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» Journal Abstract

Economical and optimal pedalling velocity characteristics during maximal and submaximal efforts on cycloergometer

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This investigation was undertaken in order to verify the hypothesis that there exist some relationship between the optimal and economical pedalling rate in maximal efforts and the economical pedalling speed in submaximal efforts. The 3-min efforts with the space of 7 days between them were performed fourfold on the cycle ergometer (Monark E 824 joined with the computer) by examined subjects during the submaximal efforts test. The effort power amounted to 250 W and mechanical work quantity to 45 kJ. The pedalling speed grew in respective trials in following manner: 40, 60, 80 and 100 rpm. The economical pedalling rate (ve) was defined as such a pedalling which enabled the least oxygen intake by applied load. The cycle ergometer Wingate test with the load equal 7.5% of body weight (BW) was performed during the maximal test by every examined subject. Next, after the interval of at least 3 days they performed 4 trials with the respective loads: 2.5%; 5%; 10% and 12.5% BW according to the Wingate test formula. The end of trial was obtained when the results of work were equal with the 7.5% BW Wingate test ones. Results obtained in the maximal efforts allowed calculation of the force-velocity (F-v) and power-velocity (P-v) dependencies for every experiment participant in purpose of the individual maximal power (Pmax) and optimal speed (vo - pedalling rate by which Pmax occurred) determination. The gas analyser (SensorMedics Co.) was used in order to oxygen intake markings. Average values (±SD) of the net mechanical efficiency (NE) in submaximal efforts for pedalling rates of 40, 60, 80 and 100 rpm amounted respectively: 23.0±1.8; 22.9±2.1; 23.5±2.2 and 19.6±2.8%. Average value of the economical pedalling rate calculated for VO2 net equalled: veVO2net=62.5±21.8 rpm and oxygen usage of VO2min=31.56±2.90 ml·mn-1 while NE veNE equalled 62.5±14.8 rpm with average NE=23.9±2.5%. Mean values (±SD) of net mechanical capacity in maximal efforts amounted respectively: 12.5±1.5; 17.3±2.3; 18.2±3.2; 19.9±4.7 and 19.1±2.4%. The average maximal power value (Pmax) calculated from the individual dependencies amounted to 1031.6±115.5 W (13.10±1.90 W/kg) by mean optimal frequency vo=109.2±12.0 rpm. Some significant dependencies between optimal pedalling frequency and economical pedalling rate in maximal and submaximal efforts were found namely: negative for the economical pedalling speed calculated from net VO2 (r=-0.51; R2=0.264) and positive for the economical pedalling rate counted from the net mechanical efficiency (r=0.95; R2=0.907). The significant dependency between the economical pedalling speed obtained during the maximal effort and economical pedalling frequency calculated for the submaximal effort (r=0.788; R2=0.622) was stated.

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