

University of South Dakota

USD RED

---

Physical Therapy Student Research Projects

Physical Therapy Research

---

2023

## Correlation of Various Heart Rate Measures and Borg CR10 Ratings within the First Five Minutes of Moderate- and Vigorous-Intensity Exercise

Maia Janae Gabrielson SPT

University of South Dakota, Maia.Gabrielson@coyotes.usd.edu

Maddison Elizabeth Hajek SPT

University of South Dakota, Maddison.Hajek@coyotes.usd.edu

Kiana Lynn Hoff SPT

University of South Dakota, Kiana.Hoff@coyotes.usd.edu

Rachel Marie Schmitz SPT

University of South Dakota, Rachel.Schmitz@coyotes.usd.edu

Jamie Lynn Schweiss SPT

University of South Dakota, Jamie.Schweiss@coyotes.usd.edu

Follow this and additional works at: <https://red.library.usd.edu/pt-studentprojects>



Part of the [Physical Therapy Commons](#)

---

### Recommended Citation

Gabrielson, Maia Janae SPT; Hajek, Maddison Elizabeth SPT; Hoff, Kiana Lynn SPT; Schmitz, Rachel Marie SPT; and Schweiss, Jamie Lynn SPT, "Correlation of Various Heart Rate Measures and Borg CR10 Ratings within the First Five Minutes of Moderate- and Vigorous-Intensity Exercise" (2023). *Physical Therapy Student Research Projects*. 21.

<https://red.library.usd.edu/pt-studentprojects/21>

This Poster is brought to you for free and open access by the Physical Therapy Research at USD RED. It has been accepted for inclusion in Physical Therapy Student Research Projects by an authorized administrator of USD RED. For more information, please contact [dloftus@usd.edu](mailto:dloftus@usd.edu).

# CORRELATION OF VARIOUS HEART RATE MEASURES AND BORG CR10 RATINGS WITHIN THE FIRST FIVE MINUTES OF MODERATE- AND VIGOROUS-INTENSITY EXERCISE

Maia Gabrielson, SPT; Maddison Hajek, SPT; Kiana Hoff, SPT; Rachel Schmitz, SPT; Jamie Schweiss, SPT  
Faculty Advisor: Adam Ladwig, PT, DPT, PhD

## INTRODUCTION

Exercise is a critical component of every individual's health regimen. Yet, 80% of American adults fail to engage in regular physical activity.<sup>1</sup> One factor driving inadequate levels of physical activity is lack of appropriate counseling by health care professionals.<sup>2</sup> For aerobic activity, the Center for Disease Control and Prevention (CDC) recommends adults engage in 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity exercise per week. A crucial component of meeting the exercise guidelines is achieving the appropriate intensity. The CDC recommends utilizing target heart rate (HR) and perceived exertion to gauge intensity. Target HR can be determined by percent of maximum HR, percent of HR reserve, or pure HR readings. Perceived exertion is a subjective measure of intensity and can be determined using the Borg Category-Ratio 10 Scale.<sup>3</sup> Individual's perception of exertion (via Borg CR10) while exercising at HRR levels classified as moderate and vigorous remain unstudied. **The purpose of this research was to investigate the relationships of various HR measures with subjective report of exercise intensity via the Borg CR10 scale. Additionally, the factor of timing of assessment on correlation was explored during the first few minutes of exercise.**

## METHODS

- Design: This was an observation study to assess correlations between various HR measures with the Borg CR10 scale.
- Setting: The study was conducted at a clinical research lab at a Midwestern university in the U.S. Research was directed by a PT faculty member with assistance of 5 doctoral PT studies. Data was collected in conjunction with another study.
- Participants: Participants included a prospective sample of 34 college students. Inclusion criteria included age of at least 18 years and English language. Exclusion criteria included any "yes" response on the PAR-Q or any vital assessment making exercise unsafe.
- Instruments: Instruments included a Physiocycle XT Recumbent Cross Trainer, Polar H7 Heart Rate Sensor, and the Borg CR10 Scale.
- Procedures: Prior to participation in the study participants completed a consent form, PAR-Q, and vital assessment. Borg CR10 scale education was provided. During the first bout of exercises participants biked at a level 3 resistance and a speed of 11 mph with intensity progressed every minute. HR and RPE reports were recorded at the conclusion of each minute. This process continued until target HR was achieved indicating moderate intensity (45% HRR) and vigorous intensity (65% HRR). The Karvonen formula was utilized to calculate individual target HR. Exercise was stopped once target HR was achieved and maintained for two minutes. Each participant had a full functional recovery between rounds of exercise. Parameters for the second bout of exercise included with bike resistance at a level 4 resistance and a speed of 11 mph.

## RESULTS

A sample of convenience consisting of 34 participants enrolled in undergraduate and graduate programs was obtained. One participant's data was excluded from the study results due to a clear misunderstanding of the Borg CR10 scale, inverting the scale midway through the assessment. Therefore, the results for this participant have been excluded from the data, and the results represent 33 participants.

**Table 2**

*Correlation of Borg CR10 to Various Heart Rate Measures During First Five Minutes of Exercise*

	HR (Moderate)	HR (Vigorous)	% HR Max (Moderate)	% HR Max (Vigorous)	% HR Reserve (Moderate)	% HR Reserve (Vigorous)
RPE	0.27	0.60	0.27	0.60	0.35	0.63
N	121	137	121	137	121	137
Sig. (2-tailed)	.003	<.001	.003	<.001	<.001	<.001

*Note.* Pearson Correlation

The table above depicts the correlation of RPE using the Borg CR10 to measures of HR, HR maximum, and HRR during the first five minutes of exercising with a goal of moderate intensity and exercising with a goal of vigorous intensity. Using the classification by Evans<sup>4</sup>, weak correlations (ranging from  $r = 0.27-0.35$ ,  $p = 0.003$ ) were found during exercising to a goal of moderate intensity for all measures of HR while strong correlations (ranging from  $r = 0.60-0.63$ ,  $p < 0.001$ ) were found with the goal of exercising to vigorous intensity. The assessed HR measures were not significantly different in terms of correlation to RPE.

In addition, the correlation of RPE and the various measures of HR were analyzed at each minute during the first five minutes of exercise with a goal of moderate intensity and exercise with a goal of vigorous intensity. Correlations were found to be variable over time and differed between the two rounds of exercise. Notably, there was a lack of significant correlation between any of the HR measures and RPE at minute 4 and 5 for both exercise rounds.

## Discussion

Differences in correlation between assessed HR measures were unfounded. It appears individualizing target HR via inclusion of participant age and/or resting HR did not result in stronger correlations between HR and RPE. Differences in correlation across time were noted, however.

The results of this study demonstrate that exercise intensity based solely on RPE may differ from expected HR levels based on when RPE is assessed. While these results should not be overly generalized, the results of this study specifically reveal potential variability in correlation of HR measures and RPE over time when ramping up to a particular exercise intensity. Correlation of objective HR values and subjective RPE cannot be guaranteed, as differences may exist over time.



## CONCLUSION

When prescribing exercise, health professionals should be aware of the variability of RPE during the first few minutes of exercise. Stronger correlations appear to be present when exercising to vigorous intensity. A direct correlation between HR and RPE cannot be assumed. Individuals beginning an exercise routine should utilize a combination of subjective and objective measures to properly dose intensity.

## REFERENCES

1. U.S. Department of Health and Human Services. (2018). *Physical activity guidelines for Americans, 2nd edition*. [https://health.gov/sites/default/files/2019-09/Physical\\_Activity\\_Guidelines\\_2nd\\_edition.pdf](https://health.gov/sites/default/files/2019-09/Physical_Activity_Guidelines_2nd_edition.pdf)
2. Meldrum, D.R., Morris, M.A., & Gambone, J.C. (2017). Obesity pandemic: causes, consequences, and solutions—but do we have the will? *Fertility and Sterility*, 107(4), 833-839. doi:10.1016/j.fertnstert.2017.02.104
3. Centers for Disease Control and Prevention. (2020, September 17). *Measuring physical activity intensity*. <https://www.cdc.gov/physicalactivity/basics/measuring/index.html>
4. Evans, J.D. (1996). *Straightforward Statistics for the Behavioral Sciences*. Brooks/Cole Publishing, Pacific Grove.