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The influence of pedalling frequency on mechanical efficiency in exercises with the same intensity

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The aim of this work was the determination of the pedalling rate on the gross and net mechanical efficiency in efforts with the same intensity (250 W) as well as checking if the HR grows linearly along with the pedalling rate. Twelve students of AWF took part in the study. Examined subjects performed four, lasting for 3 min efforts on a cycle-ergometer (Monark E 824) joined with the computer. Exercises were done with the space of 7 days between them. The effort load equalled 250 W and the amount of performed mechanical work – 45 kJ. The pedalling rate amounted in efforts 40, 60, 80, 100 rotations per min respectively. The gas analyser (SensorMedics company) with 2900/2900c Metabolic Measurements Cart/System programme was used as for the determination of the oxygen intake during exercises and while resting (until the resting value of VE occurs). The gross mechanical efficiency (GE) was calculated as a mechanical work and total energy ratio and the net mechanical efficiency (NE) as the mechanical work and total net energy ratio (the total energy diminished by the resting energy value). Pulse measurement was calculated during and after every effort using the POLAR-SportTester. A capillary blood was taken from a fingertip to the heparinized capillary tubes as for the estimation of an acid-alkali balance. It was done before the effort, immediately after it and in every 2 min of the 8 min rest. Following acid-alkali balance values were analysed in the blood gas analyser Ciba-Corning 248: BE, HCO₃act, pCO₂, pH. Average (±SD) mechanical efficiency gross values for pedalling rate of 40, 60, 80 and 100 rpm equalled respectively: 14.2±2.2, 14.9±2.6, 15.3±2.1, 12.3±1.5% and net values: 21.8±2.8, 22.6±2.1, 23.1±2.1, 19.0±2.7%. Gross and net values obtained by 100 rpm were significantly different from averages reached by 40, 60 and 80 rpm. In case of the pulse value the minimum HR occurred by the pedalling rate of 60 rpm. However, in the case of ΔHR (difference between HR value observed in the test and the resting one) the circulatory system reaction grew along with the pedalling rate. The HR values obtained by various pedalling rates did not differ crucially.

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