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Research Article

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THE EFFECT OF EXERCISE ON CARDIO VASCULAR SYSTEM IN ADOLESCENTS COMPARING THE INACTIVE AND ACTIVE MALES

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ABSTRACT

In the computer era our younger generation lifestyle has been changed to sedentary habits and also taking fast foods which are leading to obesity and health problems. The objective of this study is to evaluate the effect of exercise on cardiovascular system in adolescents comparing inactive with active males having one hour daily regular exercise.

The present study was conducted on 100 healthy volunteers, 50 are active and 50 are non active. When the subject is at rest the systolic blood pressure, diastolic blood pressure and heart rate are recorded. After 5 minutes of moderate exercise they are again recorded immediately and on alternate minutes until the pre exercise values are reached.

It was observed that there is significant difference (<0.05) in the mean raise of systolic blood pressure and in the mean decrease in the diastolic blood pressure between the non active and active males . It is also observed that the mean basic pulse rate is low in active people. The active subjects reached the pre exercise values in the third minute itself whereas non active after 5th minute

Observations of the present study suggest overall higher adaptability of cardio vascular system in active people. The reason for mean decrease in diastolic blood pressure in active people is due to decreased peripheral resistance. In them the arterial blood pressure is reduced at the same sub maximal work rate. The decreased basal pulse rate and less mean rise in pulse rate in them is due to parasympathetic vagal dominance. So in active people at lower heart rate the heart can provide optimal cardiac output. Their heart rate recovery period is short. This measurement has been used as an index of cardiac fitness. More fit person recovers faster after a standardised rate of work than a less fit person.

KEY WORDS:

Exercise, blood pressure, heart rate, vagal dominance, cardiac reserve, METS

INTRODUCTION

The awareness of the need for physical activity has altered the public to the importance of exercise physiology for the establishment of fitness programmes.

Although there was some awareness as early as in the mid 1800's of a need for regular physical activity to maintain optimum health, this idea didn't gain popular acceptance until the late 1960's. Subsequent research continues to support the importance of exercise in resisting the physical decline associated with aging.

Although exercise physiology cannot be given total credit for the current wellness movement, it provides the basic knowledge and justification for including exercise as an integral component of a healthy lifestyle and laid the foundation for the science of exercise prescription in both sickness and health.

In the computer era, our younger generation lifestyle is changed to sedentary habits, resulting in increased prevalence of childhood and adolescent obesity and early onset of diabetes, hypertension in younger age groups. This has drawn the global attention from communicable diseases to non- communicable diseases. The increased prevalence of the above said problems in adolescent age groups is due to their lifestyle changes like,

- attending more than 10 hrs of educational instructions in their institutions.
- sedentary habits of playing video games, watching television, doing project work in computers.
- higher competitive educations put the students to mental stress.
- taking more fast food and soft drinks.

Keeping all these factors in mind I have an idea to do my work on the effect of exercise on cardiovascular system in adolescents, comparing the effects in physically active with non - active males.

MATERIALS AND METHODS

The present study was conducted on 100 normal healthy volunteers of adolescent males of age ranging from 16 to19 years of three different branches that is 1st M.B.B.S, 1st BDS students of Siddhartha Medical College, Vijayawada and on students from VIMS college of MLT, Vijayawada. Out of 100 volunteers 50 are non-active subjects and 50 are active subjects. My criteria for activeness are doing exercise for one hour regularly (that is walking, jogging etc,) including their daily activities. Non activeness means not doing exercise other than daily activities.

EXCLUSION CRITERIA:

Any signs like pallor or edema history of cardiovascular or renal diseases excluded.

The study was conducted in the Department of Physiology at Siddhartha Medical College, Vijayawada, in the presence of Professors of Physiology Department. All the subjects were informed about the test protocol and their word of consent was obtained.

Bicycle Ergo meter in the Physiology Department is used to obtain Cardiovascular and respiratory system responses. Large muscle groups must be engaged during exercise. So, bicycle ergo meter is used which enable known power output of exercise. { ergo= work , meter= measure }

The bicycle ergometer I used is a mechanical friction device, which has a belt encompassing a flywheel. It can be tightened or loosened to adjust the resistant against which the subject pedal.

STANDARDIZATION : for bicycle for moderate exercise is that the subject has to pedal the bicycle for 5 minutes at a rate of 50 times per minute, which is equivalent to about 130 revolutions per minute. The tension load [breaking resistance] at the belt is adjusted to 2 kgs.

Advantages of cycle ergometer:

Our upper body remains relatively immobile when we use a cycle ergo meter, allowing more accurate determination of blood pressure.

Furthermore, the rate of work when we pedal does not depend on our body weight this is important when one is investigating physiological responses to a standard rate of work (power effect).

Cycle ergometer is the most appropriate devices for evaluating changes in Sub maximal Physiological Function before and after training in people whose weight have changed. Resistance on a cycle ergo meter is independent of body weight, but the rate of work on a treadmill is directly related to body weight.

Mercury sphygmomanometer: For recording blood pressure of the subjects.

PROCEDURE:

1. Standardized the bicycle ergo meter by checking the scale on it.
2. Asked the subject to be quite and calm.
3. Recorded the Systolic Blood Pressure and Diastolic Blood Pressure using sphygmo-manometer by auscultatory method and heart rate is also recorded.
4. The subject is asked to sit on a bicycle ergo meter, adjusted the metronome and he is instructed to pedal the bicycle at a rate of 50 times per minute for about 5 minutes.
5. Immediately after the exercise all the parameters are again recorded.

6. And the recording of the above parameters is done at alternate minutes until the subject's pre - exercise values are reached.

RESULTS AND DISCUSSIONS

The mean rise in SBP in the 1st mt and 3rd mt after exercise is shown in table-1. It is seen from the table -1 that -

1. There was no significant difference in the raise of SBP levels between non - active and active males in the 1st mt after exercise. In both groups SBP levels are raised. The mean & SD of raise in SBP after 1st mt of exercise in non-active and active males are 16 +/- 5 (range was 10 - 24) 9.9 +/- 3.1 (range was 6 - 18) respectively. The "P" value was > 0.05 and was not significant.

2. There was significant difference in the raise of SBP levels between non-active and active males in the 3rd mt of exercise. In both groups SBP levels are raised. The mean & SD of the raise in SBP in the 3rd mt after exercise in non-active and active males is 8 +/- 4 (range was 0- 20) and 0.6 +/- 1.5 (range was 0 - 6) respectively.

The "P" value was < 0.05 and was significantly high in non-active males.

The mean decrease in DBP in the 1st mt and 3rd mt after exercise is shown in table-1. It is seen from the table -1 that -

1. There was significant difference in the decrease of DBP levels between non - active and active males in the 1st mt after exercise. In both groups DBP levels are decreased. The mean & SD of decrease in DBP after 1st mt of exercise in non-active and active males are 1 +/- 1 (range was - 4 to 0) 1.3 +/- 1.9 (range was - 8 to 0) respectively. The "P" value was < 0.05 and was significant.

2. There was significant difference in the decrease of DBP levels between non-active and active males in the 3rd mt of exercise. In both groups DBP levels are decreased.

The mean & SD of the raise in DBP in the 3rd mt after exercise in non-active and active males is 0 +/- O (range was - 2 to 0) and 0.1 +/- 0.9 (range was - 2 to 0) respectively.

The "P" value was < 0.05 and was significantly high in non-active males.

The mean rise in pulse rate in the 1st mt and 3rd mt after exercise is shown in table-2. It is seen from the table -2 that -

1. There was no significant difference in the raise of pulse rate levels between non - active and active males in the 1st mt after exercise. In both groups pulse rate levels are raised. The mean & SD of raise in PR after 1st mt of exercise in non-active and active males are 36 +/- 5 (range was 48 - 30) 26 +/- 6.9 (range was 39 - 8) respectively. The "P" value was > 0.05 and was not significant.

2. There was no significant difference in the raise of PR levels between non-active and active males in the 3rd mt of exercise. In both groups PR levels are raised. The mean & SD of the raise in PR in the 3rd mt after exercise in non-active and active males is 20 +/- 8.8 (range was 38 - 6) and 4.42 +/- 4.31 (range was 12 - 0) respectively.

The "P" value was > 0.05 and was not significant.

The mean basic pulse rate (i.e. pre-exercise value) in non-active and active males is shown in table- 2. The values are 75.1 and 71.8 in non -active and active males respectively. The mean basic pulse rate of active people is less than that of non-active people.

. Most of the active people reached the pre - exercise values in all parameters in the 3rd minute itself , whereas most of the non - active people reached the pre - exercise values only after the 5th minute .

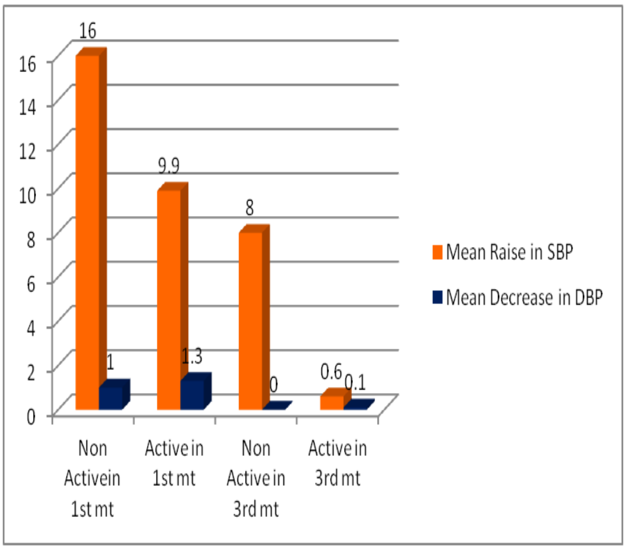

Table-1

S.No	Parameter	Time	Non Active		Active				
			Mean	SD	Mean	SD	t	P	Significance
1.	Raise in SBP	1st mt	16	5	9.9	3.1	1.73	>0.05	Non-sig
	Raise in SBP	3rd mt	8	4	0.6	1.5	3.89	<0.05	Significant
2.	Decrease in DBP	1st mt	1	1	1.3	1.9	4.47	<0.05	Significant
	Decrease in DBP	3rd mt	0	0	0.1	0.9	2.63	<0.05	Significant

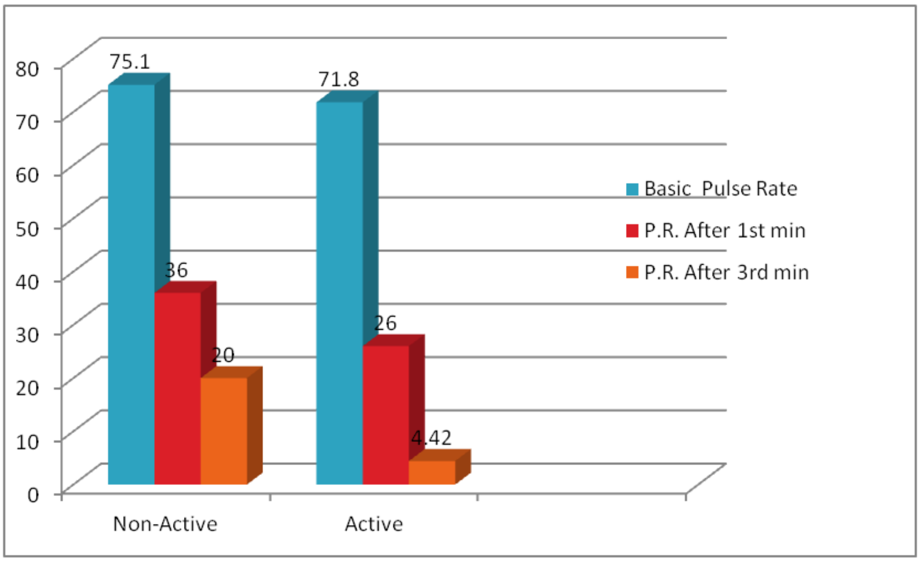

Table-2

S.No	Parameter	Non Active		Active				
		Mean	SD	Mean	SD	t	p	Significance
1.	Mean raise in pulse rate in 1st mt	36	5	26	6.9	1.34	>0.05	Non-Sig
2.	Mean raise in pulse rate in 3rd mt	20	8.8	4.42	4.31	1.6	>0.05	Non-Sig
3.	Basic pulse rate	75.1		71.8				

[1] Jack H Wilmore, David L Costil , John and Janice Fisher Chain stated in their work on physiology of sport and exercise that the resting pulse rate in sedentary individuals is around 80 beats per minute and it decreases to 70 beats per mt on regular physical exercise is in agreement with the present study.

They also observed that systolic blood pressure increased on exercise but diastolic blood pressure decreased after sub-maximal or moderate exercise. This observation is in correlation with the present study as the mean raise in SBP in 1st mt after exercise is 16 and 9.9 in active and non active respectively and the mean decrease in DBP is 1 and 1.3 in active and non active respectively .

[2] The observed mean increase in pulse rate during moderate exercise in physically active people to 37% in the present study is in agreement with the report by William D Mc Ardle, Frank I Katch Victoror L Katch .

Their study also states that systolic BP increases linearly with exercise where as diastolic pressure remains almost stable on exercise. The above statements correlated with the results of my study.

[3] RYT Sung, SSF Leung, TK Lee, during their study on cardiopulmonary response to exercise of 8 and 13 years old Chinese children in Hong Kong observed that the mean pulse rate in active adolescents as 124 after moderate exercise is higher than the results in the present study.
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[4] Pate RR, Wang CY, Dowda M, Farrell SW, O'Neill JR. in their study on Cardio respiratory fitness levels among US youth 12 to 19 years of age stated that for both males and females, those in the normal weight group had higher fitness levels than those in the overweight groups. According to their study, approximately one third of both males and females failed to meet recommended standards for cardio respiratory fitness in US youth. They also observed fitness is not related to race / ethnicity. Youth who have low levels of physical activity and high levels of sedentary behavior are more likely to have lower cardio respiratory fitness.

[5] Pakkala A, Veeranna N, Kulkarni SB stated in their comparative study of cardio pulmonary efficiency in athletes and non-athletes reported that the recovery heart rate were lower in athletes. Their observations suggest an overall higher adaptability of the cardiovascular system to the effects of training.

[6] Brian F. Robinson, Stephen E. Epstein, G. David Beiser, Eugene Braunwald in their study on Control of Heart Rate by the Autonomic Nervous System and Studies in Man on the Interrelation between Baroreceptor Mechanisms and Exercise stated that baroreceptor induced alterations in heart rate may be mediated by increased or decreased activity of either efferents of the autonomic nervous system and changes in sympathetic activity appeared to be the predominant mechanism by which speeding and slowing of the heart was achieved. The increase in heart rate with mild exercise was mediated by a decrease in parasympathetic activity

[7] Shi X, Stevens GH in their study on autonomic nervous system control of the heart in endurance exercise training observed a decrease of baseline heart rate in endurance exercise training is in correlation with my study. Their study states that training related bradycardia is due to enhanced vagal tone.

[8] Nobuyuk i Miyai, Mikio Arita, Kazuhisa Miyashita in their study on blood pressure response to heart rate during exercise test and risk of future hypertension gave results that suggest an exaggerated blood pressure response to heart rate during exercise is predictive of future hyper tension and blood pressure measurement during exercise test is a valuable means of identifying normotensive individuals at high risk for developing hypertension.

[9] G Cooke, P Marshall in their study on Physiological cardiac Reserve suggest that cardiac reserve was found to be a major determinant of exercise capacity, which is very much increased on regular exercise.

Observations of the present study suggest overall higher adaptability of cardiovascular system in active people. In them the arterial pressure is reduced at the same sub maximal work rates when compared with the non –active people. The reason for mean decrease in diastolic blood pressure is the decreased peripheral resistance. The decreased basal pulse rate and less mean raise in the pulse rate after moderate exercise in them is due to para sympathetic vagal dominance.

So, in active people at lower heart rates the heart can provide optimal cardiac output due to increased venous return. Their heart rate recovery period is also short. This measurement has been used as an index for cardio respiratory fitness. So, more fit person recovers faster after a standardized rate of work than a less fit person.

Conclusion: Physical exercise is considered beneficial in many aspects. During exercise our body must rely more heavily on oxidation of fat for energy production. Cortisol level peaks after 30 - 45 minutes of exercise which accelerates the mobilization and use of free fatty acids for energy. So, daily regular physical exercise is a recommended solution for adolescent and childhood obesity to which our teenagers are victims due to their sedentary life styles. Exercise increases high density lipoprotein cholesterol (HDL - C) in the blood. HDL- C is the desirable form of cholesterol, increased concentration are assisted with reduced risk for heart disease.

During prolonged sub- maximal activity myocardial metabolism of free fatty acids raises to almost 70% and there is "hypotensive response". During vigorous exercise coronary blood flow may increase 4-6 times above the resting level and adenosine a byproduct of ATP breakdown and hormones of sympathetic nervous system cause coronary vasodilatation. All these effects are beneficial to adolescents in preventing early onset of hypertension and coronary artery disease leading to atherosclerosis , stroke and finally decreasing the mean life span of this generation .

Research have shown that there is increase in the number and availability of insulin receptors increasing the body sensitivity to insulin. During exercise, permeability of glucose increases even in the absence of insulin. So, exercise is beneficial not only to the adolescents who are sufferers of type 1 diabetics but also it prevents the early onset of type 2 diabetes which is now-a-days an increasing global problem.

Exercise also relieves the psychological stress due to heavy competitive studies by producing endorphins in the body. .

In athletically fit person the cardiac reserve is 50% greater than non-fit person. Regular exercise improves work capacity, cardiac performance. It has been shown that age related decline in resting metabolic rate is markedly reduced in physically active individuals . Thus with regular exercise physical strength can be preserved longer. Thus with appropriate diet and exercise starting in youth, much of old age misery can be avoided and body fitness prolongs life.

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