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BLOOD PRESSURE RESPONSES TO EXERCISE IN NORMOTENSIVE ADULT MALES WITH FAMILY HISTORY OF HYPERTENSION

Shabir-ud-din Lone[1], Sheikh Imran Syed[2], Hilal Ahmad Wani[3*] and Qazi Danish[3]

[1,2]Department of Physiology, Government Medical College Srinagar.
[3]Multidisciplinary Research Unit, Government Medical College Srinagar.

***Author for Correspondence: Dr. Hilal Ahmad Wani**
Multidisciplinary Research Unit, Government Medical College Srinagar.

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ABSTRACT
It has been seen in various studies that normotensives with a high normal resting blood pressure response to exercise tests are prone to develop hypertension. There is an association between arrhythmias and actual of either increased sympathetic or decreased parasympathetic activity. Heart rate variability (HRV) is one such quantitative makers of function for ANS. The aim of this study was to know the changes in blood pressure and to know any changes in autonomic activity during rest and post exercise periods in adult normotensives with positive family history of hypertension. A total of 50 normotensive males with BMI of 18.6 – 24.9 kg/m^2, were divided into two groups with and without family history of primary hypertension, underwent a cycle ergometry exercise test. The exercise test was divided as basal (i.e.) before exercise, during exercise and after exercise i.e. recovery period. ECG and heart rate were recorded at baseline, during exercise and during recovery period of 15 minutes and blood pressure was recorded before exercise and during recovery. Frequency domain analysis of HRV was performed. The basal systolic blood pressure at 1 minute and 3 minute of recovery after exercise test were significantly higher in the study group. The basal LF were significantly higher in the study group then the control group. A significant difference in basal systolic blood pressure, and a higher LF spectrum in young adults of hypertensive parents, may be early marker of cardio-vascular changes in subjects with a family history of essential hypertension.

KEYWORDS: Heart rate variability, normotensives, blood pressure, cycle ergometer.

INTRODUCTION
Day to day living bring hemodynamics changes in cardiovascular system. An increase in systolic blood pressure and a normal or low diastolic blood pressure is the normal response to whole body weight bearing exercise.[1] It has been seen in various studies that normotensives with a high normal resting blood pressure response to exercise tests are prone to develop hypertension.[2] Those with a parental history of hypertension also show a high blood pressure response to exercise testing.[3,4] It has been in literature that there is a relationship between autonomic nervous system (ANS) and cardio vascular mortality. There is an association between arrhythmias and actual of either increased sympathetic or decreased parasympathetic activity.[5] Heart rate variability (HRV) is one such quantitative makers of function for ANS.[6] HRV is the amount of heart rate fluctuations around the mean heart rate Thus it is a valuable tool to record the impact of sympathetic and parasympathetic activity on cardiovascular system.

Therefore the study was conducted to hypothesize that normotensive adults with family history of hypertension shows a difference in their blood pressure at rest and during recovery period after exercise and also shows a difference in autonomic activity at rest and during post exercise recovery test.

MATERIALS AND METHODS
After the approval was obtained from ethics committee of Govt. Medical College, Srinagar. A total of 50 male subjects in the age group of 20-30 years were taken for the study. The subjects were recruited from the students and staff of this college with proper consent. After proper history and clinical examination all baseline investigation like CBC, Lipid Profile, thyroid profile, urine analysis, blood sugar were done and based on this inclusion and exclusion criteria were formatted. All the Male subjects in the age group of 20-30 years within normal range of body mass index (BM1 = 18.5-24.9 Kg/m^2) having no history of active smoking undergoing the Harvard step test for estimation of physical fitness index[7] were included in the study. Subjects with low hemoglobin, impaired glucose tolerance and were on medication like anti-cold, anti-hypertension, thyroxin were excluded and also subjects having any history of chest pain, exertion breathlessness, arthritis or myalgia's on personnel history were excluded. Those selected after

formatted inclusion criteria were divided into two groups based on parental history of primary hypertension and were on anti-hypertensive medication. Study group with family history of primary hypertension included 20 subjects and the second was Control Group without family history primary hypertension included 30 subjects.

Experiments were conducted in the Human laboratory, Department of Physiology, Govt. Medical College Srinagar. All the subjects were briefed about the experiment and were refrained from tea, coffee, caffeinated beverages before the exercise test in the morning. The height of the subjects was measured to the nearest 100 grams using an electronic weighing scale and height was measured to the nearest 0.10 cm using stadiometer. A braked cycle ergometer was used for the experiment. The ECG was recorded using Bionet Cardiocare 2000. The blood pressure was recorded using a digital blood pressure monitor.

After instrumentation, the subjects were given 20 minutes rest and at the end of rest, basal pre-exercise ECG (II) lead recording were taken along with Blood pressure recording at every 3 minute for next 15 minutes.[8] The mean blood pressure and the least baseline heart rate were noted in the master table. The target heart rate was calculated and the subject was instructed to start cycling.[9] In order to maintain uniformity in the experiment the subject was asked to maintain 60 revolution per minute cycling accordingly the weight was increased in the braked cycle ergometer till the subject reached the target heart rate. The ECG was continuously recorded during exercise test till 3 minutes of target heart rate was achieved and was instructed to stop exercise. During 10 minutes off-exercise, i.e. recovery period the blood pressure was recorded every 3 minutes and ECG was continuously recorded. The heart rate was calculated at the end of exercise and recovery periods from the ECG and data was saved. Then ECG's of all subjects were analyzed by using software (Kubios HRV-heart rate variability analysis software).

Analysis of the data

The student t-tests has been used to find significance between subjects with and without family history of hypertension. The Mann Whitney U test was used to assess the heart rate variability in these two groups. SPSS version 14.0 and Microsoft Excel were used for analysis of data. P Value of < 0.05 was taken as significant.

RESULTS

As given in Table 1, there was no significant difference in age, BM1 and mean basal heart rate between the two groups. The mean basal systolic blood pressure in control group was 107.80± 6.90 and in study group it was 114.60± 5.22 which was statistically significant.

Table1: Age, Body mass index (BMI) and Cardiovascular parameters.

	Control Group (n=30)	Study Group (n=20)	P value
Age (years)	20.44±1.70	21.09±2.00	0.223
BMI(Kg/m2)	21.19±2.10	22.10±1.90	0.126
Mean basal heart rate	64.2±7.70	65.50±9.50	0.597
Mean basal systolic blood pressure	107.80±6.90	114.60±5.22	<0.001*
Mean basal diastolic blood pressure	66.60±5.01	69.40±6.20	0.085

Results as Mean± SD P value <0.05 significant

The different rates are calculated as maximum heart rate is equal to a constant 220 minus age. We know heart rate reserve as maximum heart rate minus basal heart rate. Then target heart rate was calculated as basal heart rate plus 60% of heart rate reserve (9).

Table 2: Maximal heart rate, Heart rate reserve and Target heart rate in as Beats per minute (bpm)

Parameters	Control group (n=30)	Study group (n=20)	P value
Maximal heart rate(bpm)	201.60±1.70	202.01±1.90	0.429
Heart rate reserve(bpm)	136.48±8.90	136.77±7.96	0.907
Target heart rate(bpm)	146.56±6.71	145.50±9.36	0.643

Results expressed as Mean +SD.

As per data depicted in table 2, no statistical significant difference was noted between study and control group as far there target heart rate and heart rate reserve is considered.

After exercise recovery systolic blood pressure was significantly higher in the study group then in control group. There was statistically no significant difference in post exercise recovery diastolic blood pressure in both study and control groups. No significant difference were noted between the study and control groups in the heart rate during 10 minutes post exercise test period as shown in table 3.

Table 3: Heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP) during post exercise recovery period calculated during 10 minutes.

Recovery period	Control group (n=30)	Study group (n=20)	P value
HR(bpm)	100.3±8.80	102.60±10.60	0.408
SBP(mm Hg)	115.90±9.02	126.75±8.60	<0.001*
DBP(mm Hg)	76.05±7.80	78.60±4.36	0.191

As in our study the pre-exercise basal LF and HF in both study and control group no significant change was seen but a statically significant change were noticed in basal LF/HF ratio in the study group (Table 4).

Table 4: HRV parameters at rest (basal).

Heart rate variability	Control group (n=30)		Study group (n=20)		P value
Basal LF	Mean	SD	Mean	SD	0.147
	580.70	362.10	750.80	450.50	
Basal HF	760.90	530.80	580.70	402.80	0.204
Basal LF/HF ratio	0.90	0.40	1.80	1.20	<0.001*

Results are expressed in Mean ±SD.

DISCUSSION

In our study there is a consistent finding that basal systolic blood pressure in study group with family history of primary hypertension is significantly higher as some studies also supported the same finding. Even some of the studies have shown that young adults of family with history of hypertension have a higher resting diastolic blood pressure.[10] In our study the basal diastolic blood pressure in both the groups was not significantly different. The consequences of sympathetic nervous system are increase in heart rate, vasoconstriction and therefore increase in peripheral vascular resistance as a result the blood pressure rises.[11,12] The vagal activity contributes to high frequency (HF) component as seen in experimental observations like muscarinic receptor antagonism. The lower frequency (LF) component is considered as a marker of sympathetic activity.[13] Studies support persons having parental history of hypertension have altered sympathovagal balance with decreased vagal activity at the heart level.[14,15] So our study also supports that vagal high frequency power was lesser in study group. The ratio of sympathetic to parasympathetic activity was higher in the study group then the control group. The area under the curve for systolic blood pressure during recovery period is significantly higher in study group, which indicates/shows that fall of blood pressure during post exercise test was gradual during 1 to10 minute of recovery period.In the heart rate variability during recovery period there is a significant change in the both groups. We can interpret that in the study group, there is no significant change in HF during recovery period as HF represents the parasympathetic component thus represents poor vagal reaction in study group. In other studies subjects were given the mental arithmetic tasks and cold pressor test was performed they found vagal rebound was poor in the group with parental history of hypertension.[16,17] In our study the finding basal systolic blood pressure and heart rate variability LF power component are higher in the study group of the age of 20-30 years having BMI within normal limits may be an early indicator of cardiovascular autonomic changes. Accordingly awareness among the children of parental hypertension could be started in the form of life style modifications.

Competing Interests

The authors declare that there were no competing interests.

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