

THE INFLUENCE OF PARENTAL BLOOD PRESSURE LEVEL ON THEIR OFFSPRING

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Abstract: It is known fact that hypertension runs into families due to familial aggregation where genetic factors and common environmental factors to which the members of the same family are exposed. Blood pressure is affected both by heredity and environmental factors. But their magnitude and quantum of influence varies from population to population and a question to be answered by the further studies. Heredity or genotype has definite role in determination of blood pressure. In this study, Analysis of the data for parental influence was done by techniques like (i) percentile agreement (ii) partial correlation (iii) blood pressure of the children whose parents blood pressure was more than or equal to 140/90 was compared with blood pressure of total sample and (iv) pedigrees charting etc. For studying parental influence on blood pressure four different methods were adopted i.e., percentile agreement partial correlation, blood pressure of children parents with elevated levels vs, level of the children of corresponding age, sex in the total sample and pedigree chart only for illustration. Mean blood pressure of children whose parents blood pressure was more than or equal to 75th percentile was compared with children whose parents blood pressure was less than 75th percentile. With this method, parental influence of blood pressure of male children was found to be statistically significant in many age groups,. In general, influence of the father on the son was more apparent than that of the mother, particularly on the diastolic level. blood pressure of offspring *vis-à-vis* their parents who have elevated levels should be monitored regularly to make early diagnosis to prevent the onset of coronary heart diseases, congestive heart failure, stroke and peripheral arterial diseases at the early.

Introduction:

Blood pressure is known to be affected by heredity and environmental factors. The role of heredity is quite clear from the studies conducted by several researchers and concluded that rise in blood pressure with age is steeper in offspring of hypertensives than in the general population (1). The blood pressure values of monozygotic twins are strongly correlated than dizygotic twins (2). At the same time, no significant correlation has been noted between husbands and wives and between adopted children and their adoptive parents or siblings (2). Correlation for resting blood pressure and heart rate were higher in monozygotic twins than dizygotic twins (3). This clearly implies that heredity or genotype has definite role in determination of blood pressure, American journal of cardiology (2).

Environmental factors are apparent when people from one society who were earlier free of hypertension started manifesting it after their migration to new environments (4). Change in blood pressure levels were also observed in the population where social environment of non-migrants have changed rapidly (5),

It is known fact that hypertension runs into families due to familial aggregation where genetic factors and common environmental factors to which the members of the same family are exposed (6). Another study on persistent elevation of blood with family history of hypertension (7) reported that the correlation between blood pressure of mothers and their children tend to be higher between their fathers and their children. Parent child blood pressure resemblance reflects the parent- child similarity in their body built. (8) and (9) reported that essential hypertension is polygenic. There is evidence that the transmission of rare, major gene for low systolic blood pressure with a gene frequency of $q+0.02$; and most of the transmissible component to systolic blood pressure can be attributed to the polygenic back ground (10).

At least one of the genes responsible for genetic predisposition to essential hypertension is to very near or with the HLA complex (11). A study on familial aggregation on familial aggregation conducted in Allahabad (India) urban population found a regression of 0.17 for systolic and 0.15 for diastolic pressure among males and regression of 0.04 for systolic and 0.05 for diastolic among females (12). In another conducted among rural agricultural population of West Bengal yielded a genetic heritability estimate of 0.3 for both systolic and diastolic blood pressure e.g., sib-sib and mother –child correlation estimates are at 0.3 and 0.25 respectively and father child correlation 0.13 for systolic blood pressure and near zero for diastolic blood pressure (13).

The problem of hypertension begins from the childhood itself. Many researchers demonstrated in their studies that familial influence on blood pressure starts in the infancy that is as early as one month of age (14).

Both the environment and heredity have a definite role, but their magnitude and quantum of influence varies from population to population and a question to be answered by the further studies. This study is not intended to provide all the answers, but it attempt to trace the correlation between blood pressure levels of parents and their children in an effort to devise preventive steps at an early stage against control of hypertension among the young population. The study also attempted to draw an association between blood pressure levels of parents (also whether it is stronger with mother or father) and their children and its further efforts to quantification of such an association.

Material and methods:

The study was conducted in the year 1990, in the village called Dallupara village located in Delhi NCT and near NOIDA crossing. The total population of the village was 3765 and there were 662 households. Majority of the population consists of Jats, Gujjars and scheduled castes. while the Gujjar adult population engaged in milk vending in nearby peri-urban areas, the people from other communities engaged as laborers in the nearby industrial areas of NOIDA. Tap water is limited reach and majority of the people use hand pump water. Since the village is close to Delhi NCT and NCR, medical facilities comparatively accessible than many villages.

Sample size

The sample needed for the study was approximately half of the universe. The regression of blood pressure of male persons on their relatives should be 0.17 for systolic on unit scale and 0.15 for diastolic level. This was kept in view of the importance of correct estimation of regression to 0.05 with a probability of 95%.

With regression around 0.04 for systolic and 0.05 for diastolic levels for females, the sample size would be smaller for correct estimation with 0.05 on either side. To be safer side and to account for possible non- response, a sample 300families (roughly every alternative house) was planned to be investigated by adopting systematic random sampling. Taking cue from (14) that blood pressure doesn't vary between different ethnic groups, sex, socio-economic status during first five years of life and keeping in view of operational difficulty in measure g correct blood pressure in very young children, the blood pressure of cases of five years and above age was only measured. Since the objective of our study was to find out parental influence of blood pressure levels of their offspring the individuals staying single were also excluded. Cases of known hypertensives, intoxicated, agitated or in acute pain were also excluded.

Tools

A short two page pre-tested schedule was used to collect the required information. Anthropometric devices were used to measure height, weight, general physical examination, systemic examination, blood pressure both systolic and diastolic in mmHg were measured.

Discussion:

Analysis of the data for parental influence was done by techniques like (i) percentile agreement (ii) partial correlation (iii) blood pressure of the children whose parents blood pressure was more than or equal to 140/90 was compared with blood pressure of total sample and (iv) pedigrees charting etc.

Besides, parental influence on blood pressure of their offspring, correlation of blood pressure with age, body mass index (BMI), per capita income and distribution and change in age were also discussed. Both systolic and diastolic blood pressure has shown a significant correlation with age in both the sexes.

Blood pressure also increased with economic status (per-capita income). But correlation with body mass index (BMI) was very weak, and not significant. The type of diet vegetarian and non-vegetarian also didn't show any consistent influence upon blood pressure levels.

Mean blood pressure systolic as well as diastolic increased with till 24 years of age and after which a plateau phase followed till the age of 55 years and again showed an increasing trend thereafter. Blood pressure distribution in different age groups is either Gaussian type or had mild skewing to the right in some cases.

For studying parental influence on blood pressure four different methods were adopted i.e., percentile agreement partial correlation, blood pressure of children parents with elevated levels vs, level of the children of corresponding age, sex in the total sample and pedigree chart only for illustration. Mean blood pressure of children whose parents blood pressure was more than or equal to 75th percentile was compared with children whose parents blood pressure was less than 75th percentile. With this method, parental influence of blood pressure of male children was found to be statistically significant in many age groups,. In general, influence of the father on the son was more apparent than that of the mother, particularly on the diastolic level.

Partial correlation was calculated for each parent –child relationship e.g., mother-son, father-son, mother –daughter, father- daughter, mother –child and father-child to overrule the possible effect of age and body mass index on the correlations between each parent. It was found that partial correlation for systolic blood pressure was significant only between mother and daughter, father –son, mother-child and father –child. It shows that father influenced son's level and

mother influenced daughter's level. In general, parental influence on blood pressure is more in case of diastolic pressure than in case of systolic pressure. Although both mother –child and father-child partial correlations are statistically significant for diastolic pressure but father –child correlation ($p < 0.001$) is much more significant compared to mother-child (< 0.05).

Mean blood pressure of the children of parents whose blood pressure was more than or equal to 140/90 mmHg was compared with blood pressure of children of corresponding age or age –sex group in the total sample. Mean systolic blood pressure of the children whose father's blood pressure was more than or equal 40.90 mmHg was generally more than the children of corresponding age group in total sample. These children were further divided into males and females. Difference is significant only in case of male children of 5-9 years of age for systolic as well as diastolic pressure and in 10-14 years age group difference is significant only in case of systolic pressure in males. Children whose mother's blood pressure is more than or equal to 140/90mmHg were not further sub grouped sex-wise, because there were only thirteen in this group. Division into age would render each group extremely small for any valid conclusion. Difference was not significant in any case. According to this method father has positive influence on the blood pressure of children.

Even though, the result of all the methods is not uniform; it is evident that fathers' influence is more on the sons and to some extent of mothers' on the daughter. Diastolic level is affected more than systolic level. However, partial correlation indicates that father's influence on son could partly be due to similarity in body mass index, but this aspect needs further investigation. In terms of correlation, the influence of father on son is in the order of 20 percent. Statisticians use the square of the correlation for computing such a percentage. That surely is the right thing to do. In this sense, the influence of father on son's diastolic pressure is 7 percent and systolic level 3.5 percent. There are small values, nevertheless indicate that some degree of influence was pressure.

Conclusion: the study shows some influence of parents on the blood pressure level of offsprings. Therefore blood pressure of offspring *vis-à-vis* their parents who have elevated levels should be monitored regularly to make early diagnosis to prevent the onset of coronary heart diseases, congestive heart failure, stroke and peripheral arterial diseases at the early, Such families should be advised to keep weight in control, do some physical exercises and to adopt a lifestyle to keep blood pressure under control.

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TABLE 1

DISTRIBUTION OF SYSTOLIC BLOOD PRESSURE AMONG FOUR AGE GROUPS OF RESPONDENTS

Age group	5-9 years						10-14 years						15-19 years						20 + years					
	Female		Male		Total		Female		Male		Total		Male		Female		total		Male		Female		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
70-79	1	0.83	0	1	1	0.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80-89	6	4.96	2	2.06	8	3.67	2	2.63	3	2.80	5	2.82	1	1.25	0	0.00	1	0.64	0	0.00	0	0.00	0	3.67
90-99	31	25.62	36	37.11	67	30.73	16	21.05	27	25.23	43	23.50	1	1.25	3	3.33	4	2.35	16	4.83	7	1.98	23	30.73
100-109	58	47.93	12	12.37	95	43.58	29	38.16	372	34.58	66	36.50	21	26.25	18	20.00	39	22.94	79	23.87	59	16.67	138	43.58
110-119	16	13.32			28	12.84	19	25.00	27	25.23	46	36.07	38	47.50	31	34.44	69	40.59	114	34.44	121	34.18	245	12.84
120-129	8	6.61	7	7.22	15	6.88	8	10.53	10	9.35	18	25.14	16	20.00	31	34.44	47	27.65	79	23.87	116	32.77	195	6.88
130-139	1	0.83	1	1.03	2	0.92	1	1.32	1	0.93	2	9.84	3	3.75	6	6.67	9	5.29	25	7.55	27	7.63	52	0.92
140-149	0	0.00	2	2.06	2	0.92	0	0.00	2	1.87	2	1.09	0	0.00	1	1.11	1	0.59	10	3.02	15	4.24	25	0.92
150-159	-	-	-	-	-	-	1	1.32	0	0.00	1	0.55	0	0.00	0	0.00	0	0.00	2	0.60	3	0.85	5	2.82
160-169	-	-	-	-	--	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.60	4	1.13	6	23.50
170-179	-	-	-	-	--	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.30	1	0.28	2	36.50
180-189	-	-	-	-	--	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.30	0	0.00	1	36.07
190-199	-	-	-	-	--	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.60	0	0.00	2	25.14
Total	121	100.00	97	100.00	218	100.00	76	100.00	107	100.00	183	100.00	80	100.00	90	100.00	170	100.00	332	100.00	353	100.00	685	100
Mean BP	102		103		102		106		105		106		113		115		116		115		118		117	
SD	9.7		11.0		10.3		11.4		8.5		9.5		9.1		8.5		9.5		113.3		12.6		13.0	

TABLE 2

Age group SBP mmHg	5-9 years						10-14 years						15-19 years						20 + years					
	Female		Male		Total		Female		Male		Total		Male		Female		total		Male		Female		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
30-39	0	0.00	1	0	0.00	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40-49	4	3.31	2	4	3.31	2	6	7.89	6	5.61	12	6.56	0	0.00	1	1.11	1	0.59	1	0.30	0	0.00	1	0.15
50-59	21	17.36	21	21	17.36	21	13	17.11	14	13.08	27	14.75	3	3.75	4	4.44	7	4.12	7	2.11	06	1.69	13	1.90
60-69	56	46.28	49	56	46.28	49	27	35.53	40	37.38	67	36.61	23	28.75	13	14.44	36	21.18	80	24.17	68	19.21	148	21.61
70-79	31	25.62	13	31	25.62	13	22	28.95	36	33.64	58	31.69	42	52.50	45	50.00	87	51.18	128	38.67	133	37.57	261	38.10
80-89	9	7.44	10	9	7.44	10	7	9.21	9	8.41	16	8.74	12	15.00	24	26.67	36	21.18	94	28.40	108	30.51	202	29.49
90-99	0	0.00	1	0	0.00	1	0	0.00	1	0.93	1	0.55	0	0.00	3	3.33	3	1.76	16	4.83	30	8.47	46	6.72
100-109	-	-	-	-	-	-	1	1.32	1	0.93	1	0.55	-	-	-	-	-	-	3	0.91	8	2.26	11	1.61
110-119	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.30	0	0.00	1	0.15
120-129	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.60	0	0.00	2	0.29
130-139	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
140-149	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
150-159	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
160-169	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
170-179	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
180-189	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
190-199	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	121	100.00	97	100.00	218	100.00	76	100.00	107	100.00	183	100.00	80	100.00	90	100.00	170	100.00	332	100.00	353	100.00	685	100.00
Mean BP	64.84		64.21		64.59		65		64		65		71		73		72		74		76		75	
SD	9.1		8.5		9.5		11.6		10.2		10.8		7.3		8.6		8.1		10.0		9.8		10.0	

DISTRIBUTION OF DIASTOLIC BLOOD PRESSURE IN FOUR DIFFERENT AGE GROUPS

TABLE 3

MEAN SBP Of CHILDREN WHOSE FATHERS SBP IS GREATER THAN >75th PERCENTILE Vs MEAN SBP OF CHILDREN WHOSE FATHERS SBP < 75th PERCENTILE

AGE YEARS	GROUP I		GROUP 2		GROUP 3		GROUP 4	
	FATHERS SYSTOLIC > 75 th PERCENTILE		FATHERS SYSTOLIC > 75 th PERCENTILE		FATHERS SYSTOLIC > 75 th PERCENTILE		FATHERS SYSTOLIC > 75 th PERCENTILE	
	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
5-9	103.33+12.93 (15)	108.30+ 13.80 20	101.46+9.30 (99)	100.90 + 8.00 (33)	64.38 +7.98 (26)	69.22 + 10.59 (18)	65.57 +9.05 (88)	62.70 +8.82 (71)
10-14	108.83+ 12.41 (24)	109.64+14.17 (33)	103.22+ 9.19 (41)	102.64+8.00 (53)	65.27+ 12.08 (22)	69.84 + 11.19 (37)	63.40 + 10.78 43)	4.34 + 8.65 (49)
15-19	113.06+ 9.87 (17)	117.91+9.97 (22)	112.86+10.96 21	113.75 +8.39 (64)	72.26+8.48 (15)	74.46+7.81 (23)	68.96+7.29 (23)	71.96+8.05 (47)
20+	-	118.82 + 11-13 (39)	116.67+12.47 (3)	115.17 + 10.2 (63)	-	77.06 +8.19 (37)	74.67 + 5.25 (3)	72.97 + 11.83 (65)

MEAN IS SIGNIFICANTLY (P<0.05) HIGHER THAN IN GROUP II &IV SBP SYSTOLIC BLOOD PRESSURE

TABLE 4

MEAN SBP OF CHILDREN WHOSE MOTHER'S SBP IS GREATER THAN >75th PERCENTILE Vs MEAN SBP OF CHILDREN WHOSE FATHERS SBP < 75th PERCENTILE

AGE YEARS	GROUP I		GROUP 2		GROUP 3		GROUP 4	
	MOTHERS SYSTOLIC > 75 th PERCENTILE		MOTHERS SYSTOLIC > 75 th PERCENTILE		MOTHERS SYSTOLIC > 75 th PERCENTILE		MOTHERS SYSTOLIC > 75 th PERCENTILE	
	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE
5-9	102.39 + 8.59 (38)	101.53+13.26 (17)	100.46 + 9.68 (85)	103.14 + 11.46 79	69.19 + 7.87 (37)	64.38 +12.76 (26)	63.85 + 9.62 (82)	64.27 + 8.81 (66)
10-14	109.50 + 12.64 (16)	107.00 + 11.43 (24)	106.00 + 12.42 (54)	104.43 + 11.61 (79)	67.50 +9.51 (28)	66.82 +7.47 (34)	62.93 + 12.73 (41)	65.56 + 11.33 (64)
15-19	108.00 + 10.00 (10)	112.19 + 9.91 (21)	113.23 + 10.33 (31)	113.74 +9.32 (54)	72.38 + 7.25 (16)	75.00 + 8.35 (34)	69.33 +8.00 (27)	71.14 + 8.67 (44)
20+	110.00 + 0.00 (01)	114.50 +11.33 (36)	106.67 + 4.71 (3)	117.76 +9.383 (76)	82.00 +0.00 (1)	75.73 + 11.78 (51)	70.67 + 0.94 (3)	73.93 + 11.31 (70)

SBP SYSTOLIC BLOOD PRESSURE * MEAN is significantly (p <0.05) higher than in group IV

TABLE 5

MEAN BLOOD PRESSURE OF ALL CHILDREN OF “HYPERTENSIVE” FATHER & MOTHERS vs CHILDREN OF BOTH SEX IN TOTAL SAMPLE

AGE GROUP (YEARS)	SBP OF ALL CHILDREN		DBP OF ALL CHILDREN		SBP OF MALE CHILDREN		DBP OF MALE CHILDREN		SBP of MALE CHILDREN		DBP of MALE CHILDREN	
	FATHERS BP >140/90mm Hg	TOTAL SAMPLE	FATHERS BP >140/90 mmHg	TOTAL SAMPLE	FATHERS BP >. 140/90 (mmHG)	TOTAL SAMPLE	FATHERS BP >. 140/90 (MMHG)	TOTAL SAMP LE	MOTHERS BP >.140/90 mmHG	Total SAMPLE	MOTHERS BP >.140/90 mmHG	Total Sample
5-9	119.50+16-15 (4)	101.95+10.3 (218)	78.00+10.77 (4)	64.59+9.6 (218)	126.00+13.37 (3)	102.54+11.0 (97)	84.00+3.24 (3)	64.21+10.0 (97)	100.00+0.00 (1)	105.66+11.37 (183)	70.00+0.00 (1)	65.99 + 10.82 (183)
10-14	117.38+16.38 (13)	105.66+11.4 (183)	71.54+16.02 (13)	65.99+10.83 (183)	116.86+18.51 (7)	105.35+11.25 (107)	73.71+16.98 (7)	66.71+10.2 (107)	115+7.07 (2)	113.95+9.00 (170)	75.00+7.07 (2)	72.15+8.10 (170)
15-19	112.36+10.44 (11)	113.95+9.1 (170)	74.91+9.16 (11)	72.15+8.1 (170)	116.57 +7.51 (7)	114.80+9.5 90	78.29+7.28 (7)	73.27+8.6 (90)	120.00+0.00 (1)	116.31+9.9 (157)	80+0.00 (1)	73.89+8.1 (157)
20-24	119.33+0.94 (3)	116.31+9.9 (157)	73.33+9.43 (3)	73.89+8.7 (157)	114. 92+6.35 (11)	117.42+9.6 (79)	73.69+4.56 (3)	74.08+8.4 (79)	122.00+0.00 (3)	114.58+9.9 (234)	84.67+10.50 (3)	73.03 +9.0 234)
25-34	114.73+6.88 (11)	114.58+9.9 (234)	73.45 + 4.43 (11)	73.03+9.00 (234)	114.73+6.68 (11)	116.+8.6 (120)	73.45+4.44 (11)	74.81+8.1 (120)	110.00+0.00 (1)	114.24 +11.8 (118)	68.00+0.00 (1)	76.46+10.3 (118)
35-44	112.00 +0.00 (1)	115.24+11.8 (118)	70.00+0.00 (1)	76.46+10.3 (118)	112.00+0.00 (1)	116.69+13.2 (61)	70.00+0.00 (1)	78.23+11.1 (61)	122.05+21.79	115.54+10.90 (74)	80.00+19.03	76.57+7.90 (74)
55-64										80.00+19.03 (58)		78.38 +12.9 (58)

In this study a patient is considered as hypertensive if >. 140/90 mmHg

• P<0.05

**P<0.01

***P<0.001

BP BLOOD PRESSURE

SBP SYSTLIC BLOOD PRESSURE

DBP BDIABOLIC BLOOD PRESSURE

Note: DIVISION BY SEX OF CHILDRENDONE DUE TO SMALL NUMBER OF CHILDREN