An Anthropometric Study Of The Children And Young Adults (5-18 Years Old) Of Hypertensive And Normotensive Parents Belonging To Middle Income Areas Of Lahore Pakistan.

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A total number of 200 children and young adults (5-18 years) of the hypertensive and normotensive parents belonging to middle class socioeconomic status were included in this study. 100 children of the normotensive parents formed the control group (Group-I) and the experimental group was constituted by the hundred children of hypertensive parents.(Group-II). The height, weight, pulse rate and blood pressure of these subjects was recorded on two separate occasions to obtain the mean values. The systolic and diastolic blood pressure in children of the hypertensive parents was found to be on the higher side and these children were relatively obese. This study showed a relationship between blood pressure, age and different indices of body mass. Height independent of weight showed no significant association with blood pressure but a highly significant assocation ($P<0.0001$) was seen with blood pressure when height and weight algorithm wt (kg)/Ht (m^2) was taken. Analysis of the subjects in different age groups suggests that age may affect blood pressure levels in children independent of height and weight. Pulse rate showed no significant difference ($P<0.85$) within the two groups.

Key Words : hyper tension, anthopometry

Most cross sectional studies in children have shown a strong positive relation between blood pressure, height, weight and various indices of body mass.[1,2,3,4] The relationship between obesity and hypertension has long been recognized.[5,6] According to a report[7] although there was a higher prevalence of hypertension in the obese patients, obesity was not necessarily the chief determinant factor in these patients who were hypertensive. In another report, it was found that the prevalence of obesity was significantly higher in the hypertensive children than in the control group.[8]

The initial body weight was positively related to the rate of change of systolic and diastolic pressure in older boys and girls.[9] According to the same study, a difference of 10 kg in body weight, adjusted for differences in initial blood pressure, height and age was associated with a mean difference in change of systolic and diastolic pressures of about 0.5-0.7 mm Hg/years in boys and girls aged 5-19 years. Initial body weight was only significantly positively related to change in systolic pressure, when all age categories were combined. For diastolic pressure, no such association was found. These relations were observed after adjusting for differences in initial pressure, age and body weight. The present study was undertaken to study these relationships comparatively in the children of hypertensive and normotensive parents.

Patient And Methods

From the middle class income areas of Lahore namely Model Town, Model Town Extension, Gulberg and Samanabad and identified from the different private clinics of these areas 200 children of 55 selected families were included as subjects for study. Each family on an average had 7 members and an average monthly income of Rs. 10,000/= only. The subjects were selected and grouped as under.

i) 100 children and young adults 5 to 18 years of age, with one or both parents hypertensive formed the test or experimental group. All children of hypertensive families irrespective of sex but falling in the specified age group were selected.

ii) Same number of age matched subjects with both parents normotensive formed the control group.

iii) Each of the above two groups was further structured into five age subgroups. That is 5 to 7 years, 8 to 10 years, 11 to 13 years 14 to 16 years and 17 to 18 years. This was done for a ready comparison of different parameters with advancing age.

iv) Subjects with a history or an incidence of renal, cardiovascular, endocrine or any other chronic disease or anomaly were not included in the study. Those psychologically handicapped or recently operated were excluded. Rest were included.

These subjects and their parents were examined at the clinics of their vicinity and at their residences. Written parental consent was obtained for each participating subject. A detailed preliminary record of the hypertensive parents was obtained from their physicians. Only those subjects were included in the study whose parents had no established secondary cause of hypertension. The normotensive parents were declared so after blood pressure estimations on two separate occasions, with two readings each to ensure that the blood pressure was within the normal range. A detailed history of the subjects was taken according to a pretested proforma[10] and an appropriate physical examination was carried out. Blood samples were taken for laboratory investigations and in each case an x-ray chest with E.C.G was done. Height,

weight, puse rate and blood pressure of the subjects was measured. Quetelet's Index (relative body weight or index of obesity) usually estimated by weight kg/height (m^2).[3] modified by Davenport[11] was assessed as follows: Quetelet's Index (Q.I.) = 100 x weight/height^2. Two readings of the pulse with the mean pulse rate was assessed. Blood pressure was taken in the left arm of the subject , in a sitting position with the arm supported at the chest level. In each case the largest cuff was used which encircled the arm comfortably.[9] The mercury sphygmomanometer (ERKA, Germany) pretested for uniform performance was employed. Two blood pressure readings were taken at one sitting and two repeated after one month, a mean of total four readings was noted. To adjust for age and sex the blood pressure readings were expressed in standard deviation units.

RESULTS

Table I Distribution of subject into two main groups

Sex	Cont. Subs. GR I	Cont. Subs. GR II	Total
Boys	41 (20.5)	53 (26.5)	94 (47.0)
Girls	59 (29.5)	47 (23.5)	106 (53.0)
Total	100 (50.0) (50.0)	100 (50.0) (50.0)	200 (100) (100)

Table-I shows the distribution of the subjects in two main groups. In total 41 male children were present in the control group whereas 53 male children belonged to experimental group. The female children were 59 and 47 respectively in the two groups whereasTable-II shows the five subgroups of subjects structured according to age from the two main groups. Table-III shows maximum number of control

Table II

Age (Years)	Frequency	%age
5-7	44	22
8-10	51	25.5
11-13	30	20
14-16	40	15
17-18	35	17.5
Total	200	100

Table III

Age Groups (Years)	Experimental Groups(No. of classes)	Control Group (No. of classes)
5-7	16	28
8-10	20	31
11-13	12	31
14-16	26	14
17-18	26	9
Total	100	100
Mean Age	12.66 +/- 0.86	10.41 +/- 0.78

subjects to be within the 8-10 years age group whereas 90% of subjects were below the age of 16 years in this group, with a mean age of 10.41 years (±2SE). Maximum number of experimental subjects were within the age groups of 14-16 and 17-18 years. 90% of the subjects were below the age of 17 years in this group, with a mean age of 12.66 years (±0.86 2SE).

Table IV

Sex(groups)	5-7	8-10	11-13	14-16	17-18	Total
Male Control	17	11	8	4	1	41
Row %	41.5	26.8	19.5	9.8	2.4	20.5
Col%	38.6	21.6	26.7	10	2.9	
Female Control	11	20	10	10	8	59
Row %	18.6	33.9	17	17	13.6	29.5
Col %	25	39.2	33.3	25	22.9	
Male Expt.	11	13	8	8	13	53
Row %	20.8	24.5	15.1	15.1	24.5	26.5
Col %	25	25.5	26.7	20	37.1	
Female Expt	5	7	4	18	13	47
Row %	10.6	14.9	8.5	38.3	27.7	23.5
Col %	11.4	13.7	13.3	45	37.1	
Total	44	51	30	40	35	200
	22	25.5	15	20	17.5	100

Table-IV shows that the distribution percentage was greatest in the 8-10 years group (25.5%), followed by 5-7 years group, 14-16 years group and 17-18 years group. The least number of subjects were of 11-13 years. Female subjects formed a greater percentage of control subjects whereas males were more in the experimental group.

Table v-comparison of the mean values of body weight, height, quetlet's index, pulse, blood pressure

	Control Group N=100	Expt Group N=100	Statistical Significance p
Variables	Mean	Mean	p
Body Weight (Kg)	32.83±2.26	47.32±3.50	< 0001
Height (cm)	134.30±3.32	145.79±3.96	< 0001
Quetelet's Index wt/ht^2	0.17±0.008	0.21±0.008	< 0001
Pulse (per min)	83.54±2.04	83.28±1.91	< 0.85
Systolic B.P (mm of Hg)	101.01±1.52	110.27±2.62	< 0001
Diastolic B.p (mm of Hg)	67.20±1.40	71.48±1.54	< 0001

Table-V shows an overall comparison n=100 vs n=100 of the mean values of body weight, height, Quetelet's index, pulse and blood pressure

TABLE VI-total comparison of the mean values of different variables in male and female subjects of both the groups

	MALES			FEMALES		
	CONTROL Gp I n=14	EXPERIMENTAL Gp I n=53		CONTROL Gp II n=59	EXPERIMENTAL Gp II n=47	
VARIABLES	Mean values	Mean values	p<	Mean values	Mean values	p<
AGE(YRS)	9.19±1.08	11.84±1.15	0.001	11.25±1.01	13.57±1.16	0.001
WIGHT (Kgs)	32.53±3.31	47.15±5.09	0.0001	33.03±2.98	47.51±1.53	0.001
HEIGHT (cms)	131.39±5.74	145.28±6.2	0.002	136.32±3.74	146.36±4.36	0.0001
Q.I.	0.17±0.009	0.02±0.009	0.0001	0.16±0.009	0.20±0.01	0.0001
PULSE (per min)	81.17±3.29	83.54±2.56	0.26	85.18±2.41	82.97±2.83	0.25
SYS.B.P (mmhg)	101.82±2.56	112.22±3.71	0.0001	100.44±1.78	108.06±3.15	0.0001
DIA.B.P (mm hg)	63.85±2.02	68.86±2.19	0.001	69.52±1.62	74.42±1.75	0.0001

TABLE VII-comparison of mean values of weight, height, sys b.p, dia b.p and weight/height^3 in different age groups

AGEGROUP(yrs)	5-7		8-10		11-13		14-16		17-18	
GROUP	I	II	I	II	I	II	I	II	I	II
VARIABLES	MEAN	MEAN	MEAN	MEAN	MEAN	MEAN	MEAN	MEAN	MEAN	MEAN
WEIGHT (Kgs)	22.35±1.41	24.93±3.04	27.64± 1.49	33.80±4.79	38.16±2.85 *	45.08±5.68	47.28± 1.26	55.88±1.10	50.11±2.74	63.96±3.88
HEIGHT (cms)	114.14±1.41	115.25±2.78	130.58±2.56	129.80±5.28	148.38 ±2.91	150.00±3.46	154.00±3.69 *	157.73±2.62	151.00±3.96 *	163.00±3.58
WT/HT^3 (kg/M^3)	15.03±0.81	16.07±0.85	12.55±0.89 *	15.20±1.26	11.62± 0.54 *	13.26±1.22	12.93 ±1.03	14.23±0.95	11.56±0.61	14.83±0.89
Q.I	0.16±0.009	0.18± 0.01	0.15±0.009 *	0.18± 0.01	0.15± 0.01 *	0.19± 0.01	0.18± 0.02 *	0.21± 1.96	0.21± 0.007 *	0.23± 0.01
SYS B.P(mm Hg)	95.60±1.36 *	99.93± 2.80	99.16± 2.48	100.10±2.87	103.88±2.18	110.25±6.33	108.14±3.57	114.07±1.83	107.33±2.33 *	120.65±4.52
DIA B.P (mm Hg)	61.35± 1.57	63.93± 3.19	65.70± 2.01	65.85±2.70	69.94± 2.52	72.08±3.18	73.78±2.84	74.65±2.07	71.77±3.13	77.00±2.30

whereas tables VI and VII present the same comparison sexwise and in the different age subgroups indicating that the average body weight was 32.83 ± 2.26 kg (± 2 SE) in the control subjects and 47.32 ± 3.50 kg (± 2 SE) in the experimental subjects.

On an average the children of the hypertensive parents (Gp-II) were heavier by 14.49 kg than the children of the normotensive parents (Gp-I). This difference in body weight between the subjects of the two groups was statistically significant ($p < 0.0001$). The male children in group-II were heavier on an average from the group-I children by 14.62 kg (± 2 SE) and the difference was highly significant ($p < 0.0001$).

The female children of group-II were heavier than the female children of group-I by 14.48 kg (± 2 SE). This too was statistically significant ($p < 0.001$). The weight increased with age and the maximum weight subjects were in the 17 - 18 years group. The weight difference between the males and females was significant in the 14 - 16 and 17 - 18 years groups ($p < 0.05$). The weight ranged from 15 to 70 kg in the control subjects whereas 20 to 79 kg in the experimental subjects. 90% of the subjects were below 49.30 kg whereas 10% were above 50 kg in the control group. Likewise 90% of the subjects were below 69.60 kg and 10 % were above 70 kg in the experimental group.

The Quetelet's Index (Q.I) was found to be on the higher side in the children of the hypertensive parents as compared to the children of the normotensive parents. The difference was significant statistically ($p < 0.0001$). Therefore the children of the hypertensive parents were relatively more obese than the children of the normotensive parents. The Q.I. was significant in all the age groups except in the 5-7 years old children. Q.I. was significant statistically when compared sexwise, only in the age groups of 14-16 and 17-18 years. The males in these age groups were found to be heavier than the females.

To control for obesity we determined the ponderosity index^3 given as weight/height^3 As compared to Q.I the wt/ht^3 relationship showed no significance when compared sexwise in all the age groups. However, this index of ponderosity was significant when compared in the 8-10 and 11-13 years old subjects.($p<0.05$). The mean height of the subjects in group-I was 134.30 ± 3.32 Cms (±2 SE)as compared to the mean height of the subjects in group-II which was 145.79± 3.96 cms (±2 SE). The children of the hypertensive parents were on an average taller than the children of normotensive parents by 11.49 cms. This difference was found statistically significant. ($p<0.0001$). The height ranged from 98-165 cms In the control subjects whereas this range was 110-180 cms in the experimental subjects. 90% of the subjects were less than 155 cms in height in the control group wheras the same percentile of the experimental subjects were less than 170 cms.

There was no significant difference between pulse rates within the two groups ($p<0.85$) and within the males and the females of the two groups. The pulse rate was also found to be insignificant when observed within the different age groups

Four readings of blood pressure were taken two at each sitting with a gap of one month apart and the average value was recorded.

The 95th and 90th percentile for systolic and diastolic blood pressure were determined from this data base. The mean systolic blood pressure in the subjects of the two groups showed a difference of 9.26 mm Hg and this was highly significant ($p< 0.0001$).

The difference of diastolic blood pressure was also highly significant ($p<0.0001$). Therefore on an average the systolic and diastolic blood pressure in the children of the hypertensive parents were on the higher side. The 95th percentile systolic bloodpressure was 132 mm Hg in the gp-II subjects whereas it was 114 mm Hg in the gp-I subjects. The 90th percentile values computed in the above two groups were respectively 130 and 109 mm Hg. The 95th and 90th percentile for diastolic blood pressure were 82 and 79 mm Hg in the Gp-II and 77 mm Hg in the control subjects.

7 out of 100 experimental subjects showed values for systolic B.P. consistently above the 95th percentile (132 mm Hg) and 6 out of 100 had diastolic B.P. above the 95th percentile (82 mm Hg). Fourteen subjects of the same group showed systolic pressure values consistently above the 90th percentile (130 mm Hg) whereas twenty subjects showed values for diastolic pressure persistently above the 90th percentile (79mm Hg).

The systolic pressure shows a greater increase in boys

than girls with progression of age. The diastolic pressure shows no significant difference in the boys and girls with the increasing years in the different age subgroups.

Discussion

Because of the fact that the measures of body size and maturation depend on age, it is difficult to determine the role of each of these factors and the extent to which these factors are responsible for causing hypertension. This study has attempted to show that there is a relationship between the childhood blood pressure, age and various indices of body mass. Similar results have been shown by many other studies.[1,12,13,14]

There is a slow and gradual rise in blood pressure in the begining years but with the onset of puberty there is a tendency for sudden increase in blood pressure. Age and height do not show any correlation with diastolic blood pressure in the girls of the experimental group. Boys in the experimental group show a strong association between the index of obesity and blood pressure. The children of hypertensive parents were generally found to be obese for their age and height as compared to those of the normotensive parents. In the experimental group an association was found between the index of obesity and systolic and diastolic blood pressures whereas it was associated with diastolic pressure only in the females. We further studied this association by controlling for obesity taking the Wt/Ht^3 in the different age subgroups but no significant finding was obtained. This meant that height independent of weight was not positively associated with blood pressure in disagreement with[3] but in agreement with another study.[13] This further indicated that weight/height^2 (Quetelet index) increased proportional to height and so did the blood pressure. Both increased height and weight, in the experimental subjects as compared to the normotensive subjects may be the cause of the raised blood pressure in these subjects. This finding was supported by the evidence of raised blood pressure in 2% subjects of Group-I. These subjects were also found to be obese and tall as compared to their peers in the same age group. These findings were comparable to those of another researcher.[15] The other supporting evidence to this effect is the great number of studies in which the dietary weight reduction(without low salt diet) in patients and volunteers was accompanied by a decrease in blood pressure.[16,17] On subgroup analysis and plotting of curves for systolic and diastolic blood pressures a more sudden increase in systolic blood pressure was observed[18] in males from pubertal age to age18.

The opposite was the case with the diastolic pressure. This showed a greater prevalence of raised blood pressure in the age group 17-18 with a noticeable change in the slope of the progression. This finding was consistent with other studies in that the prevalence of hypertension increased significantly according to increase in age.[18,19] A logitudinal study of a more representative sample of male adolescent population can give further useful information. This study maintains that raised blood pressure in children is not uncommon and the frequency of this is even greater in the children of hypertensive parents. Age is related to blood pressure but the causative effect of the same on blood pressure could not be tracked. Obesity is related to blood pressure but height independent of weight plays a minor role in the determination of blood pressure.

References

1. Lauer, M; Burns, T. L; and Clarke, W. R. Assessing children'sblood pressure-considerations of age and body size; The Muscatine Study. Pediatrics 1985; 75:1081 - 1090.
2. Voors, A. W; Foster, A. T; Fredrichs, R. R; Webber, L. S; and Berenson, G. S. Studies of blood pressure in children, ages 5 - 14 years, in a total biracial community. Circulation 1976; 54: 319 - 327.
3. Voors, A. W; Harsha, D. W; Webber, L. S; and Berenson, G. S. Relation blood pressure to stature in healthy young adults. Am J Epidemiol 1982;15; 6: 833 - 840.
4. Heyden, S; Bartel, A. G; Hames, C. G; and McDonough, J.R. Elevated blood pressure levels in adolescents, Evans County, Ga. JAMA 1969; 209: 1683 - 1690.
5. Pickering, G.W. High blood pressure. Ist ed. Churchill - Livingstone, London. 1955; pp 1 -58.
6. Hahn, L. The relationship of blood pressure to weight, height and body surface area in school boys ages 11 to 15 years. Arch Dis. Child 1952; 27: 43 - 48.
7. Kannel, W. B; Gordon, T; and Schwartz, M. J. Systolic versus diastolic blood pressure and risk of coronary heart disease. Am J Cardiol 1971; 27: 335-335.
8. Londe, S; Bourgoinie, J. J; Robson, A. M; and Goldring, D. Hypertension in apparatently normal children. J Pediatr 1971; 78: 569.
9. Hofman, A; and Valkenburg, H. A. Determinants of change in blood ressure during childhood. Am J Epidemiol 1983; 117: 735-743.
10. Morris, J. N; Adam, C; Chave, S.P.W; Sirey, C; Epstein, L; and Sheehan, D. J. Vigorous exercise in leisure time and the incidence of coronary heart disease. Lancet 1973; 1: 333-339.
11. Billewicz, W. Z; Kemsley, W.F.F. and Thomson, A.M. Incidence of adiposity. Brit J Prev Soc Med 1962; 16: 183-189.
12. Higgins, M; Keller, J; Moor, F; Ostrander, L; Metzner, H; and Stock, L. Studies of blood pressure in Tecumseh, Michigan-blood pressure in young people and its relationship to personal and familial characteristics and complications of pregnancy in mothers. Am J Epidemiol 1980; 111: 42-155.
13. Annest, J. L; Sing, C. F; and Mongean, J. G. Familial aggregation of blood pressure and weight in adoptive families. AmJEpidemiol 1979; 110: 479 - 491.
14. Gupta, R, Guptha, S Gupta, V.P; Prakash, H. Prevalence and determinants of hypertension in urban population of Jaipur in western India, J-hypertens.1995 Oct; 13 (10): 1193-200.
15. Williams, P. T; Fortman, S. P; Terry, R. B; Garay, S. C; Vranizan, K. M; Ellsworth, N; and Wood, P. D. Association of dietary fat, regional adiposity, and blood pressure in men. JAMA 1987; 257; 3251 - 3256.
16. Smoak, C. G; Burke, G. L; Webber, L. S; Harsha, D.W; Srinivasan, S. R; and Berenson, G. S. Relation of Obesity to clustering of cardiovascular disease risk factors in children and young adults. The Bogalusa heart study. Am J Epidemiol 1987; 125: 364-372.
17. Whincup, P. H; Shaper, A. G; Cook, D. G; Macfarlane, D. J; and Walker, M. Blood pressure in British children: Assocoations with adult blood pressure and cardiovascular mortality. Lancet 1988; 10: 890 -893.
18. Cotran, R. S. Basic Pathology. 4th ed. W. B. Saunders Company. 1987 chapter 14, pp478 - 483.
19. Akatsu, H; and Aslam, A. Prevalence of Hypertension and Obesity among women over age 25 in a low income area in Karachi, Pakistan. JPMA 1996; 46: 191 - 193.