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ORIGINAL ARTICLE

EFFECT OF PHYSICAL EXERCISE ON CARDIAC AUTONOMIC ACTIVITY: A CLINICAL STUDY

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ABSTRACT:

Background: Incremental levels of regular physical activity are inversely proportional to long-term cardiovascular mortality when controlled for the presence of other risk factors in both men and women. The present study was done to evaluate the effect of physical exercise on cardiac autonomic activity in healthy adult men along with their daily physical activity level. **Materials & Methods:** The present study was conducted in the department of physiology year 2015. It included 44 men of 18-30 years of age who were undergoing regular exercise programme. Another 44 aged and BMI matched men were selected from general population. Measurement of height (Metre) and weight (Kgs) was done in all subjects. BMI was calculated as weight divided by height^2 (kg/m^2). Blood pressure was also recorded. Physical activity level of all the subjects was assessed using Global Physical Activity Questionnaire. All subjects were subjected to ECG and findings were noted. HRV was also assessed. Global Physical Activity Questionnaire (GPAQ) was used in both groups. **Results:** Group I (Exercising group) comprised of 44 men and group II (Non exercising group) comprised of 44 men. The difference was non – significant (P – 1). Group I had mean heart rate of 72.38 beats/.min and group II had 74.21 beats/ min. The difference was non - significant (P > 0.05). The mean systolic blood pressure in group I was 114.26 mmHg and in group II was 110.42 mm Hg. The mean diasystolic blood pressure in group I was 74.56 mmHg and in group II was 75.8 mm Hg. The difference was non - significant (P > 0.05). Total power of HRV in both groups was compared which was not statistically significant (P> 0.05). There was no significant difference in LF and HF components of frequency domain parameters both in absolute and normalized units. LF/HF component did not show any significance statistically. Physical activity level was 4120±1235.23 in group I and 1206.4±1025.13 in group II. The difference was significant (P-0.01). **Conclusion:** We found that there was significant difference in the physical activity levels in both groups. However, three months of regular exercise did not have significant effect on cardiac autonomic activity including heart rate variability.

Key words: Exercise, Physical exercise, Systolic blood pressure

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INTRODUCTION

Physical activity has been defined as any bodily movement produced by skeletal muscles that result in energy expenditure. Exercise is a subset of physical activity that is planned, structured, repetitive, and purposeful in the sense that improvement or maintenance of physical fitness is the objective. Physical fitness includes cardio-respiratory fitness, muscle strength, body composition, and flexibility, composing a set of attributes that people have or achieve that relates to the ability to perform physical activity.[1]

Obesity, diabetes mellitus, hypertension, hyperlipidemia, coronary artery diseases and cancers are the leading causes of death worldwide. The burden of cardiovascular diseases and diabetes mellitus is very high in developing countries. Among the various risk factors, physical inactivity is an important risk factor for cardiovascular diseases and for increased cardiovascular mortality. Worldwide, physical inactivity is estimated to be the primary cause of approximately 21-25% of breast and colon cancers, 27% of diabetes and approximately 30% of ischemic heart disease.[2] Several population-based studies show that incremental levels of regular physical activity are inversely proportional

to long-term cardiovascular mortality when controlled for the presence of other risk factors in both men and women. In studies of male college alumni, the risk of death became progressively lower as physical activity dose levels increased from an expenditure of 2.1 to 14.7 MJ/wk, 500 to 3500 kcal/wk. There was a 24% reduction in cardiovascular mortality
in subjects whose energy expenditure was .8.4 MJ/wk, 2000 kcal/wk. Alumni who were initially inactive and later increased their activity levels demonstrated significantly reduced cardiovascular risk compared with those who remained inactive. WHO mentioned that physical activity includes exercise as well as other activities which involve bodily movements and are done as part of playing, working, active transportation, household chores and recreational activities.[3]

The present study was done to evaluate the effect of physical exercise on cardiac autonomic activity in healthy adult men along with their daily physical activity level.

MATERIALS & METHODS

The present study was conducted in the department of physiology year 2015. It included 44 men of 18-30 years of age who were undergoing regular exercise programme (endurance training - treadmill walking, running, cycling etc.) for a period of minimum 3 months, 3-5 days per week, for at least 30 minutes per day. Another 44 aged and BMI matched men were selected from general population as a control who were not indulge in any exercise program. All were informed regarding the study and written consent was obtained.

Measurement of height (Metre) and weight (Kgs) was done in all subjects. BMI was calculated as weight divided by height^2 (kg/m^2). Blood pressure was also recorded. Physical activity level of all the subjects was assessed using Global Physical Activity Questionnaire. All subjects were subjected to ECG and findings were noted.

Heart rate variability was assessed using software, after exclusion of artifacts automatically. Spectral analysis was performed using the Fast Fourier Transform. Frequency domain parameters like total power (TP), high frequency (HF), (0.15 - 0.4 Hz), low frequency (LF), (0.04 - 0.15 Hz) and LF/HF components were obtained. Spectral powers of HF, LF were expressed in absolute (ms^2) and normalized units (nu). HRV analysis was done according to the standard guidelines prescribed by Task Force of the North American Society of Pacing Electrophysiology.

Global Physical Activity Questionnaire (GPAQ) was used to evaluate the physical activity of the subjects. GPAQ gives the time spent doing different types of physical activity in a typical week. It collects information on physical activity participation in three settings (activity at work, travel to and from places and recreational activities) and sedentary behavior. The data was analyzed using METs (Metabolic Equivalents) which are commonly used in the analysis of physical activity. One MET is defined as 1kcal/kg/hour. Total physical activity is expressed as MET-minutes/week. Results thus obtained were subjected to statistical analysis for correct inference. P value < 0.05 was considered significant.

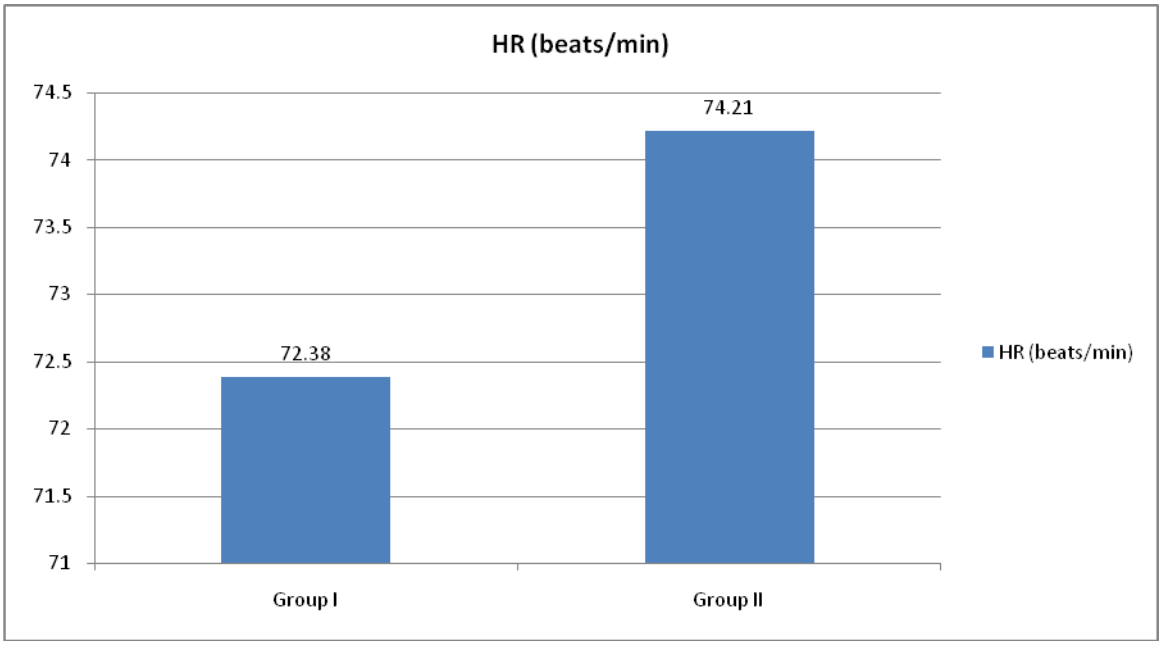
RESULTS

Table I shows that group I (Exercising group) comprised of 44 men and group II (Non exercising group) comprised of 44 men. The difference was non – significant (P – 1). Graph I reveals that group I had mean heart rate of 72.38 beats.min and group II had 74.21 beats/ min. The difference was non - significant (P > 0.05). Graph II shows that the mean systolic blood pressure in group I was 114.26 mmHg and in group II was 110.42 mm Hg. The mean diastolic blood pressure in group I was 74.56 mmHg and in group II was 75.8 mm Hg. The difference was non - significant (P > 0.05). Table II shows that total power of HRV in both groups was compared which was not statistically significant (P> 0.05). There was no significant difference in LF and HF components of frequency domain parameters both in absolute and normalized units. LF/HF component did not show any significance statistically. Table III shows that physical activity levels was 4120±1235.23 in group I and 1206.4±1025.13 in group II. The difference was significant (P-0.01).

Table I Distribution of subjects

Total - 88		
Group I (Exercising group)	**Group II (Non- exercising group)**	**P value**
44	44	1

Graph I Assessment of Heart rate



Graph II Assessment of blood pressure

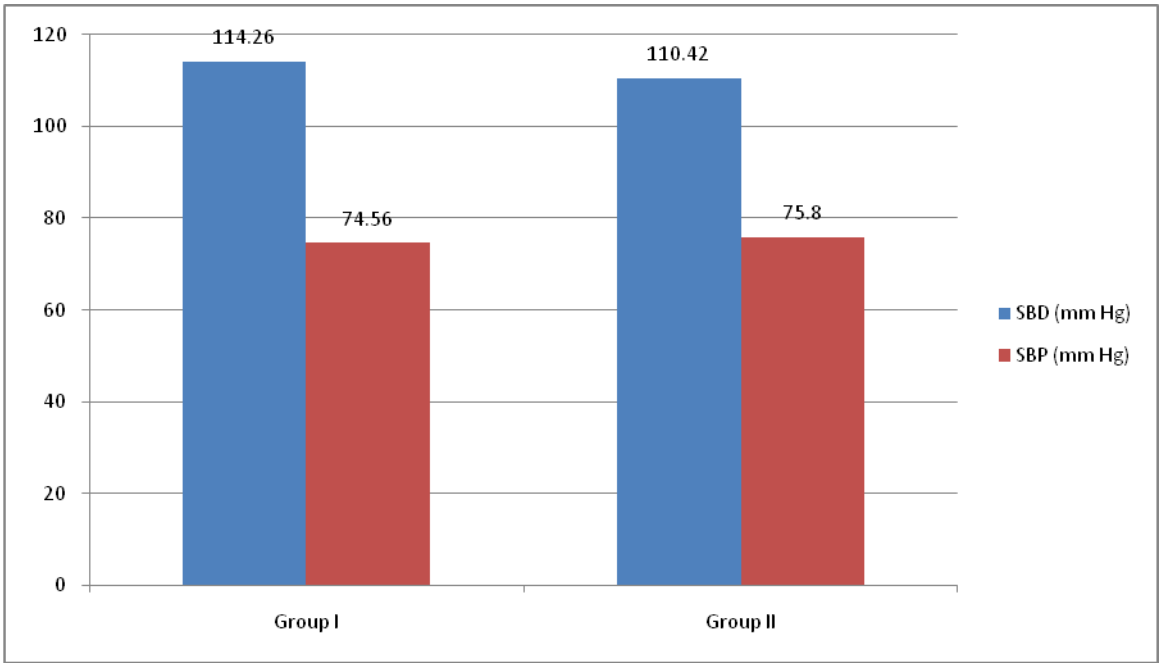


Table II Total Power and HRV in both groups

	Group I	Group II
Total Power	2911.23±1726.32	3241.03±1546.39
LF (ms^2)	902.52± 814.51	912.41±713.48
LF (nu)	46.02±16.14	42.25±16.11
HF (ms^2)	782.20±513.93	1110.97±1017.25
HF (nu)	41.20±16.15	42.23±16.19
LF/ HF	1.62±1.01	1.23±0.84

Table III GPAQ (MET-min/week)) in both groups

Group I	Group II	P value
4120±1235.23	1206.4±1025.13	0.01

DISCUSSION

Physical activity has been associated with favorable modifications of cardiovascular disease risk through a reduction in obesity, improved distribution of body fat, and lower incidence of non–insulin-dependent diabetes. Regular exercise also yields a modest but beneficial effect on blood
pressure and lipoprotein profiles. However, the beneficial effect of physical activity cannot be accounted for solely by means of risk factor reduction, since the association with reduced mortality rates is independent of other coronary risk factors.[4]

The present study was done to evaluate the effect of physical exercise on cardiac autonomic activity in healthy adult men along with their daily physical activity level.

In our study, both group I (Exercising group) and group II comprised of 44 men. In this study we found that group I had mean heart rate of 72.38 beats.min and group II had 74.21 beats/ min. This is in agreement with Sloan RP et al.[5] We also compared systolic and diastolic blood pressure in both groups. The mean systolic blood pressure in group I was 114.26 mmHg and in group II was 110.42 mm Hg. The mean diasystolic blood pressure in group I was 74.56 mmHg and in group II was 75.8 mm Hg. This is similar to Pigozzi F et al.[6]

In this study, total power of HRV in both groups was compared which was not statistically significant. There was no significant difference in LF and HF components of frequency domain parameters both in absolute and normalized units. LF/HF component did not show any significance statistically. Similar results were seen in study by Madden KM et al.[7] We found that physical activity level was more in group I as compared to group II. This is in accordance to Ueno et al.[8]

Exercise training has also shown to improve blood pressure and is associated with decrease in the incidence of hypertension. Regular exercise has been found to lower blood pressure (10 mmHg average reduction in both systolic and diastolic pressure).[9]

Regular endurance or resistance training results in specific changes in the muscular, cardiovascular, and neurohumoral systems that lead to improvement in functional capacity and/or strength. These changes are referred to as the training effect and allow an individual to exercise to higher peak work rates with lower heart rates at each submaximal level of exercise.[10] Exercise training at moderate intensity, 3 to 5 times per week, leads to marked improvements in peak fitness levels after 8 to 10 weeks among patients with heart disease, much as in healthy individuals.

CONCLUSION

We found that there was significant difference in the physical activity levels in both groups. However, three months of regular exercise did not have significant effect on cardiac autonomic activity including heart rate variability.

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