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COMPARATIVE STUDY OF CARDIOVASCULAR RESPONSES ON VARIOUS SURFACES

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Abstract:
Life is sustained through physical activity. The Nature scope and worth of physical activity require study from the various scientific disciplines, in order to ensure proper use of activity for favorable development. Running is the supreme cardiovascular conditioning activity. It is the standard against which all other exercises and programmes can be measured, running stresses the heart and lungs more than almost any other forms of physical activity, while running, the heart rate rise and remain elevated, rather than fluctuating up and down as it does in other games. Therefore, realizing that when the running will be done on different surfaces, it will call for different cardiovascular responses. The study of this aspects will highlight to coaches and physical education teachers to prepare conditioning programme according the stress particular surface puts on an individual.

Keywords: cardiovascular responses, physical activity, running

1. Introduction

Gentry determined the effects of a nine weeks aerobic jogging programme on selected cardiovascular functions of young male college student through a time course evaluation programme. Pre-test and post test administered at the end of third, sixth and ninth weeks were employed in order to evaluate effects of training programme, He studied the following cardiovascular functions: resting and exercise cardiac out-put, cardiac index, stroke volume 02 pulse, and heart rate. He concluded that there was a significant increase in resting cardiac out-put, stroke volume, resting and exercise 02

pulse, and further observed that there was significance decrease in resting diastolic blood pressure and steady state heart rate, while no change occurred in exercise cardiac out-put and resting rate white evaluated the effects of six month walking or aerobic dance programme on skeletal and cardiovascular systems of postmenopausal females. His finding indicated that both walking and dancing were equally effective in increasing the efficiency of the cardiovascular system in postmenopausal women. Both groups showed significance increase in treadmill while showing decreases in resting heart rate and recovery heart rate, These findings reflected on increased efficiency of the heart and a decreased myocardial oxygen demand at given submaximall work load. In conclusion, a six month exercise programme for postmenopausal women resulted in favourable changes in bone status and cardiovascular fitness.

Costill compared the heart rate responses and work efficiency of exercise performed horizontally on land and in the water, and sitting on land. The subjects of this investigation were physically active men ranging in age from 21 years to 36 years. Heart rate responses and energy requirements were compared among sitting on land, supine on land, prone in water and supine in water during sub maximal and maximal cycling exercise. He found that maximum work load achieved by the man exercising in water, maximum oxygen consumption and maximum heart rates were significantly lower than those recorded on land. During cycling activities, water resistance was found to reduce substantially the work efficiency by approximately 4.0-5.8 percent.

1.1 Purpose of the study

The purpose of this study was to compare the cardiovascular responses on various surfaces.

2. Methodology

2.1 Selection of Subjects

Twenty male students of Bachelor of Art and Master of Art classes from IGGPG College BangarmauUnnao were randomly selected for the study. Their Age group ranges from 17 to 22 years.

2.2 Experimental Design

Single group design was used for this study as it was considered the most appropriate because through this inter subject variability is controlled.

2.3 Prescription of Load

For equating the load on both the surfaces subjects were asked to run 1.5 mile distance with their maximum effort. 1.5 mile distance was chosen with the view that it is a standard alternative for cooper's 12 minute run walk test. This test is also appropriate as all the measurement related to the problem can be recorded near the finish line.

Two students at a time were asked to run 1.5 mile distance taking standing start. They were instructed that they are required to put their maximum effort so that distance could be covered in the shortest period of time. However, they were told that running can be interspersed with waling but the object is to cover the distance in shortest possible time. Their time was recorded in minutes & seconds as soon as one crossed the finish line.

2.4 Criterion Measures

The following criterion measures were chosen:-

1- Heart rate-recorded in terms of number of beats per minute.
2- Respiratory rate-recorded in terms of number of breathing per minute.
3- Blood Pressure-recorded in terms of pressure exerted on the walls of artery during systole and diastole (systolic and diastolic) recorded in M.M. of Hg.

2.5 Administration of the Test

2.5.1 Heart Rate

The heart rate was determined by Pulse count. Pulse was taken from radial artery of the wrist on the palm side, directly in line with the base of the thumb. The tips of the index and middle fingers were used to feel the pulse. Due care was taken to apply appropriate pressure on the artery, so that a reaction to pressure did not produce an alteration in the beat. The stop watch started coinciding with a pulse beat. In counting pulse, the beat felt was designated as zero and then pulse was counted for one minute. The subjects were given instruction to remain silent and refrain from moving or talking since these would affect pulse rate.

The heart rate was taken immediately after the exercise.

2.5.2 Respiratory Rate

Subjects were asked to site on the easy chair comfortable. The stop watch was started coinciding with tester's observation. Then the upward and downward movements of abdominal region was recorded for the duration of one minute, and the total counts were divided by two, which denoted the respiratory rate. The reparatory rate was taken immediately after exercise.

2.5.3 Blood Pressure

A dial type of Sphygmomanometer made in Japan and a stethoscope supplied by Biological Concern, Calcutta, was used for measuring the systolic and diastolic pressure. While taking blood pressure the subject's left arm were completely bared to make sure that the clothing did not constrict the blood vessels. The blood pressure measurement was taken with subject in a sitting position, his forearm was supported on the handle of the chair. The cuff was warpped around the arm, evenly, with the lower edge approximately on inch above the anticubital space. The stethoscope receiver was placed gently over the artery in antecubital space.

2.6 Statistics to Be Used

For the comparing cardiovascular responses after running on different surface, "t" test was employed.

Level of significance was set at .05.

3. Analysis of Data and Results of the Study

The statistical analysis of data on systolic Blood Pressure, Diastolic Blood Pressure, Heart Rate and Respiratory rate collected on 20 male, student of B.A and M.A Class of IGGPG College BangarmauUnnao presented in this chapter.

3.1 Scoring Of Data

Students were asked to run 1.5 mile distance with their maximum effort on both the surface. However, they were told that walking is permitted, but they are required to cover the distance in shortest possible time. This effort on both the surface equated the load & their measurement pertaining to cardio-vascular responses was taken immediately after completing the 1.5 mile race.

Both systolic and diastolic blood pressure was measured with the help of sphygmomanometer. Heart rate was measured by pulse court. Pulse was taken from radial artery of the wrist for the period of one minute. For measuring respiratory rate upward and downward movement of abdominal region was recorded in numbers for the duration of one minute. Above mentioned data was collected separately on synthetic and clay surfaces after a gap of one week.

3.2 Tester's Competency and Reliability of Data

To ensure that the investigator was well versed in the techniques of conducting tests, the investigator had a number of practice session in the testing procedure under the expert guidance of Dr. Sunil Rathaur M.B.B.S Bangarmau. To ensure taster's

competency the measurement taken on five student in the selected variable by the investigator were co-related with those taken by Dr. Lalit Saini under the similar conditions, the coefficient of co-relation of the measures taken by the investigator and the expert have been shown in table-I. Since high co-relation from '86 to '92 were obtained the investigator's competency to administer the test was established.

Table 1: Tester's Competency for Tests in Selected Physiological Variables

Variables	Coefficient of Correlation
Heart rate	0.92
Respiratory rate	0.96
Systolic Blood Pressure	0.88
Diastolic Blood Pressure	0.82

3.3 Instrument Reliability

The Sphygmomanometer, stethoscope, stop watch, used in the study were new and obtained from reputed suppliers of standard equipment therefore the calibration were accepted as accurate enough for the purpose of study.

4. Findings

Finding pertaining to each of the cardiovascular variable of heart rate, respiratory rate, Systolic Blood pressure, and diastolic blood pressure on Synthetic and clay surfaces was worked out be following formula.

$$t = \frac{D.M.}{\sigma_{D.M.}}$$

Where:

D.M. = Difference between both means.

$\sigma_{D.M.}$ = Standard error of the difference between both means.

For the mean difference to the significant at 0.05 level of confidence the t-value required to be obtained should be greater than 2.09.

4.1 Heart Rate

t-ratio obtained for heart rate after completing 1.5 mile race on synthetic and clay surfaces is present in table 2.

Table 2: Significance of mean difference between the heart rate taken after completing 1.5 mile race on synthetic and clay surfaces

Surface	Mean	Standard Deviation	Mean Difference	Standard Error of Difference of Mean	t-Ratio
Synthetic	119.4	16.85	18.75	6.570	2.85
Clay	138.15	24.05			

Significant at 0.05 level of confidence, t-value needed to be significant at 0.05 level with 19 degree of freedom in 2.09.

The analysis of data in Table 2 reveals that there is significance difference between the heart rate, recorded after completing 1.5 mile race on Synthetic and clay surfaces as the obtained t-ratio 2.85 is greater than the required t-value 2.09.

4.2 Respiratory Rate

t-ratio obtained for respiratory rate after completing 1.5 mile race on synthetic and clay surface is presented in Table 3.

Table 3: Significance of mean difference between the respiratory rate taken after completing 1.5 mile race on synthetic and clay surfaces

Surface	Mean	Standard Deviation	Mean Difference	Standard Error of Difference of Mean	t-Ratio
Synthetic	34.85	5.96	1.05	1.90	0.552
Clay	33.8	6.085			

Significant at 0.05 level of confidence, t-value need to be significance at 0.05 level with 19 degrees of freedom is 20.09.

The analysis of data in Table 3 reveals that there is no significance difference between the respiratory rate recorded after completing 1.5 mile race on synthetic and clay surfaces as the obtained t-ratio .552 is Lesser than the required t-value 2.09.

4.3 Systolic Blood Pressure

t-ratio obtain for systolic blood pressure after completing 1.5 mile race on sysnthetic and clay surfaces is presented in Table 4.

Table 4: Significant of mean for difference between the Systolic Blood Pressure taken after completing 1.5 mile race on synthetic and clay surface

Surface	Mean	Standard Deviation	Mean Difference	Standard Error of Difference of Mean	t-Ratio
Synthetic	161.0	13.84	13.9	5.58	2.45
Clay	174.9	20.77			

Significant at 0.05 level of confidence, t-value need to be significant at 0.05 level with 19 degree of freedom is 2.09.

The analysis of data in Table-4 reveals that there is significance difference between the systolic blood pressure recorded after completing 1.5 mile race on synthetic and clay surface as the obtained t-ratio 2.45 is greater than the required t-value-2.096.

4.4 Diastolic Blood Pressure

t-ratio obtained for diastolic blood pressure after completing 1.5 mile race on synthetic and clay surface is presented in Table 5.

Table 5: Significant of mean for difference between the Diastolic Blood Pressure taken after completing 1.5 mile race on synthetic and clay surface

Surface	Mean	Standard Deviation	Mean Difference	Standard Error of Difference of Mean	t-Ratio
Synthetic	78.25	17.76	6.95	5.43	1.27
Clay	85.2	16.55			

Significant at 0.05 level of confidence, t-value need to be significant at 0.05 level with 19 degree of freedom is 2.09.

The analysis of data in Table-5 reveals that there is significance difference between the diastolic blood pressure recorded after completing 1.5 mile race on synthetic and clay surface as the obtained t-ratio 2.45 is greater than the required t-value-2.09.

5. Discussions of Findings

1. The analysis of data using 't' ratio showed that significant difference exists among the measurements recorded after 1.5 mile running on synthetic and clay surfaces in the cardiovascular variables of systolic blood pressure and Heart rate. Two other cardiovascular variables under study namely Diastolic blood pressure and respiratory rate, which were also measured after 1.5 mile race did not show significant difference. Hence, Hypothesis is partially accepted.

2. Significant difference in systolic blood pressure and Heart rate may be due to the fact that 1.5 mile running on clay surface puts more demand on heart as compared to that of synthetic surface as the mean value of 161.0 mm. Hg. & 174.9 mm. Hg. For systolic blood pressure recorded for synthetic and clay surfaces respectively, differ significantly with each other. Same is the case with Heart Rate, where mean value of 119.4 and 13.15 recorded after running 1.5 mile race on synthetic and clay surface respectively showed significant difference.
3. This difference among the both these cardiovascular variables may be attributed to the fact that running on clay surface put more demand on muscular system whereby more supply of blood to the working muscles is required and this supply is met by the heart. As result cardiac out-put increase and in the process to supply more blood to the working muscles heart has to supply blood in great amount forcefully and rapidly. This evident in the form of increased systolic blood pressure and heart rate.
4. Analysis of other two cardiovascular variables under study indicates that variation exists among their measurement after running 1.5 mile race on synthetic and clay surface, but that variation is not significant. If we observe the mean value of 78.25 & 85.2 of diastolic blood pressure and 34.85 and 33.8 of respiratory rate after running on synthetic and clay surfaces respectively, we find that mean value obtained after running on clay surface is greater than those values obtained after running on synthetic surface. Hence, it may be attributed that although significant difference does not exist but running of clay surface puts more demand on the cardiovascular parameters of an athlete than that of running on synthetic surface.
5. The insignificant difference obtained for Diastolic blood pressure after running on synthetic and clay surface may be due to the fact that during exercise vasodilatation takes place in the arteries, hence the pressure of blood on arteries during diastole is considerable reduced. It might be the cause for insignificant difference in Diastolic Blood Pressure recorded after running on synthetic and clay surfaces.

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