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Energy Expenditure and Availability in Active Individuals with Physical Disabilities

Scott Richmond

Lindenwood University, srichmond@lindenwood.edu

Amanda Bayer

Lindenwood University

Chad Kerksick

Lindenwood University, ckerksick@lindenwood.edu

Heather Pennington

Lindenwood University, hpennington@lindenwood.edu

Petey Mumford

pmumford@lindenwood.edu

See next page for additional authors

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Authors

Scott Richmond, Amanda Bayer, Chad Kerksick, Heather Pennington, Petey Mumford, and Annie Alameda

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Abstract

The purpose of this study was to evaluate the risk of low energy availability (LEA) in a population of active individuals with physical disabilities. Healthy, active males and females with a physical disability (n=13; Mean±SD; Age: 26.4±6.5 years; Height: 143.4±59.6 cm; Body mass: 57.5±27.3 kg; Fat-free mass: 41±20.8 kg;) were recruited to participate in this study. Participants were expected to track their exercise energy expenditure (EEE) and energy intake (EI) over the course of five days using portable wrist and chest-strap heart rate monitors. Body composition assessment completed via dual-energy x-ray absorptiometry (DXA) and resting energy expenditure (REE) performed via indirect calorimetry. Energy availability (EA) was then calculated to assess the subjects' risk for LEA. The participants' mean EA values were 26.0 kcal/kg FFM/day showing a low level of EA leftover according to the cutoff values. In conclusion, individuals with physical disabilities who are at least moderately active should be cautious when it comes to their EA each day. There is potential for near sub-optimal EA levels in this population.

Introduction

- Parasports such as wheelchair rugby, wheelchair basketball, para powerlifting, and others are increasingly more popular
 - 2022 Winter Paralympic Games in Beijing - over 650 athletes from 49 countries
 - 2020 Summer Paralympics in Tokyo - over 4,400 athletes from 162 countries
- Recent studies have begun to examine energy availability, nutrient deficiencies, metabolic function, and physical activity participation in individuals with physical disabilities
- Low energy availability (LEA) is a state in which body lacks sufficient energy stores to carry out basic physiological processes after exercise
- Long-term LEA can lead to wide array of negative health outcomes in males and females
 - Decreased bone mineral density, amenorrhea, hormonal abnormalities, unfavorable lipid profiles, increased susceptibility to infections, immunosuppression, impaired metabolic function



Methods

Participants

- Thirteen men and women with physical disabilities between ages 17-35 years were recruited
 - Types of physical disabilities included: Ataxia (2), Spinal cord injury (2), Spina bifida (3), Traumatic brain injury (4), Cerebral palsy (1), Amputee (1)
- Participants required to be physically active 30-min ≥3 d/wk
 - Meets ACSM recommendations for moderately active individuals

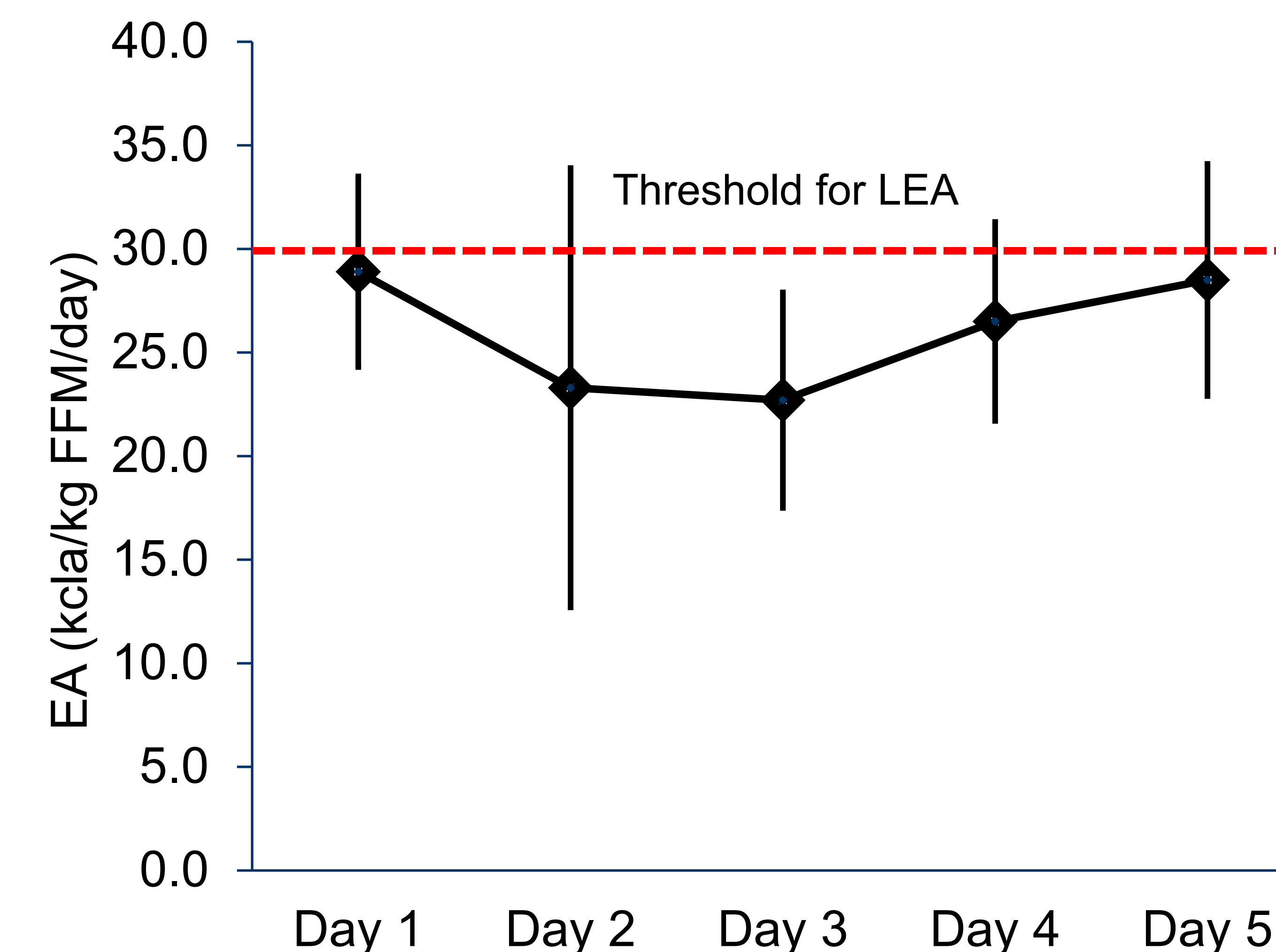
Study Design

- Body Comp – DEXA
- Resting Energy Expenditure – metabolic cart
- Energy intake (EI) – food recall for five days (same days as EEE)
- Exercise energy expenditure (EEE) – Polar Ignite and Polar H10 portable wrist and chest-strap heart rate monitors
- Energy availability (EA) = (EI – EEE)/FFM
 - Low EA: <30 kcal/kg FFM/day
 - Moderate EA: 30-45 kcal/kg FFM/day
 - Optimal EA: >45 kcal/ kg FFM/day

Variable	Mean ± SD
Age (years)	26.4 ± 6.5
Height (cm)	165.5 ± 13.5
Weight (kg)	66.3 ± 15.3
Body fat (%)	29.1 ± 7.2
FFM (kg)	47.3 ± 13.4
REE (kcal/day)	1600.2 ± 465.2
EI (kcal/day)	1673.5 ± 243.2
EEE (kcal/day)	307.5 ± 359.4
EA (kcal/kg FFM/day)	26.0 ± 2.9*

* = below threshold of LEA

Results



Summary

- Moderately active individuals with physical disabilities are at risk for sub-optimal EA levels
- Should be cautious when it comes to their daily EA
- Understanding REE in this population and how it relates to EI can help reduce risk of LEA in para-athletes and active individuals with physical disabilities
- Exercise professionals and researchers need a well-developed protocol for properly evaluating energy expenditure in individuals with disabilities

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