Blood pressure profiles and hypertension in Iraqi primary school children

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ABSTRACT

Objectives: To elucidate blood pressure (BP) levels and the prevalence of hypertension (HT); as well as to address some epidemiological variables which contributes to BP and suggest certain primordial guidelines for control and prevention of childhood HT.

Methods: A cross-sectional study recruiting 1427 (46.1% boys versus 53.9% girls) school aged students (6-12 years) from 8 primary schools in Baghdad during the period November 2001 to May 2002. The BP readings were plotted adopting principles of the 1996 American Task Force on High Blood Pressure in Children and Adolescents.

Results: For both genders, the combined mean systolic blood pressure (SBP) was 106.66 ± 9.03 mm Hg and combined mean diastolic blood pressure (DBP) was 67.09± 7.98 mm Hg. There was no significant statistical differences noted with respect to SBP and DBP among boys and girls except at the age range of 10–12 years, where girls manifest higher SBP ($p<0.01$) and DBP ($p<0.05$) than boys. Obesity was reported in 7.3% of sample with significant girl's preponderance (3.2% for boys versus 4.1% for girls, $p<0.05$). Hypertension was recorded 1.8 fold higher among obese (4.7%) than non-obese children (2.6%) ($p<0.05$). Multiple regression analysis showed positive and significant correlation of age, weight, height and body mass index with each SBP and DBP. The overall prevalence of HT was 1.7% with significantly higher systolic HT (1.1%) than diastolic HT (0.6%) ($p<0.05$) but with no significant gender distribution (0.8% for boys versus 0.9% for girls). For both genders in the hypertensive group, the mean SBP was 127.66 ± 5.46 mm Hg and DBP was 77.26 ± 6.19 mm Hg.

Conclusion: Despite the low prevalence of our childhood HT (1.7%) compared to some Arabian and foreign countries, careful approach to the problem deems crucial through routine recording of BP and constructing our own national nomograms, age, gender and height specific, inspired from our nutritional, cultural, ethnic and social backgrounds. Moreover, implementing school heart health curriculum seems tentative to interrupt or ameliorate progression of HT as our children enter adulthood.

Saudi Med J 2006; Vol. 27 (4): 482-486

More than a quarter of the worlds adult population, totalling nearly one billion, had hypertension (HT) in 2000 and that this proportion will increase to 29% (1.56 billion) by 2025.[1] High blood pressure causes one in every 8 deaths worldwide making HT the third leading killer in the world.[2]

Pediatric cases of HT start nowadays to surge[3,4] since the incorporation of blood pressure (BP) measurement into routine pediatric examination has enabled both the discovery of significant asymptomatic HT secondary to a previously undetected disorder and the confirmation that mild elevation in BP during childhood are more common than previously recognized in adolescents.[5] It was noticed that a substantial number of pediatric patients would not have BPS measured at triage, elevated BP

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Received 16th October 2005. Accepted for publication in final form 22nd February 2006.

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in children would often go unnoticed and that the frequency of BP measurement would increase with increasing age.[6] Blood pressure patterns were studied previously in Iraqi children[7] based on the 1987 Second Task Force on Blood Pressure Control in Children which defines normal BPS as both systolic and diastolic readings below 90th percentile for age and gender.[8] However, at present there are no studies based on the 1996 "Update on the 1987 Task Force Report" defining BPS nomograms by age, gender and height considering HT as average systolic or diastolic BPS equal or greater than 95th percentile for age and gender with measurements obtained on at least 3 occasions.[9] We aimed to scrutinize the BP profiles, study some epidemiological variables related to BP, determine the prevalence of HT and suggest certain strategic guidelines for control and prevention of childhood HT.

Methods. This cross-sectional study was carried out by randomly selecting 1427 students (658 boys and 769 girls) aged 6-12 years from 8 primary schools in Baghdad from November 2001 to May 2002. Parents of the studied sample were informed and their consents were obtained. All students were examined clinically with special emphasis on cardiovascular system. Anthropometric indices as recommended[10] of weight to the nearest 0.1 kg and height to the nearest 0.5 cm using stadiometer (Seca, Germany) were taken.

Checking of blood pressure were made according to the guidelines[11] throughout daily school attendance in a quiet isolated setting with the student in a sitting position. The mid-point between olecranon and acromion was identified. The arm circumference was measured at that point and appropriate cuff size was determined by a bladder width covering two thirds of upper right arm. The position of right arm was adjusted with a small stand so that the ante-cubital fossa was at the same level of heart. After 5 minutes of rest, a pulse rate was taken followed by 3 BP readings with a mercury sphygmomanometer (Japan). After the first BP recording, the arm was held vertically for 5 seconds before being returned to the resting position for the second BP recording. The 3 readings were separated by at least 30 seconds. Systolic BP (SBP) was calculated with appearance of first Korotkoff sound while the diastolic BP (DBP) was deduced with the disappearance of sound. The BPs were measured to the nearest 2 mm Hg. Data presented were the average of 3 readings. All readings were made by same observer to avoid inter-observer variation. All BP figures were matched against age, gender and height percentiles where normal BP was defined as SBP and DBP less than 90th percentile for age and gender while HT was defined as an average SBP or DBP equal or greater than 95th percentile for age and gender measured on at least 3 separate occasions.[9] Those with initial BPS readings equal or greater than 95th percentile were rechecked 3 times at intervals of one month to ensure persistent elevation of BP. Body mass index (BMI) was estimated by the formula: BMI = weight (kg) / height $(m)^2$. It was determined for each student using pediatric normative data based on age and gender. Obesity was defined as BMI exceeding 95th percentile.[12]

Statistical analysis through Chi-square and Beta coefficient tests were employed. A $p<0.05$ was regarded statistically significant.

Results. Of 1427 students recruited, girls (53.9%) outnumbered boys (46.1%) with a male to female ratio of 1:1.16. The characteristics of studied sample tabulated by age and gender and their anthropometric indices of weight, height and BMI is shown in **Table 1.**

Figure 1 depicts that SBP among boys and girls showing a steady increment with age rising from a mean of 102.2 mm Hg in boys and 101.9 mm Hg in girls at age group 6-7 years to 108.9 mm Hg in boys and 113.8 mm Hg in girls at age group 11-12 years with a statistically significant downward drift in boys at age group 10-11 years ($p<0.05$) and 11-12 years ($p<0.01$). The DBP illustrates nearly a similar trend rising gently from a mean of 65.5 mm Hg in boys and 65.1 in girls at age group of 6-7 years to 68.1 mm Hg for boys and 69.9 mm Hg at age group of 11-12 years with a statistically significant drop for boys at age group of 10-11 years and 11- 12 years ($p<0.05$).

Obesity was found in 105 (7.3%) children. It was significantly higher in girls 59 (4.1%) than boys 46 (3.2%) ($p<0.05$). The HT was recognized 1.8 fold higher in obese (4.7%) than non-obese (2.6%) children ($p<0.05$).

Schematic representation of prevalences of HT with their gender distribution and mean SBP and DBP in each screening of studied sample is seen in **Table 2**. In the first screening, the prevalence of HT was 7.8% (4.2% for systolic HT and 3.6% for diastolic HT) with boys predominance (4.5% for boys versus 3.3% for girls) that dropped in the third screening to a prevalence of 1.7% with significantly higher systolic HT (1.1%) than diastolic HT (0.6%) ($p<0.05$). However, the prevalence was not significantly different among boys (0.8%) than girls (0.9%).

Using multiple regression analysis to evaluate the independent effect of certain variables on each SBP and DBP revealed positive and significant correlation

Table 1 - Distribution of mean weight, height and body mass index (BMI) in studied sample by age and gender.

Age (years)	Male				Female			
	n (%)	Weight (kg)	Height (cm)	BMI (kg / M^2)	n (%)	Weight (kg)	Height (cm)	BMI (kg / M^2)
6-7	51 (3.6)	21.83 ± 4.65	117.22 ± 7.31	16.05 ± 5.98	73 (5.1)	21.54 ± 3.14	116.91 ± 2.23	16.07 ± 2.68
7-8	104 (7.3)	22.87 ± 7.93	118.95 ± 5.12	16.45 ± 6.52	91 (6.4)	22.98 ± 3.5	119.31 ± 4.34	16.29 ± 3.92
8-9	116 (8.1)	24.11 ± 8.85	124.76 ± 4.32	15.75 ± 6.58	121 (8.5)	24.81 ± 4.12	123.37 ± 7.35	16.43 ± 5.73
9-10	113 (7.9)	26.7 ± 7.77	130.35 ± 3.24	15.79 ± 5.5	186 (13)	26.71 ± 5.43	129.2 ± 5.94	16.09 ± 5.68
10-11	147 (10.3)	30.19 ± 7.98	134.72 ± 8.69	16.86 ± 6.33	203 (14.2)	29.66 ± 6.45	133.71 ± 6.18	16.85 ± 6.13
11-12	117 (8.2)	32.65 ± 7.19	138.88 ± 3.51	17.18 ± 5.35	105 (7.3)	31.80 ± 5.9	136.82 ± 7.44	17.28 ± 6.67

BMI - body mass index

Table 2 - Prevalence of hypertension (systolic, diastolic, systolic and diastolic, and total samples) with their gender distribution and mean systolic blood pressure (SBP) and diastolic blood pressure (DBP) in each screening of studied sample.

Screening	Prevalence of hypertension (%)				Gender (%)			Mean SBP (mm Hg)	Mean DBP (mm Hg)
	Systolic	Diastolic	Systolic and diastolic	Total	Male	Female	Total		
First	60 (4.2)	51 (3.6)	- -	**111 (7.8)**	64 (4.5)	47 (3.3)	**111 (7.8)**	108.64 ± 8.51	67.17 ± 7.99
Second	46 (3.2)	39 (2.7)	- -	**85 (5.9)**	45 (3.15)	40 (2.8)	**85 (5.9)**	115.87 ± 9.83	71.21 ± 9.6
Third	16 (1.1)	9 (0.6)	- -	**25 (1.7)**	12 (0.8)	13 (0.9)	**25 (1.7)**	127.66 ± 5.46	77.26 ± 6.19

Table 3 - Correlation of systolic blood pressure and diastolic blood pressure with some variables in studied sample.

Variable	Systolic blood pressure		Diastolic blood pressure	
	Beta coefficient	*P* value	Beta coefficient	*P* value
Age	0.11	0.00	0.15	0.00
Weight	0.23	0.00	0.20	0.00
Height	0.02	0.04	0.04	0.03
BMI	0.08	0.03	0.18	0.03

BMI - Body mass index

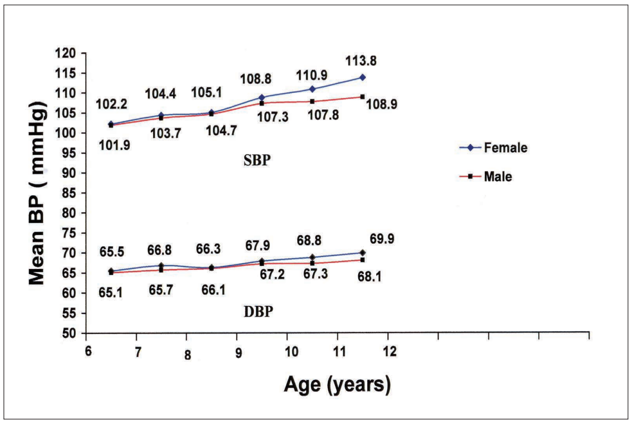

Figure 1- Distribution of mean systolic blood pressure and diastolic blood pressure by age and gender in studied sample.

of age, weight, height and BMI with each SBP and DBP (**Table 3**).

Discussion. The prevailing of infectious and nutritional problems in Iraqi children due to imposed sanctions since August 1990[13,14] has reduced the public health awareness of non-communicable diseases like childhood HT. The study of childhood HT is important for several reasons: 1. The sequelae of long term HT are irreversible and are associated with significant morbidity and mortality.[15] 2. Stratification of BP by age group has been shown in adults and children.[16] 3. The best predictor of adult BP is childhood BP.[17] 4. It is helpful in planning primordial preventive strategies.[18]

In an agreement with other studies,[7,9,19-21] the mean SBP and DBP increased progressively with advancing age in both genders (**Table 3**). Nevertheless, girls showed significantly higher mean SBP and DBP than boys and within age group 10-12 years. This contradicts with what was reported previously where girls had significantly higher mean SBP and DBP than boys throughout age group 3-14 years.[7] The higher BP among girls aged 10-12 years than boys of same age group in our study may be related to significant cardiovascular changes in adolescence where SBP increases in boys and plateaus in girls[23,24] together with physiological changes of puberty where menarche and development of secondary general characters impose tension and anxiety in girls in our relatively conservative society and hence higher BP profiles.

Obesity assessed by BMI was noted in 7.3% of sample that was significantly higher in girls (4.1%) than boys (3.2%) (p<0.05). Such low prevalence of obesity compared to that in USA (24%)[25] and UK (11-17%)[26] may be related to economic sanctions making children consuming less calories and nutrients.[13,14] The HT was reported 1.8 fold higher in obese (4.7%) than non-obese children (2.6%) (p<0.05). Genetic factors initiating BP programming early in fetal life[27] tend to interact with familial predisposition,[28] obesity,[29] stress,[30] physiological and biochemical factors,[31] dietary component,[32] nutritional status[33] and social class[34] to produce HT.

The overall prevalence of HT after the third screening was 1.7% with significant higher systolic HT (1.1%) than diastolic HT (0.6%) (p<0.05). However, no significant gender difference was noted (0.8% for boys versus 0.9% for girls). Previous studies support our finding of systolic HT preponderance.[35,36] Although indirectly, systolic HT in children represents an early stage of essential HT that may indicate hyperdynamic state reflecting possibly basal sympathetic nervous system hyperactivity.[37]

In accordance with other studies,[7,19-22] both SBP and DBP were significantly correlated with age, weight, height and BMI after controlling for each other. Thus, suggesting the recommendation of An Update Report on 1987 American Task Force[9] that BP values must be identified for each age, gender and height percentile category. The prevalence of HT in our study ranks less than those reported in Arabian countries of Tunisia (9.6%),[38] Kuwait (5.1%),[19] Saudi Arabia (4.8%),[39] and Jordan (3.6%).[20] Meanwhile, it is less than those reported in foreign countries such as Brasil (9.4%),[40] India (5.7%),[41] Ireland (5.2%)[42] and USA (4.5%)[43] but nearly similar to Poland (1%)[44] and Germany (1%).[45] These differences may be attributed to variations in study design, definition of HT, methods of BP recording, observer effect, age range, sample size, ethnicity and social class.[46]

In conclusion, childhood HT should not be considered a rare condition. It must be approached carefully through routine recording of BP and adopting our own national nomograms, age, gender and height specific, derived from our nutritional, social, ethnic and cultural standards. Moreover; implementation of school heart health curriculum is necessary to interrupt or modify progression of HT as our children move into adulthood.

Acknowledgment. We would like to thank all demonstrators, teaching staff and students of primary schools involved in the study for their kind help. Thanks also are due to Department of Community Medicine, Al-Kindy College of Medicine, Baghdad University for their help in statistical analysis.

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