# The Effect of Three Kinds of Motion Mode on Cardio Respiratory System

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**Abstract.** This study explores the three movement patterns stepping, treadmills and bicycling. In different workloads observe the physical work ability index load (Load) and heart rhythm (HR) relationship. Including oxygen uptake ( $V_{02}$ ), carbon dioxide discharge amount ( $V_{C02}$ ), RQ ( $V_{C02}/V_{02}$ ), respiratory frequency (RF), work (W) and ventilation (VE). Through the response of the heart rate during exercise and understand the movement of the body loading. Then can estimate the personal physical stamina level.

## Introduction

"Sport has become a cultural industry", this sentence for modern people, has a special significance. Unfortunately, there are still some people who seldom exercise. Many famous quotes every one all know, people must move to live. Exercise can physical fitness, enhance the resistance etc. Every one all know the causes of adult diseases of civilization among the most likely are due to lack of exercise.

The lack of exercise cause inadequate physical, cardiopulmonary dysfunction, poor circulation, poor metabolism, nervous and endocrine system adverse, muscle and joint degeneration, people can easily aging. It is afraid for the results of do not excise. Some researches have discussed the effect of physiological states due to different state of motion [1-6]. The purpose of this study is to understand the people's level of fitness. And then provide some warning to reach the goal of promoting national sport.

## **Exercise equipment**

The equipments include wooden, treadmill, bicycle dynamometer and Metasoft instrument software and subjective rating scale (RPE).

# Research method and step

To discussed under the three operations (stair stepping, treadmills and bikes) with different workloads. Observe their physical work ability index load (LOAD) and heart rhythm (HR) relationship. Because muscle strength during operation, HR and operations performed by proportional relationship with strength. Also in the personal, non-maximum load of all the body load level. The HR level of resistance into the person's fitness level and has an inverse relationship. So in order to understand the individual's fitness level, this study was conducted PWC (Physical Work Capacity) of the stepping test, treadmill test and bicycle experiment; called PWC (Physical Work Capacity) at work for the heart and lungs to supply energy to the maximum capacity of the body tissues.

The standardized test procedures and precautions of PWC are as follows:

- i) Subject officers within 2 hours before the test. Do not eat, smoke and is at rest or with mild active. In testing must be dressed in light sportswear.
- ii) The first before of test to measure and record the basic information of subject officer including age, height, weight etc.
- iii) The test is staring by a low load level stage. Each stage of the load is increasing by the arithmetic. To make the subject officer of the body and the heart may be in a desirable state. The intermediate stages can be given appropriate time to rest.

Maximal oxygen uptakes amount are estimated by test of stepping, treadmill and bicycle dynamometer.

## **Experimental I: Walking for stepping**

If the metronome remains the same, the work will increase with increasing ladder step height. When the step height is same, the work is increasing by the metronome rhythm increases. The speed of stepping is following the metronome rhythm. The metronome rhythm has four types, is up, up, down, down, subjects had to up and down with the rhythm of a metronome.

### **Experiment II: Running for treadmill**

Treadmill test adjust the speed according the different subject officers. Then can provide maximum load of cardiopulmonary system.

## **Experiment III: Cycling**

The difference of bicycle dynamometer and treadmill is that the subject is supported by the seat. The load is in accordance with the initial speed and the load of wheel. This means that with the same work, light of the subjects of the maximum oxygen uptake mount is higher than heavier subjects.

#### **Result analysis**

#### **Experiment of walking for stepping.**

The Fig.1 presents the effect of exercise of stepping. The heart rhythm (HR) is increased as time increases. As work (W) increases the heart rhythm (HR) increases subsequently. The proportional with time is HR and  $V_{0_2}$ . Similarly the proportional with W is HR and  $V_{0_2}$ . But the inversely proportional with time is  $V_{C0_2}$  and the ratio of  $V_{0_2}$  and  $V_{C0_2}$  (RQ).



Fig.1: Experiment of walking for stepping

#### **Experiment of running for treadmill.**

The Fig.2 presents the effect of exercise of running for treadmill. As time increases the HR and  $V_{\mathrm{O}_2}$ increase subsequently. The RQ is decreased due to time increases, but is balanced after 270 second. As the amount of  $V_{CO_2}$  increases the HR increase subsequently. As time increases the HR and  $V_{O_2}$ increase.



Fig.2: Experiment of running for treadmill

## Experiment of cycling dynamometer.

The Fig.3 presents the effect of exercise of bicycle dynamometer. This presents the proportional relationship between time for HR, time for Vo2, W for HR and VE for Vo2. But is the inverse proportional relationship between V<sub>CO2</sub> for RQ. This study is according to the experimental data to find the regression equation. The equation based on the maximum heart rate Max HR = 220-age (bpm). And finally to identify the Max HR value into the regression equation, the estimate of the individual Max Vo<sub>2</sub> (PWC).



Fig.3: Experiment of bicycle dynamometer

#### Conclusion

In this study is measurement heart rate,  $V_{CO_2}$ ,  $V_{O_2}$ , VE, W and RQ. The heart rate and exercise intensity are all very close. Through the heart rate response during exercise can understand the physical load. Exercise intensity to 60-80% of maximum heart rate is better. The basic exercise intensity is feeling a little gasp but can also speak. Maximum heart rate is 220 - age to estimate.

Affect the level of oxygen uptake were body weight, gender, age, height, genetics and activity level and so on. Maximal oxygen uptake by the body weight significantly affected. Maximal oxygen uptake per unit weight is often a relative oxygen consumption, to represent the body's ability to use oxygen. Gender factors also affect the maximal oxygen uptake of the main factors. Men typically maximal oxygen uptake (the relative values divided by weight) approximately 15% more than women. Generally student's maximal oxygen uptake, men and women were only 45 and 40 ml / kg / min respectively.

People out of the lungs with each breath of air volume, called the tidal volume (TV), about the equivalent of a large cup of air. The breaths frequency varies between roughly 8-15 times. The ventilation is tidal volume of each breath and breathing frequency multiplied approximately 5-8 liters. The maximum amount of ventilation per minute called maximum pulmonary ventilation ( $VE_{max}$ ). This value is about the size of between 120 to 140 liters.

The human heartbeat rhythm and oxygen demand are proportional to the work (W). The RQ decreases in ladder step and treadmill after 200 second. The RQ of cycling is decreased due to time increases.

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