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# COMPARISON OF THE COUNTING TALK TEST AND HEART RATE RESERVE METHODS FOR ESTIMATING EXERCISE INTENSITY IN HEALTHY YOUNG ADULTS

JOSEPH F. NORMAN, JOANN KRACL, DARRICK PARKER, AND ANGIE RICHTER

Division of Physical Therapy Education, University of Nebraska Medical, Center, Omaha, NE

**ABSTRACT**

COMPARISON OF THE COUNTING TALK TEST AND HEART RATE RESERVE METHODS FOR ESTIMATING EXERCISE INTENSITY IN HEALTHY YOUNG ADULTS. **Joseph F. Norman, JoAnn Kracl, Darrick Parker, Angie Richter**. **JEPonline**. 2001;4(4):15-22. The purpose of this investigation was to compare the Counting Talk Test (CTT) method to the Heart Rate Reserve (HRR) method for estimating exercise intensity. Thirty-four healthy individuals (21 F and 13 M) aged 20-31 years old participated in two separate treadmill trials. During the first trial subjects walked/jogged on a treadmill at 50%, 60%, 75% and 85% of their HRR. Blood pressure (BP), heart rate (HR), CTT score and rating of perceived exertion (RPE) were obtained at each workload. During the second trial subjects again walked/jogged on the treadmill at four different intensities based on the CTT values obtained during the first trial. BP, HR, and RPE were recorded. Two-way repeated measures ANOVA were used to compare variables. Moderate Pearson correlations (r) were found between the CTT and HRR, RPE and MET level, and that exercising at 30%-55% of the resting CTT value corresponded to the American College of Sports Medicine recommendations for moderate to vigorous exercise intensity. Strong correlations were found between the two treadmill trials for; 1) %HRR (r= 0.90), 2) RPE (r= 0.83), and 3) MET levels (r= 0.88). Comparing the CTT method to the HRR method, the CTT appears to be a reasonable means of estimating exercise intensity.

Key Words: Exercise prescription, cardiorespiratory endurance, Fitness, Training

## INTRODUCTION

Approximately 25% of adults in the United States do not engage in any leisure-time physical activity and, of those that do, only about 20% engage in regular, sustained leisure-time physical activity (1). The Surgeon General's Report on Health and Physical Activity contains public health recommendations that now endorse moderate as well as vigorous levels of physical activity for achieving cardiorespiratory fitness (1). People who are inactive can significantly improve their health and well-being by participating in moderate levels of physical activity on a regular basis while even greater health benefits can be attained by regular participation in more vigorous physical activity (1). Cardiorespiratory endurance is considered an important health-related component of physical fitness which can reduce the morbidity and mortality risks associated with some of the leading causes of illness and death in the United States (1). The goal, then, is to guide individuals to moderate to vigorous intensity exercise conducive to achieving the most health and fitness benefits for their time invested.

Heart rate (HR) is considered the standard for estimating exercise training intensity in the field based on its linear relationship to $VO_2$. The recommendations of the American College of Sports Medicine (ACSM) for moderate to hard relative exercise training intensities for cardiorespiratory fitness based on HR are 55%-90% of maximum heart rate (HRmax) or 40%-85% of heart rate reserve (HRR) (2). Although the use of heart rate to monitor exercise intensity is common practice, several drawbacks of this method have been noted (3, 4). To be effective, an accurate determination of HR must be obtained, often requiring individuals to stop their activity temporarily to palpate their pulse rate (3). In addition, many individuals experience difficulty palpating a pulse or accurately timing their pulse count which can result in subject error (3,4). It has been suggested that individuals who use HR to monitor their exercise intensity may become overly preoccupied with the monitoring of their HR in order to avoid deviating from their targeted training range (3,5). This preoccupation and frequent pauses in activity to obtain an accurate heart rate are believed to have a negative effect on activity enjoyment and long-term compliance (3,5). Use of a heart rate monitor would eliminate many of the problems associated with palpating a pulse and would provide an alternative means by which an individual could use HR as a guide to estimating exercise intensity. However, some individuals may perceive the need to wear a device during exercise as bothersome or the additional expense of a HR monitor a barrier to initiating an exercise regimen.

Another method advocated for prescribing an exercise training intensity is based on the talk test method or ability of an individual to carry on a conversation during exercise; the counting talk test (6). The rationale for this method is based on the premise that exercising at or above the ventilatory threshold generally does not allow complete conversational sentences without pausing for breaths and thus serves well as a means of estimating the ceiling training intensity (6). The main advantage of this method is its simplicity of use. Recently it has been shown that when using the talk test method to estimate exercise intensity, individuals exercised at 85-88% of HRmax at the maximal point at which they could speak comfortably or were equivocal in their response. When subjects could no longer speak comfortably their exercise intensity was greater than the 90% HRmax limit advocated by the ACSM (7). Though the talk test method is effective for defining an upper limit of exercise intensity for cardiorespiratory training, it does not provide adequate feedback as to lower levels of exercise intensity that produce cardiorespiratory fitness. This is caused by the ability to converse comfortably in complete sentences when exercise at intensities that range from rest to this "ceiling intensity". Finding ways that would address use of the talk test method in determining an appropriate exercise intensity range, both upper and lower, would certainly enhance the usefulness of this method.

The purpose of this study was to compare a variation of the talk test method, the "Counting Talk Test" (CTT), to the HRR method for estimating exercise intensity and assess the utility of the CTT as a semi-quantitative approach for estimating exercise intensity. We hypothesized that the CTT method would be comparable to the HRR method for estimating cardiorespiratory exercise intensity.

## METHODS

### Subjects

Thirty-four subjects (21 males, 13 females) were recruited from the university student population and local community. Subjects ranged in age from 20 to 31 (24.7±2.2) years, with a mean height of 175.8±9.9 cm, and weight of 72.9±14.8 kg. This study was approved by the University Institutional Review Board, and each subject gave written informed consent prior to participation. All subjects were apparently healthy young adults as defined by the ACSM, and were informed of the risks and benefits associated with the investigation (8).

**Measures of Exercise Intensity**

Subjects attended two separate sessions, completed within one week. Each subject was instructed in the CTT method. Subjects were asked to take in a full breath and count out loud, at their normal pace, using the following sequence: one-one thousand, two-one thousand, three-one thousand, four-one thousand, etc. The number the subject was able to count to before having to take a second breath was recorded. Only complete counts (e.g., "three-one thousand") were used to record the highest number attained before taking a second breath. Partial counts (e.g., "three-one", breath) were not included. In addition, each subject was shown the 15 point Borg Rating of Perceived Exertion scale (RPE) and instructed in its use (9). The RPE scale was mounted on the wall in front of the treadmill and easily visible to the subjects. The subjects were monitored with an electrocardiogram using a modified V5 chest lead ($CM_5$) at rest, during and post-exercise (10). Heart rate and blood pressure were obtained at rest. The age predicted maximum heart rate (220-age) and resting HR were used to calculate the four initial exercise intensities as a percentage of HRR using the Karvonen method (11). All subjects were familiar and adept at walking and running on the treadmill.

**Treadmill Protocols**

During the first session, subjects began walking on the treadmill at 2.5 to 3.5 mi/hr and 0% elevation for three min as a warm up period. Treadmill speed was selected based on the subject's report of being at a "comfortable walking speed". The control panel was not visible to the subjects during testing. Treadmill workload (speed and/or elevation) was then increased until the subject was at 50% of his/her calculated HRR for 3-5 min, in order to reach a steady state. This exercise intensity was recorded as workload I. Blood pressure, HR, CTT score, RPE, treadmill speed and elevation were recorded. The treadmill workload was then increased such that the subject was at 60% of HRR (workload II) for 3-5 min. Blood pressure, HR, CTT score, RPE, treadmill speed and elevation were again recorded. This step-wise increase in intensity was repeated at 75% HRR (workload III) and 85% HRR (workload IV) while measurements were recorded in the same manner and sequence as above. Following completion of the final stage, the treadmill was slowed to 3 mi/hr at 0% grade for the subject to walk as part of the cool-down phase until heart rate was ≤120 b/min.

During the second session, the subjects again exercised at four different intensities as in session one, however, intensities were set based on the CTT score obtained during session one at workloads I-IV. Subjects were randomly assigned to perform the testing protocol in one of six different intensity sequences (Table 1). Subjects began the second session by warming up on the treadmill as in session one. Each subject then began the second session's testing phase according to their assigned workload sequence and based upon his/her CTT scores obtained during session one. Blood pressure, HR, CTT score, RPE, treadmill speed and elevation were recorded as in session one.

**Table 1. Sequencing order for performing workloads during session two.**

| *Sequence* | *Intensity* 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ***A (N=5)*** | I | II | III | IV |
| ***B (N=6)*** | I | II | IV | III |
| ***C (N=6)*** | I | III | II | IV |
| ***D (N=6)*** | I | IV | II | III |
| ***E (N=5)*** | I | III | IV | II |
| ***F (N=6)*** | I | IV | III | II |

**Data Analysis**

Percent of CTT (%CTT) was calculated as the value obtained during exercise (ETT) divided by the value obtained at rest (RTT) times 100, ([ETT/RTT] x100 = %CTT). Metabolic equivalents (METS) were calculated for the achieved treadmill workloads using the formulae published by the ACSM (8).

Two-way repeated measures ANOVA were utilized to compare values obtained for each of the following dependent variables, %CTT, %HRR, RPE and BP. A paired t-test was performed to compare resting BP values between sessions. Pearson correlation coefficients were determined for the relationships of %CTT to %HRR, %CTT to RPE, %CTT to METS, %HRR to RPE and %HRR to METS. Correlation coefficients were also determined between session one and session two for: 1) %HRR, 2) RPE, and 3) MET level. All statistical analyses were performed using the SigmaStat software package (Version 2.03; SPSS Inc., San Rafael, CA). Statistical significance was set at P   0.05.

## RESULTS

Comparisons between session one and session two at each of the four workloads for %CTT, %HRR, RPE, and BP are illustrated in Figures 1-4 respectively. Two-way repeated measures ANOVA demonstrated significant differences in the CTT among the four workloads ($p < 0.001$) but not between the test sessions ($p=1.00$). No interaction was found between the test sessions and workloads for the CTT ($p=1.00$). Significant differences were noted between each of the four workloads for the %HRR ($p<0.001$) as well as between the two test sessions ($p=0.04$). The difference of the means between test sessions one and two was 1.6% of the HRR, which corresponds to a mean difference in HR of 2-3 b/min. No significant interaction was found between test sessions and workloads for HRR ($p=0.88$). Significant differences in RPE values were noted among the four workloads ($p<0.001$) and between session one and session two ($p=0.004$). The difference of the means between test sessions was 0.5 RPE units. There were significant interactions between test session and workload for RPE at Workload II ($p<0.001$) with a difference of the means being 0.9 RPE units, and at Workload IV ($p=0.008$) with a difference of the means being 0.6 RPE units. No significant interactions between the test session and workload were noted for RPE at Workload I ($p=0.70$) or Workload III ($p=0.07$). No significant differences were found between test sessions for the systolic BP ($p=0.08$) or the diastolic BP ($P= 0.72$). A significant difference was noted among each of the four workloads for the systolic BP ($P<0.001$) but not the diastolic BP ($p=0.20$). No interactions were found between the test sessions and workloads for the systolic BP ($p=0.43$) or the diastolic BP ($p=0.18$). No significant differences in resting BP were noted between the sessions ($p>0.30$).

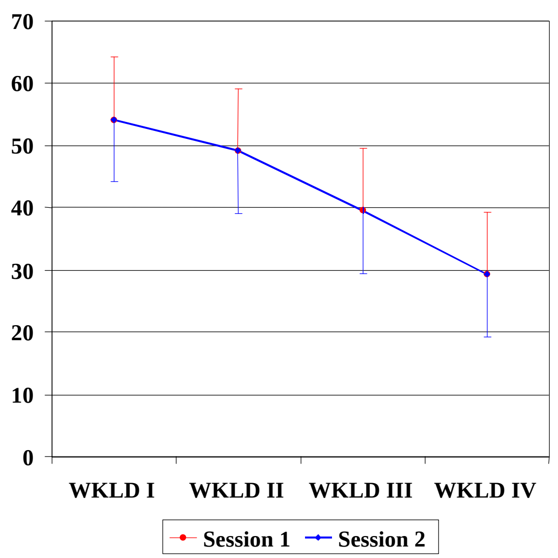


**Figure 1. Comparison of the percent of the Counting Talk Test (%CTT) values (mean±SD) for test session one and session two at each of the four workloads. For session one, intensities of Workloads I-IV were 50%, 60%, 75% and 85% HRR respectively. For session two, intensity was set based on the Counting Talk Test value obtained during session one at each workload. WKLD= Workload. (N= 34)**

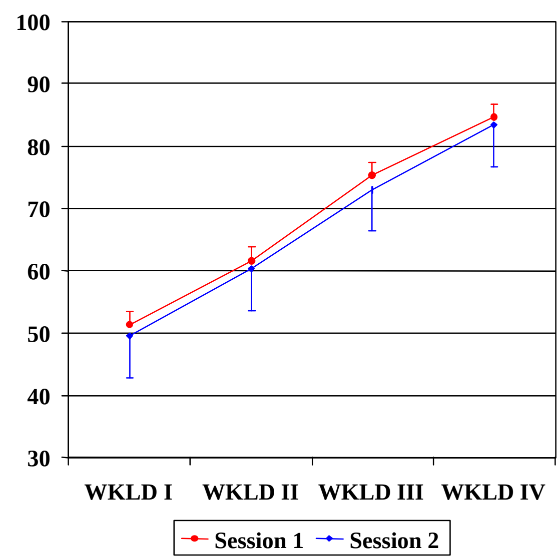


**Figure 2. Comparison of the percent Heart Rate Reserve (%HRR) values (mean±SD). See Figure 1 legend for details.**

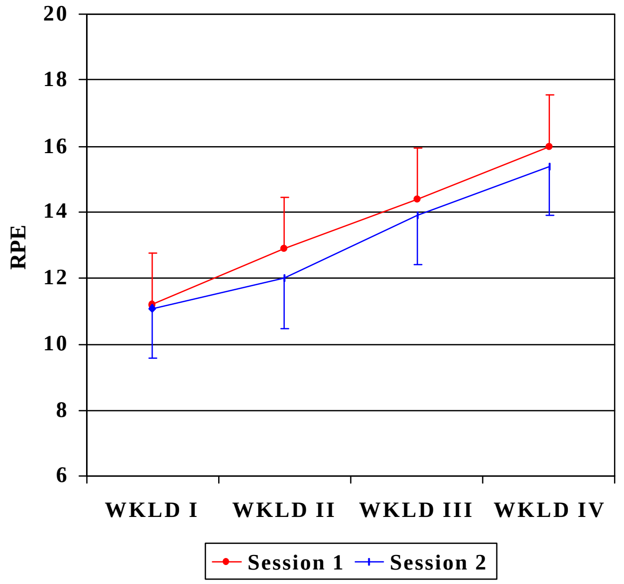


**Figure 3. Comparison of Ratings of Perceived Exertion (RPE) values (mean±SD) for test session one and session two at each of the four workloads. See Figure 1 legend for details.**

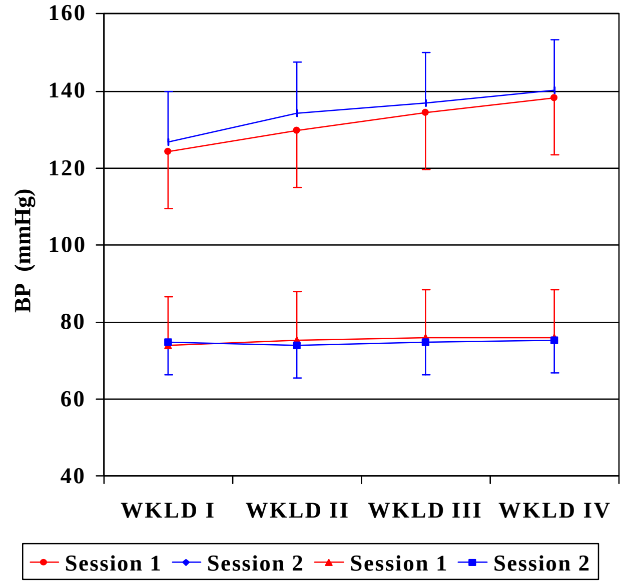


**Figure 4. Comparison of the systolic and diastolic blood pressure (BP) measures (mean± SD) for test session one and session two at each of the four workloads. See Figure 1 legend for details.**

Table 2 is a comparison of the Pearson correlation coefficients demonstrating moderate to good inverse correlations between the %CTT and %HRR, %CTT and RPE and %CTT and METS (12). Likewise, moderate to good correlations were noted between the %HHR and RPE and %HRR and METS. Strong correlations were found between session one and session two for %HRR values (r=0.90, p<0.001), the RPE scores (r=0.83, p<0.001), and the calculated MET levels (r=0.88, p<0.001).

**Table 2. Correlation Coefficient Comparison for the Counting Talk Test (%CTT), Heart Rate Reserve (HRR), Rating of Perceived Exertion (RPE) and METS.**

| *METHOD* | *%HRR* | *RPE* | *METS* |
|---|---|---|---|
| ***%CTT*** | - 0.66* | - 0.57* | - 0.56* |
| ***%HRR*** | | 0.72* | 0.64* |

* P< 0.001

**Table 3. Comparison of the Counting Talk Test method and the ACSM recommendations for moderate to vigorous exercise intensities.**

| *Moderate to Vigorous Exercise Intensity Range* | *Relative Intensity* | | *Absolute Intensity* |
|---|---|---|---|
| | %HRR | RPE | METS |
| ***ACSM Guidelines*** | 40% - 84% | 12 - 16 | 4.8 - 10.1 |
| ***CTT Method**** | 50% -84% | 11 - 16 | 6.7 - 10.0 |

* Based on exercising at 30%-55% of resting CTT value.

Table 3 compares the CTT method results to the ACSM recommendations for moderate to hard exercise intensity. Exercising at 30%-55% of the resting CTT value was consistent with the ACSM recommendations for moderate to hard exercise intensities based on %HRR, RPE and METS. Approximately 84% HRR corresponded to 30% of the resting CTT value and 50% HRR corresponded to 55% of the resting CTT value. Based on our findings, individuals should exercise at least to 50-60% of their resting CTT value but should not exercise at a level less than 30% of their resting CTT value. This range, 30%-55% resting CTT value, would correspond to a moderate to vigorous exercise intensity range. Therefore if an individual was to count to 12 ("twelve-one thousand") at rest using the CTT method, their recommended exercise intensity range would be 4-7 using the CTT method during physical activity.

**DISCUSSION**

The purpose of this study was to compare the CTT method to the HRR method for estimating exercise intensity range and assess if appropriate recommendations for use of the CTT method could be made. Our findings showed that the %CTT method was reasonably well correlated to %HRR method for estimating exercise intensity range. In addition, the CTT method was comparable to HRR, RPE and METS for estimating exercise intensity in accordance with the ACSM recommendations for moderate to vigorous exercise intensities (2).

Using %HRmax as an indicator of exercise intensity, Dehart-Beverley et al. (7) have shown that when individuals were no longer able to converse comfortably the exercise intensity was about 90% HRmax and served well as an indicator of a "ceiling intensity" for exercising. Our findings indicate the CTT method has utility in defining a range of exercise intensities, as opposed to just a maximum intensity, that correspond with the ACSM recommendations for moderate to vigorous intensities. Such intensities are also within the range associated with achieving the health and fitness benefits recommended by the Surgeon General's Report on Health and Physical Activity (1).

The Borg 15-point RPE scale is another popular non-heart rate dependent alternative for estimating exercise intensity based on the relationship of RPE to $VO_2$ and HR. A rating of 12 to 16 on the Borg 15-point RPE scale corresponds to a moderate to hard relative exercise intensity for cardiorespiratory training (2). Aerobic exercise studies involving treadmill and bicycle ergometer trials with adults have found correlations between RPE and HR of r=0.56 to r=0.94 (5,13). Our correlation results for RPE to % HRR and RPE to %CTT are consistent with those previously reported. One drawback cited in using the RPE is that the scale needs to be visible to the individual while exercising (14). Abadie (14) reported that when the RPE scale was not viewed during moderate to vigorous exercise, exertion was underestimated resulting in higher heart rate responses during exercise than when the scale was viewed. The advantage of the CTT method is that it can be performed by the individual at any time during exercise without having to have a script or scale readily visible.

One of the premises for this preliminary study was to assess if the CTT method had utility as an indicator of exercise intensity range. Comparing %HRR, RPE and calculated MET levels from session two to session one, strong correlations were found for each of these measures between the sessions. The relative consistency of these measures between trials shows an encouraging trend suggesting reliability of the CTT, but this warrants further investigation.

We made some general assumptions in conducting this study in order to assess its potential utility in the field. Instead of determining each subject's actual HRmax, we used 220-age to estimate the HRmax of subjects realizing that the standard deviation of this method is 10 b/min (15). For resting HR we used the heart rate which was obtained at rest prior to testing versus the waking heart rate which Karvonen reported (11). Using subjects' actual HRmax and waking HR to calculate the %HRR might have improved upon the associations we found. Though our method of determining HRR may be viewed as a weakness in our study, we felt it was important to use measures that would be realistic to obtain in the field with relative ease and accuracy and without requiring additional testing for comparison.

Another factor that we were unable to control was the degree to which subjects inhaled prior to performing the talk tests. Subjects were instructed to take a full breath prior to performing the talk tests, thus making it an effort-dependent measure. Although this was a variable in this study, it would also occur in the field. Possible refinement of instructions to the individuals, such as to take a "maximum breath" prior to counting, might aid in further decreasing the variability we found using the CTT method for estimating exercise intensity. In addition, using partial counts may have a positive impact on the associations we found. Despite these limitations, we found the CTT to be a reasonable, semi-quantitative method for estimating an exercise intensity range.

Areas requiring further investigation relate to the reliability of the CTT method for intra-modal and inter-modal exercise applicability, as well as its suitability for use with other age groups. The main advantage of this CTT method, especially in encouraging apparently healthy individuals to exercise at an intensity that will achieve cardiorespiratory health and fitness benefits, is its simplicity. Once instructed in the method individuals can simply perform the test themselves to gauge if their exercise intensity is within the appropriate range.

**Conclusion**

The present investigation evaluated the utility of a modified "conversational" talk test for estimating exercise intensity range in young healthy adults. Providing only simple instructions in performing the CTT, we found it to have reasonably good potential as a method of estimating exercise intensity. Although further work is necessary before recommending its use on a broad scale, our findings are encouraging with regard to its usefulness as a non-heart rate dependent method for developing a cardiorespiratory exercise prescription in a young healthy population.

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**Address for Correspondence**: Joseph F. Norman, PhD, PT, Division of Physical Therapy Education, University of Nebraska Medical Center, 984420 Nebraska Medical Center, Omaha, NE 68198-4420; Phone: (Office) 402 559-5715; Fax: 402-559-8626; email: jfnorman@unmc.edu

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