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RESEARCH ARTICLE

A cross-sectional study of anthropometric parameters in normotensive offsprings of hypertensive parents

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ABSTRACT

Background: Globally, hypertension is a major disease burden affecting nearly 1 billion people. India in 2000 had 41.5 million people with hypertension which is estimated to increase by another 5 million by the year 2025. Association of high blood pressure (BP) among siblings as well as between parents and children has been shown by various studies establishing hereditary nature of hypertension. **Aims and Objectives:** This study aims to measure and correlate the anthropometric parameters of normotensive offsprings of hypertensive parents (HTP) and normotensive offsprings of normotensive parents. **Materials and Methods:** A cross-sectional study was carried out in 200 healthy subjects in the age group of 18–20 years after the approval of the ethical committee of the institute. Height, weight, body mass index (BMI), waist circumference (WC), hip circumference, fat percentage, and BP were measured with standard technique and analyzed using Chi-square test. **Results:** About 71.4% of males and 45.5% of females of HTP showed increased BMI ($P = 0.002$**). 57.1% of males and 56.4% of females of HTP showed increased body fat percentage ($P = 0.01$*). 50% of males and 41.8% of females of HTP showed increased WC ($P = 0.000$***). 21.4% of males and 10.9% of females of HTP showed increased diastolic BP ($P = 0.04$*). **Conclusion:** Offsprings of HTP should be considered as a special group. Health professionals who deal with patients with cardiovascular diseases should utilize every opportunity to involve the families concerned in screening, follow–up, and health education.

KEY WORDS: Hypertension; Family History; Special; Lifestyle Modifications

INTRODUCTION

Non-communicable diseases are the major threat of morbidity and mortality affecting worldwide population. Globally, hypertension is a major disease burden affecting nearly 1 billion people.[1] India in 2000 had 41.5 million people with hypertension which is estimated to increase by another 5 million by the year 2025.[2] Family history is a non-modifiable contributory factor for hypertension. Association of high blood pressure (BP) among siblings as well as between parents and children has been shown by various studies establishing hereditary nature of hypertension.[3,4]

The risk of the prevalence of hypertension doubles with positive family history.[5] Studies in normotensive individuals with positive family history have shown early morphological changes in their myocardium, increased peripheral vascular resistance, and reactivity to pressor stimuli.[6]

Exploration of the family history of hypertension even in a normotensive individual should, therefore, be a routine and should be given due importance. Teenagers with hypertensive

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parents (HTP) and/or siblings should be treated as a special risk group and should be monitored closely. Such studies carried out to identify various risk factors for the development of hypertension will aid in identifying high-risk individuals at an early stage of the disease.

This study was conducted to measure and correlate the anthropometric parameters of normotensive offsprings of HTP and normotensive offsprings of normotensive parents (NTP).

MATERIALS AND METHODS

Study Setting

This study was conducted in Dr. D. Y. Patil Medical College, DPU, Pimpri, Pune.

Study Design

A cross-sectional non-interventional study was conducted in teaching institute Dr. D. Y. Patil Medical College, DPU, Pimpri, Pune.

Institutional Ethical Committee

A study protocol was submitted to and was approved by the institutional ethical committee.

Participants

The participants were the students from Dr. D. Y. Patil Medical College, DPU, Pimpri, Pune.

A total of 200 medical students were enrolled for the study. The written informed consent was taken from the participants. Participants were in the age group of 18–20 years. Detailed history of all the participants was taken.

Exclusion Criteria

Those with present or history of any acute or chronic disease state and history of taking cardioactive drugs such as antihypertensive and antilipidemics were excluded from the study. Students with a history of smoking were excluded from the study. Unwilling students were excluded from the study.

Data Collection

Data were collected using a questionnaire. A history of diagnosis and/or treatment of hypertension in any of the family members were taken as a positive family history. Parents, siblings, grandparents, uncles, aunts, nephews, nieces, and cousins were included as family members. A detailed clinical examination was carried out. The anthropometric parameters such as height in cm, weight in kg, waist circumference (WC) in cm, body mass index (BMI), waist–hip ratio (WHR), and fat percentage were measured. BP was measured as per the World Health Organization (WHO) guidelines.[7] Hypertension was defined as per the WHO/ISH guidelines.

Body weight was measured (to the nearest 0.5 kg) with the subject standing erect and motionless on the weighing scale.

Height was measured (to the nearest 0.5 cm) with the subject standing in an erect position against a vertical scale and with the head positioned so that the top of the external auditory meatus was in level with the inferior margin of the bony orbit (Frankfurt's plane).

BMI was measured as weight in kilograms divided by the square of the height in meters. The WHO criteria were used for the classification of BMI.

WC was measured at the midpoint between the lower margin of the lowest palpable rib and the top of the iliac crest, using a stretch-resistant tape that provides a constant 100 g tension. Hip circumference (HC) was measured around the widest portion of the buttocks, with the tape parallel to the floor. For both measurements, the subject was standing with feet close together, arms at the side, and body weight evenly distributed. The subject was relaxed and the measurements were taken at the end of a normal expiration.

WHR was calculated as WC divided by HC. To reduce subjective error, all measurements were taken by the same person. Males with WHR >0.9 and females with WHR >0.8 were considered as obese.[8]

Body Composition

Body fat percentage (BF%) was measured using the instrument OMRON HBF-306 which is based on the principle of bioelectrical impedance.[9]

Measuring BP

Practice guidelines laid down by the WHO were used for the measurement of BP.[10] Measurements were taken in sitting position after 5 min of rest using Omron automatic BP monitor (model: HEM-8712). Three readings were taken with the interval of 3 min between consecutive measurements. To reduce bias and variations in the BP measurement, same instrument was used throughout the study, an average of three readings was calculated for the analysis, readings were taken at the same time of the day to minimize the effect of diurnal variation for all the subjects, and avoidance from tea, coffee, and physical exertion an hour before the measurement was followed.

Statistical Analysis

Data were analyzed using software Primer of Biostatistics version 7.0 after importing it into Excel sheet. Chi-square test was used for statistical analysis.

RESULTS

Of 200 participants, 30% were male and 70% were female. Of 70% females, 40% were having positive family history of hypertension. Of 30% males, 23% were having HTP [Table 1].

Mean systolic BP (SBP) and mean diastolic BP (DBP) in males as well as females of HTP were more compared to those of NTP [Table 2].

Percentage of males (71.4%) and females (45.5%) having BMI of ≥25 of HTP was higher and statistically significant compared to males (31.9%) and females (28.6%) of NTP, respectively. Percentage of males (50%) of HTP having WC ≥80 cm was more and statistically significant compared to males (8.5%) of NTP. Percentage of females (41.8%) of HTP having WC ≥90 cm was more and statistically significant compared to females (23.8%) of NTP [Table 3].

Percentage of males (57.1%) of HTP having BF% ≥25 was more and statistically significant compared to males (34%) of NTP. Percentage of females (56.4%) of HTP having BF% ≥32 was more and statistically significant compared to females (39.3%) of NTP. Percentage of males (14.3%) of HTP having WHR ≥0.9 was more even though statistically not significant compared to males (8.5%) of NTP. Percentage of females (43.6%) of HTP having WHR ≥0.8 was more even though statistically not significant compared to females (32.1%) of NTP [Table 3].

Percentage of males (21.4%) of HTP having DBP >80 was more and statistically significant compared to males (12.7%) of NTP. Percentage of females (10.9%) of HTP having DBP >80 was more and statistically significant compared to females (3.6%) of NTP. Percentage of males (50%) of HTP having SBP >120 was more and statistically significant compared to males (36.2%) of NTP. Percentage of females (7.3%) of HTP having SBP >120 was more even though statistically not significant compared to females (6%) of NTP [Table 4].

Table 1: Distribution of study participants

Parents	Males (%)	Females (%)	Total
HTP	14 (22.9)	55 (39.6)	69 (34.5)
NTP	47 (77)	84 (60.4)	131 (65.5)
Total	61 (30.5)	139 (69.5)	200 (100)

HTP: Hypertensive parents, NTP: Normotensive parents

Table 2: Comparison of mean blood pressure

BP in mmHg (Mean±SD)	Males		Females	
	HTP	NTP	HTP	NTP
SBP	118.5±12.5	117±11	105.4±8.8	103.3±9.8
DBP	72.4±9.9	71.3±7.3	71.6±6.9	70.5±6.3

HTP: Hypertensive parents, NTP: Normotensive parents,
SBP: Systolic blood pressure, DBP: Diastolic blood pressure

DISCUSSION

In this study, greater propensity of developing high BP in offsprings of HTP compared to offsprings of NTP was seen. Susceptibility of increased BMI, WC, BF%, and WHR in both males and females of HTP compared to those of NTP was seen in this study.

The relationship between cardiovascular disease and the family history starts right from the first decade of life. Even though it is asymptomatic, it predicts cardiovascular risk later in adult life.[11-13] In this population, high BP is one of the major risk factors for cardiovascular disease. Normotensive children of HTP show early cardiovascular changes and are exposed to the risk of developing hypertension later in life.[12,13] An early reduction in arterial elasticity with increased stiffness and lower carotid diameter in the children of HTP compared to children of NTP has been studied.[14]

Calentano *et al*. showed increase in the left ventricular mass of the normotensive children of HTP.[15] Persistently elevated BP and an early metabolic syndrome disorder in normotensive adolescents of HTP have been shown by various longitudinal studies.[16-18] Increase in SBP in children of HTP could be due to early alterations in the structure and a function of the arterial wall.[19] Mechanisms explaining the relationship between the high SBP in adolescents and endothelial dysfunction years later such as increase in leukocyte adherence and endothelial permeability, the proliferation of smooth muscle cells, and increased expression of cytokines and intimal growth factors have been studied.[20] Increased BMI and other anthropometric parameters such as WC and BF% in adolescents of HTP are an independent risk factor for developing cardiovascular disease later in life.[21,22] The increased activity of the renin-angiotensin system and plasma aldosterone levels, leading to increase in renal sodium reabsorption, might be the cause of increase in BP levels in obese adolescents of HTP.[23] Relationship of weight gain in children with decreased arterial elasticity in adulthood, leading to some degree of inflammation of the arterial wall and with elevated leptin levels in plasma, has been shown.[24-26] A strong relationship between parental hypertension and cardiometabolic risk factors in adolescents has been studied.[27]

Susceptibility of developing hypertension in normotensive offsprings of HTP compared to normotensive offsprings of NTP was confirmed by this study. Increased anthropometric parameters such as BMI, WC, BF%, and WHR in these

Table 3: Distribution of anthropometric parameters in relation to family history of hypertension

Parameters	Males (%)		Females (%)		χ^2 (3 degrees of freedom)	*P* value
BMI	<25	≥25	<25	≥25	15.022	0.002**
HTP	04 (28.6)	10 (71.4)	30 (54.5)	25 (45.5)		
NTP	32 (68)	15 (31.9)	60 (71.4)	24 (28.6)		
WC	< 90	≥ 90	< 80	≥ 80	20.350	0.000***
HTP	7 (50)	7 (50)	32 (58.2)	23 (41.8)		
NTP	43 (91.5)	4 (8.5)	64 (76.2)	20 (23.8)		
BF%	< 25	≥ 25	< 32	≥ 32	11.197	0.014*
HTP	6 (42.9)	8 (57.1)	24 (43.6)	31 (56.4)		
NTP	31 (65.9)	16 (34)	51 (60.7)	33 (39.3)		
WHR	< 0.9	≥ 0.9	< 0.8	≥ 0.8	7.498	0.075
HTP	12 (85.7)	2 (14.3)	31 (56.4)	24 (43.6)		
NTP	43 (91.5)	4 (8.5)	57 (67.9)	27 (32.1)		

Statistically significant at **P*<0.05, ***P*<0.01, ****P*<0.001. HTP: Hypertensive parents, NTP: Normotensive parents, BMI: Body mass index, WC: Waist circumference, BF%: Body fat percentage, WHR: Waist–hip ratio

Table 4: Distribution of blood pressure measurements in relation to family history of hypertension

BP	Males (%)		Females (%)		χ^2 (3 degrees of freedom)	*P* value
DBP	> 80	≤ 80	> 80	≤ 80	8.811	0.041*
HTP	3 (21.4)	11 (78.6)	6 (10.9)	49 (89)		
NTP	6 (12.7)	41 (87.2)	3 (3.6)	81 (96.4)		
SBP	> 120	≤ 120	> 120	≤ 120	5.958	0.150
HTP	7 (50)	7 (50)	4 (7.3)	51 (92.7)		
NTP	17 (36.2)	30 (63.8)	5 (6)	79 (94)		

Statistically significant at **P*<0.05. HTP: Hypertensive parents, NTP: Normotensive parents, SBP: Systolic blood pressure, DBP: Diastolic blood pressure

people can be considered as predisposing factors, leading to hypertension and cardiovascular diseases later in life. Longitudinal studies with larger population in normotensive offsprings of HTP may provide further insight into this subject.

CONCLUSION

Normotensive offsprings of HTP have increased BMI, WC, BF%, and WHR compared to normotensive offsprings of NTP. Normotensive offsprings of HTP also have increased BP compared to normotensive offsprings of NTP.

Normotensive offsprings of HTP should be considered as a special group which needs an intervention to promote lifestyle modifications, changes in diet and physical activity to prevent future cardiovascular events. Health professionals who deal with patients with cardiovascular diseases should utilize every opportunity to involve the families concerned in screening, follow–up, and health education.

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