ABSTRACT

KELSO, A.J. Strategies for provoking speech during the Talk Test. MS in Adult Fitness/Cardiac Rehabilitation, December 2002, 25pp. (C. Foster)

The Talk Test (TT) has been shown to be effective in prescribing exercise. Two strategies have been widely used: recitation of a standard paragraph during incremental exercise, and responding to recorded interviews during steady-state exercise. We compared heart rate (HR) and work rate (METs) responses using the two strategies. Healthy volunteers (n=20) performed incremental exercise tests to define ventilatory threshold (VT) and intensity associated with TT and a free-range walk while responding to recorded questions. During the TT, %HRR (78 +/- 9 vs 78 +/- 7), % METs (77 +/- 6 vs 79 +/- 6), HR 166 +/- 18 vs 165 +/- 13 bpm), and METs (9.7 +/- 0.9 vs 9.9 +/- 0.8 METs) for the strategies weren't significantly ($p<0.05$) different from each other and were within ACSM guidelines. HR and METs during TT were not different than HR and METs at VT (174 +/- 18 bpm and 10.6 +/-0.9 METs). HR ($r=0.79$) and METs ($r=0.65$) were well correlated between the strategies. We conclude that different strategies for using the TT result in a common exercise intensity that is very close to VT. Our data support the generalizability of the TT as a method of prescribing exercise.

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STRATEGIES FOR PROVOKING SPEECH DURING THE TALK TEST

A MANUSCRIPT STYLE THESIS PRESENTED

TO

THE GRADUATE FACULTY

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OF THE REQUIRMENTS FOR THE

MASTER OF SCIENCE DEGREE

BY

AMY KELSO

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TABLE OF CONTENTS

LIST OF TABLES

TABLE PAGE

LIST OF FIGURES

FIGURE PAGE

LIST OF APPENDICES

APPENDIX PAGE

INTRODUCTION

Most individuals entering a fitness program are taught about the components of exercise: mode, intensity, frequency, duration, and progression. It is well known that the most difficult component to assess and prescribe is the intensity of exercise.

There are several strategies for prescribing exercise intensity including metabolic equivalents (METS) derived from a percentage of maximal oxygen consumption (VO_2max), percentages of maximal heart rate (HRmax), a fractional percentage of the ventilatory threshold (VT), and subjective markers including Rating of Perceived Exertion (RPE), and more recently, the Talk Test (TT). The two subjective measures of intensity, RPE and the Talk Test, use an individuals' own perceptions of how hard they are working during exercise as the basis of monitoring training intensity.

The greatest value of the RPE scale is that it provides exercisers of all fitness levels with easily understood guidelines regarding exercise intensity (1). The TT involves asking a subject to exercise while carrying on a conversation or structured speech. This method is easy to apply to the general population due to the fact there is nothing to comprehend or charts to use.

The first studies regarding the TT took place in 1995 (2) and again in 1997 (3). Exercise intensities where subjects could still speak comfortably fell within ACSM's recommendations of 60-90% of VO_2max in both studies. Another study performed in 2000 (4) demonstrated that the TT could be used with a college-aged population and was closely correlated with the VT. In this study, the results also fell within ACSM's

exercise intensity guidelines of 60-90% of VO_2max (5,6). More recent studies have demonstrated that the TT can be used in patients with stable heart disease (7), untrained healthy adults (8), and athletic individuals (9). Porcari et al. (6) suggest that the highest intensity at which an individual can still speak comfortably is a good marker of VT across a wide range of populations.

The two laboratories (Detroit and La Crosse), where work with the TT has been done, use somewhat different strategies. The Detroit protocol involves a taped interview which asks the participant to keep their intensity low enough so that they can still respond to the interview. The La Crosse protocol involves using a standard paragraph repeated during each stage of an incremental exercise test, with focus on the relationship between the TT and the VT. The purpose of this study is to compare the physiologic responses during exercise at the intensity associated with "passing" the TT using these two different strategies.

METHODS

Subjects

All of the subjects were university students or staff and were classified as moderately active, meaning they exercised aerobically 3-5 times a week for 30-60 minutes and were capable of running for 30 minutes straight. The participants were in good health and had no history or symptoms suggestive of cardiovascular disease. Informed consent was obtained prior to testing and the Institutional Review Board for the Protection of Human Subjects had approved the protocol. Characteristics of the subjects are presented in Table 1.

Table 1. Means and Standard Deviations of the Characteristics of Subjects

Variable	Men (n = 4)	Women (n = 16)
Age (yrs)	21.8 ± 1.5	22.3 ± 2.4
Height (cm)	179.0 ± 5.0	167.5 ± 6.5
Weight (kg)	77.5 ± 3.8	63.3 ± 6.4
VO_2peak ($L*min^{-1}$)	3.50 ± 0.52	2.79 ± 0.34
VO_2peak ($ml*min^{-1}*kg^{-1}$)	45.0 ± 4.6	43.6 ± 3.4
VO_2peak (%predicted)	94 ± 9	111 ± 8
VO_2 at VT ($L*min^{-1}$)	2.73 ± 0.43	2.35 ± 0.30
VT (%VO2peak)	78 ± 3	84 ± 4
HRpeak ($b*min^{-1}$)	196 ± 13	191 ± 13
HR at VT ($b*min^{-1}$)	174 ± 18	171 ± 14
% HRpeak at VT	89 ± 15	90 ± 3

Protocol

Each subject performed three exercise tests in one day. A Modified Balke treadmill protocol was used for the first test. Each subject exercised to fatigue. The subject warmed-up for five minutes by walking on a horizontal treadmill at a slow speed. At stage one, the belt speed for the test was increased to 3.5 mph. The grade was initially 0% and was increased by 2% every 2 minutes. At stage seven of the test, the speed was increased to 5.0 mph and the grade was brought back to 0%. The grade was again increased 2% every two minutes. At stage thirteen of the test, if the subject was still going, the speed of the treadmill was increased to 6.0 mph. The grade at this stage was maintained at 10%, and was then to be increased by 2% for the subsequent stages. This exercise test was performed while measuring respiratory gas exchange using open circuit spirometry. VT was identified using the V slope method during this test (10).

Radiotelemetry was used to monitor HR at each minute of the exercise test. The RPE was recorded at the same time (11).

The next two tests were performed in random order, without measuring respiratory gas exchange. One test (La Crosse protocol) consisted of incremental treadmill exercise using the same treadmill protocol, but with the requirement of reciting the Pledge of Allegiance (PoA), a 31-word paragraph well known to most people in American culture during the last minute of every stage. The test was terminated when the participant answered the question, "Can you still talk comfortably?", with the answer "No." The other test (Detroit protocol) performed by the participant involved a free range 12-minute walk/jog, while listening to a portable cassette player with a recorded structured interview. The participant responded out loud to questions throughout the exercise test and was instructed to adjust their speed so that they could still speak comfortably. If the participant had a hard time answering the questions, they were instructed to slow down, and if it was easy to answer the questions, they were instructed to speed up. The heart rate and speed were recorded at every lap of the test on the track, which was measured at 77 meters in length.

Statistical Treatment

Repeated measures of variance (ANOVA) was used to test the hypothesis that the metabolic intensity and heart rate during the two different approaches to using the TT would be the same, and that both would be comparable to the metabolic intensity and HR at the VT.

RESULTS

Figures 1 and 2 illustrate the average velocity and HR throughout the free range exercise bout. Ambulatory pace and HR were stable over the last six minutes of the protocol. The mean exercise intensity at the last positive stage of the talk test during the incremental exercise test (9.7 ± 0.9 METs) was not significantly different from that during the last 6 minutes of the free range test (9.9 ± 0.8 METs) ($p > 0.05$). Likewise, the HR during the last positive stage of the incremental test (166 ± 18 bpm) was not significantly different from the HR during the last 6 minutes of the free range test (165 ± 13 bpm) ($p > 0.05$) (Figures 3 and 4). The METs (10.5 ± 1.0) and HR (172 ± 15 bpm) at VT were not significantly different from the METs and HR derived using either approach to the talk test ($p > 0.05$). This illustrates that the participants were working below VT during both TT protocols. The lack of mean differences in HR and METs was supported by the generally good correlation between the La Crosse and Detroit data points (Figure 5).

The % maximal METs during incremental (77.3%) and free range (79.5%) tests were within ACSM guidelines (60-80%max METs). Similarly the %HR max (86.3% and 86.1%) and %HRR (heart rate reserve) (78.3% and 78.1%) during the incremental and free range, respectively, approaches to the talk test were also within ACSM guidelines for exercise prescription (5) (Figure 6).

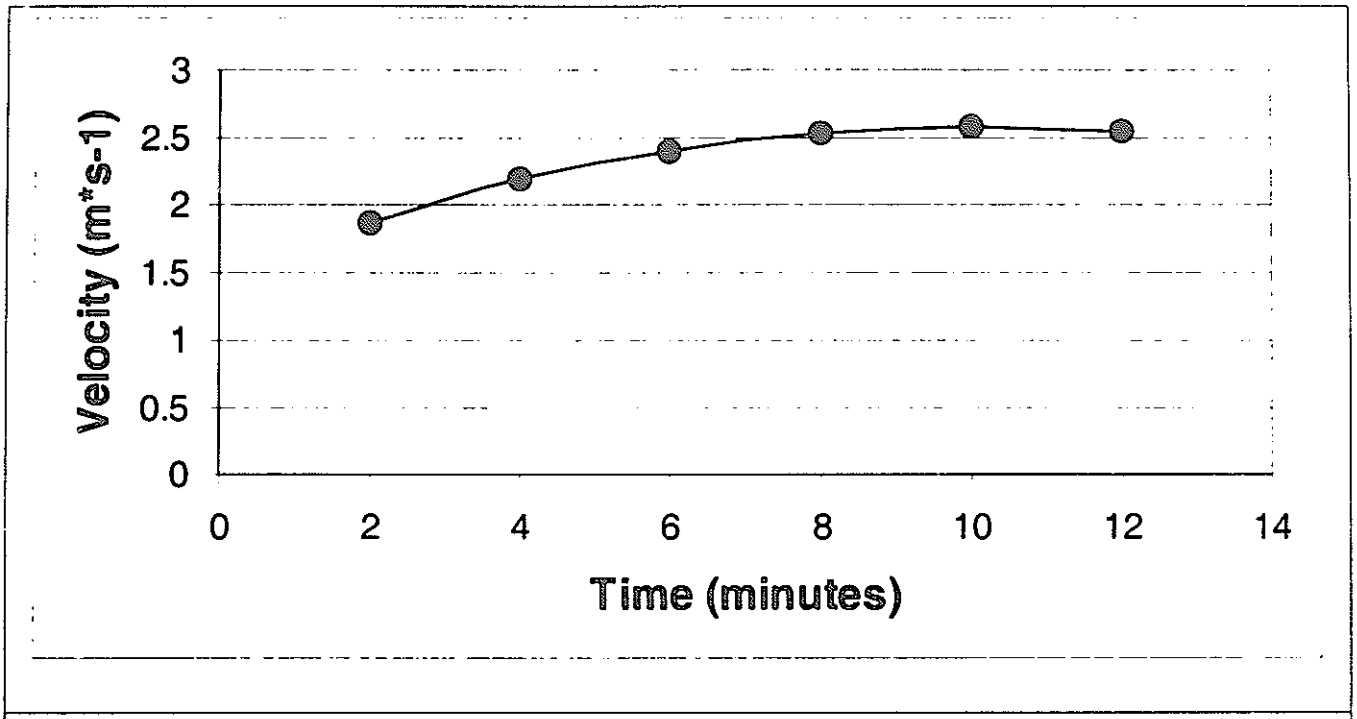

Figure 1. Velocity versus Time during the Detroit TT protocol.

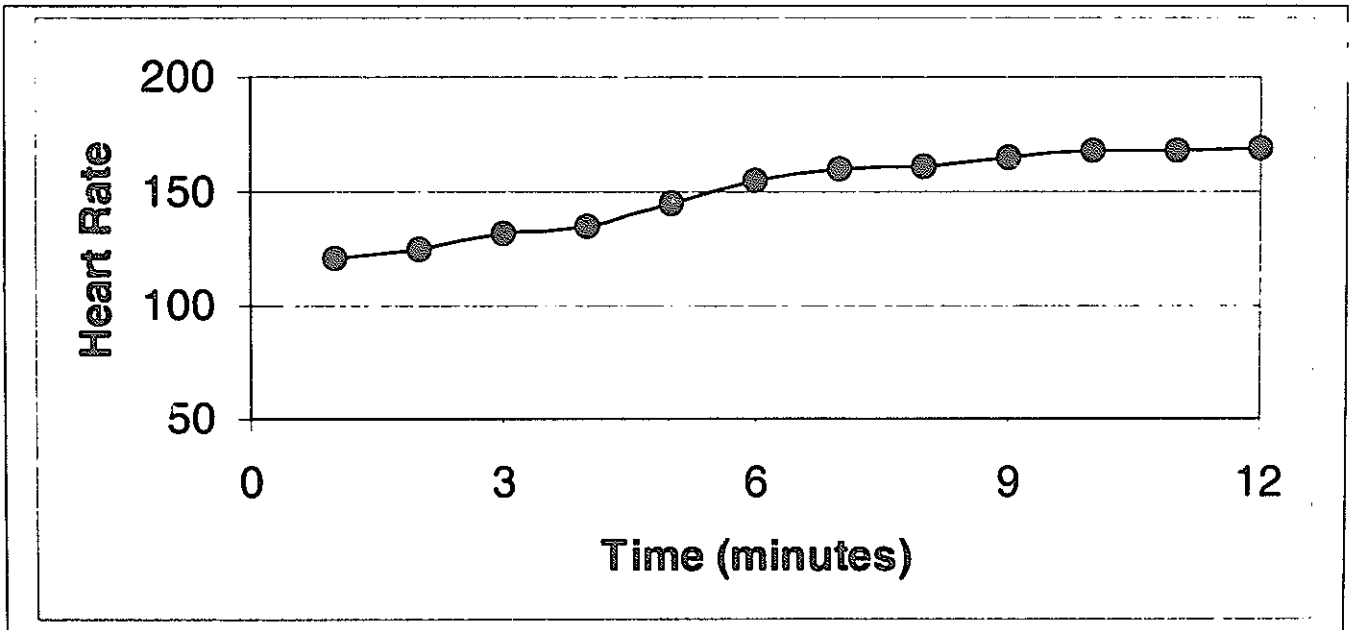

Figure 2. HR versus Time during the Detroit TT protocol.

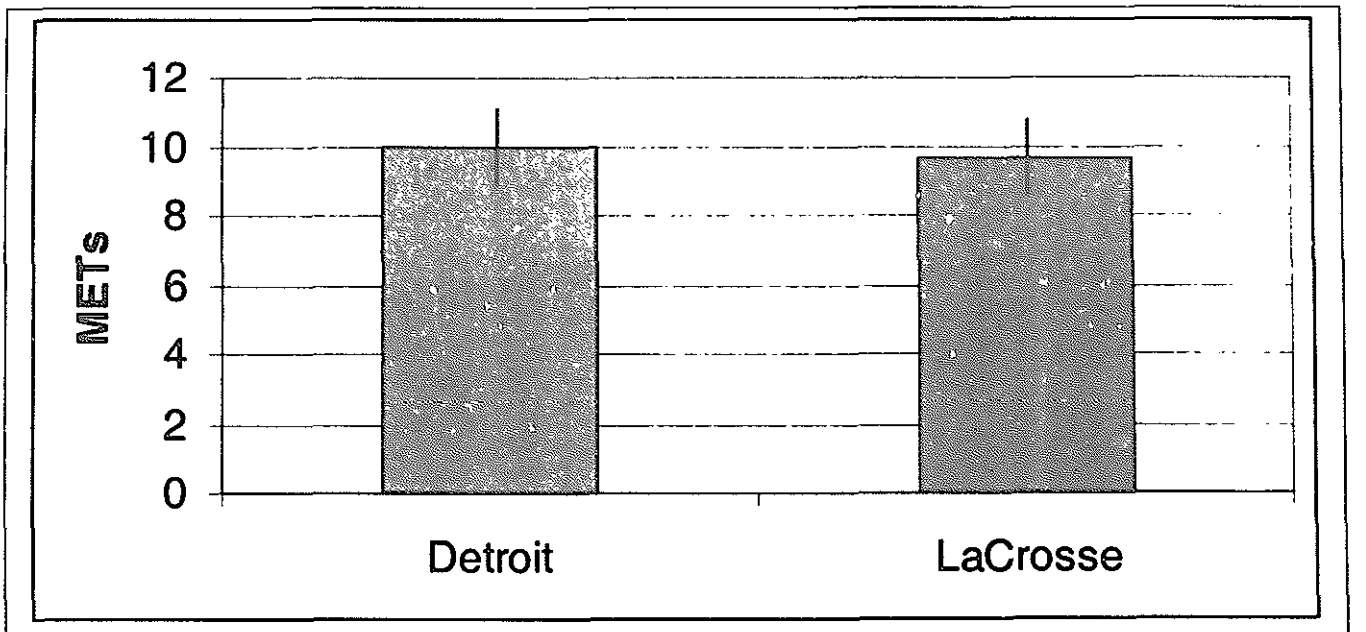

Figure 3. Exercise intensity for Detroit and La Crosse TT protocols (mean ± SD).

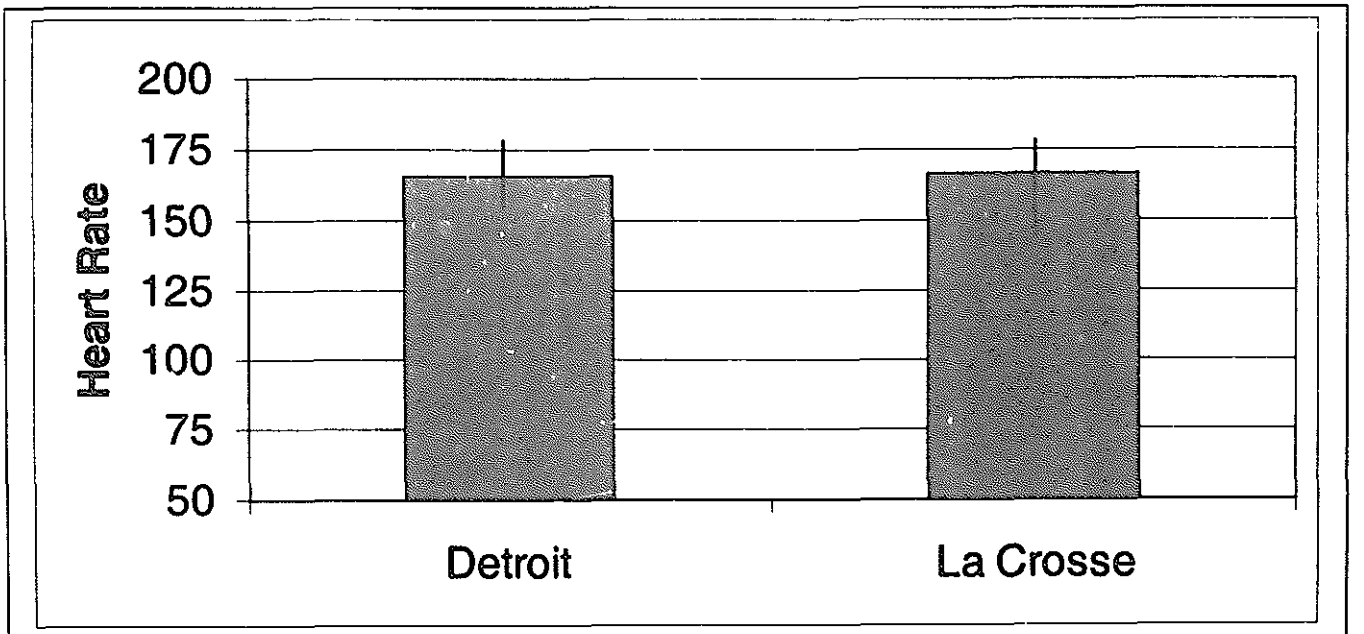

Figure 4. HR for Detroit and La Crosse TT protocols (mean ± SD).

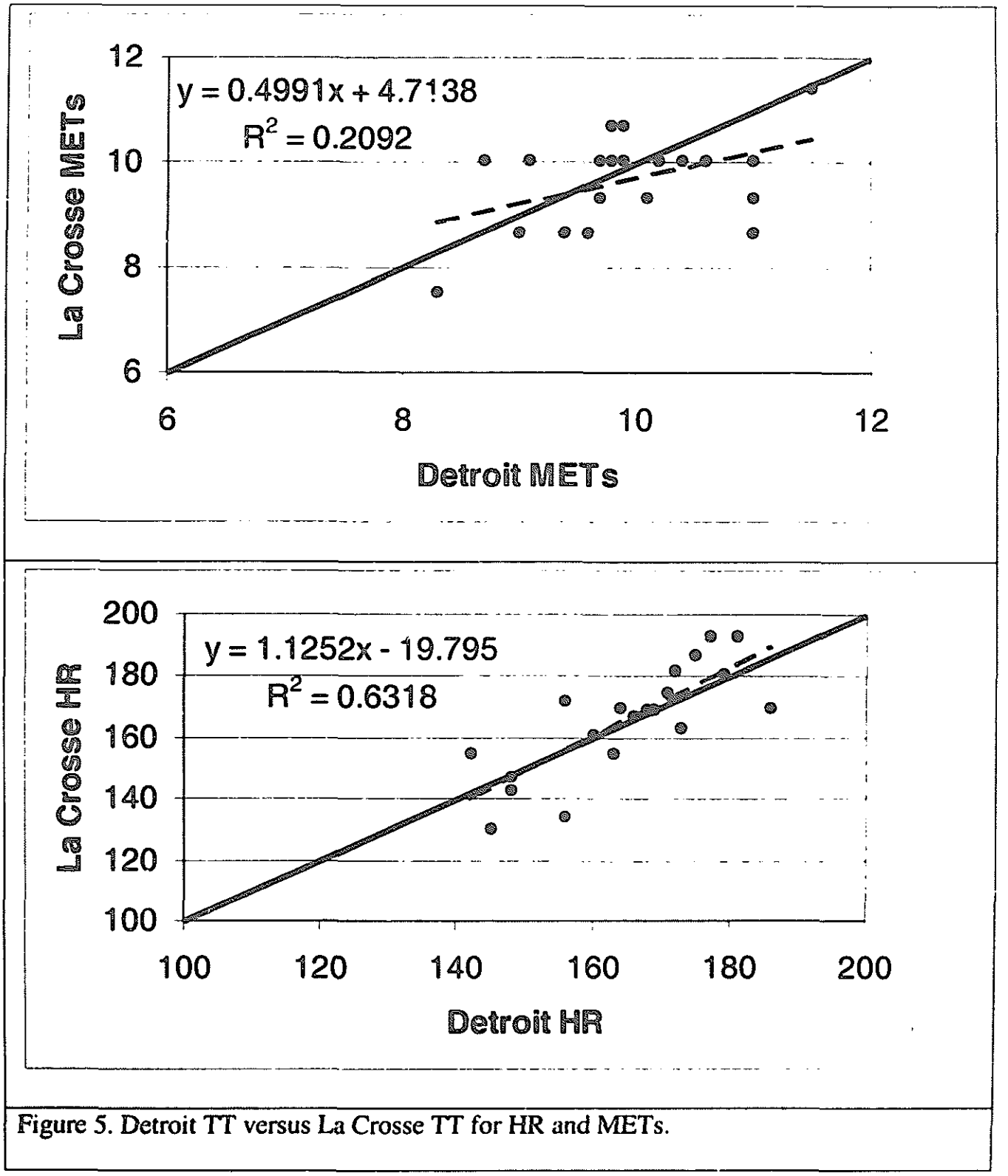

Figure 5. Detroit TT versus La Crosse TT for HR and METs.

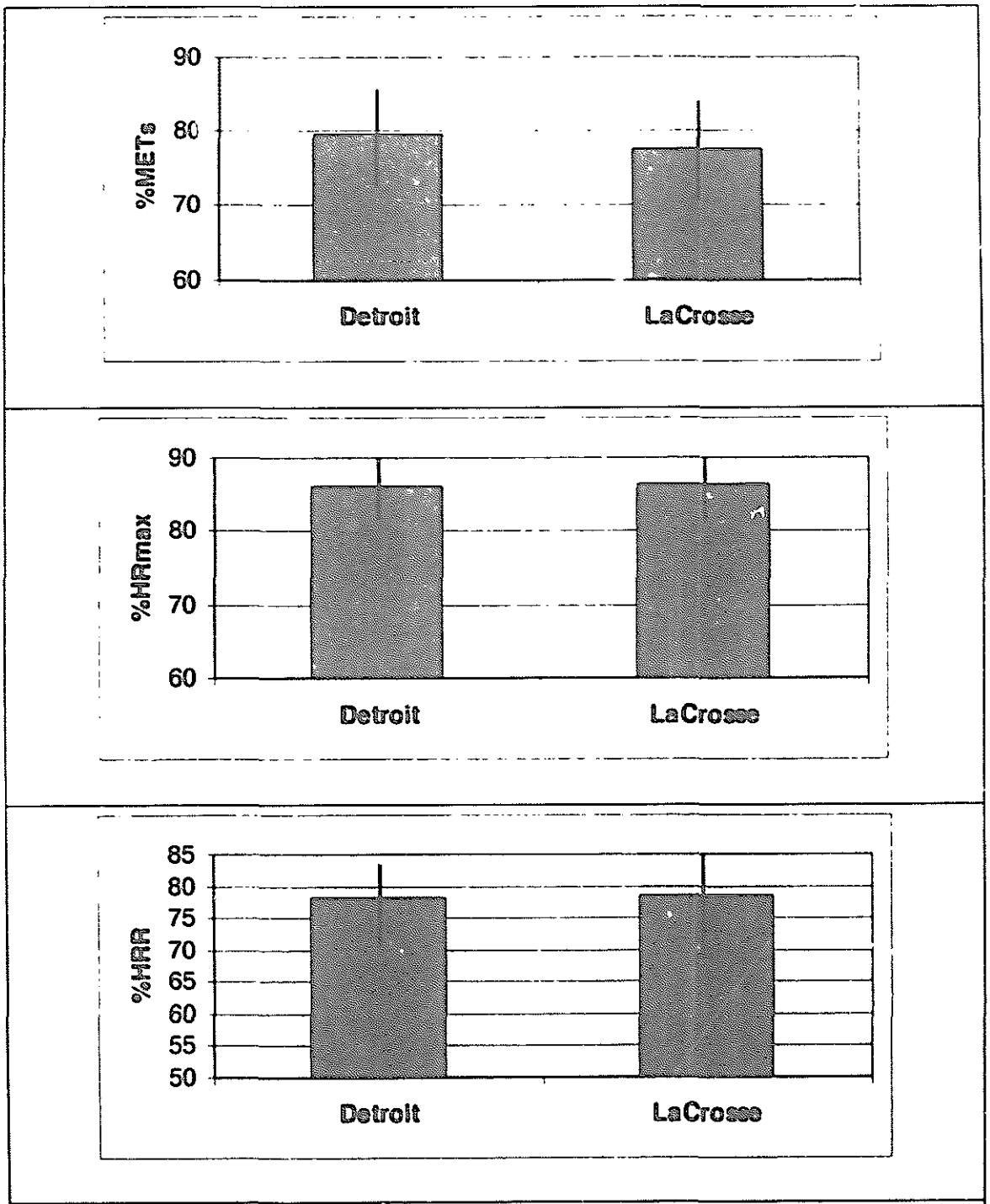

Figure 6. Both TTs within ACSM guidelines for intensity (mean ± SD).

DISCUSSION

The results of this study are consistent with findings from prior studies from our laboratory (4,7,8,9) regarding the relationship between ventilatory threshold and the Talk Test. Specifically, when subjects 'pass' the Talk Test, objective markers of exercise intensity such as %HR max, %HRR, and %METs are within accepted guidelines for exercise training intensity (5). The physiologic responses during exercise (HR and METs) at the intensity associated with 'passing' the incremental and free range TT strategies were not significantly different between the two strategies. As such, the results suggest the generalizability of the TT as a marker of exercise intensity.

Several previous studies have been conducted to research the Talk Test and have demonstrated that the exercise intensity associated with still being able to speak comfortably is below ventilatory threshold. These studies were conducted in university students (4,5,6), untrained healthy adults (8), athletic individuals (9), and patients with stable heart disease (7). This study, as well as previous studies, supports the generalizability of the TT. Thus, the TT (which involves either a structured, recorded interview, or repetition of a standard paragraph) serves to show common conversation can act as a prescriptive tool for intensity of exercise. The TT is easy to apply to the general population and there is nothing to comprehend or charts to use.

There were possible technical limitations to the study. First, the TT protocol used two-minute stages. Ventilatory threshold is best obtained through a shorter stage (12). However, our experience with the technique (4,5,6,7,8,9) is that the act of speaking tends

to modify the sensation of breathlessness and that a relatively long two-minute stage duration is necessary to give reliable results. Also, VO_2 was not measured during the free range approach to identifying the TT. Since the subject was asked to speak out loud consistently, a portable gas analyzer mask device would have been impossible to use for collecting VO_2 data during the 12-minute free range exercise. Also, just because this study shows no significant difference between the two TT strategies with this population doesn't mean it is a universal phenomenon. More research needs to be done comparing these approaches to using the TT in other populations.

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APPENDIX A

INFORMED CONSENT

Informed Consent

STRATEGIES FOR PROVOKING SPEECH DURING THE TALK TEST

I, _____(name), volunteer to participate in a research study conducted at the University of Wisconsin- La Crosse in La Crosse, Wisconsin. I have been informed that the purpose of the study is to compare physiologic responses (heart rate and rate of metabolism during exercise) during exercise at the intensity associated with "passing" the Talk Test, in a healthy population.

I have been informed that my participation will involve three exercise tests, one of which is a VO_2max test (a treadmill test measuring oxygen consumption). I will wear a heart rate monitor on my chest to monitor my heart rate during the tests. During my first test, I will wear a nose clip and a scuba-type mouthpiece to collect and analyze my breathing (this is only performed on the first test). During the test, I will warm up for five minutes by walking on a horizontal treadmill at a slow speed. After this, every two minutes the grade on the treadmill will increase by 2.5%. During the test my heart rate and Rating of Perceived Exertion will be recorded every two minutes until I am fatigued. My participation will involve a second test utilizing the same protocol. During the last minute of every two minute stage of this test, I will be reading "The Pledge of Allegiance" to evaluate how well I can speak during increased workloads. Heart rate and Rating of Perceived Exertion will be recorded every two minutes. The third test will involve a self paced 30-minute walk on the track with a portable cassette player with a recorded structured interview. I will respond to these questions throughout the exercise test and adjust my speed so I can talk. Heart rate and Rating of Perceived Exertion will be recorded every two minutes.

I have been informed the approximate total amount of time that I will be devoting to this research is 3.5 hours total. I have also been informed that I can withdraw from the study at any time for any reason without penalty.

I have been informed of the potential risks of participation in the study, which include muscle soreness, general fatigue and abnormalities in heart rate. The tests will be terminated if complications occur. Personnel trained in CPR and ACLS will be on site. I have been informed that the risk of serious or life threatening complications during exercise testing in patients suspected of having heart disease is 6/10,000 tests, and that in prospectively healthy individuals, like myself, the risk of serious complications approximates zero.

I have been informed the results of this study may be presented or published. However, my name/identity will remain confidential.

I have been informed the benefit I will gain from this study is satisfaction in knowing that I contributed to advances in exercise science, as well as information about my personal fitness level. I have also been informed that this study will provide benefit to society by providing a better understanding of how to regulate exercise intensity to

minimize the side effects associated with exercise training. Lastly, I have been informed if I so desire, a copy of my exercise test results will be provided for my physician.

I have read all of the information on this consent form. I have been informed about the testing procedures, expectations, and risks associated with this study. All of my questions have been answered to my satisfaction. If I have any further questions, I can contact Amy Kelso, (779-4856) the principle investigator, or her research advisor, Dr. Carl Foster, Department of Exercise and Sport Science, UW-La Crosse, La Crosse, WI (608) 785-8687. Questions regarding the protection of human subjects may be addressed to Dr. Dan Duquette, the Chair of the UW-La Crosse Institutional Review Board for the Protection of Human Subjects, (608) 785-8124.

Subject: _____ Date: _____

Investigator: _____ Date: _____

APPENDIX B

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Introduction

Many people across the globe are currently participating in cardiorespiratory fitness programs, thus, there is a need for guidelines of how to prescribe exercise. While some components of an exercise program are relatively straightforward, there is a need to assess the most difficult component, which is intensity. Often, two individuals will receive the same training HR range, but one will perceive the intensity as easy, whereas the other might perceive it as hard.

The question, "How hard should I be working?" is frequently asked, yet the concept of intensity is often overlooked, as it can be measured in many different ways. Several strategies for prescribing exercise intensity are used including percentage of maximal heart rate (HRmax), percentage of maximal oxygen consumption (VO_2max), metabolic equivalents (METS), a fractional percentage of the ventilatory threshold (VT), the Rating of Perceived Exertion (RPE), and the Talk Test (TT). The RPE and the Talk Test, two subjective measures of intensity, are used as the basis for prescribing exercise intensity from individuals' perceptions of how hard they are working. The other objective measures of intensity are not always practical, because exercise tests are required. The RPE scale is of great value in that it provides easily understood guidelines regarding exercise intensity to exercisers of all fitness levels (1). The TT involves asking a subject to exercise while carrying on a conversation or structural speech. The TT method is easy to apply to the general population because there is nothing to comprehend

or charts to use, whereas using RPE involves knowing and understanding the RPE scale (2).

An abundance of research has been done documenting the validity and reliability of the RPE scale. The Talk Test is still not yet as popular, mainly because of the lack in documentation. The available research indicates that the Talk Test offers some advantages over the more commonly utilitezed RPE scale. One study found 48% of subjects would rather use subjective measures to guide their exercise intensity instead of monitoring heart rate (3).

VO_2max

Traditionally accepted by ACSM, cardiorespiratory fitness has been measured by VO_2max (1). VO_2max is defined as the maximal amount of oxygen the body can take in, transport, and use. Often times many fitness programs focus on improving VO_2max (4), but using VO_2max to estimate cardiorespiratory fitness has been in question. VO_2max is limited by peak cardiac output, and therefore muscles don't receive an adequate oxygen delivery during max exercise such as running (5). ACSM concluded that measuring VO_2max kinetics gave information about metabolic potential of exercising muscles instead of the functioning of the cardiovascular, pulmonary, and muscular systems as a whole. This indicates that although VO_2max was historically considered the best at determining intensity levels and cardiorespiratory fitness, it is being questioned for its validity.

Ventilatory Threshold

There are various definitions of the term ventilatory threshold, and much information has been published on it. VT has been used in estimating anaerobic threshold, which can be defined as the oxygen uptake at which blood lactate begins to rise systematically during graded exercise (6). With the advantage of being noninvasive, ventilatory threshold has been used in the past to estimate anaerobic threshold. The validity of this was questioned by Powers, Dodd, and Garner (7) who believed the systematic increase in blood lactate and nonlinear increase in expired ventilation graphed as a function of VO_2 do not always happen at the same point. This is suggestive of a limitation in using VT to estimate anaerobic threshold. For the purposes of this study, VT and anaerobic threshold were defined as separate measures from each other, and VT wasn't assumed to predict anaerobic threshold. As described by Schneider, Phillips, and Stoffolano (8), based on a concept by Beaver, Wasserman, and Whipp (9), ventilatory threshold was determined in this study by using the V-slope method. The elimination or output of carbon dioxide was plotted against oxygen consumption during incremental exercise. Visual interpolation was utilized next to identify where the first nonlinear departure was, with a slope greater than 1.00. This point was determined to be VT. The study is useful in illustrating that the V-slope method is simple in identifying VT as a measure of exercise intensity.

Rating of Perceived Exertion

Developed by Borg (10), the RPE scale subjectively asks an individual to rate their perceived level of exertion throughout their entire body on a scale from 6-20. This

traditional scale has been modified into a 10-point category ratio scale, with 0 being the point of rest and 10 being maximal exertion (2). Currently, using the RPE scale as a method of interpreting exercise intensity is highly recognized and is used often in the health and fitness industry.

Many studies have correlated the RPE scale with other methods of assessing exercise intensity (11,12,13). Steed, Gaesser, and Weltman (11) believe RPE is a valid tool for the prescription of exercise intensity when the purpose is to use the lactate threshold and blood lactate concentration as the intensity criterion. According to Purvis and Cureton (12), an RPE of "somewhat hard" corresponds to anaerobic threshold. They also found RPE is linearly related to percentage of VO_2max, and there is a strong positive correlation between RPE and HR, VO_2, and ventilation. Glass, Knowlton, and Becque (13) stated that using the RPE scale as a method of assessing exercise intensity is an advantage, because the individual doesn't have to stop and measure heart rate, but can simply make pace adjustments while exercising based on their perception of their own effort. A major disadvantage of using the RPE scale to manage exercise intensity is that the individual must know and understand it, and a significant percentage of individuals have a hard time using the scale.

Talk Test

The Talk Test is subjective, in that it uses the individual's own perception of how hard they are working during exercise as the basis of monitoring training intensity. It involves asking a subject to carry on a conversation or structured speech at an intensity in which they can still respond in a comfortable way. There is research to suggest the Talk

Test is an acceptable method to prescribe exercise and guide intensity in different populations. The first studies regarding the TT took place in 1995 (14) and then again in 1997 (15). In both studies, exercise intensities where subjects could still speak comfortably fell within ACSM's recommendations of 60-90% of VO_2max. Another study was performed in 2000 (16), which suggested the TT could be used with a college-aged population and was closely correlated with VT. In the first test, VT was measured by gas exchange. In the second test, the Talk Test was administered using the "Rainbow Passage" (17). The results suggest when individuals are still able to speak comfortably while exercising, they are at or below their VT. When speaking while exercising is no longer comfortable, individuals are past their VT and perhaps beyond an appropriate intensity (16). Porcari and colleagues (18) analyzed data of Dehart-Beverly and colleagues and found the negative stage of the Talk Test was beyond ACSM guidelines for percent of maximal heart rate and percent VO_2max. More recently, studies have demonstrated that the TT can also be used in patients with stable heart disease (19), untrained healthy adults (20), and athletic individuals (21). Voelker and colleagues (19) administered the Talk Test to patients with stable heart disease. Voelker had each subject read out loud "The Pledge of Allegiance," a 31-word paragraph familiar to most people in the U.S. The results were similar to previous findings, in that the positive and equivocal stages of the test were within conventional guidelines for exercise prescription, and the negative stage was beyond clinically accepted guidelines for exercise prescription. Shafer and her colleagues (20) used the "Rainbow Passage" test procedure with untrained healthy adults and found similar results. In a study with athletic

individuals, Recalde and colleagues (21) again asked subjects to recite the "Pledge of Allegiance" and concluded that the TT may be used by coaches and athletes as a simple marker for controlling the intensity of exercise training.

Conclusion

In conclusion, the intensity of exercise is very important in providing exercise prescription. Subjective methods in dealing with exercise intensity are often preferred and are up and coming. The two laboratories (Detroit and La Crosse) where work with the TT has been done use somewhat different strategies. One uses a taped interview and asks the participant to keep their intensity low enough that they can still respond to the interview (Detroit). The other uses a standard paragraph repeated during incremental exercise, with focus on the relationship between the TT and VT (La Crosse). Research needs to be done in regard to which strategy may be better. Comparing the physiologic responses during exercise at the intensity associated with "passing" the TT using these two different strategies could be beneficial in the prescription of exercise intensity.

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