followed up periodically. Students in whom all three measurements were high were called to the out-patient clinic of the Department of Nephrology in the Uludag University Medical School in order to find the aetiologic factor and provide treatment.

After the analysis, it was found that there was no statistically significant difference between the first and second measurements, so only the first BP values were evaluated.[7] Analyses were performed with the EPI INFO Program.

RESULTS

Of the 3,641 students screened, 1,574 (43.2%) were girls and 2,067 (56.8%) were boys. *Table 1* presents the means and standard deviations of height, weight, body mass index and systolic and diastolic BPs by age for girls and boys. Up to 16 years of age, BP increased with age among girls and then a decrease was observed. The BP values increased with age among boys. According to the Second Task Force on Blood Pressure Control in Children–1987,[7] of the 3,641 students screened, 262 (7.2%) had elevated systolic and/or diastolic BP, 161 (4.4%) students had significant hypertension and 101 (2.8%) students had severe hypertension. *Table 2* represents the classification of hypertension by age groups.

DISCUSSION

Hypertension rarely produces symptoms in the early years of life. Although hypertension screening is not recommended in children and adolescents by the WHO,[10] we conducted this prevalence survey because we have no data on the prevalence of hypertension among adolescents in our country. Screening was the only way to obtain the figures.

Many studies have documented that hypertension may begin in childhood. This finding has had an impact on the improvement of diagnostic and therapeutic methods, as well as the development of preventive measures against the causative factors of hypertension.

In different studies, the prevalence of hypertension was calculated among different age groups.[11–21] As shown in *table 3*, we found the second highest prevalence among adolescents. In the previous study among adults in Gemlik, a higher prevalence of hypertension was also found.[9] The reason for this discrepancy should be investigated by conducting further studies.

Table 2 Classification of hypertension by age groups

Age groups	Normal		Significant hypertension		Severe hypertension		Total	
(years)	n	%	n	%	n	%	n	%
13–15	2,325	91.6	147	5.8	67	2.6	2,539	100.0
16–18	1,054	95.6	14	1.3	34	3.1	1,102	100.0
Total	3,379	92.8	161	4.4	101	2.8	3,641	100.0

Table 3 Results of some studies on hypertension

Residence	Study population	Age group (years)	Prevalence of hypertension
Edirne, Turkey[11]	968	7–11	6.2
Sao Paulo, Brasil[12]	1,000	6–18	6.9
St Paul and Minneapolis, Minnesota, USA[13]	14,686	10–15	4.2
Port Moresby, PNG[14]	626	8–16	5.1
Baden Württenberg, Germany[15]	410	4–18	2.9
Cordoba, Argentina[16]	1,698	4–18	3.4
Aligarh, India[17]	3,861	5–15	6.6
Jaipur, India[18]	1,500	5–12	2.9
India[19]	2,073	5–14	2.9
Tulsa, Oklahoma, USA[20]	5,537	14–19	6.0
Napoli, Italy[21]	168	11	8.0
Gemlik, Turkey	3,641	13–18	7.2

Table 1 The means and standard deviations (sd) of male and female subjects' height, weight, body mass index (BMI) and diastolic blood pressures (DBP) and systolic blood pressure (SBP) by age

Age (years)			Height (cm)		Weight (kg)		BMI		DBP (mmHg)		SBP (mmHg)	
	M	F	M	F	M	F	M	F	M	F	M	F
	n	n	Mean ± sd	Mean ± sd	Mean ± sd	Mean ± sd	Mean ± sd	Mean ± sd	Mean ± sd	Mean ± sd	Mean ± sd	Mean ± sd
13	535	447	157.4 ± 9.8	156.5 ± 6.5	48.8 ± 9.5	50.1 ± 8.5	19.5 ± 2.5	20.4 ± 3.0	70.2 ± 10.4	73.8 ± 8.4	109.6±12.3	111.7±10.8
14	446	376	163.3 ± 9.0	158.5 ± 6.5	53.9 ± 9.4	52.1 ± 7.1	20.1 ± 2.6	20.8 ± 2.8	71.4 ± 10.5	75.1 ± 9.6	112.3±12.1	114.7±12.2
15	401	334	169.1 ± 7.8	160.3 ± 6.9	59.3 ± 10.0	53.6 ± 7.4	20.7 ± 2.8	20.9 ± 2.8	74.9 ± 9.3	76.5 ± 9.8	116.0±12.7	114.2±13.0
16	376	281	171.3 ± 7.0	160.5 ± 5.9	61.9 ± 9.7	55.3 ± 8.3	21.1 ± 2.9	21.5 ± 3.1	77.1 ± 10.7	77.2 ± 8.6	118.7±13.5	115.2±11.0
17	202	96	172.0 ± 6.1	159.7 ± 6.8	63.7 ± 8.8	54.5 ± 6.4	21.5 ± 2.8	21.4 ± 2.5	77.0 ± 9.8	74.9 ± 8.8	118.7±12.0	113.6±11.9
18	107	40	172.7 ± 6.7	158.2 ± 7.1	65.0 ± 8.0	53.9 ± 7.3	21.8 ± 2.8	21.5 ± 2.2	76.4 ± 10.5	77.3 ± 8.2	118.8±12.7	113.9±12.3

M: male; F: female

In our study, we found that systolic and diastolic BP increased with age, height and weight. Previous studies have shown that the influence of maturation of the body is more important than age.[3,4,7,15,19,20,22–28] It is not a general rule that BP increases with weight. Race and ethnic groups may influence BP. For example, one study found that Southeast Asian refugee children had greater mean systolic BP than did black and white American children across all weight strata.[26]

In our study, the BP levels increased up to 16 years of age among girls and then a decrease was observed. The mean values of height and weight also decrease among 17 and 18 year old girls. In a study conducted in Sao Paulo similar results were obtained.[12] In our study, the number of 17 and 18 year old girls were few. The reason for this may probably be early marriage. In Turkey, approximately half of the women are married at the age of 18 years. In particular in rural areas, it is very probable that the girls who mature earlier will leave school and get married at younger ages.[28] For this reason, the results of the 17–18 year old girls may not be representative of the whole population.

The BP of most adolescents and children is not measured during routine physical examinations. In a study done in Edirne (Turkey), it was pointed out that none of the hypertensive children's BP had been measured before.[11] In our study, the hypertensive subjects were similarly unaware.

The proposal to measure BP once a year among children three years of age through to adolescence as recommended in the Report of Second Task Force on Blood Pressure Control in Children–1987[7] could be achieved with the minimum of effort in our country. Midwives whose duties are to follow up children of up to 6 years of age could also measure BP. Training midwives about the right measurement techniques can be done with little effort. BP measurements should be included in physical examinations as part of the continuing care of the child, not as an isolated procedure. In Turkey, health centers are responsible for school health. Measuring the BP of the schoolchildren should be added to routine school health examinations. The public should be taught that hypertension is not only a disease of adulthood. People should be educated in order to encourage physical exercise and change eating habits that may both protect them from cardiovascular diseases and decrease their weight to the ideal.

REFERENCES

1 Hypertension in developing countries. WHO Statistics Quarterly 1988;41(3/4).

2 de Man SA, André JL, Bachmann H, et al. Blood pressure in childhood: pooled findings of six European studies. J Hypertens 1991;9:109-14.

3 Kotchen JM, McKean HE, Neill M, Kotchen TA. Blood pressure trends associated with changes in height and weight from early adolescence to young adulthood. J Clin Epidemiol 1989;42(8):735-41.

4 Uhari M, Nuutinen EM, Turtinen J, et al. Blood pressure in children, adolescents and young adults. Ann Med 1991;23:47-51.

5 Yong LC, Kuller LH, Rutan G, Bunker C. Longitudinal study of blood pressure: changes and determinants from adolescence to middle age. The Dormont high school follow-up study, 1957-1963 to 1989-1990. Am J Epidemiol 1993;138(11):973-83.

6 Andersen LB, Henckel P, Saltn B. Risk factors for cardiovascular disease in 16-19-year-old teenagers. J Int Med 1989;225:157-63.

7 Report of The Second Task Force on Blood Pressure Control in Children–1987. Pediatrics 1987;79(1):1-25.

8 Daniels SR. Primary hypertension in childhood and adolescence. Pediatr Ann 1992;21(4):226-9.

9 Erkenci Y. Umurbey Köyünde Hipertansiyon Prevalansi ve Risk Faktörleri (Prevalence of hypertension and risk factors in Umurbey) (dissertation). Bursa: Uludag University, 1990.

10 Braveman PA, Tarimo E, editors. Screening in primary health care: setting priorities with limited resources. WHO: Geneva, 1994.

11 Dindar I, Saltik A. Edirne Merkezinde 7-11 Yas Grubu 968 Ilkokul Çocugunda Hipertansiyon Taramasi (Hypertension screening among primary school children aged 7-11 in Edirne, Turkey). Proceedings of the Fourth National Congress of Public Health; 1994 Sept 16-20; Didim. Izmir: 9 Eylül University Medical School; Ege University Medical School; Izmir Chamber of Medicine 1994:436-40.

12 Simonatto DM, Dias MD, Machado RL, Abensur H, Cruz J. Arterial hypertension in students of the Great Sao Paulo area. Rev Assoc Med Bras 1991;37(3):109-14.

13 Sinaiko AR, Gomez-Marin O, Prineas RJ. Prevalence of 'significant' hypertension in junior high school-aged children: the children and adolescent blood pressure program. J Pediatr 1989;114:664-9.

14 Ampofo EK. Blood pressure distribution in children at Port Moresby, Papua New Guinea. PNG Med J 1989;32(2):101-8.

15 Klimm HD, Reuter-Kuhn I. Pravalenz der Hypertonie im Kindesalter: eine Untersuchung in 21 Hausarztlichen Praxen (Prevalence of hypertension in childhood: a study of 21 family physician practices). Fortschr Med 1994;112(5):49-52.

16 Lodolo AD, Novoa P, Sakuyama E, Lodolo MM, Palma JA, Martinez JR. Arterial hypertension in childhood and adolescence. Rev Fac Cien Med Univ Nac Cordoba 1989;47(1-2):19-22.

17 Gupta AK, Ahmad AJ. Normal blood pressures and the evaluation of sustained blood pressure elevation in childhood. Indian Pediatr 1990;27(1):33-42.

18 Mangal N, Bansal RK, Barar V, et al. Blood pressure studies in Jaipur children. Indian Pediatr 1989;26(4):358-65.

19 Laroia D, Sharma M, Diwedi V, Belapurkar KM, Mathur PS. Profile of blood pressure in normal school children. Indian Pediatr 1989;26(6):531-6.

20 O'Quin M, Sharma BB, Miller KA, Tomsovic JP. Adolescent blood pressure survey: Tulsa, Oklahoma, 1987 to 1989. S Med J 1992;85(5):487-90.

21 Ferrara LA, Marotta T, Mainenti G, Borrelli R, Mancini M, Soro S. Resting blood pressure and cardiovascular response to sympathetic stimulation in adolescents. Int J Cardiol 1992;36(2):197-201.

22 St.George IM, Williams SM, Silva PA. Blood pressure level, trend and variability in Dunedin children: an 8-year study of a single birth cohort. Circulation 1990;82:1675-80.

23 Török E, Gyarfas I, Csukas M. Factors associated with stable high blood pressure in adolescents. J Hypertens 1985;3(suppl.3):389-90.

24 Bendersky M, Resk J, Kuschnir E, et al. Blood pressure control in children of Cordoba, Argentina. Hypertension 1992;19(suppl.2):11273-8.

25 Hansen HS, Nielsen JR, Hyldebrandt N, Froberg K. Blood pressure and cardiac structure in children with a parental history of hypertension: the Odense schoolchild Study. J Hypertens 1992;10(7):677-82.

26 Munger RG, Gomez-Marin O, Prineas RJ, Sinaiko AR. Elevated blood pressure among Southeast Asian refugee children in Minesota. Am J Epidemiol 1991;133(12):1257-65.

27 Gupta AK, Ahmad AJ. Childhood obesity and hypertension. Indian Pediatr 1990;27(84):333-7.

28 Turkish Government, UNICEF. Türkiye'de Anne ve Çocuklarin Durum Analizi (The situations of mothers and children in Turkey). T.C. Hükümeti- UNICEF Is Birligi Programi (Coordination Program Between Turkish Government and UNICEF). Ankara: Turkish Government, 1991:253.

Received 24 January 1996, accepted 29 May 1996