# The American College of Sports Medicine Exercise Intensity Guidelines for Cardiorespiratory Fitness: Theoretical or Practical?

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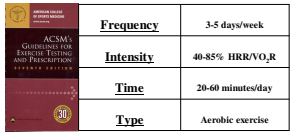


| | |
|---|---|
| Frequency | 3-5 days/week |
| Intensity | 40-85% HRR/$VO_2R$ |
| Time | 20-60 minutes/day |
| Type | Aerobic exercise |

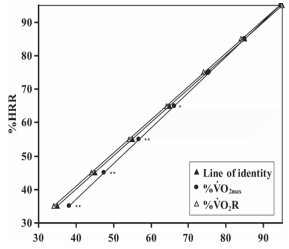
## Abstract

**Purpose:** To quantify the misinterpretation and misapplication of the current American College of Sports Medicine (ACSM) exercise intensity guidelines for cardiorespiratory fitness, based on exercise prescription by means of $\%VO_2$max rather than %HRR or $\%VO_2R$. **Methods:** A literature review was completed to identify research studies conducted on the effects of exercise training on $VO_2$ in adults from 2000 to present. References from research articles were cross-referenced for additional studies. **Results:** Seven instances of misinterpretation were identified in which exercise intensity was referred to in $\%VO_2$max terms, yet incorrectly cited as the current guidelines. Twenty-two instances of misapplication were identified; prescribing exercise intensity in terms of $\%VO_2$max, rather than in currently recommended terms of either %HRR or $\%VO_2R$. **Conclusions:** Based on the review of many research studies, there is considerable misinterpretation and misapplication of the ACSM exercise intensity guidelines. According to Swain and Franklin (2002), the utilization of $\%VO_2R$ allows for equal adjustment from resting $VO_2$ to target $VO_2$ among individuals with unequal fitness levels, while exercise prescription in terms of $VO_2$max does not allow for this equal adjustment. Therefore, when prescribing the same exercise intensity to individuals among different fitness levels by $\%VO_2$max, the results will be an unequal adjustment from rest to target $VO_2$. Researchers prescribing intensity in terms of $\%VO_2$max are introducing error, especially at lower intensity levels. The result is inadequate exercise treatment programs among individuals and inaccurate exercise guidelines recommended and published, which may be attempting to standardize exercise. Continued use of exercise intensity prescribed in terms of $\%VO_2$max perpetuates an outdated recommendation and offers different training stimuli among individuals. Exercise prescription in terms of $\%VO_2R$ places individuals with different fitness levels at equivalent relative exercise intensities, allowing for a more accurate conversion from resting $VO_2$ to target $VO_2$, resulting in more successful treatment programs and more valid recommendations pertaining to all individuals. In conclusion, our main recommendation is for exercise professionals to integrate the current exercise intensity guidelines for the development and maintenance of cardiorespiratory fitness into research and practice.

## Introduction

Cardiorespiratory fitness is the collective ability of the cardiovascular and pulmonary systems to deliver oxygenated blood to contracting skeletal muscle. Cardiorespiratory fitness can be used as a good indicator of overall health; low levels of cardiorespiratory fitness have been associated with an increased risk for cardiovascular disease and premature death, while moderate to high levels of cardiorespiratory fitness have been attributed to longevity and a decreased risk for cardiovascular disease. The American College of Sports Medicine (ACSM) currently recommends 20-60 minutes of aerobic exercise 3-5 days/week at an intensity of 40/50-85% of heart rate reserve (HRR) or oxygen uptake reserve ($VO_2R$) [calculated from the difference in resting and maximal oxygen levels], as the ratio of %HRR to $\%VO_2R$ is more ideal. Prior to 1990 exercise was prescribed in terms of $\%VO_2$max, however, in 1998 the ACSM revised the exercise intensity guidelines based on the discrepancy between %HRR and $\%VO_2$max, with increased levels of inaccuracy among sedentary or low-fit individuals exercising at lower intensities (illustrated in Figure 1 – Lounana et al. 2007). Despite the shift from prescribing exercise in terms of $\%VO_2$max to $\%VO_2R$, many researchers continue to refer to and/or apply the out-of-date and inaccurate guidelines.

**Figure 1. Regression lines for predicted values of $\%VO_2$max and $\%VO_2R$ at a given value of %HRR**



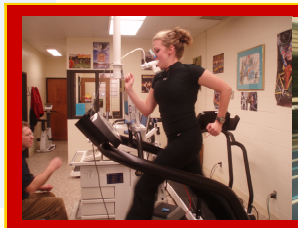

## Purpose

The purpose of this study was to quantify the misinterpretation and misapplication of the current American College of Sports Medicine (ACSM) exercise intensity guidelines, based on exercise prescription in terms of $\%VO_2$max rather than %HRR or $\%VO_2R$. Misinterpretation refers to a misunderstanding of the guidelines while misapplication consists of incorrectly applying the guidelines.

## Methods

- MEDLINE search (2000-2007) performed: Exercise Intensity (independent variable); Cardiovascular fitness (dependent variable). Key words: Cardiovascular fitness, aerobic fitness, endurance training, exercise training, maximal oxygen uptake, and $\%VO_2$max.
- Reference list of articles obtained and were cross-referenced for additional studies.
- 2001-2007 MSSE (Medicine & Science in Sports & Exercise) issues were perused for exercise training studies with prescribed intensity in %HRR, $\%VO_2R$, and %HRmax (ACSM recommended), as well as $\%VO_2$max (not-recommended).

**Table 1. Brief summary of sources misinterpreting the current ACSM exercise intensity guidelines**

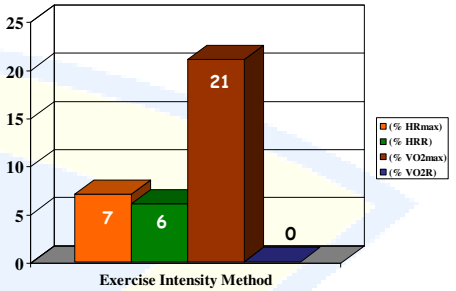


| Authors | Year | Publication |
|---|---|---|
| Branch et al. | 2000 | Journal of Women's Health & Gender-Based Medicine |
| Asikainen et al. | 2002 | British Journal of Sports Medicine |
| Teh & Aziz | 2002 | Medicine & Science in Sports & Exercise |
| Morss et al. | 2004 | Medicine & Science in Sports & Exercise |
| Pintar et al. | 2006 | Medicine & Science in Sports & Exercise |
| Mackinnon et al. | 2003 | Exercise Management Textbook |
| McArdle, Katch, & Katch | 2007 | Exercise Physiology Textbook (6th ed) |

## Results

Seven instances of misinterpretation were identified; discussing exercise intensity in $\%VO_2$max terms and referring to them incorrectly as the current ACSM exercise intensity guidelines. Twenty-two instances of misapplication were identified in which training studies prescribed exercise intensity by means of $\%VO_2$max rather than in %HRR or $\%VO_2R$. Table 1 displays the seven sources of misinterpretation of the current ACSM exercise intensity guidelines. Figure 2 summarizes the method of exercise intensity prescribed in training studies from MSSE publications from 2001-2007.

**Figure 2. MSSE publications (2001-2007) of training studies and the method of exercise intensity prescribed**




## Summary and Conclusions

- Cardiorespiratory fitness has been attributed to longevity and a decreased risk for cardiovascular disease. Specific guidelines have been set by the ACSM on how to maintain and improve this physiological parameter.
- Based on the review of many research studies, there is considerable misinterpretation and misapplication of the current ACSM exercise intensity guidelines for cardiorespiratory fitness.
- The utilization of $\%VO_2R$ allows for an equal adjustment from rest to target $VO_2$ among individuals with unequal fitness levels. In comparison, when prescribing the same exercise intensity to individuals among different fitness levels at $\%VO_2$max, the results will be an unequal adjustment from rest to target $VO_2$.
- Researchers prescribing exercise intensity in terms of $\%VO_2$max are introducing error. The result is inadequate exercise treatment programs among individuals coinciding with inaccurate exercise guidelines recommended and published.
- Exercise prescription in terms of $\%VO_2R$ places individuals with different fitness levels at equal relative intensities, allowing for a more accurate conversion from rest to target $VO_2$, and therefore, will ultimately result in more successful treatment programs and more valid recommendations pertaining to all individuals.
- Continuing to prescribe exercise intensity in terms of $\%VO_2$max perpetuates an outdated recommendation, adds a confounding variable in research, leading to invalid recommendations and inappropriate standardization of exercise, and potentially creates confusion amongst the general population.
- Based on our current findings, we conclude that there is considerable misinterpretation and misapplication of the current ACSM exercise intensity guidelines. We recommend exercise professionals integrate the current guidelines into both research and practice.

## References

- AMERICAN COLLEGE OF SPORTS MEDICINE. *ACSM's Guidelines for Exercise Testing and Prescription*, 7th Ed. Philadelphia: Lippincott Williams & Wilkins, 2006, pp. 139-147.
- Lounana, J., Campion, F. Noakes, T.D., & Medelli, J. Relationship between %HR max, %HR Reserve, $\%VO_2$max, and $\%VO_2$ Reserve in Elite Cyclists. *Med. Sci. Sports Exerc.* 39:350-357. 2007.
- Swain, D.P. & Franklin, B.A. Dose-response to exercise in women aged 45-75 yr (DREW): Design and Rationale. *Med. Sci. Sports Exerc.* 36:336-344. 2004.