

Study of Changes in Respiratory Rate Following an Exercise Bout

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ABSTRACT

During all types of exercise respiratory rate is increased as a result of increased demand of Oxygen. The purpose of the study was to find out the maximum changes in respiratory rate following an exercise bout and to study the recovery period of respiratory rate after completing an exercise bout in three categories of women - obese, normal and lean. A total of 13 young adult female within the age of 21-30 years were volunteered as subject for this study. Each subject's body fat were measured and classified under three groups' namely overweight or obese group (G1), Normal group (G2) and Lean or underweight group (G3). Respiratory rate was considered as criterion of the present study. Respiratory rate was measured manually by observation of breath in and breathe out per minute. Standard stop watch was used for time specification. Step up and down for five minutes was used as exercise protocol. All data for the present study was collected at average 25.21⁰C temperature and 63.33% humidity. Multiple group design with three independent groups was considered for the present study. All calculations were done by the standard statistical procedure. Findings have revealed that respiratory rate significantly increased ($F=9.4$) for all groups of subjects immediately after exercise ($p<0.05$). The raise of respiratory rate immediate after exercise was found highest for G1 group and lowest for G3 group. The recovery period was found longest for G1 group (15.33 min) and shortest for G3 group (7.5 min). Result clearly indicated that respiratory rate increased significantly immediately after exercise in all categories of women but recovery period of respiratory rate was not significantly different for women having different body fat.

Key word: Respiratory rate, Recovery period, Exercise bout, Body Fat, Obese, Normal and Lean.

INTRODUCTION

The respiratory rate (RR), also known as the ventilation frequency (V_f), respiration frequency (R_f) or breathing frequency, is the rate (frequency) of ventilation, that is, the number of breaths (inhalation and exhalation cycle) taken within a set amount of time (typically 60 seconds). Human respiration rate is measured when a person is at rest and involves counting the number of breaths for one minute by counting how many times the chest rises.

The usual respiratory rate for a healthy adult at rest is 12-20 breaths per minute. ^[1] During all types of exercise respiratory rate is increased as a result of increased demand of Oxygen to produce more energy. The most efficient way to meet these needs involved the use of oxygen to break down glucose. This occurred when one glucose molecule and six oxygen molecules combined to produce ATP, a usable source of energy. This process also produced carbon dioxide molecules. Breathing rate also increased, in order to facilitate the removal of carbon dioxide by

the haemoglobin molecules from the actively working muscle cells. This increase is influenced by the sympathetic nerves stimulating the respiratory muscles to increase the rate of breathing. . At rest, the respiratory rate is about 14 per minute but can increase to 32 per minute during exercise. The increased respiration rate allows more oxygen to reach the lungs and blood to be delivered to the muscles. [2,3]

The purposes of the study were to find out the maximum change in respiratory rate following an exercise bout and to study the recovery period of respiratory rate after completing an exercise bout in three categories of women - obese, normal and lean.

MATERIALS AND METHODS

Subject: A total of 13 young adult female within the age of 21-30 years were volunteered as subject for this study. Each subject's body fat were measured and classified under three groups' namely overweight or obese group (G1), Normal group (G2) and Lean or underweight group (G3).

Criterion measure: Respiratory rate was considered as criterion of the present study.

Table1: Mean and standard deviation of respiratory rate at Rest, Immediate after exercise and for the total recovery period for different groups

Subject Groups	Rest		Immediate after Exercise		Recovery period	
	Mean	SD	Mean	SD	Mean	SD
Gr-1	20.67	2.31	37.67	0.58	15.33 min	7.02
Gr-2	20.17	2.04	31.00	3.74	13.33 min	2.42
Gr-3	20.00	2.83	28.00	2.83	7.50 min	4.73
F-value	0.07		9.40*		0.31	

*Significant at 0.05 level (To be significant 0.05 level the F-value should be 4.10).

Table-1 indicated that F-value for resting respiratory rate and for recovery period were not significant statistically but the f-value for the increased respiratory rate immediate after exercise found in this study was significant statistically.

Table-2: Results of t-test computed for different groups for the increased respiratory rate immediate after exercise

Groups Considered	Mean Difference	t-value
Gr-1 and Gr-2	6.67	2.03
Gr-2 and Gr-3	3.00	0.99
Gr-3 and Gr-1	9.67	2.74*

Test and Tool used: Respiratory rate was measured manually by observation of breath in and breathe out per minute.

Standard stop watch was used for time specification.

Exercise protocol: Step up and down for five minutes was used as exercise protocol. All data for the present study was collected at average 25.21⁰C temperature and 63.33% humidity.

Design of the study and Statistical procedure: Multiple group design with three independent groups was considered for the present study. All calculations were done by the standard statistical procedure. Standard statistical software was used for all the calculations. Only 0.05 level of confidence was considered in the study.

RESULTS AND FINDINGS

The mean value and standard deviation of respiratory rate at Rest, Immediate after exercise and the Total Recovery period for G-1, G-2 and G-3 have presented in Table-1 and result of ANOVA for all these variables have also presented in same table.

*Significant at 0.05 level (To be significant, the t-value should be 2.23)

As the f-value for the increased respiratory rate immediate after exercise found in this study significant statistically, the t-test was conducted for different groups and results have presented in Table-2 below:

Table indicated that t value for G1 – G2 and G2 – G3 were *not* statistically significant but t value for G1 – G3 was found significant statistically.

DISCUSSION ON FINDINGS

Findings have revealed that respiratory rate significantly increased for all groups of subjects immediately after exercise (Figure-1). Stevens and Randall reported increase in respiratory rate during exercise. [4] Several other review studies also supported this physiological fact. [5,6]

The raise of respiratory rate immediate after exercise was found highest (37.67) for G1 group, followed by G2 group (31) and lowest for G3 group (28). This increase in respiratory rate for G1, G2 and G3 group have presented graphically in Figure-1. This increased in respiratory rate was 1.82 times for G1 group, 1.54 times for G2 group and 1.40 times more for the G3 group. Table-2 has shown that the difference in this variable was significant for G3-G1 group.

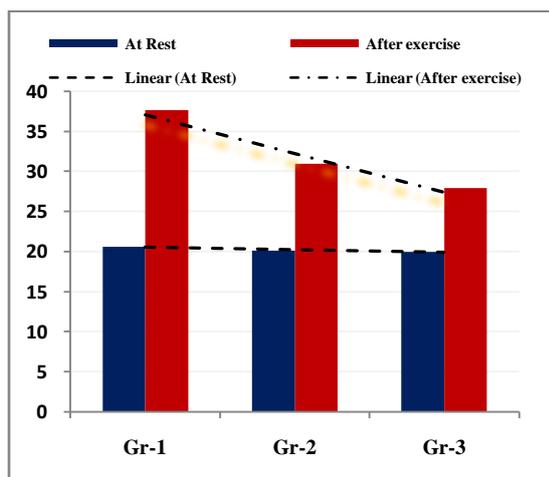


Figure-1: The raise of respiratory rate immediate after exercise for different groups

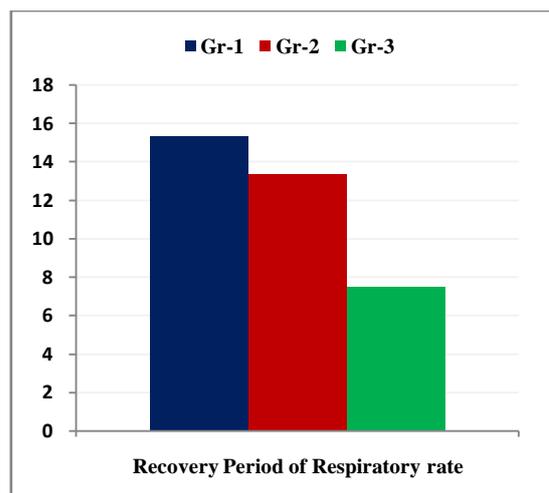


Figure-2: The recovery period of the respiratory rate after exercise for different groups

The recovery period of the respiratory rate was found longest for G1 group (15.33 min) and shortest for G3 group (7.5 min) [figure-2]. The recovery period of the respiratory rate of the G2 group was 13.33 min. The lean group might involve some physical activities more than the obese group and thus they have the better ventilator capacity which might be the cause of this fact. Study reported better ventilator capacity among young people patient performing exercise and training. [7,8]

CONCLUSION

- ▶ Result clearly indicated that respiratory rate increased significantly immediately after exercise in all categories of women.
- ▶ Increased in respiratory rate immediate after exercise was significant between obese and lean women group.
- ▶ There was no significant difference in recovery period of respiratory rate after an exercise bout among women having different body fat.

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