Relationship Between Metabolic Cost of Transport and Stride-to-Stride Variability

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INTRODUCTION

-Humans prefer to walk at speed which conserves the most metabolic energy[1].

-The ability to walk economically requires the optimization of a variety of parameters, including changes in stride characteristics[2].

-While the gross variation of strides is related to energy consumption[3], how this variation is organized from stride to stride may also contribute to metabolic economy.

The purpose of this study is determine the relationship between metabolic energy consumption, stride variability, and stride-to-stride organization.

We hypothesize that:

-Stride length variability and stride length organization will be positively correlated with energy consumption.

-Stride length variability will be more strongly related to energy consumption than stride length organization.

METHOD (N = 1)

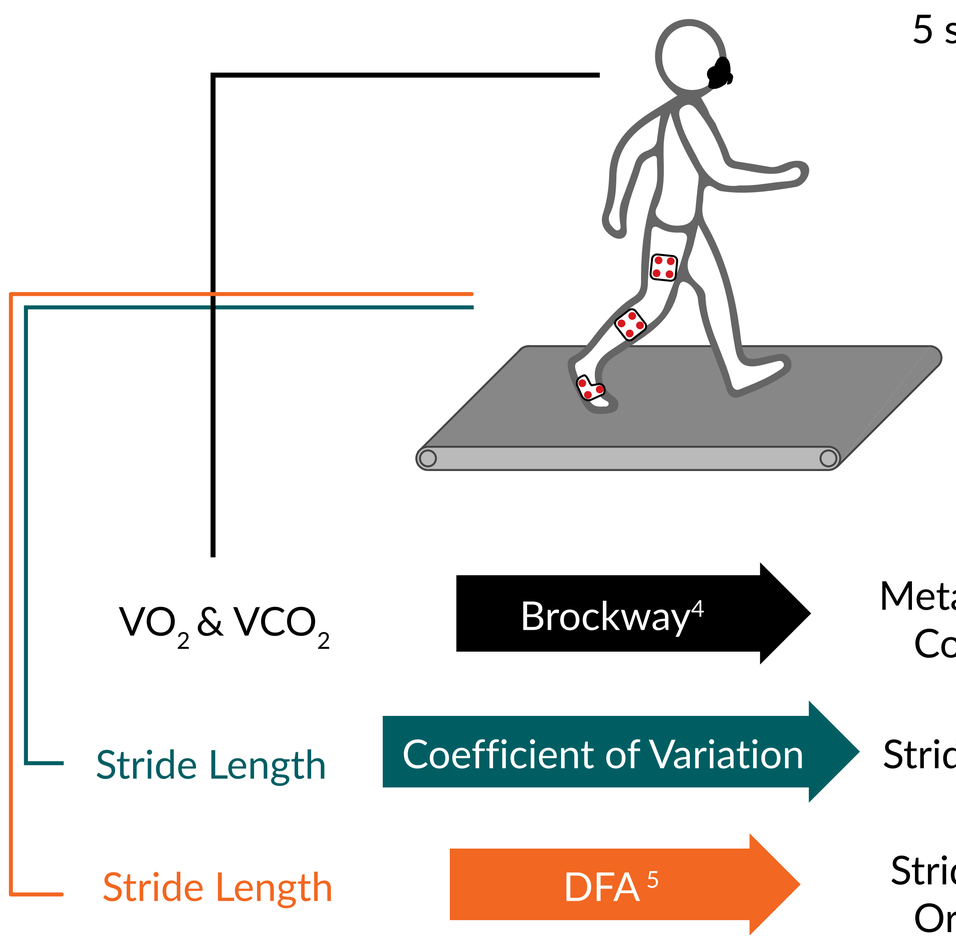

Figure 1. Metabolic cost of transport was calculated from VO_2, VCO_2 [4] and walking speed. Coefficient of variation was calculated from the mean and standard deviation of stride length. Detrended Fluctuation Analysis (DFA) was applied to the stride length time series to describe stride pattern organization [5].

-The participant walked for 15 minutes at each speed, while gas exchange and stride length were measured (Fig 1).

RESULTS

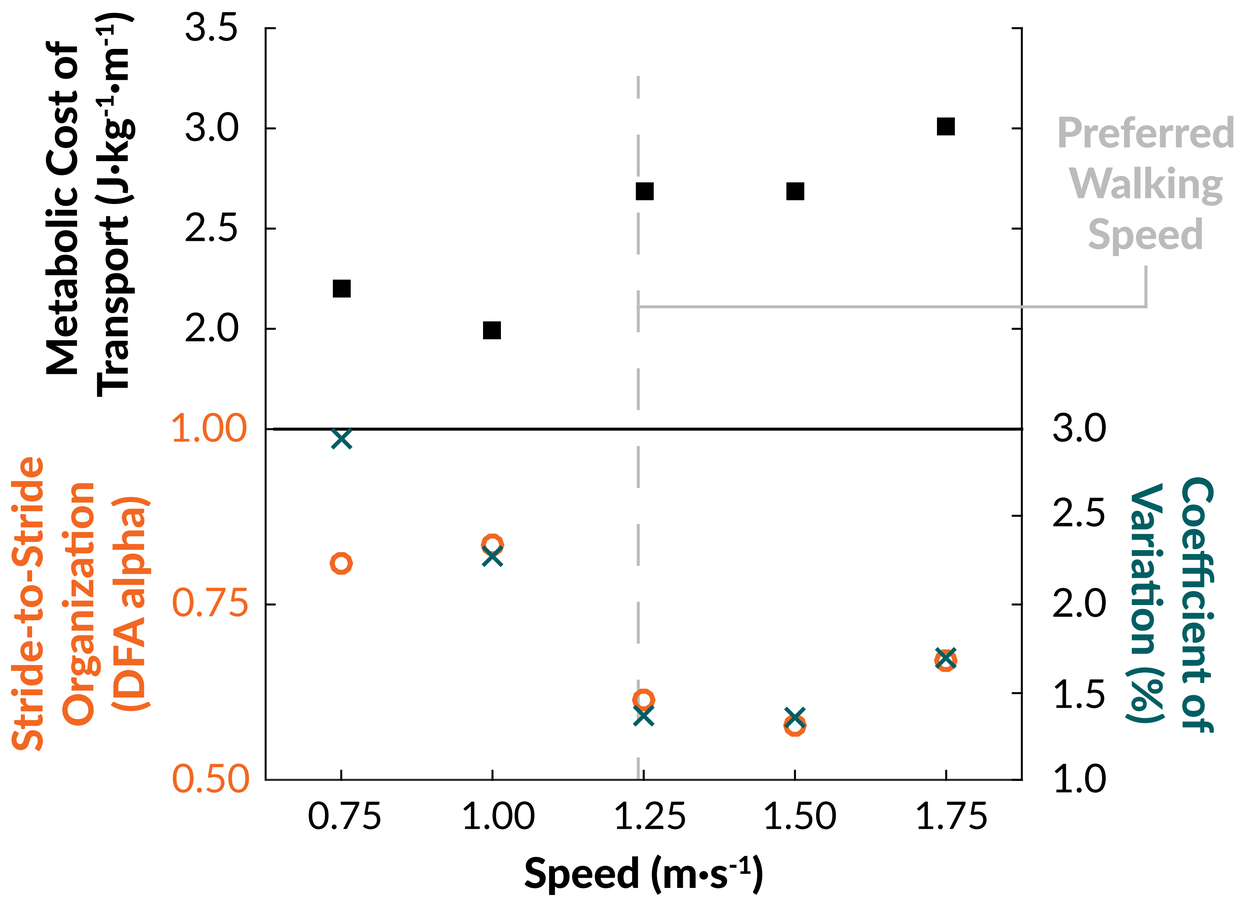

Figure 2. Metabolic cost of transport (black) and the persistence of stride length pattern (orange) were lowest on opposing sides of the estimated preferred walking speed (1.24 $m \cdot s^{-1}$, vertical dashed line).

-DFA values close to 0.50 indicate more randomness, with increasing values denoting higher statistical persistence.

DISCUSSION

-Organization of the stride pattern may co-vary with metabolic energy consumption across speeds.

-This interaction resembles the relationship between coefficient of variation and metabolic energy consumption (Fig. 2).

-These relationships will be further investigated as we continue this study with additional participants.

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ACKNOWLEDGEMENTS

This work is supported by the Center for Research in Human Movement Variability of the University of Nebraska at Omaha, NIH (P20GM109090) and NIH (1R15HD086828), the Graduate Research and Creative Activity Award from the University of Nebraska at Omaha, and the NASA Nebraska Space Grant Fellowship.