

Comparing two methods of exercise intensity indexes in asthma patients

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Abstract. Background and Aim: American College of Sport Medicine (ACSM) assumes that %HRR provides the same intensity as the equivalent %VO_{2Max}. But, recently some studies suggested that some factors particularly kind of disease is influenced the relationship between exercise intensity indexes. **Material and methods:** Thirty adult males with asthma performed a cycle ergometry test according YMCA protocol and heart rate and VO₂ of each stages of test measured and monitored. HR and VO₂ were used for calculation %HRR, %VO_{2max}, and %VO_{2R} in each stage. Liner regression analysis used for determine relations between %HRR, %VO_{2max}, and %VO_{2R}. **Results:** The correlation between %VO_{2max} and %HRR was lineally but the regression line is not according to the identity. In addition, the data showed that in these patients the correlation between %VO_{2Max} and %VO_{2Reserve} is perfectly. **Conclusion:** Our finding demonstrated that percentage of maximal oxygen uptake (%VO_{2Max}) provides the same intensity as the equivalent percentage of maximal oxygen uptake reserve.

Keywords: Exercise intensity, Heart rate, Maximal oxygen consumption

1. Introduction

Intensity is an essential part of the traditional cardiovascular exercise-rehabilitation recommendations. An optimal exercise prescription for improving in cardiovascular fitness is a balance between the frequency, intensity and duration of exercise and exercise-rehabilitation mode (1). Exercise intensity is a major factor affecting the efficacy of an exercise intervention (1). Determine and using the appropriate exercise intensity when prescribing exercise-rehabilitation is an important factor in effectively improving cardiorespiratory fitness in patients. Some of these indexes consist of %VO_{2max}, %HRmax and %HRR. Using the appropriate exercise intensity when prescribing exercise-rehabilitation is an important factor in effectively improving cardiorespiratory fitness. For exercise prescription purposes in normal people, the American College of Sport Medicine (ACSM) assumes that a percentage of heart rate reserve (%HRR) provides the same intensity as the equivalent percentage of maximal oxygen uptake (VO_{2Max})(2). But, recently some studies suggested that some factors particularly kind of disease is influenced the relationship between exercise intensity indexes (3, 4). Percentage of maximal oxygen uptake reserve (%VO_{2R}) in new method for determines exercise intensity that represents a percentage of the difference between VO_{2rest} and VO_{2peak} (5, 6). The clinical studies demonstrated those Individuals that are at high risk, such as those with cardiac, pulmonary, and other chronic diseases, which develop signs of exertional intolerance such as ischemia or hypoxemia at specific workloads, need accurately computed and prescribed exercise intensity (5). The swain et al study showed that the fitness level is significantly affecting the relationship between exercise intensity indexes (8). A review on studies in this area indicates that regardless the accuracy ACSM guideline for prescription exercise intensity for healthy people but the relationship between exercise intensity indexes should be determined directly in each patient (9). Therefore; it seems that the relationship between these indexes should be determined directly in each patient. In this study, we investigated the relationship between %VO_{2max}, %VO_{2R} and %HRR in asthma patients.

2. Methods

In this study, to evaluate the relations between %HRR, %VO₂max, and %VO₂R in asthma patients and to check whether the intensity scale recommended by ACSM is also applicable to this specific population. We studied this objective in 30 patients with mild – moderate asthma (30 – 45 aged). For this purpose, all patients performed a cycle ergometry test according YMCA protocol.

Testing protocol: All subjects performed the McMaster protocol (Submaximal and specific for children) (2) on an electronically braked cycle ergometer (Ergo Tunturi, E604, Finland). The test was preceded by a 2 minute warm-up period. A physician supervised each test. The protocol is performed in four stages that the time of each stage was two minute. In first stage, power output was set at 12.5 watt. Then the power output was increased by 25 watt in each stage or every 2 minute. On the other hand, the power outputs in other stages were: 37.5 watt in second stage, 62.5 watt in third stage and 87.5 watt in forth stage. Subjects were instructed to maintain a constant pedal rate throughout the entire test. All subjects were verbally encouraged to continue exercise until final stage. For each subject, HR and VO₂ was monitored continuously, and recorded in the rest and over the last 10 of each stage of the MacMaster ergometry protocol, as well as during the final 10 s of test and used of those for calculation exercise intensity indexes (%VO₂max, %VO₂R, %HRR). HR monitored by polar telemetry. VO₂ in each stage calculated by ACSM guideline on cycle ergometer (10). Vo₂ is the volume of oxygen consumed at any level of activity and VO₂ max is the aerobic capacity. Individual linear regressions based on HR and VO₂ values measured end of each stage, and maximum, were used to calculate slopes and intercepts, and to predict %HRR, %VO₂max, or %VO₂R for a given exercise intensity.

3. Results

Results indicated that the correlation between %VO₂max and %HRR is lineally in these patients but they are not equivalent together and the regression line is not according to the identity line (R = 0.76)(figure 1). In addition, the data showed that in these patients the correlation between %VO₂Max and %VO₂Reserve is perfectly lineally and regression equation is (%VO₂max = 0.91 × %VO₂R + 9.9, R=0.99). Therefore percentage of maximal oxygen uptake (%VO₂Max) provides the same intensity as the equivalent percentage of maximal oxygen uptake reserve (Figure 2).

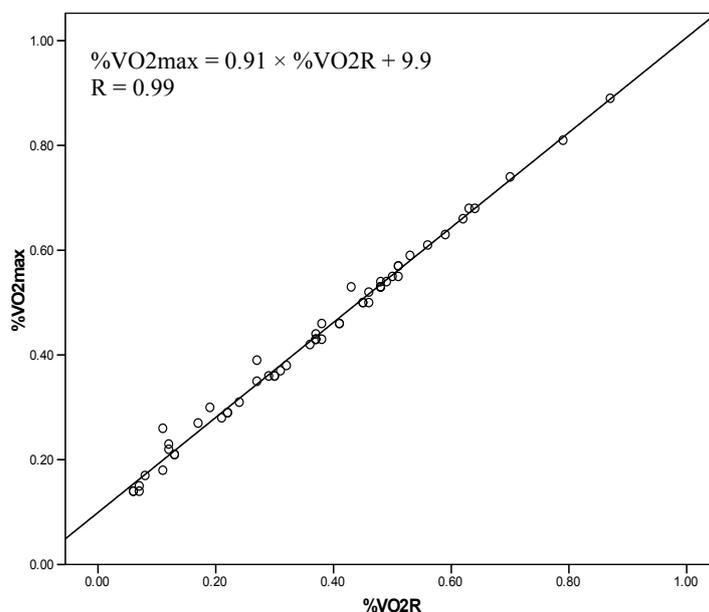


Figure 2. Regression of %VO₂max versus %VO₂R in asthma patients

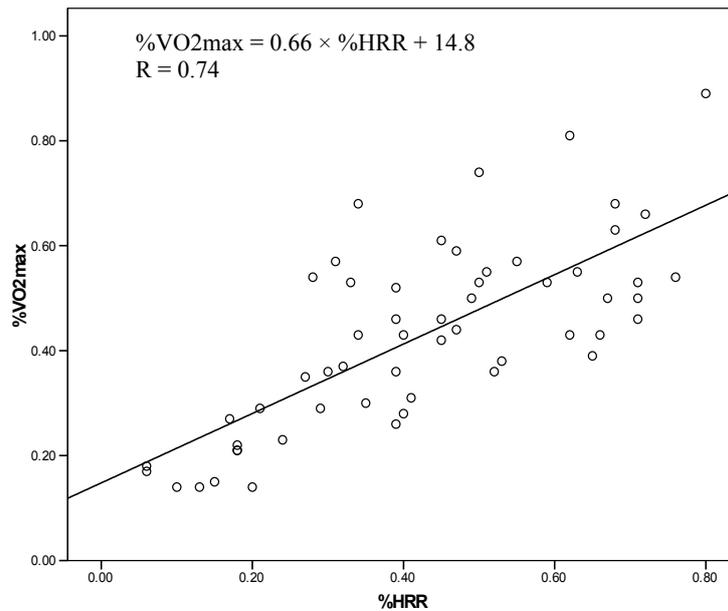


Figure 1. Regression of %VO₂max versus %HRR in asthma patients

4. Discussion / Conclusion

Asthma is a chronic lung disease that inflames and narrows the airways. Exercise- rehabilitation program used for improving cardiorespiratory fitness in asthma patients. Physiological benefits gained from exercise training rely primarily on the intensity of the training stimulus. A critical component of cardiac rehabilitation (CR) is an individualized exercise prescription that defines appropriate type, duration, frequency, and intensity of exercise specific to the patient's condition. American College of Sports Medicine (ACSM) presumed that for normal people, Heart rate (HR) monitoring represents a promising tool for measurement because it is a physiological parameter that correlates well with energy expenditure (EE) and since HR monitoring in fielded exercise is facility and feasible, the more studies used of %HRmax or % HRreserve as a suitable method for prediction of %VO₂max (2). Recently, the some research showed that relationship between these indexes described by ACSM is not applicable to the some patient population (6, 7, 8). Our findings demonstrated that intensity values in each stage of protocol for basis %VO₂max is equal to %VO₂R (with at least difference) in asthma patients, so that the values of two exercise intensity indexes included %VO₂max and %VO₂reserve are equivalent and with enhancing exercise workload lead to increasing relationships and correlation between these indexes. Of course, the relationship between %VO₂max and %HRR also is close, but this relation is lower significantly. In the other hand, the regression of %VO₂max versus %VO₂R was significantly closer to the line of identity than was the regression of %HRR versus %VO₂R. Our finding according other studies on patient's population are suggested that the regression pattern in each disease is difference to normal people and the relationship between these indexes should be determined directly in each patient. In addition, future studies are necessary to determine equivalency between these indexes in the each disease.

5. References

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