TACSM Abstract

Driving Entrainment of Locomotor and Respiratory Systems to Determine Metabolic Efficiency

[1]MICHAEL T. YOUNG, [1]KUANTING CHEN, & [1]JENNIFER M. YENTES

[1]Human Movement Complexity Lab; Kinesiology & Sport Management; Texas A&M University; College Station, TX

Category: Undergraduate

Advisor / Mentor: Yentes, Jennifer (jyentes@tamu.edu)

ABSTRACT

Many biological rhythms, including breathing and locomotor rhythms, are interconnected through a phenomenon known as coupling. Locomotor respiratory coupling (LRC) is quantified using a ratio of stride cycles to breaths. For example, an entrained LRC ratio of two strides to one breathing cycle, is a typical ratio humans use while walking. While various ratios have been recorded, previous research has suggested that not deviating from a particular ratio is associated with low energy expenditure. However, recent research challenges the assumption that stronger LRC correlates with lower energy expenditure, but rather, LRC variability is associated with lower energy expenditure. In addition, preferred stride frequency is associated with low energy expenditure. Both LRC variability and stride frequency may play pivotal roles. **PURPOSE**: This study investigates the intricate relationship between LRC variability, stride frequency variability, and energy expenditure during human walking, offering potential insights into the significance of variability within biological rhythms, movements, and processes as an indicator of a healthy statistic. **METHODS**: 10 college-aged females (age: 21 ± 1.2; height: 170 ± 4.1 cm; mass: 66 ± 10.8 kg) underwent a 1-minute walking trial to determine their self-selected walking speed. After motion capture marker placement, the subjects underwent a 5-minute walking bout to assess their preferred LRC. Following that, they were provided with a portable VO2 measurement device and participated in a 7-minute treadmill trial that included seven conditions that manipulated visual cues for timing the breathing and/or walking rates based on preferred LRC. The seven conditions were: (1) familiarization, (2) no cue, (3) walking cue, (4) no cue, (5) breathing cue, (6) no cue, and (7) walking + breathing cue. Energy expenditure and LRC variability were recorded and subjected to ANOVA analysis. **RESULTS**: Findings indicate that the impact of breath, walking, or breathing + walking cues on energy expenditure during walking was not significantly different from the non-cued condition ($p= 0.43$). The difference in coupling variability between cued conditions and the non-cued conditions were also not significant ($p=0.21$). **CONCLUSION**: The present findings indicate that manipulation of breath or step timing did not impact energy expenditure nor variability of LRC. Future data analyses could include the confirmation of LRC ratios, number of ratios, and percent of time spent in different ratios to determine how often subjects changed LRC ratios throughout the cuing conditions. Upon visual inspection of the data, it did appear that there were two different strategies. A sample of subjects had higher energy expenditure in the cued conditions, indicating that when variability was restricted, energy expenditure was affected. The other strategy was that no difference in energy expenditure was seen between any of the cue conditions versus the non-cued conditions. Future work is needed to determine if personal characteristics contribute to different strategies. Increasing the sample size may yield more substantial outcomes as standard deviations were quite high.