Fall 11-6-2013

Effect of Knowledge of Heart Rate on Performance of the Six-Minute Walk Test in Older Adutls

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B.S., Southern Illinois University Carbondale, 2011

A Research Paper
Submitted in Partial Fulfillment of the Requirements
for the Masters of Science in Education

Department of Kinesiology
in the Graduate School
Southern Illinois University-Carbondale
December 2013

RESEARCH PAPER APPROVAL

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Southern Illinois University Carbondale
December 2013

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CHAPTER 1

INTRODCTION

Thirty percent of older adults over the age of 65 years fall at least once per year (Guidelines for the Prevention of Falls in Older Persons, 2001), with individuals living in assisted living or nursing homes having a three times greater chance of falling (Sieri & Beretta, 2004). Balance and mobility skills heavily influence the risk of falling and are important determinants of quality of life in older adults (Hagedorn & Holm, 2010). These skills tend to decrease with increasing age, increasing the likelihood of falling. Activities such as walking in the grocery store or walking while on a family vacation allow for a maintenance of independence as we age and anything that can be done to maintain physical activity with age will enhance quality of life; however, many older adults may not take advantage of their ability to walk as they get older. Simple walking exercise can be a great tool to maintain this capacity. This important fact has led to the development of tests designed to assess the various components of fitness in older adults and walking tests figure prominently in most test batteries.

A recent study conducted in Sweden examined a school-based intervention designed to increase adolescent physical activity through various methods such as walking or cycling to and from school, physical education, and participation in organized sports (Slingerland, Borghouts, & Hessellink, 2012). In order to increase awareness of heart rate, each participant wore a heart rate monitor for six consecutive days. The results showed that there was an increase in activity while wearing heart rate monitors during leisure time sports and transportation to and from school. Despite the positive results in this population, studies regarding the influence of

knowledge of heart rate on performance of activities of daily living tasks or during assessments of fitness in older adults are scarce.

There are several different modalities used to assess cardiovascular fitness in older adults. Examples of fitness tests include the shuttle-walk test, stair climb test, and the ACSM six-minute walk test (American Thoracic Society, 2002). The ACSM six-minute walk is one of the most popular exercise tests used to assess cardiorespiratory fitness in older adults (Rikli & Jones, 2013). This is a simple test that requires no exercise equipment no advanced training for the participant or technicians, and measures the distance the participant can quickly walk on a flat, hard surface in six minutes. It is a self-paced assessment in which the participant chooses their walking speed (individual choice of exercise intensity) and allows them to stop or rest at any time during the test. Test results are a good indicator of pulmonary and cardiovascular system response to exercise.

There are many studies that have used the six-minute walk test for children, adults and older adults, and many of these studies examined individuals or patients that are limited with issues such as cardiovascular disease and traumatic brain injury (Geiger et al., 2007; Verrill, Barton, Beasley, Lippard, &King, 2003; Mossberg & Elizabeth Fortini, 2012). While the six-minute walk test was originally designed for use in an older adults (Rikli & Jones, 2013), to the best of our knowledge, the impact of knowledge of heart rate response on performance during the six-minute walk test has not been assessed in this population. At this point, it is unknown whether knowledge of heart rate during the six-minute walk test will impact performance in a similarly positive fashion as described in the aforementioned study examining adolescent physical activity level (Slingerland, Borghouts, & Hessellink, 2012).

The purpose of this study was to determine whether the knowledge of heart rate influenced performance during a six-minute walking test of aerobic endurance.

We hypothesized that older adults would walk further during the six-minute walk test when provided with knowledge of their heart rate.

CHAPTER 2

METHODS

Participant recruitment

Twenty-three healthy older adults were asked to volunteer for this study. Three of the participants were not included in this study because of medication they were taking for heart conditions; therefore, data from 20 healthy adults (17 female, 3 male) was used in the analysis (age range: 60-94 years old, mean age: 74). Participants were recruited from an "active adults" class at Southern Illinois University of Carbondale Student Recreation Center.

All participants completed a medical history form prior to participating in the study. Participants were excluded from the study if they took any form of beta-blocker due to the impact of these medications on the heart rate response to exercise. Participants were also excluded if they had any cardiovascular or musculoskeletal problems that hindered their ability to walk for six minutes as quickly as possible (e.g. congestive heart failure, hip or knee replacement, etc.). Participants were excluded if they were under the age of sixty or had been sedentary for the previous six months. Sedentary was defined as not being involved in regular, structured physical activity such as walking or cycling. The participants indicated their typical level of physical activity in the medical history packet. Informed consent was obtained from each participant before they began the research, in accordance with SIUC's Human Subjects Committee. Participants were naïve to the purpose of this study.

Protocol

Participants attended one session lasting approximately 50 minutes. All particpants were instructed to refrain from consuming caffeine or exercising two hours before their session. Each participant rested for ten minutes prior to and between trials.

Participants were randomly assigned a testing order. The two tests were identical except during the Known Heart Rate (KHR) condition, participants were verbally informed of their heart rate at the end of every minute. During the Unknown Heart Rate (UKHR) condition participants were not informed of their heart rate.

Participants wore a Polar heart rate monitor around their chest. The reseacher maintained control of the monitor during both KHR and UKHR condtions, so the participant would not be able to see their heart rate. Prior to the first trial of the experiment, participants completed a five-minute walking warm up around the test course (perimeter of a gymnasium) at a self-selected pace. The warm-up was followed by two minutes of seated rest followed by the completion of the six-minute walk. During both trials, the participants had their HR (heart rate) recorded by the researcher after every minute and were told their current HR at the time of recording during the KHR trial. At the end of the six minute test, each participant was told to stop and was asked for their RPE (rate of percived exertion; *Figure 1*) and had their HRrecorded again. Following ten minutes of quiet rest, and return of heart rate to resting levels, the participants repeated the six minute walk test protocol in the 2nd condition. The test scores werecalculated by multiplying the number of complete laps walked by 45 meters. The number of meters of an incomplete final lap were added to the total.

Study variables

The independent variable in this study was knowledge of heart rate. The distance in meters walked was the dependent variable.

Data Analysis Procedures

Using a within-participant analysis, a paired-samples t-test was used to determine if any performance differences existed between the KHR and UKHR conditions (PASW 18).

rating	description
6	NO EXERTION AT ALL
7	EXTREMELY LIGHT
8	
9	VERY LIGHT
10	
11	LIGHT
12	
13	SOMEWHAT HARD
14	
15	HARD (HEAVY)
16	
17	VERY HARD
18	
19	EXTREMELY HARD
20	MAXIMAL EXERTION

Figure 1: Borg RPE Scale

CHAPTER 3

RESULTS

Twenty participants (3 males, 17 females; with a mean age of 74, ± standard deviation of 9.47) completed the requirements for this study and were considered in the data analysis. Participant's level of fitness was tested during the six-minute walk test. Participants walked significantly further in the KHR (515 yards) trial than then UKHR (500 yards) trial (p=.009403; *Figure 2*), thus supporting the hypothesis. As had been reported in prior studies, males were able to walk significantly greater distances than the females and this was the case during both conditions. (*Figure 3* and *Figure 4).* Regardless of gender, no differences were found between the trials for average heart rate or RPE (*Figure 5* and *Figure 6*).

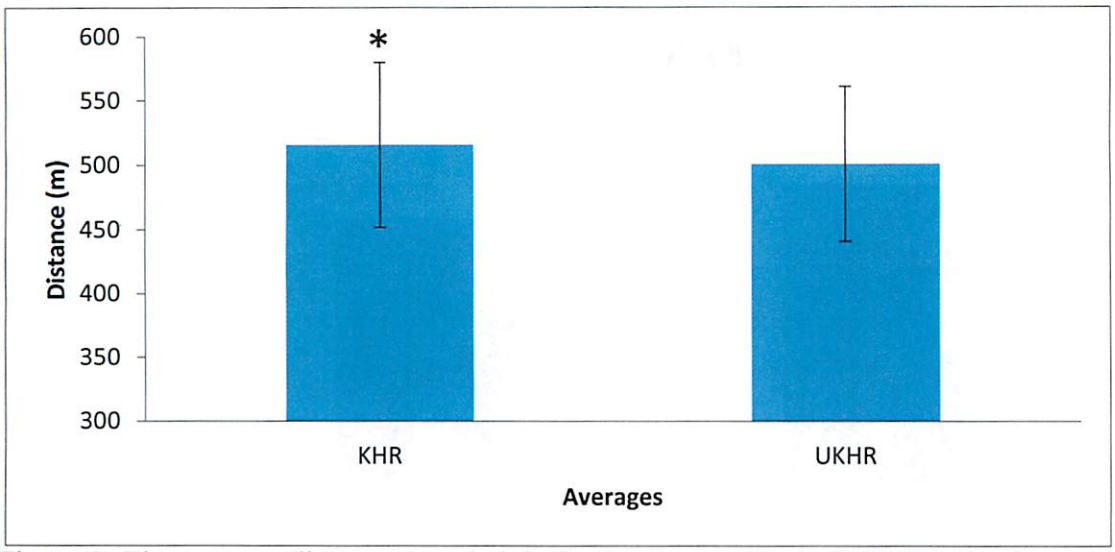

Figure 2: The average distance traveled during known heart rate (KHR) and unknown heart rate (UKHR) conditions during the six-minute walk test * $p<.05$

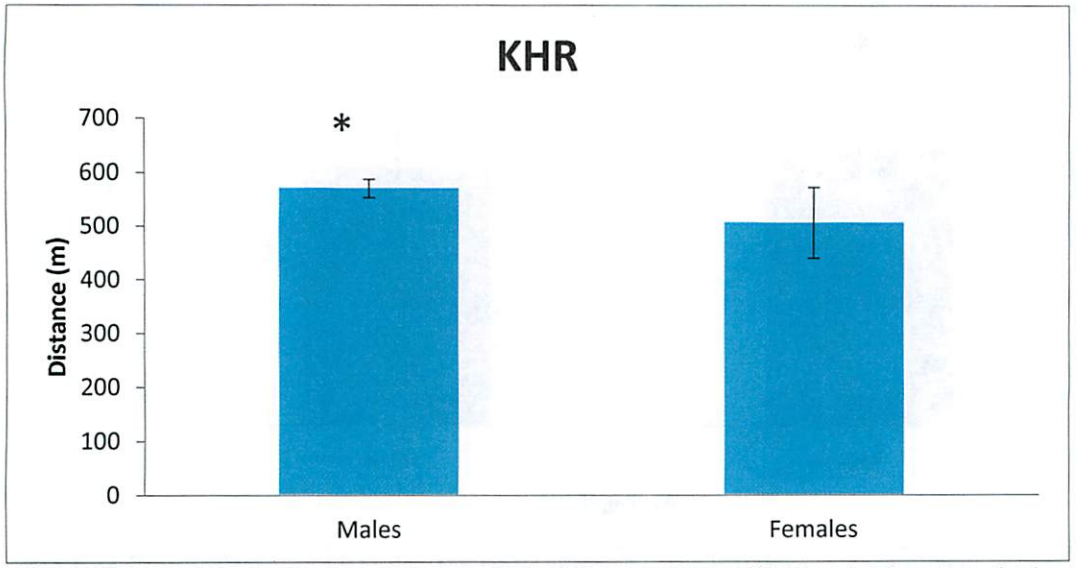

Figure 3: The distance covered by the 3 males compared with the 17 females during the KHR condition of the six-minute walk test. * $p<.05$

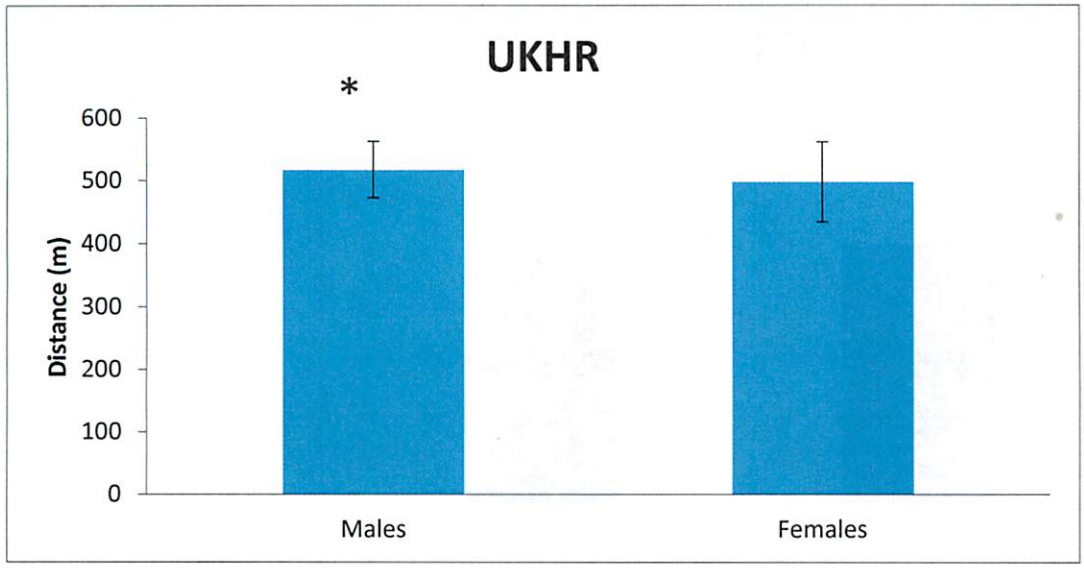

Figure 4: The distance covered by the 3 males compared with the 17 females during the UKHR condition of the six-minute walk test. * $p<.05$

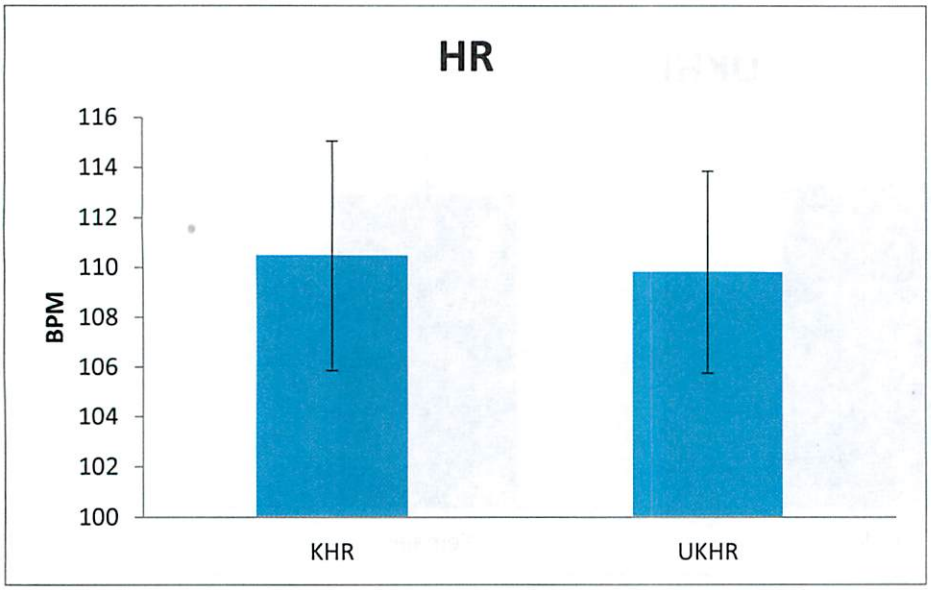

Figure 5: The average heart rate of all 20 participants during the known (KHR) and unknown heart rate (UKHR) conditions while performing the six-minute walk test.

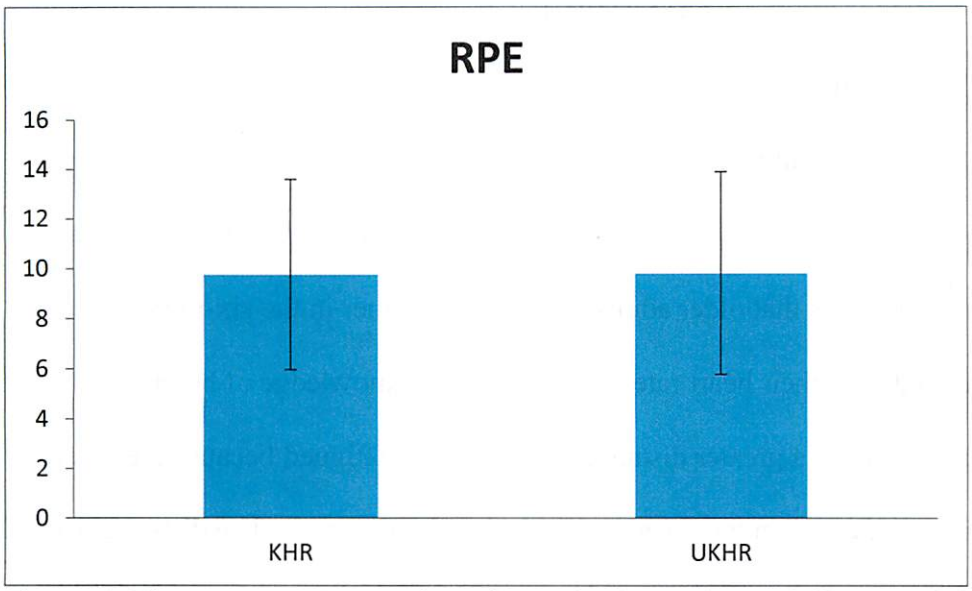

Figure 6: The average RPE (Rating of Perceived Exertion) of all 20 participants during the known and unknown heart rate conditions while performing the six-minute walk test.

CHAPTER 4

DISCUSSION AND CONCLUSION

In this study, apparently healthy/active older adults were examined to test the hypothesis that knowledge of heart rate during a six-minute walk test would enhance their performance. Our results support our hypothesis that older adults would walk further in the six-minute walk test when they had knowledge of their heart rate. We believe that knowledge of heart rate motivated the participants to walk a greater distance before feeling fatigued because they were able to imagine the amount of exertion they were using during the protocol. The distance walked in the KHR condition was significantly greater; however, the average heart rate of both trials was roughly the same at 110 bpm and the RPE for both trials was approximately 11. The results of this study may influence the thought process regarding instructions/feedback given to participants engaging in the six-minute walk test, as well as other aerobic capacity assessments.

Performance

When the participants were told their heart rate, some of the participants tried to reach a certain HR on their own, without the researcher giving them a set heart rate to aim for during the test. Not all participants pushed themselves as hard as others during the KHR trail. Some of the participants were interested in their HR to be able to push themselves to walk further and work harder during the 6-minute walk test. When looking at RPE for both trails, they are similar. Although the participants were pushing themselves harder in the KHR trail to walk a greater distance, their fatigue level did not change. Thus, it is interesting that the average heart rates were not different despite the improved performance in the KHR trial.

Walking is a physical activity that many individuals are able to perform, whether they are healthy or diagnosed with a disease. Walking is an action that requires strength, balance, and

timing (Andersson et al., 2011). With an increase in age, a decline in postural control can slow down an individual's pace while walking (Sieri & Beretta, 2004). Previous findings have shown an increase in walking distance while performing the six-minute walk test can improve older adult's mobility and resistance to fatigue (Andersson et al., 2011, Hagedorn & Holm, 2010). Testing HR during the six-minute walk test has shown to improve distance walked, which can improve older adults ability during physical activity and regular exercise.

Gender

When looking into the differences in six-minute walk distance between the males and females, we only had three males participate in this study compared to our 17 females. Due to their gender-specific superiority in aerobic capacity, the men walked a greater distance in both conditions, as well as maintained a lower heart rate. This finding supported previous research and was not a surprising result. What we can conclude from the current study is that when an individual does know their heart rate while exercising, their heart rate tends to be higher, along with an increase in their performance (Mossberg & Fortini, 2012).

As stated earlier, the six-minute walk test has been found to be very successful in detecting performance differences through different age groups and levels of physical activity (Rikli and Jones, 2013). A topic that is not discussed as widely is the difference between older adult males and females performing the six-minute walk test. In the present study, the male increase in distance covered in the KHR condition was greater compared to the females increase in this same condition (vs. the UKHR condition). Thus, males were able to show a stronger response than the females to knowledge of heart rate. The males walking distance averaged to be further possibly because of their physical capacity. These specific males tended to be younger than most of the female participants and this may have influenced the results.

Potential Limitations

One potential issue of this study was having a drastic difference between the number of males and females in the study. As stated earlier, males had a greater response to the KHR condition than the females, but with only three male subjects completing the study, we were not able to definitively evaluate if there was a significant difference between the genders. Verrill and colleagues (2003) showed improvement from 11% to 20% for women, and 12% to 16% for men in six minute walk performance following cardiac rehabilitation. Thes participant's overall distance had increased 26% over the 12 weeks of supervision. The study showed that by participating in this supervised exercise their distance was improved. This data offers a better look at real life benefits for older adults in tasks that involve activities of daily living (i.e., bringing groceries in from the car or while on a family vacation). It is possible that with a more equitable division between the genders, the performance response in the KHR condition may have been diminished.

Another possibility of error could be that participants were instructed not to speak during the two six-minute tests. However, during the ten-minute rest period, participants were able to carry a light conversation if they wished. Although the conversation was meant to stay as "small talk", the conversations could have affected their resting heart rate. Researchers were to test participants heart rate before starting the second trial to be sure their HR was within 5 bpm from original resting HR.

Finally, age difference could also be considered a limitation. Age difference between participants could have given the younger ones more of an advantage at the study. The younger participants tended to be more physically active compared to the older participants.

Future Directions

To expand this current study, results could also be monitored for a comparison between age and gender. By separating age and gender into different groups, researchers could investigate the KHR effect more specifically. Instructions to participants should include knowledge of heart rate for optimal performance. As stated earlier as a limitation, participants had a large gap between years of age, (60-94), a future study may be to examine different age groups, dividing by age classifications.

Conclusion

In this study, we found that knowledge of heart rate can help older adults to obtain longer distances in the six-minute walk performance. This finding could potentially translate to better performance during daily tasks, such as grocery shopping, and/or recreational activities. By allowing these individuals to hear or see their HR, they could go grocery shopping on their own, or take family vacations without becoming fatigued as quickly. This would potentially help older individuals become more active and less dependent on others.

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Effect of Knowledge of Heart Rate on Performance of the Six-Minute Walk Test in Older Adults

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