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Assessing the Predictive Validity of Actical® Accelerometers for Individuals with Impaired Gait

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ABSTRACT

Accelerometers are movement devices that have been proven to be great tools to assess physical activity levels, determine intensity of activities, and measure energy expenditure in the majority of the population. However, these devices may not accurately assess energy expenditure in individuals with altered gait patterns. In order to better understand this discrepancy we are measuring energy costs of low to vigorous Physical Activity (PA) in individuals with altered gait while monitoring omni-directional ambulatory movement using a Actical® Accelerometer (Philips Respironics, Bend, OR) monitoring system to develop a generalizable, useful equation that can better predict energy expenditure. Participants will be assessed and categorized through the 10-meter Walk Test, Timed Up and Go Test, Four-stage Balance Test, 30 second Sit-to-Stand Test, and the Functional Gait Assessment. The participants actual energy expenditure will be measured with an Oxycon Mobile Metabolic System through the following tests; Resting Metabolic Rate (RMR), five minutes of self paced walking, five minutes of brisk-paced treadmill walking, and the Six-Minute-Walk Test. We will then look for correlations between the established categories of participants and their actual energy expenditure which will provide a more accurate equation for estimating energy expenditure with the Actical® Accelerometer. We will be combining this new data with data previously collected in Actical® Accelerometer validity research to have a larger data set to analyze. The intention of this study is to offer a more suitable adapted energy expenditure prediction equation, which will benefit those with physical disabilities in the assessment of physical function in the future.

INTRODUCTION

Accelerometry has been an approachable and innovative tool to track physical activity and predict Active Energy Expenditure (AEE). The data these devices provide allow us to observe physical activity patterns and adhere to fitness prescriptions. Accelerometer devices have been proven to be reliable and valid in the able bodied population. The assumption has been made that these devices are appropriate and effective when used by those with impaired gait (IG). This is of interest because those with IG may be influenced by lower gait speed, asymmetrical gait patterns, and decreased efficiency; thus contributing to altered levels of AEE to perform locomotion. The able-bodied derived AEE equations may not accurately predict AEE in those with IG.

PURPOSE

- To examine the validity of AEE prediction equations in a diverse group of individuals with IG.
- Investigate elements that can improve the prediction of AEE in this population.

SUBJECTS

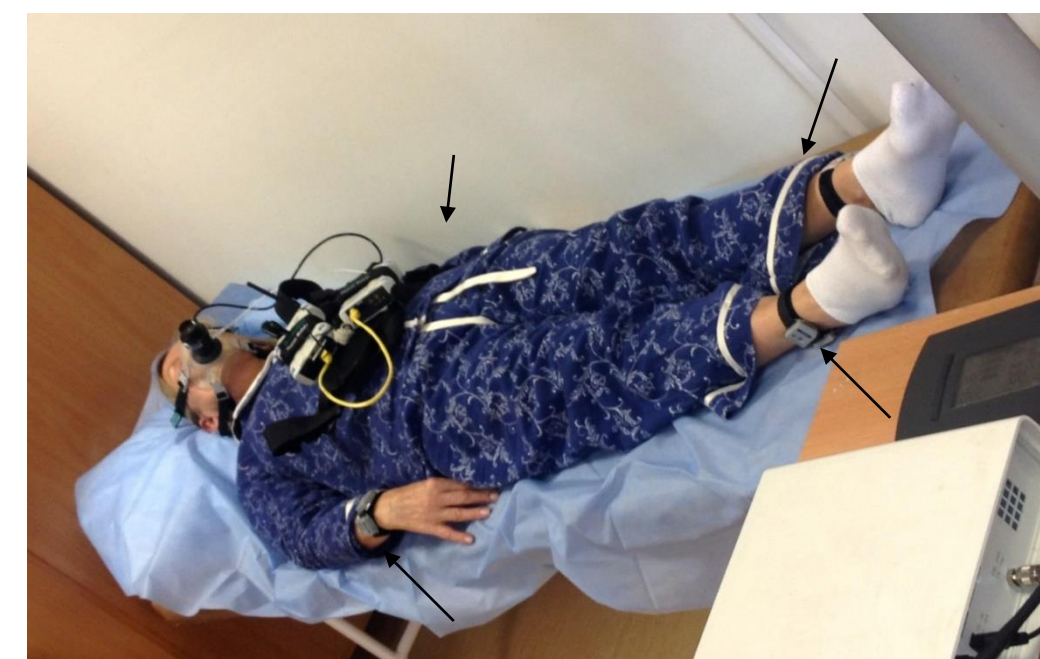
- 65 adults (31 men & 34 women; 55.1 ± 19.1 yrs, 164.6 ± 12.6 cm, 72.9 ± 21.0 kg, 26.6 ± 6.2 BMI) were recruited and volunteered for this study.
- A medical history was taken to confirm subjects were otherwise healthy non-smoking adults.
- Diagnoses: Cerebrovascular Accident, MS, Brain Injury/tumor, arthritis, and other orthopedic/neurological conditions

METHODS

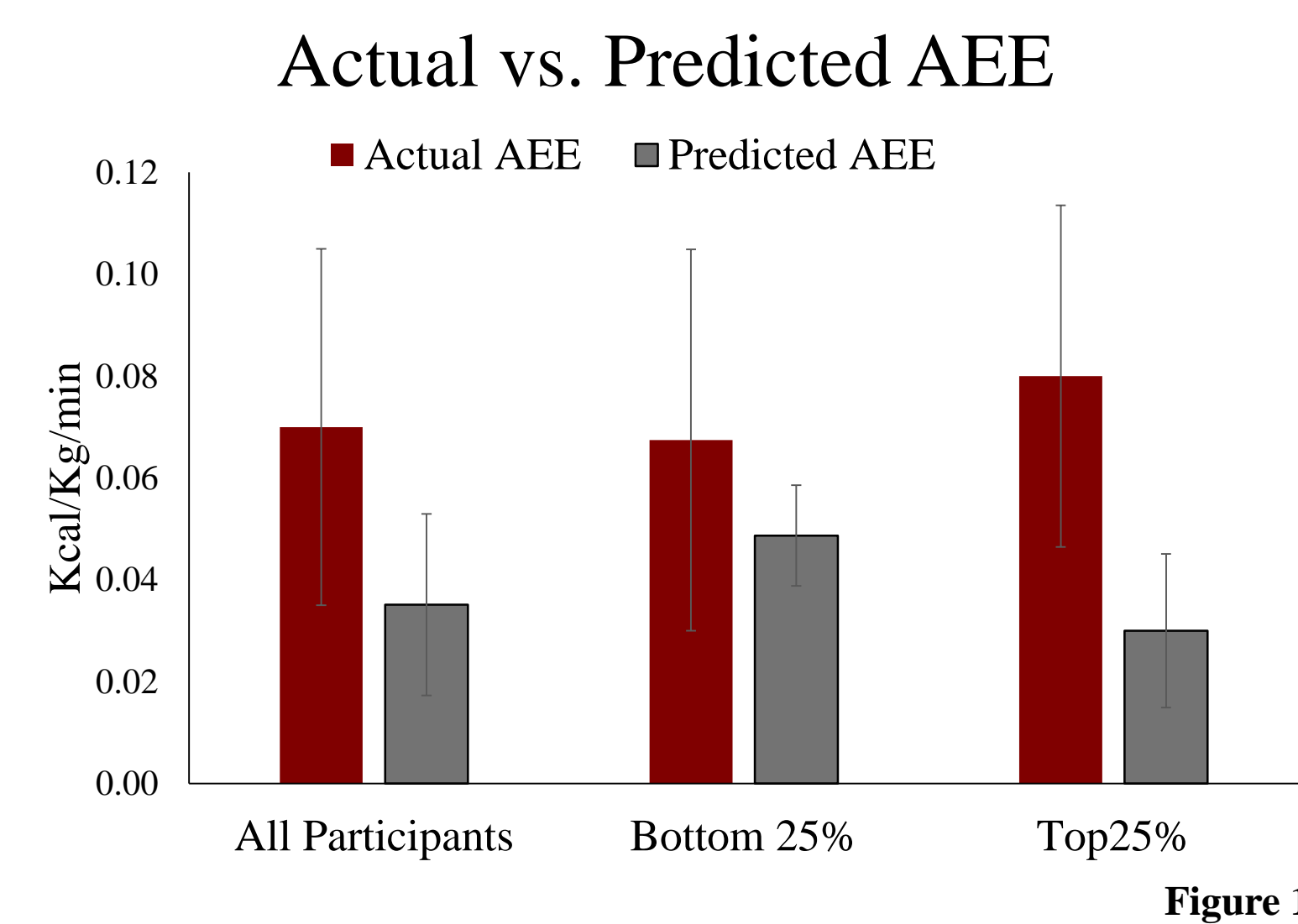
- This study took place in three locations:
 - Ban Suan Dok Nursing Home (Dept. of Physical Therapy, Chiang Mai University, Chiang Mai, Thailand)
 - Bielanski Hospital (Dept. of Physical Therapy, Jozef Pilsudski University of Physical Education, Warsaw, Poland)
 - New Directions Wellness Center (School of Physical Therapy, University of Montana, Missoula, Montana)

Experimental Design at New Directions Wellness Center

- Oxycon Mobile Metabolic System collected participants actual total energy expenditure during the following tests:
 - 5 minutes supine
 - 6-minute Walk Test (6MWT)
- Participants wore Actical® Accelerometers on their wrists and ankles, these devices collected Activity counts that are used in the prediction equation for AEE.
- Subjects participated in The Functional Gait Assessment (FGA), a test that predicts fall risk in individuals with IG.



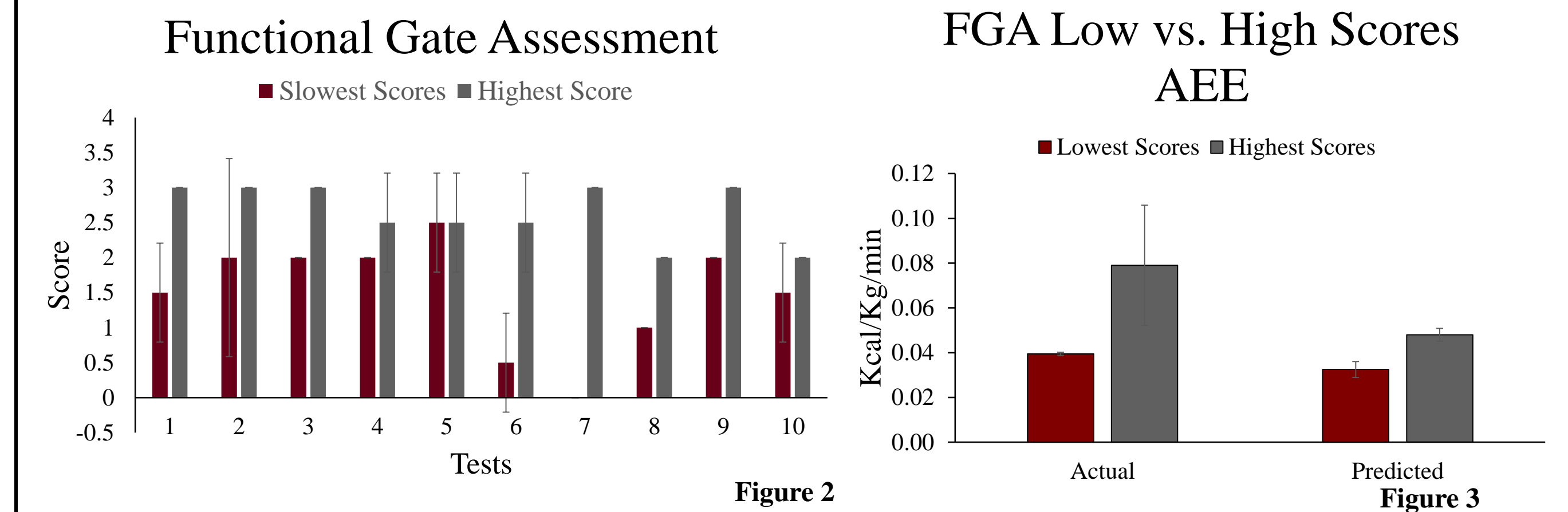
RESULTS



- All Participants
 - Actual (.07±.04 kcal/kg/min) vs. Predicted (.04 ±.02 kcal/kg/min) p = .000000002
- Bottom* 25% (Participants placing in bottom 25% distances of 6MWT)
 - Actual (.07±.04 kcal/kg/min) vs. Predicted (.05 ±.01 kcal/kg/min) p 0.019
- Top* 25% (Participants placing in top 25% distance of 6MWT)
 - Actual (.08 ±.03 kcal/kg/min) vs. Predicted (.03 ±.02 kcal/kg/min) p = .00029

*Distance covered during the 6 minute walk test.

RESULTS



- Scores in **Figure 2**. Tests:
 - Gait Level Surface
 - Change in Gait Speed
 - Gait with Horizontal Head Turns
 - Gait with Vertical Head Turns
 - Gait and Pivot Turn
 - Step Over Obstacle
 - Gait with Narrow Base of Support
 - Gait with Eyes Closed
 - Ambulating Backwards
 - Steps (Stairs)

- Previous data collection for this study has considered tests such as the timed-up-and-go, 10 m walk test, 4-stage balance test etc. These data did not correlate well enough to be included in a regression equation for predicting IG AEE.
- The participant with the highest overall score on the FGA compared to the participant with the lowest overall score had an increased Actual AEE compared to the predicted AEE. This data is trending to demonstrate that individuals with IG that scores high on the FGA has a larger discrepancy in Actual AEE and Predicted AEE. Further research is needed to confirm these findings, as there is no statistical significance in our findings thus far.

CONCLUSION

- The Actical® Accelerometer Device is not a valid instrument in predicting AEE in individuals with IG regardless the magnitude of their IG.
- Individuals with IG demonstrate an overall increase in Actual AEE compared to predicted AEE.
- Further research is needed to either confirm the FGA as a valid test for our purposes, or to characterize a new metric to be included in a more reliable and valid prediction equation that can be used by the IG population.

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