ORIGINAL ARTICLE

ASSESSMENT OF SELECTED CARDIAC FUNCTIONS OF SPORTSPERSON OF VADODARA CITY

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ABSTRACT

Aims and objective: Sports activity had always been an epitome of physical fitness activities. Multiple studies have shown that people, who maintain appropriate body fitness, using judicious regimens of exercise and weight control, have the additional benefit of prolonged life. The aim of this study was to find out and confirm the fact that regular exercise or sports activity have a beneficial effect on the various system of our body especially the cardiovascular system. **Methodology:** A comparative study was carried out at IPCL sports complex of Vadodara city in between the sportsperson and control persons using unpaired 't' test for resting heart rate and blood pressure. They were subjected to hopping test: following which the maximum heart rate achieved and time taken for recovery to resting heart rate was measured.
Results: As a result of our study we came to know that sportsperson have a significantly lower resting heart rate; lower maximum heart rate achieved and a reduced recovery time after hopping test than sedentary individuals.
Conclusion: Our study reaffirms the fact that regular physical activity in any form slows the rate of decline with age of most of the physiological parameters that we associate with health and fitness especially by decline in basal heart rate and increased cardiac reserves.

Keywords: heart rate, blood pressure, hopping test

INTRODUCTION

Sports activity, regular exercise and physical fitness have always been the most sought after topics. Sports persons along with their respective fields also undergo regular aerobic and anaerobic exercises. The effect of organs when they are put to endurance test have been a subject of discussion in past. Irrefutable evidence now exists to slow the rate of decline with age of most of the physiological parameters that we associate with health and fitness viz. Muscle strength, aerobic capacities, reaction time and joint flexibilities[1]. ' Body fitness prolongs life; as regular exercise/physical activity a) maintains moderately low blood pressure, b) reduced blood cholesterol and LDL along with increased HDL, which all work together to reduce the number of attacks and brain strokes. Second and perhaps equally important, the athletically fit person has more bodily reserves to call on when he or she does become sick. As in the case of cardiac reserve, the normal untrained person can increase cardiac output a little over fourfold, and the usual well trained athelete can increase cardiac output sixfold. Although both of them have normal resting cardiac output; this normal cardiac output is achieved by a large stroke volume at a reduced heart rate. The heart- pumping effectiveness of each heart beat is greater in the highly trained athlete than in the untrained person, but there is a corresponding decrease in heart rate at rest.'[2]

'Training' or 'Conditioning' i.e. hard physical exercise done regularly improves the 'physical working capacity' of an individual. Person on term training develops bradycardia due to excessive tone of the vagi that will also cause less rise of pulse rate in the exercise of same intensity. In the present study we tried to see the effect of regular exercise and training on resting heart rate and blood pressure of sportsperson. And observe the variation in cardio vascular activity of sport persons and untrained persons in response to hopping test which is kind of stress test for cardiovascular system.

MATERIALS AND METHODS

The subjects selected were sports persons and residents of Vadodara city who had been playing in their

respective fields for 5 years or more, who routinely performed a minimum of 40 minutes of aerobic activity per week as suggested in the study by Ishida R and Okada M[3]. They were on season during their investigation. The control population was represented by untrained persons.

Total number of subjects included in the present study was 30, which were Football players and tract field athletes involved in 100m, 400m, 800m, and 1200m races. All the subjects were male between the age group of 20 – 35 years.The subjects were explained the purpose and importance of study. Only those who were motivated consented and without past history and family history of Diabetes Mellitus, HTN, IHD, TB, Asthma etc. were included in the present study. Also the subjects were not having any personal history of tobacco and alcohol consumption. They were free from any disease and were not taking any medicine at the time of evaluation.

With the similar criterion 30 male persons of same age group of Vadodara city who were not involved in any sports activity or regular daily exercise like walking, cycling, jogging etc. were taken as controls.

All the participants were explained the methodology and made well versed with the functioning of the instruments. Live demonstrations for measurements of all the parameters for hopping test were carried out before actual recording.

Cardio-vascular parameters were taken in the morning time 8 am to 10 am in the month of December 2003 to January 2004 to avoid diurnal variations. All the parameters were recorded throughout the study by the same instruments to avoid instrumental errors.

The cardio-vascular parameters recorded in the study were:
1. Resting Pulse Rate in supine and standing postures.
2. Resting Systolic Blood Pressure in supine and standing postures.
3. Resting Diastolic Blood Pressure in supine and standing postures.
4. Maximum Heart Rate achieved by hopping test.
5. Time taken (seconds) to come to resting Heart rate.

The resting pulse rate in supine posture was recorded by pulse oxymeter after rest of 10 minutes and then in standing posture after 10 minutes[3] in right index finger as given in the book 'hutchinson's clinical methods' by Michael swash[4].

Resting systolic and diastolic blood pressure was recorded over right brachial artery at the level of cubital fossa by using sphygmomanometer and stethoscope through Auscultatory method.

After demonstrations subjects were asked to do hopping with attachment of pulse oxymeter to right index finger. They were to hop (jump) about 50 times on one foot as performed in study conducted by Close K M[5] on her study of cardiovascular tests. At the end of exercise i.e. at 0 second pulse rate was recorded on pulse oxymeter (Maximal Heart Rate) and then was recorded every 15 seconds till the resting heart rate on standing is achieved and the total duration in seconds was recorded.

The data was analyzed using unpaired 't' test and the results were consider statistically significant where p values were less than 0.001.

RESULT & DISCUSSION

On analyzing the results in our study resting heart rate of sports person in supine posture were 68.27 ± 6.53 per minute and standing posture were 73.47 ± 7.79 per minute were significantly less than the control persons having resting heart rate 76.93 ± 6.21 per minute in supine and 81.80 ± 5.42 per minute in standing posture.

Table 1: Comparison of Age and Anthropometric measurement of sport person and Control subjects

	Sportsperson (n=30)		Non-sportsperson (n=30)	
	Mean (SD)	**Range**	**Mean (SD)**	**Range**
Age (yrs.)	27.77 (4.93)	20-35	29.80(2.71)	25-34
Height (cm)	168.4(4.32)	164-178	167.47(5.61)	157-178
Weight (kg)	60.90(5.98)	50-72	62(7.63)	47-77

Table 2: Comparison of Resting Heart Rate, Maximal Heart Rate achieved and Time taken to come back to resting Heart Rate in sports person and Control subjects

	Sports Person (n=30)		Non-sports Person (n=30)		Total		
	Mean	**SD**	**Mean**	**SD**	**cSD**	**SEP**	**'t'**
HR (sp) (Per min.)	68.27	6.53	76.93	6.21	6.37	1.64	*** 5.27
HR (st) (Per min.)	73.47	7.79	81.80	5.42	6.71	1.73	*** 4.81
Max. HR (Per min.)	133.73	20.05	157.47	12.01	16.53	4.26	*** 5.57
Time taken (sec.)	116.50	21.10	185.27	32.76	27.55	7.11	*** 9.67

HR (sp) = Heart rate in supine posture, HR (st) = Heart rate in standing posture, and Max. HR = Maximum heart rate achieved. *** = P < 0.001 (High significant), cSD = Combined Standard Deviation, SEP = Standard Error of Probability

Table 3: Mean and SD values of Blood pressure in sports persons (n=30) and non-sport persons (n=30)

	Sports Person		Non-sports Person		Total		
	Mean	**SD**	**Mean**	**SD**	**cSD**	**SEP**	**'t'**
SBP (sp) (mm Hg)	115.60	20.13	124.33	9.37	15.70	4.05	* 2.16
SBP (st) (mm Hg)	114.73	20.67	121.33	12.05	16.92	4.36	1.51
DBP (sp) (mm Hg)	76.73	6.11	78.53	5.61	5.87	1.51	1.19
DBP (st) (mm Hg)	77.87	14.33	79.27	5.57	10.87	2.80	0.50

SBP (sp) = Systolic Blood Pressure in supine posture, SBP (st) = Systolic Blood Pressure in standing posture, DBP (sp) = Diastolic Blood Pressure in supine posture and DBP (st) = Diastolic Blood Pressure in standing posture.
* = $P < 0.05$ (Just significant)

Costa et al[6] carried out a prospective study of athletes and sedentary healthy control group sex and age for measuring the resting heart rate matched using ECG signals and found that athletes had a significantly low resting heart rates that corresponds to our results and which reveals the predominance of parasympathetic activity, without reduction of the sympathetic tone.

After hopping test maximum heart rate achieved were 133.73 ± 20.05 and 157.47 ± 12.01 per minute; and time taken to come back to resting heart rate on standing 116.50 ± 21.10 and 185.27 ± 32.76 seconds in sports person and control individuals respectively, which shows very significantly lower values in sports person as compared to control persons living sedentary life.

By using power spectral analysis of heart rate variability on electrocardiographic signals Shin ET al[7] studied the effects of long-term physical training on autonomic function in athletes and the response of the autonomic nervous system to dynamic exercise were investigated in non-athletes and athletes using a bicycle ergometer. Although both groups showed similar trends in heart rate at all stages of protocols, heart rate in athletes was significantly lower than that in non-athletes during rest and post exercise. Also, the recovery of HR was more rapid in athletes than in non-athletes.the results of our study were similar to the study carried out by shin et al. It is likely that, in athletes, the lower HR during rest and the more rapid recovery of HR post exercise was due to a high level of vagal activity was enhanced by the adaptive changes in neural regulation produced by long-term physical training.

The values for blood pressure viz. Systolic Blood Pressure in standing posture 114.73 ± 20.67 and 121.33 ± 12.05 mm Hg, SBP in supine posture 115.60 ± 20.13 and 124.33 ± 9.37 mm Hg, Diastolic Blood Pressure in standing posture 77.87 ± 14.33 and 79.27 ± 5.57 mm Hg, and DBP in supine posture 76.73 ± 6.11 and 78.53 ± 5.61 mm Hg in sports person and control individuals respectively. Though there were slightly lower values found in sports person than the sedentary non-sports persons, the difference was found to be non-significant except SBP in supine posture ($p < 0.05$)

Shin et al[8] studied the adaptive effects of endurance training on autonomic functions in athletes with spectral analysis of cardiovascular variability signals using Continuous ECG, arterial blood pressure (ABP), and respiratory signals The resting HR in athletes was significantly lower than that in non-athletes. These differences might reflect an alteration of sympatho-vagal interaction with predominance of parasympathetic activity. However, there was no significant difference in the systolic arterial blood pressure and Diastolic blood pressure auto spectra, reflecting the sympathetic vascular control. In our study we were also not able to find any significant alteration in blood pressure of sports person and sedentary controls but a significant difference was seen in heart rate. They suggested that the changes are due to increased vagal activity, baro-receptor sensitivity but with decrease in sympathetic tone of sports person.

Aubert et al[9] examined the influence on heart rate variability indices in athletes from training status, different types of exercise training, sex and ageing, presented from both cross-sectional and longitudinal studies and showed a reduced heart rate as seen in our study.

Dixon et al[10] examined the cardiac autonomic responses to orthostatic stress and recovery from steady state exercise in endurance trained athletes and sedentary subjects The resting heart rate of athletes was lower than controls These data support the hypothesis that endurance training modifies heart rate control in whole or in part through neuro-cardiac mechanisms.

Furlan ET al[11] reported in their article that the changes were due to increase in both parasympathetic as well as sympathetic tone but with predominance of vagal activity. Similar results were obtained by the studies carried out on different sports persons by Ishida R and Okada M[3], Neumayr et al[12], Macek et al[13] , Pihl E and Jurimae T [14] and DeVan et al.[15]

Isabel Walker[16] in his studies showed lower resting heart rate, systolic and diastolic blood pressure in sports persons. He explained the beneficial effect of exercise is related to preservation of NO availability by a mechanism probably linked to the prevention oxidative stress and the consequent NO breakdown. The exercise (training) play a fundamental role in determining the amount of C-GMP produced during exercise with enhanced production in physically active person.

CONCLUSION

Our study reaffirms that regular physical activity in the form of sports, aerobic or workouts; slows the rate of decline with age of most of the physiological parameters that we associate with health and fitness. It also increases the physiological reserves and capacities of the person undertaking them. Thereby regular physical activity not only improves the health but also prolongs the life and physical working capacity of an individual giving a better quality of life.

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