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# CARDIOVASCULAR RESPONSES ON TWO DIFFERENT CARDIOVASCULAR TASKS

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## *Abstract*

The present study aimed to examine and compare cardiovascular responses elicited by two different cardiovascular tasks, namely the Harvard Step Test and the 600-yard run. Ten male postgraduate residential students of the University of Kalyani, aged between 20 and 25 years, were randomly selected as subjects. Resting and post-exercise heart rate, systolic blood pressure, and diastolic blood pressure were measured following both exercise protocols. Data were collected on two separate days, and statistical analysis was carried out using the *t*-test at the 0.05 level of significance. The results revealed a significant increase in post-exercise heart rate following the Harvard Step Test, while the increase after the 600-yard run was not statistically significant when compared with resting values. Diastolic blood pressure did not show significant changes following either task. A significant rise in systolic blood pressure was observed after the 600-yard run. Furthermore, a significant difference in post-exercise heart rate was found between the two exercise tasks. The findings indicate that cardiovascular responses vary according to exercise modality and intensity and support existing theories of central cardiovascular regulation during dynamic exercise.

**Keywords:** cardiovascular response, heart rate, blood pressure, Harvard Step Test, 600-yard run, exercise physiology.

## I. INTRODUCTION

Human heart and its allied organ have got a high responsiveness during any sort of muscular work or exercise performed or a considerable period. The workability of the muscle is highly dependant upon the adequate fuel supply in the muscle through its vascular network. Such along and continuous muscular works need regular supply of oxygen through a process known as cardiovascular system. The other important that plays an important role is the pulmonary function. These together for the cardio-respiratory function which all the related to phenomenal task of oxygen consumption in human being. The prolong activities in this regard are popularly known as endurance. Therefore the dynamics of oxygen regulation in human body is under the very command of cardiovascular central command lying at the higher centre of brain. The blood flows that continues during the course of exercise to maintain blood pressure (Ross and Willson 1998).

Cardiovascular adjustment is rapid at the initial stage of exercise. The vegal flow the heart is withdrawn within one sec of the commencement leads to of exercise and that s leads to increased sympathetic stimulation to heart. In the same time there is vasodialation of arterioles in active muscle and a

reflex increase the resistance of vessels in less active areas. That increases cardiac output to the active muscles to meet adequate metabolic needs. This follows the central commands theory. Fig -1 represents the operational phenomena of the cardiovascular control and function during the course of exercise. (Dormer and Stone 1982, Eldridge 1981, 1985, Mitchell et.al 1980,Smith et.al. 1960, Williamson 1995).

Cardiovascular system comprises of heart and blood vessels. Heart is the central pump and the blood vessels are the series of distributing and collecting tubes. The thinnest blood vessels are called capillaries where gaseous exchange takes place. The main function of heart is continuous pump out the blood which circulates within the blood vessels throughout the body. Normally at rest cardiovascular system running at basal rate but during any muscular work it gradually increases.

## II. PURPOSE OF THE STUDY

1. To find out the cardiovascular responses on two different cardiovascular tasks.
2. To compare the condition of Resting Heart Rate and Post Exercise Heart Rate.
3. To compare the condition of Resting Diastolic Blood Pressure and Post Exercise Diastolic Blood Pressure.
4. To compare the condition of Resting Systolic Blood Pressure and Post Exercise Systolic Blood Pressure.
5. To compare the condition of Post Exercise Heart Rate between Stepping task and 600 yards run.
6. To compare the condition of Post Exercise Diastolic Blood Pressure between Stepping task and 600 yards run.
7. To compare the condition of Post Exercise Systolic Blood Pressure between Stepping task and 600 yards run.

## III. METHODOLOGY

In this chapter detailed procedure in respect of the subject criterion measure, instrument and tools used, procedure for
collecting data and analysis of data has been presented.

**The subject:**

Ten male students of the “PG-III Hostel, University of Kalyani” were selected randomly as subject for the research project. The age of the student ranges from 20 through 25 years.

**Criterion measure:**

The following criteria were measures for the study –

1. Resting Heart Rate
2. Exercise Heart Rate
3. Blood Pressure
    a) Resting Blood Pressure
    b) Post- Exercise

**Design:**

A group of 10 subjects were administered 600 yards W/R and Harvard Stepping Tasks for 5 minutes. The cardiovascular responses were recorded on Resting Heart Rate and Blood Pressure. The data were collected or result and analysis.

**Instrument and tools used:**

For Harvard Step Test following equipment were used -

1. 20 inch High Bench
2. Stop Watch
3. Metronome

For 600 yards run following equipment were used –

1. Stop Watch
2. Whistle
3. 100 meters Measuring Tape

For measuring Blood Pressure Sphygmomanometer were used.

**Data collection:**

The Data were collected on Resting Heart, Blood Pressure and Exercise Blood Pressure, Exercise heart rate through Harvard Step Test and 600 yards Run.

The data of the variables were collected on two different days.

**Procedure for administering test:**

**Measurement of Heart Rate and Blood Pressure through Harvard Step Test**

Prior to the test no activity or warming up was given. The test computes the capability to exercise continuously for extended intervals of time without tiring. The subject steps up and down on a platform at a height of about 20 inch at a rate of 30 steps per minute for 5 minutes. The subject immediately sits down on completion of the test, and the heartbeats are counted, blood pressures were measured and recorded by Pal pressure method.

**Measurement of Heart Rate and Blood Pressure through 600 yards Run**

Prior to the test no activity or warming up was given. The subject start running up to 5 minutes continuously in a 400 yards track one and half lap. The subject immediately sits down on completion of the test. and the heartbeats are counted, blood pressures were measured and recorded by Palpressure method.

**Statistical computations:**

The ‘t’ test was calculated by using the following formula –

## IV. RESULTS AND DISCUSSION

**Presentation of Data:**

The data collected in the present study are presented in tabular form for clear understanding. Mean and standard deviation were used to describe heart rate and blood pressure values. The *t*-test was applied to compare resting and post-exercise conditions as well as between the two tasks. All tables present the results in a systematic and scientific manner.

**Table – 1:** Comparison between Resting Heart Rate and Exercise Heart Rate of Harvard Step Test of the hostel residential students -

| Variable | Resting Heart Rate | | Exercise Heart rate | | t - Value |
|---|---|---|---|---|---|
| Heart rate | Mn | SD | Mn | SD | 8.66* |
| | 65.2 | ±5.31 | 144.1 | ±6.59 | |

Df =9 *sig. at 0.05 level

Table – 1 shows the means RHR and Post Exercise HR are 65.2 ±5.31 and 141.1 ±6.59 respectively the results shows that the Post Exercise HR following the Step up exercise increased significantly at .05 level.

**Table – 2:** Comparison between Resting Heart Rate and Exercise Heart Rate of 600 yards Run of the hostel residential students -

| Variable | Resting Heart Rate | | Exercise Heart Rate | | t - Value |
|---|---|---|---|---|---|
| Heart rate | Mn | SD | Mn | SD | 1.86 |
| | 65.2 | ±5.31 | 168.4 | ±5.17 | |

*Not Significant

Table – 2 shows the means RHR and Post Exercise HR are 65.2 ±5.31 and 168.4 ±5.17 respectively the results shows that the Post Exercise HR following the 600 yards Run increased not significantly at .05 level.

**Table – 3:** Comparison between Resting Diastolic Blood Pressure and Exercise Diastolic Blood Pressure of Harvard Step Test of the hostel residential students -

| Variable | Resting Diastolic Blood Pressure | | Exercise Diastolic Blood Pressure | | t - Value |
|---|---|---|---|---|---|
| Diastolic Blood Pressure | Mn | SD | Mn | SD | 0.19 |
| | 76.4 | ±4.50 | 75 | ±5.52 | |

*Not Significant

Table – 3 shows the means Resting Diastolic Blood Pressure and Post Exercise Diastolic Blood Pressure are 76.4 ±4.50 and 75 ±5.52 respectively the results shows that the Post Exercise Diastolic Blood Pressure following the Step up exercise increased not significantly at .05 level.

**Table – 4:** Comparison between Resting Diastolic Blood Pressure and Exercise Diastolic Blood Pressure of 600 yards Run of the hostel residential students -

| Variable | Resting Diastolic Blood Pressure | | Exercise Diastolic Blood Pressure | | t - Value |
|---|---|---|---|---|---|
| Diastolic Blood Pressure | Mn | SD | Mn | SD | 0.04 |
| | 76.4 | ±4.50 | 80.2 | ±4.02 | |

*Not Significant

Table – 4 shows the means Resting Diastolic Blood Pressure and Post Exercise Diastolic Blood Pressure are 76.4 ±4.50 and 80.0 ±4.02 respectively the results shows that the Post Exercise Diastolic Blood Pressure following the 600 yards Run increased not significantly at .05 level.

**Table – 5:** Comparison between Resting Systolic Blood Pressure and Exercise Systolic Blood Pressure of Harvard Step Test of the hostel residential students -

| Variable | Resting Systolic Blood Pressure | | Exercise Systolic Blood Pressure | | t - Value |
|---|---|---|---|---|---|
| | Mn | SD | Mn | SD | |
| Systolic Blood Pressure | 121.8 | ±3.77 | 145.8 | ±6.41 | 1.12 |

*Not Significant

Table – 5 shows the means Resting Systolic Blood Pressure and Post Exercise Systolic Blood Pressure are 121.8 ±3.77 and 145.8 ±6.41 respectively the results shows that the Post Exercise Systolic Blood Pressure following the Step up exercise increased not significantly at .05 level.

**Table – 6:** Comparison between Resting Systolic Blood Pressure and Exercise Systolic Blood Pressure of 600 yards Run of the hostel residential students -

| Variable | Resting Systolic Blood Pressure | | Exercise Systolic Blood Pressure | | t - Value |
|---|---|---|---|---|---|
| | Mn | SD | Mn | SD | |
| Systolic Blood Pressure | 121.8 | ±6.59 | 157.4 | ±5.52 | 2.38* |

***sig. at 0.05 level

Table – 6 shows the means Resting Systolic Blood Pressure and Post Exercise Systolic Blood Pressure are 121.8 ±6.59 and 157.4 ±5.52 respectively the results shows that the Post Exercise Systolic Blood Pressure following the 600 yards Run increased significantly at .05 level.

**Table – 7:** Comparison of Exercise Heart Rate between 600 yards run and Harvard Step Test of hostel residential students -

| Variable | Harvard Step Test | | 600 yards Run | | t - Value |
|---|---|---|---|---|---|
| | Mn | SD | Mn | SD | |
| Heart rate | 144.1 | ±3.77 | 168.4 | ±5.17 | 9.79* |

***sig. at 0.05 level

Table – 7 shows the means Step Test Post Exercise HR and 600 yards run Post Exercise HR are 144.1 ±3.77 and 168.4 ±5.17 respectively the results shows that the Post Exercise HR following the two tests increased significantly at .05 level.

**Table – 8:** Comparison of Exercise Diastolic Blood Pressure between 600 yards run and Harvard Step Test of hostel residential students –

| Variable | Harvard Step Test | | 600 yards Run | | t – Value |
|---|---|---|---|---|---|
| | Mn | SD | Mn | SD | |
| Diastolic Blood Pressure | 75 | ±5.52 | 80.2 | ±4.02 | 0.02 |

*Not Significant

Table – 8 shows the means Step Test Post Exercise Diastolic BP and 600 yards run Post Exercise Diastolic BP are 75 ±5.52 and 80.2 ±4.02 respectively the results shows that the Post Exercise Diastolic BP following two tests increased not significantly at .05 level.

**Table – 9:** Comparison of Exercise Systolic Blood Pressure between 600 yards run and Harvard Step Test of hostel residential students –

| Variable | Harvard Step Test | | 600 yards Run | | t - Value |
|---|---|---|---|---|---|
| | Mn | SD | Mn | SD | |
| Systolic Blood Pressure | 145.8 | ±6.41 | 157.4 | ±5.52 | 0.0004 |

*Not Significant

Table – 9 shows the means Step Test Post Exercise Systolic BP and 600 yards run Post Exercise Systolic BP are 145.8 ±6.41 and 157.4 ±5.52 respectively the results shows that the Post Exercise Systolic BP following two tests increased not significantly at .05 level.

The findings of the study demonstrated distinct cardiovascular responses to the two exercise modalities. A statistically significant increase in post-exercise heart rate was observed following the Harvard Step Test. This result reflects rapid cardiovascular adjustment to rhythmic stepping exercise and supports previous findings that dynamic exercise elicits immediate vagal withdrawal and sympathetic activation (Eldridge et al., 1985; Williamson, 1995).

Although the 600-yard run resulted in a considerable elevation in heart rate compared to resting values, the increase was not statistically significant. This may be attributed to individual differences in aerobic fitness and pacing strategies. Similar observations were reported by Mitchell et al. (1980), who noted variability in heart rate responses during short-duration endurance activities.

A comparison between the two tasks revealed that the 600-yard run produced a significantly higher post-exercise heart rate than the Harvard Step Test. This indicates that running imposes greater cardiovascular strain, likely due to higher oxygen demand and cardiac output requirements (Powers & Howley, 2018).

Diastolic blood pressure did not show significant changes following either exercise task. This finding aligns with established physiological principles that diastolic pressure remains relatively stable during aerobic exercise due to vasodilation in active muscles and reduced peripheral resistance (Ross & Willson, 1998; Smith et al., 1960).

Systolic blood pressure increased following both exercise protocols; however, a statistically significant rise was observed only after the 600-yard run. This suggests that exercise intensity plays a critical role in systolic blood pressure regulation. Previous research has demonstrated that systolic blood pressure rises proportionally with increasing exercise intensity as a result of increased stroke volume and sympathetic stimulation (Eldridge et al., 1981).

Overall, the findings support the central command theory of cardiovascular regulation and confirm that cardiovascular responses are task-specific and influenced by the nature and intensity of physical activity.

## CONCLUSION

Based on the findings of the study, the following conclusions were drawn:

1. Post-exercise heart rate increased significantly following cardiovascular exercise.
2. The increase in heart rate after the 600-yard run was not statistically significant when compared with resting values.
3. No significant differences were observed between resting and post-exercise diastolic blood pressure in either task.
4. Systolic blood pressure increased after both exercise tasks, with a significant increase observed only after the 600-yard run.

5. A significant difference in post-exercise heart rate was found between the Harvard Step Test and the 600-yard run.
6. Post-exercise diastolic blood pressure did not differ significantly between the two tasks.
7. Differences in post-exercise systolic blood pressure between the two tasks were not statistically significant.

The study confirms that different cardiovascular tasks produce varying physiological responses and highlights the importance of exercise specificity in cardiovascular assessment.

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