THE RELATIONSHIP BETWEEN GAIT TRANSITION SPEED AND THE AEROBIC THRESHOLDS FOR WALKING AND RUNNING

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Background
No direct evidence exists to show that the preferred transition speed between walking and running in humans is functionally linked to the aerobic threshold (the first increase in blood lactate concentration above resting value, 'lactate' or 'anaerobic' threshold according to Wasserman). Few studies dealing with this issue have serious methodological flaws. We hypothesize that the ventilatory aerobic thresholds for the two basic modalities of human locomotion, walking and running, are related to the preferred transition speed between walking and running (PTS).

Purpose
The aim of this study is to determine whether the speed at the ventilatory aerobic thresholds for walking (ATw) and for running (ATr) differ from PTS, and to explore the relationship between them.

Methods
Twenty-two physical education students (21.4+/-2.4y, 182+/-7cm), performed two incremental treadmill tests to volitional exhaustion, walking in one and running in the other. Gas exchange data were analyzed (V-slope method) in order to determine the ventilatory AT for each gait modality. A third treadmill test was also performed in all subjects, in order to determine their individual PTS.

Results
The preferred gait transition speed had the same average value (7.1+/-0.4 km/h) as ATw (7.1+/-0.6 km/h) and ATr (7.1+/-1.3 km/h). The PTS was significantly correlated with ATr (r = 0.82), but not with ATw (r = 0.11).

Discussion and conclusions
Turvey et al (1999) defined the Q factor (the ratio of kinetic energy change to metabolic energy expended at a certain speed) for walking (Qw) and for running (Qr). According to their experimental data, Qw asymptotes on a value of approx. 1, changing little in the range of walking speed close to the PTS. For running, Qr increases linearly with speed, and is greater than 1 above the PTS. The relationships between ATw, ATr and the PTS found in this study suggest that a) mechanical and metabolic measures of locomotion are linked, and b) humans do not use running as a gait pattern at velocities below the aerobic threshold, as they normally do not use walking at velocities above the anaerobic threshold. This implies that the natural speed range of locomotion includes only one physiological threshold for a particular gait – the aerobic for walking, and the anaerobic for running. The controversy in the literature regarding the terminology and structural description of the two metabolic thresholds leads to the question: have they evolved for the two basic human gaits – walking and running, were the lower, aerobic threshold, represents the speed where the gait change occurs, and the higher, the anaerobic threshold (maximal lactate steady state), represents the speed above which the speed of running gets priority over metabolic balance between aerobic and anaerobic processes.

References

Keywords: Gait, Speed Changes, Threshold

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