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Cardiovascular Reactivity in young adults with hypertensive and normotensive parents: A Gender based Comparative Study

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ABSTRACT

Introduction: Essential hypertension begins due to mutation of specific genes that contribute to the risk of developing hypertension. Genetic contribution was recognized 25 years ago, now formulated from time to time. Some studies have also proven that the hypertension in father had strong contribution in their individual than mother. The aim of the study is to compare the cardiovascular reactivity in male and female subjects with hypertensive and normotensive parents. **Materials and methods:** This comparative study was conducted in physiology department of Teerthanker Mahaveer medical college and research center, Moradabad. The research work was initiated after taken the ethical clearance from the ethical committee of the college. Three different stressors: cold pressor task, cycling and videogame were used. Total 120 subjects were taken for the study in which 77 were male and 43 were female. **Result:** Male subjects of normotensive parents had slightly higher HR rate (mean: 76.73/min) compared to the female subjects (mean: 75/min) with p value >0.05. Female subjects of hypertensive parents had higher HR rate (mean: 82.72/min) compared to the male subjects (mean: 73.95/min) with p value <0.001. **Conclusion:** Male subjects with normotensive parents had higher resting HR, SBP & DBP than Female subjects with normotensive parents, but the difference was significant only in SBP. Female subjects with hypertensive parents group was showing higher resting HR than male subjects with hypertensive parents group, remains higher after stress also with insignificant difference. Thus, subjects with hypertensive parents showing increased CVR to stress are more likely to develop future hypertension, and the risk is greater for male subjects.

Key words: Hypertension, Cardiovascular reactivity, Normotensive, Mutation, Higher resting HR.

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INTRODUCTION

Essential hypertension begins due to mutation of specific genes that contribute to the risk of developing hypertension. Genetic contribution was recognized 25 years ago, now formulated from time to time. Some studies have also proven that the hypertension in father had strong contribution in their individual than mother Hypertensive.⁶ Genetically such young individuals with parental history of hypertension may have some alteration in normal physiological control of satiety. Primarily food intake is controlled by lateral hypothalamus (LH) and satiety centre is Vento Medial Hypothalamus (VMH) lesion of Basolateral Amygdale (BLA), Nucleus Septal Lateralis (NSL) leads to increase in intake and brain areas inhibit ingestive behaviour.⁷

Some evidences were also observed in the cross sectional study that hypertension is the product of the interaction of genes and environment or we can say that environment enhance the hypertension in the normotensive individuals with history of hypertensive parents.⁸

According to WHO, Dec.2014, Prevalence of hypertension was also increased, worldwide in last 20 years, (children & adolescents) continuously.^{9,10} Study showed that HTN was related with family history, and the condition of HTN worsens with age since as already stated, it can't be detected in early ages and thus remains untreated. Survey of National Health and Nutrition (NHANES- IV-1999-2001) states that the

prevalence of Pre-hypertension (PH) has increased to 29.7% from 3.7% (NHANES-III-1988-1991).¹¹

Burden of Cardiovascular disease (CVD) on world is very broad. According to the data from Russian federation (WHO) the mortality rate is 6-fold higher in Russians than that in French.¹ In China, mortality rate has doubled from 1988 due to CVD.² In 1990, a quarter of deaths were observed due to CVD among South Asian countries including India and its subcontinent (Nepal, Sri Lanka, Pakistan & Bangladesh)³ The World Health Organization (WHO) reported a high prevalence of Cardiovascular Diseases (CVD) in India and China as compared to many of the other developing and developed nations of the world. According to a remarkable study, India is the third most obese country in the world.⁴ Rapid urbanization and economic progress in India have changed the life style of the population, with promotion of poor eating habits, sedentary style of living, and increased mental and physical stress. Consequently, the incidence of life style diseases (obesity, hypertension, diabetes mellitus, hyperlipidemia, heart diseases etc) is increasing in direct proportion to the progress.⁵

According to the study of “The National Health and Nutrition survey” 1960 to 1991, death due to Pre-hypertension is approximately 7.1 million per year out of which 30% i.e. approx. 2.13 million adults due to their unawareness about their hypertensive nature & 40% i.e. approx. 2.84 million hypertensive patients due to remained untreated and remaining 30% i.e. approx. 2.13 million died even after taking treatment because of no response of treatments on their hypertensive condition.¹²

Longitudinal studies have shown that normotensive adolescents of hypertensive parents followed for more than ten years, had persistently elevated the blood pressure (BP) values and showed an early metabolic syndrome disorders such as higher plasma insulin levels, increased triglycerides and values of Systolic BP (SBP), Diastolic BP (DBP) and heart rate.¹³⁻¹⁵ The increased activity of the renin-angiotensin system and plasma aldosterone levels, which would produce an increase in renal sodium reabsorption, would be linked to the increase in BP levels in obese adolescents with hypertensive parents.¹⁶ Some studies advocate the pathophysiologic role of CVR in the development of primary hypertension. However, role of genetic factors are rarely accounted in the studies relating to CVR and high blood pressure. Physical stress in the form of exercise on a cycle ergo meter, mental stress (in the form of video game: Need For Speed - Most Wanted, requiring driving skills), and pain stress (in the form of cold pressor task) shall be used to elicit CVR in normal and obese young adults with normotensive and hypertensive parents. Cycle ergometer, video game and cold pressor task have been successfully used as stressors to produce CVR.

The aim of the study is to compare the cardiovascular reactivity in male and female subjects with hypertensive and normotensive parents.

MATERIALS AND METHODS

This comparative study was conducted in physiology department of Teerthanke rmahaveer medical college and research center. The research work was initiated after taken the ethical clearance from the ethical committee of the college. Total 120 subjects were taken for the study and divided into two groups A and B. group A consists of 77 males whereas in group B there were 43 females. The number of the male subjects with normotensive parents (M-NT) were 57 and female subjects with normotensive parents (F-NT) were 32. the male subjects with hypertensive parents (M-HT) were 20 and the females (F-HT) were 11. The age group of subjects was 20-25 years were included in this study. The subjects within normal limits of body mass index and willing to participate in this study were included. The subjects who were doing regular exercise and have any musculoskeletal, neurological, respiratory or cardiovascular problem were excluded in this study written consent were taken from all the subjects. Cold pressure task, video game and cycling by ergometer were performed by the subjects for observe the cardiovascular reactivity. Steel Water tub (30 X15X16cm), separator (29X14X9CM) S water reservoir (6L capacity), ice and thermometer were used for cold pressure task, Bicycle ergometer used for cycling and Personal computer (HCL) with U.P.S, Video Game (NFS/most wanted) in which the subject had to save her/himself from police attack used for playing.

Baseline parameters (weight, height, waist and hip circumference, resting HR/blood pressure and parental history) of each subject were recorded at the beginning of experiment. Written informed consent was obtained only if the volunteer satisfied the inclusion and exclusion criteria. HR and blood pressure were recorded before and immediately after each experiment.

Statistical analysis

Statistical analyses were performed using SPSS 24 latest version. The results were presented in number, percentage, mean and standard deviation as appropriate. Unpaired t test used for comparison of mean between male and female. A p-value of <0.05 was considered statistically significant.

RESULTS

The comparison of Basal Parameters in Male (Group A) and Female (Group B) Individuals of normotensive parents were shown in Table 1, Figure 1. Male subjects had slightly higher HR rate (mean: 76.73/min) compared to the female subjects (mean: 75/min) with pvalue >0.05. Male subjects had higher systolic & diastolic blood pressure (mean: 115.33 mmHg & 71.22 mmHg) than female subjects (mean: 112.88 mmHg and 70.37 mmHg) p value <0.05 & >0.05. In Cold Pressor Task- Insignificant difference was observed in the dHR value, with lower mean value in male subjects (0.98/min) compared to female subjects (1.15/min) p-Value > 0.05. The difference in dSBP & dDBP values was statistically significant (p-Value <0.01) between male (2.21 mmHg and 2.24 mmHg) and

female (1.12 mmHg & 0.94 mmHg) subjects. After 5 min. of CPT all values was higher in female with insignificant difference. (Table 2,3, Figure 2,3)

In Cycling insignificant difference in the dHR but dSBP & dDBP value was significantly higher in the male subjects with normotensive parents (mean: 2.17 mmHg and 2.21 mmHg) compared to the female subjects with normotensive parents (mean: 0.93 mmHg & 0.56 mmHg) (p value< 0.001). After 5 min of Cycling dHR was higher in female subjects with normotensive parents with significant difference but dSBP & dDBP was higher in male subjects with normotensive parents (0.28 mmHg & 0.18 mmHg) than female subjects with normotensive parents group(0.73 mmHg & 0.18 mmHg)with insignificant difference(p value>0.05). (Table 4,5, Figure 4,5)

As in case of cardiovascular reactivity to video-game between female and male subjects by showed no significant differences in the dHR but dSBP & dDBP values was significantly higher in male subjects with normotensive parents (1.15 mmHg & 0.08 mmHg) than female subjects with normotensive parents (0.06 mmHg & 0.12 mmHg)(p value<0.001). However, mean values after 5 min of Videogame dHR was slightly lower in the male subjects compared to the female subjects (p value>0.05) but dSBP & dDBP value was insignificantly lower in female subjects with normotensive parents (0.06 mmHg and 0.18 mmHg) compared with the values in male subjects with normotensive parents (0.21 mmHg and 0.14 mmHg) (p-Value>0.05). (Table 6,7, Figure 6,7)

Table 1: Comparison of Basal Parameters in Male and Female subjects of Normotensive Parents

Basal parameter	M-NT (Group A)	F-NT (Group B)	P-values
	Mean± SD	Mean± SD	
HR(/ min)	76.73±5.81	75±4.28	>0.05
SBP(mmHg)	115.33±5.67	112.88±5.49	< 0.05
DBP(mmHg)	71.22±5.03	70.37±3.19	>0.05

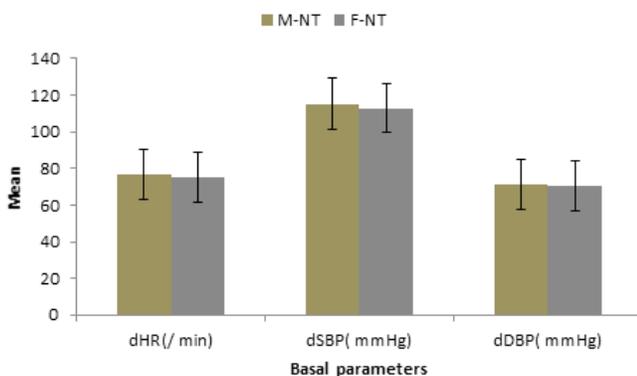


Figure 1: Comparison of Basal Parameters in Male and Female subjects of Normotensive Parents.

Comparison of Basal Parameter in Male and Female Individuals with Both Hypertensive Parents were showed in table 8, Figure 8. Female subjects had higher HR rate (mean: 82.72/min) compared to the male subjects (mean: 73.95/min) with p value <0.001. Male subjects had higher systolic & diastolic blood pressure (mean: 129.5 mmHg & 84.9 mmHg) than female subjects (mean: 119.09 mmHg & 76.18 mmHg)with highly significant difference(p value <0.001). Cold Pressor Task shows insignificantly higher values of CVR parameters. Mean values of dHR & dDBP was higher in F-HT(3/min&3.09 mmHg) than M-2HT (2.6/min&2.9mmHg) , dSBP and was significantly higher in the M-HT group(4.1 mmHg) compared to the values observed in the F-HT group (3.63 mmHg).After 5min of cycling showed insignificant difference showing slightly higher values in F-HT then M-2HT. (Table 9,10, Figure 9,10). In Cyclingthe mean values of dHR, dSBP and dDBP were showing insignificant difference in F-HT(2.6/min,3.63mmHg and 4.00 mmHg, respectively) compared to M-HT(2.5/min,0.9 mmHg and 3.5 mmHg, respectively). After 5min of stressor dHR and dSBP values was higher in female than male but with insignificant difference. (Table 11,12, Figure 11,12). In video Game no significant differences in dHR, and dSBP with higher value in F-2HT(1.09/min,1.63 mmHg) than M-2HT(0.75/min,2.5 mmHg).The mean values of dDBP was higher in M-HT(2.5 mmHg) compared to F-HT(1.63 mmHg)with insignificant difference. After 5min of Videogame the mean dHR,dSBP and dDBP value was higher in F-HT(0.40/min,1.00 mmHg and 1.04 mmHg) compared to M-HT(0.2/min, 0.7 and 1.0 mmHg), but the difference was not statistically significant in dSBP and dDBP. (Table 13,14, Figure 13, 14)

Table 2: Comparison of Cardiovascular Reactivity in Male and Female subjects of Normotensive Parents after 1 min.of CPT

Cardiovascular Reactivity	M-NT (Group A)	F-NT (Group B)	p-value
	Mean± SD	Mean± SD	
dHR(/min)	0.98±0.76	1.15±0.88	>0.05
dSBP (mmHg)	2.21±1.04	1.12±1.33	<0.001
dDBP (mmHg)	2.24±0.93	0.62±0.94	<0.001

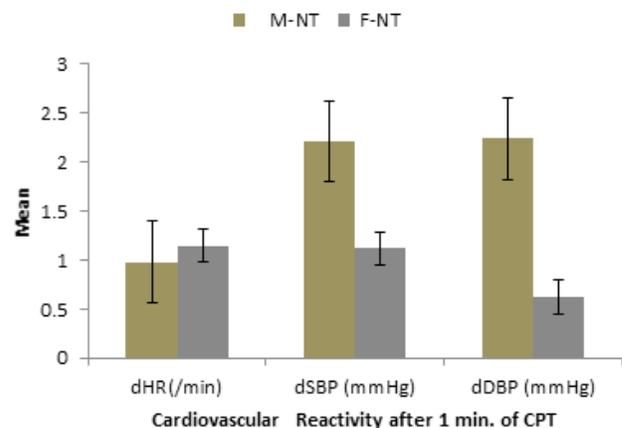


Figure 2: Comparison of Cardiovascular Reactivity in Male and Female subjects of Normotensive Parents after 1min.of CPT.

Table 3: Comparison of Cardiovascular Reactivity in Male and Female subjects of Normotensive Parents after 5 Min. of CPT

Cardiovascular Reactivity	M-NT(Group A)	F-NT(Group B)	P-Value
	Mean± SD	Mean± SD	
dHR(/ min)	0.28±0.59	0.37±0.60	>0.05
dSBP(mmHg)	0.31±0.73	0.31±0.73	>0.05
dDBP(mmHg)	0.42±0.98	0.12±0.70	>0.05

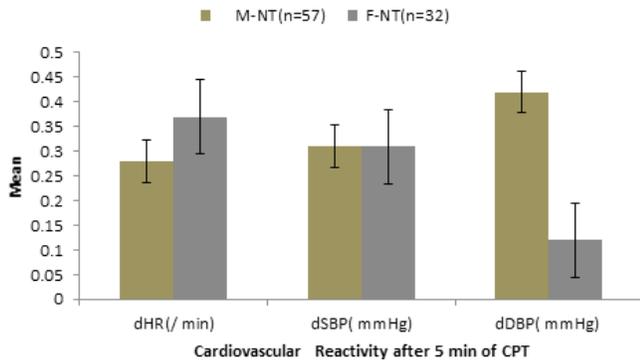


Figure 3: Comparison of Cardiovascular Reactivity in Male and Female subjects of Normotensive Parents after 5 Min. of CPT.

Table 4: Comparison of Cardiovascular Reactivity in Male and Female subjects of Normotensive Parents after 1 min. of Cycling

Cardiovascular Reactivity	M-NT (Group A)	F-NT (Group B)	p-value
	Mean± SD	Mean± SD	
dHR(/ min)	1.26±1.07	1.12±0.94	>0.05
dSBP(mmHg)	2.17±1.21	0.93±1.34	<0.001
dDBP(mmHg)	2.21±1.17	0.56±0.91	<0.001

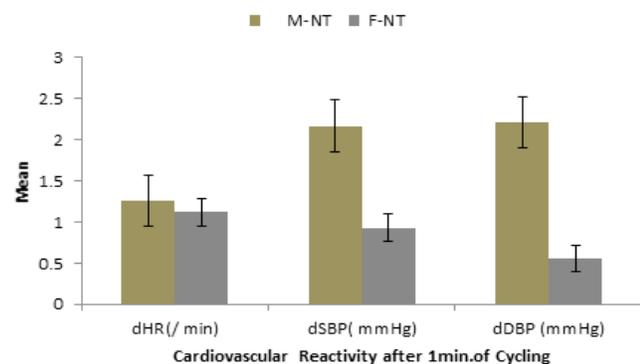


Figure 4: Comparison of Cardiovascular Reactivity in Male and Female subjects of Normotensive Parents after 1 min. of Cycling.

Table 5: Comparison of Cardiovascular Reactivity in Male and Female subjects of Normotensive Parents after 5 Min. of Cycling

Cardiovascular Reactivity	M-NT (Group A)	F-NT (Group B)	P value
	Mean± SD	Mean± SD	
dHR(/ min)	0.03±1.20	0.43±0.71	<0.05
dSBP(mmHg)	0.28±0.88	0.06±0.80	>0.05
dDBP(mmHg)	0.52±1.10	0.18±0.59	>0.05

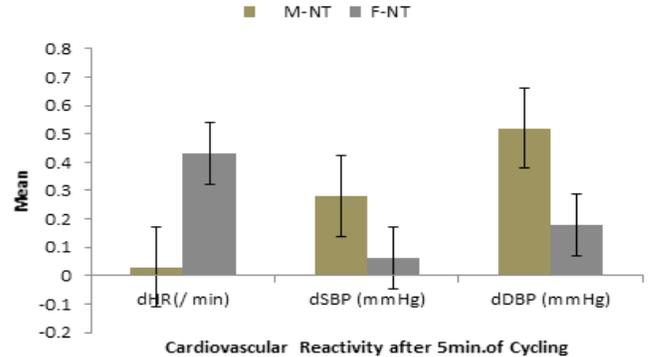


Figure 3: Comparison of Cardiovascular Reactivity in Male and Female subjects of Normotensive Parents after 5 Min. of Cycling.

Table 6: Comparison of Cardiovascular Reactivity in Male and Female Individual of normotensive Parents after 1 min. of Videogame

Cardiovascular Reactivity	M-NT (Group A)	F-NT (Group B)	p-value
	Mean± SD	Mean± SD	
dHR(/ min)	0.61±0.70	0.37±0.55	>0.05
dSBP(mmHg)	1.15±1.13	0.06±0.35	<0.001
dDBP(mmHg)	0.80±0.98	0.12±0.49	<0.01

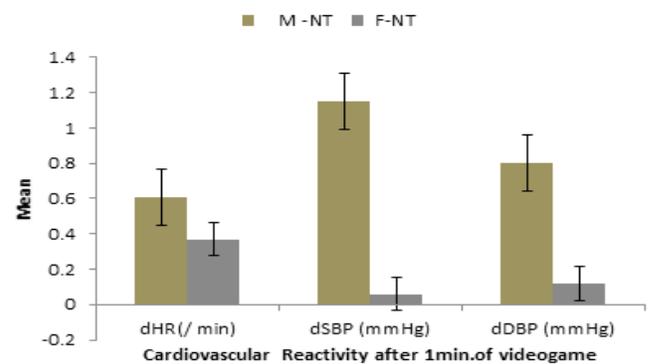


Figure 6: Comparison of Cardiovascular Reactivity in Male and Female Individual of normotensive Parents after 1 min. of Videogame.

Table 7: Comparison of Cardiovascular Reactivity in Male and Female subjects of Normotensive Parents after 5 Min. of Videogame

Cardiovascular Reactivity	M-NT (Group A)	F-NT (Group B)	p-value
	Mean± SD	Mean± SD	
dHR(/ min)	0.14±0.44	0.15±0.51	>0.05
dSBP(mmHg)	0.21±0.61	0.06±0.35	>0.05
dDBP(mmHg)	0.14±0.74	0.18±0.78	>0.05

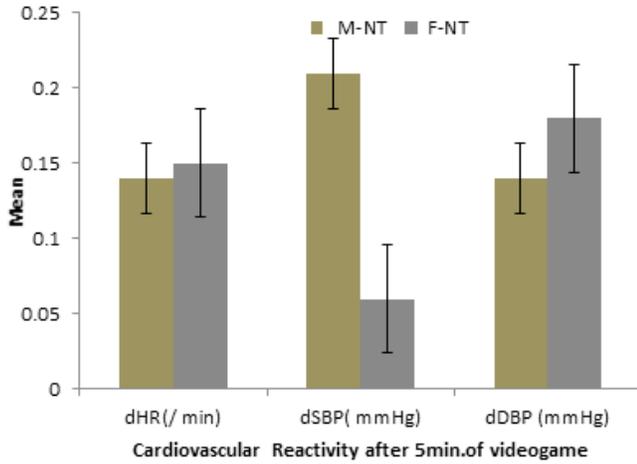


Figure 7: Comparison of Cardiovascular Reactivity in Male and Female subjects of Normotensive Parents after 5 Min. of Videogame.

Table 8: Comparison of Basal Parameter in Male and Female Individuals with Hypertensive Parents

Basal Parameter	M- HT (Group A)	F- HT (Group B)	P-VALUE
	Mean± SD	Mean± SD	
HR(/ min)	73.95±4.81	82.72±2.05	< 0.001
SBP(mmHg)	129.2±5.12	119.09±5.39	< 0.001
DBP(mmHg)	84.9±4.42	76.18±5.54	< 0.001

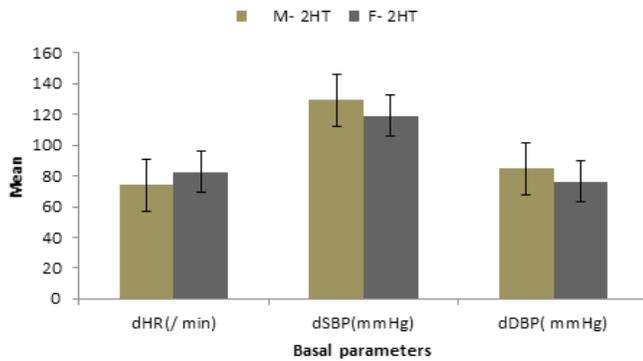


Figure 8: Comparison of Basal Parameter in Male & Female Individuals with Hypertensive Parents.

Table 9: Comparison of Cardiovascular Reactivity of Male& Female Individuals with Hypertensive Parents after 1min. CPT

Cardiovascular Reactivity	M- HT (Group A)	F-HT (Group B)	P-value
	Mean± SD	Mean± SD	
dHR(/ min)	2.6±1.50	3±1.67	> 0.05
dSBP(mmHg)	4.1±1.37	3.63±1.20	> 0.05
dDBP(mmHg)	2.9±1.02	3.09±1.04	>0.05

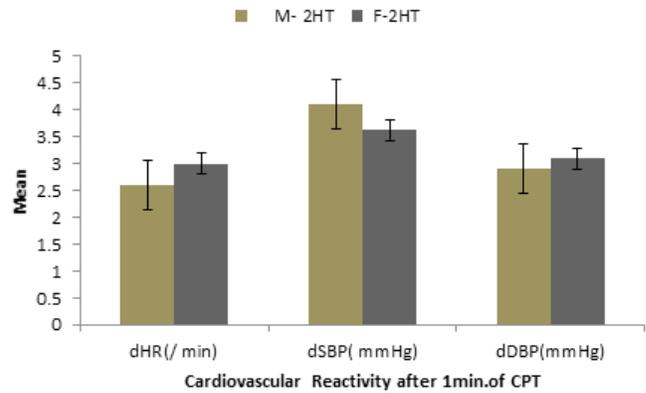


Figure 9: Comparison of Cardiovascular Reactivity of Male & Female Individuals with Hypertensive Parents after 1 min. CPT.

Table 10: Comparison of Cardiovascular Reactivity in Male& Female Individuals with Hypertensive Parents after 5 min. of CPT

Cardiovascular Reactivity	M- HT(Group A)	F-HT(Group B)	P-VALUE
	Mean± SD	Mean± SD	
dHR(/ min)	1.05±1.35	1.09±1.81	>0.05
dSBP(mmHg)	1.3±1.17	1.45±0.93	> 0.05
dDBP(mmHg)	1.3±1.17	0.72±1.00	>0.05

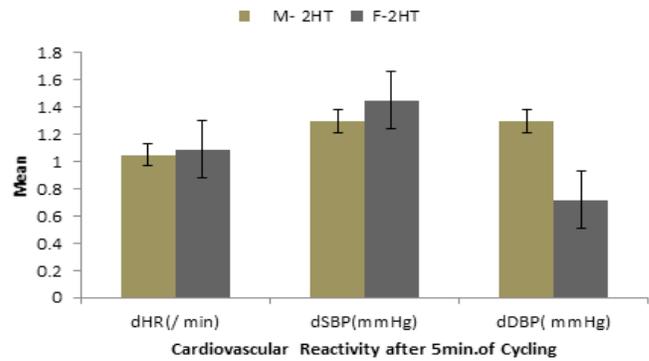


Figure 10: Comparison of Cardiovascular Reactivity in Male & Female Individuals with Hypertensive Parents after 5 min. of CPT.

Table 11: Comparison of Cardiovascular Reactivity in Male & Female Individuals with Hypertensive Parents after 1min. of Cycling

Cardiovascular Reactivity	M- HT (Group A)	F- HT (Group B)	P-VALUE
	Mean± SD	Mean± SD	
dHR(/ min)	2.5±1.35	2.6±1.36	> 0.05
dSBP(mmHg)	3.8±1.02	3.63±1.96	>0.05
dDBP(mmHg)	3.5±1.43	4±1.26	>0.05

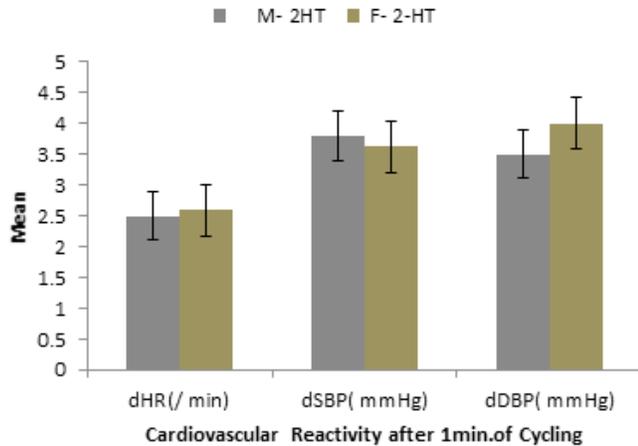


Figure 11: Comparison of Cardiovascular Reactivity in Male & Female Individuals with Hypertensive Parents after 1 min. of Cycling.

Table 12: Comparison of Cardiovascular Reactivity in Male & Female Individuals Hypertensive Parents after 5 min. of Cycling

Cardiovascular Reactivity	M- HT(Group A)	F- HT(Group B)	p-value
	Mean± SD	Mean± SD	
dHR(/ min)	0.75±1.29	0.81±0.75	> 0.05
dSBP(mmHg)	1.3±0.97	1.09±1.04	>0.05
dDBP(mmHg)	1.2±1.00	0.90±1.04	> 0.05

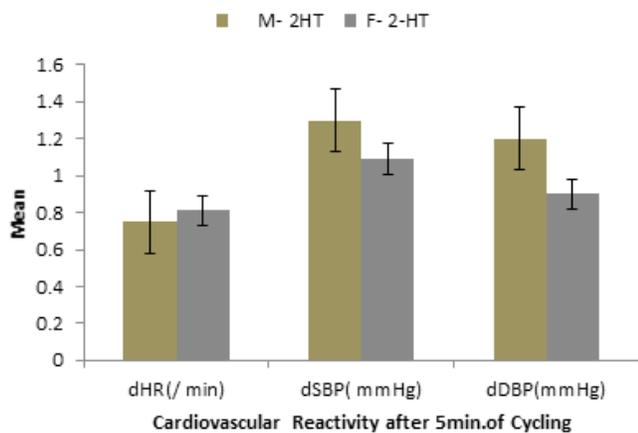


Figure 12: Comparison of Cardiovascular Reactivity in Male and Female Individuals Hypertensive Parents after 5min. of Cycling.

Table 13: Comparison of Cardiovascular Reactivity in Male and Female Individuals with Hypertensive Parents after 1min. of Videogame

Cardiovascular Reactivity	M- HT (Group A)	F- HT (Group B)	P-value
	Mean± SD	Mean± SD	
HR(/ min)	0.75±0.71	1.09±0.53	>0.05
SBP(mmHg)	0.9±1.02	1.18±1.07	<0.05
DBP(mmHg)	2.5±2.03	1.63±0.80	>0.05

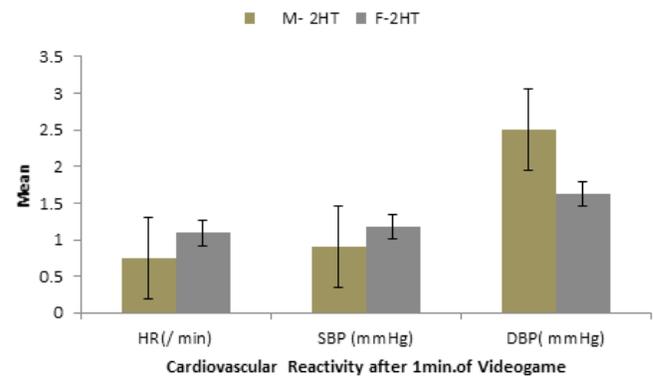


Figure 13: Comparison of Cardiovascular Reactivity in Male and Female Individuals with Hypertensive Parents after 1 min. of Videogame.

Table 14: Comparison of Cardiovascular Reactivity of Male and Female Individuals with Hypertensive Parents after 5 min. of Videogame

Cardiovascular Reactivity	M- HT (Group A)	F- HT (Group B)	P-value
	Mean± SD	Mean± SD	
dHR(/ min)	0.2±0.52	0.18±0.40	< 0.001
dSBP(mmHg)	0.7±0.61	0.72±1.00	>0.05
dDBP(mmHg)	1.0±1.65	0.90±1.04	>0.05

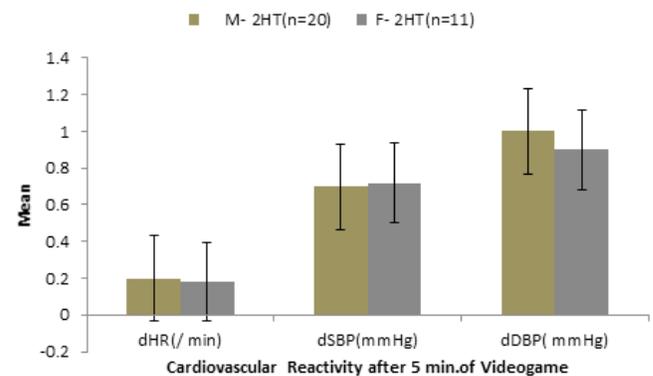


Figure 14: Comparison of Cardiovascular Reactivity of Male & Female Individuals with Hypertensive Parents after 5min. of Videogame.

DISCUSSION

Comparison of cardiovascular reactivity between Group A and Group B subjects with Normotensive parents in Cold Pressure Task the Insignificant difference was observed in

the dHR value, with lower mean value in male subjects compared to female subjects. In cycling insignificant difference in the dHR with higher value in M-NT but dSBP and dDBP values was significantly higher in the M-NT compared to the F-NT (control female) p -value < 0.001 . After 5 min of Cycling dHR was higher in F-NT with significant difference but dSBP and dDBP was higher in M-NT group than F-NT group with p value > 0.05 . As in case of cardiovascular reactivity to video-game between female and male subjects showed no significant differences in the dHR but dSBP and dDBP values was significantly higher in M-NT than F-NT group.

Comparison of cardiovascular reactivity between Group A and Group B subjects with Both Hypertensive parents in Cold Pressor Task shows insignificantly higher values of CVR parameters. dSBP and was insignificantly higher in the M-HT group compared to the values observed in the F-HT group. After 5 min of cycling showed insignificant difference showing slightly higher values of dHR and dSBP in F-HT than M-HT. In Cycling the mean values of dHR, dSBP and dDBP were showing insignificant difference in F-HT compared to M-HT. Difference in dHR and dDBP was slightly higher in F-HT than M-HT but all parameter were showing insignificant difference. After 5 min of stressor dSBP and dDBP values was higher in male than female but with insignificant difference. In Video Game significant differences in dHR, and dSBP with higher value in F-HT than M-HT. The mean values of dDBP was higher in M-HT compared to F-HT with insignificant difference. After 5 min of Videogame the mean dHR, dSBP and dHR. value were higher in M-HT compared to F-HT, but the difference was not statistically significant except HR rate.

According to Thomas G. Pickering "Stress is defined as a situation perceived as an uncontrolled threat to the individual's well-being, and can raise blood pressure both acutely as well as chronically.¹⁷ After 13 years of follow-up study on more than 4100 normotensive male and female age of 18-30 yrs. Matthews KA, Katholi CR *et al.*¹⁸ concluded that CVD had positive association with stress response on the risk for hypertension. After the study on 22 subjects in the University of Zurich, whose life style is normal and healthy¹⁹ Nicholas Christenfeld. Observed that out of 72 healthy individuals, one group losses their self-control after stress (cold pressor). Stress involves both neural and hormonal activity. Chronic stress causes weakening of the autonomic nervous system and leads to rise in the blood pressure. The increase of blood pressure/heart rate depends on the type of stress (acute/chronic). Acute stress is usually responsible for increase in blood pressure for short period but chronic stress is responsible for sustained hypertension. Some other studies showed that prevalence of hypertension is more in stressed individual than unstressed individual.¹⁹⁻²⁴ Stress may activate the sympathetic nervous system directly. This sympathetic nervous system under the control of central nervous system causes over-activity with high sodium intake, the rennin-angiotensin system and insulin resistance leading to higher blood pressure. It has also been observed that the descendants of hypertensive parents also respond in a similar way even though the component of hypertension has yet not been precipitated. Hyperactivity of SNS to stress may contribute to pre hypertension and other

CVD due to release of epinephrine and norepinephrine and catecholamine increases force and rate of contraction of heart vascular changes.²⁵

The cardiovascular reactivity has shown conflicting results to the cold pressor task.^{26,27} This could be due to fact that genetic factors have not been considered in these studies.^{28,29} Besides the cold pressor task, CVR in response to mental stress produced by playing video game has also been studied.³⁰⁻³²

The Influence of genetic factor on BP has been shown by a correlation of blood pressure levels among their natural siblings and their parents.³³⁻³⁶ Harrap analysed that genetic Contribution of mother is more than father in their male individual in comparison to female individual.³⁷ Gender differences in blood pressure responses to acute stress have been reported previously.³⁸⁻⁴⁰ Pain sensitivity is known to be diminished in subjects with elevated blood pressure⁴¹ In the subjects with normotensive parents, where genetic predisposition was not involved, male subjects with higher values of resting blood pressure experienced less pain during CPT or Cycling, and therefore showed lower increases in CVR to these stresses.

Koller and Kaley⁴² have reported greater BP increases in males to challenging achievement tasks like video game but Our results show that CVR was higher in individuals of both hypertensive parents but this difference was insignificant difference between males and females after 1 min of task/5 min of task. According to Iris B *et al.*⁴³ male individuals with both hypertensive parents had higher blood pressure in comparison with normotensive parents.

Both female and male subjects showed maximum cardiovascular reactivity to the cycling as well as Cold pressor task. It appears that the isotonic exercise can be used to differentiate increased CVR responses amongst subjects with normotensive and hypertensive parents.

CONCLUSION

Group A with normotensive parents had higher resting HR, SBP & DBP than Group B with normotensive parents, but the difference was significant only in SBP. After 5 min of cold pressure task/ cycling/VG HR was higher in Group B with normotensive parents than Group A with normotensive parents with insignificant difference. Systolic blood pressure & Diastolic blood pressure was higher in male subjects but significant difference showed after 1 min/5 min of CPT/ cycling /VG. Female subjects with hypertensive parents group was showing higher resting HR than male subjects with hypertensive parents group, remains higher after stress also with insignificant difference. Systolic blood pressure was higher in male subjects with hypertensive parents group before and after 1 min of stress with insignificant difference but after 5 min of stress difference was insignificant. Diastolic blood pressure was slightly higher in Group B with hypertensive parents after 1 min of stress with insignificant difference. Thus, subjects with hypertensive parents showing increased CVR to stress are more likely to develop future hypertension, and the risk is greater for male subjects.

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CONFLICT OF INTEREST

Nil

ABBREVIATIONS USED:

CVR: Cardiovascular Reactivity; **CVD:** Cardiovascular disease; **VMH:** Ventr Medial Hypothalamus; **BLA:** Basolateral Amygdale; **NSL:** Nucleus Septal Lateralis; **PH:** Pre-hypertension.

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