

中高年女性の陸上および水中歩行時の呼吸 循環応答と下肢筋活動

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Cardiorespiratory Responses and Muscle Activity in Lower Extremity during Walking on Land and in Water in Middle-Aged and Elderly Women

by

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ABSTRACT

The purpose of the present study was to examine cardiorespiratory responses and muscle activity in the lower extremity during walking on land and in water in middle-aged and elderly women. Seven healthy female volunteers, with a mean age of 62.6 ± 4.0 years, took part in this study. Walking on land was performed on a treadmill (40, 60 and 80 m/min). Walking in water was performed in a device for water-walking (Flowmill), which is a treadmill positioned at the base of a water flume (belt and water-flow velocity: 20, 30 and 40 m/min). The water depth was at the level of the xiphoid process of each subject. The water temperature was 30.6 ± 0.1 °C. The electromyogram (EMG) of five muscles, tibialis anterior (TA), medial gastrocnemius (MG), vastus medialis (VM), rectus femoris (RF) and biceps femoris (BF),

were recorded by bipolar surface electrodes in the right lower extremity. TA, VM and BF activity levels in water at 40 m/min were significantly higher than on land at 40 m/min. The velocity at 40 m/min was slower on land and faster in water. Oxygen uptake ($\dot{V}O_2$), heart rate (HR) and METs were significantly higher in water than on land. During walking on land and in water at a similar $\dot{V}O_2$ level, MG and RF activity levels tended to be lower in water than on land. Based on the relationship between $\dot{V}O_2$ and activity in each muscle, TA, VM and BF tended to increase similarly during both land-walking and water-walking. However, there was a tendency for MG and RF activity levels to be lower in water than on land at the same $\dot{V}O_2$. These results showed that muscle activity $\dot{V}O_2$ level, and suggested that the lower extremity muscles can be trained selectively.

要 旨

中高年女性7名(62.6 ± 4.0歳)を対象に、トレッドミルを用いた陸上歩行時(40, 60, 80m/分)と回流水槽の底面にトレッドミルを備えた水中歩行装置(フローミル)を用いた水中歩行時(ベルトおよび水流速度: 20, 30, 40m/分)の呼吸循環応答と下肢筋活動(前脛骨筋, 腓腹筋, 内側広筋, 大腿直筋, 大腿二頭筋)について比較検討を行なった。陸上および水中での同速度(40m/分)歩行時には、前脛骨筋, 内側広筋および大腿二頭筋で、水中歩行時の方が有意に大きな活動量を示した。また、酸素摂取量($\dot{V}O_2$), 心拍数(HR)およびMETsも、水中歩行時の方が有意に高値を示した。同一 $\dot{V}O_2$ レベルの歩行時、腓腹筋および大腿直筋の活動量は、水中歩行時の方が小さくなる傾向が認められた。 $\dot{V}O_2$ と各筋の活動量との関係から、水中歩行時の前脛骨筋, 内側広筋および大腿二頭筋の活動は、 $\dot{V}O_2$ の増加に伴い、陸上歩行時と同様の増加傾向が認められた。しかし腓腹筋および大腿直筋は、同一 $\dot{V}O_2$ 時の活動が陸上歩行時より少ない傾向が認められた。

以上の結果から、水中歩行は浮力の影響が大きくなる条件では、術後のリハビリテーションや肥満症者および中高年者のコンディショニングのた

めの運動として有効である。また、抵抗の影響が大きくなる条件では、重力方向への負荷を軽減しての心肺機能訓練の運動として有用である。さらに、水中歩行では同一 $\dot{V}O_2$ レベルでの下肢筋群の活動様式が陸上歩行とは異なり、選択的な筋力訓練の可能性が示唆された。