

**Title: "Reliability of heart rate indices for the measurement of energy cost during walking".**

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Introduction:

A study was undertaken to determine the reliability of two energy cost indices, the Physiological Cost Index (PCI) and Total Heart Beat Index (THBI).

$$\text{PCI} = \frac{\text{mean walking heart rate} - \text{mean resting heart rate}}{\text{mean walking speed}}$$

$$\text{THBI} = \frac{\text{total number of heart beats during walking period}}{\text{total distance walked}}$$

Methodology:

Healthy volunteer adults wore a downloadable Polar Heart Rate Monitor during a five minute resting period, followed by a ten minute walking period around a 25metre figure-of-eight indoor track, at their self-selected normal walking speed. They attended on four separate occasions. Heart rate was recorded every five seconds, and lap times and total distance walked were noted.

PCI and THBI for the first five minutes and whole ten minutes of walking were calculated, and results across all four sessions were analysed.

Results:

This study found a mean PCI value of 0.17 (0.03 – 0.32) and mean THBI value of 1.23 (0.97 – 1.62).

Reliability of the raw heart rate was determined for five and ten minute periods. Very high reliability (ICC's 0.93 – 0.95) was attained.

Reliability of the derived energy cost measures over five and ten minutes was calculated. Results for PCI and THBI showed moderate to very high reliability across the recording sessions (0.67 – 0.96). However, the THBI displayed very high reliability (0.95 – 0.96), compared with moderate to high reliability for the PCI (0.67 - 0.71).

Coefficients of Variation were also calculated, with THBI showing less variation across subjects compared with PCI (THBI: 14.3-17.1; PCI: 23.1 – 47.7).

Bland & Altman plots confirmed this good agreement between the five and ten minute measures, for both PCI and THBI, although the THBI showed less variation of scores.

Summary:

Where a reliable energy cost measure is required, using raw heart rate data, the THBI appears to be more reliable and less variable than the PCI.

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