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Metabolic Efficiency of the Rotor System compared to a Conventional Bicycle in Professional Athletes

A. Córdova, F. Navas, P. Carrasco*.

Dpto. Fisiología. E.U. Fisioterapia-SORIA.

During the execution of any exercise, as long as the work-load and time practiced is increased, lactic acid concentration in the blood increases, which reduces the athlete's ability to perform, and also promotes muscular fatigue. Various factors, such as the crank system or the frequency or intensity of the exercise, determine the bio-mechanical and metabolic efficiency of the cyclist. The Rotor system, a crank system for bicycles, is a mechanism made up of independent cranks that optimize kinematics through the pedal, so that each crank moves slower during the lowering of the pedal, creating a situation where both cranks never coincide at the dead point of the pedal cycle. As a result of this kinematics, the pair (force) that the system requires from the knees during the lowering of the pedal (extension of the knee) is greater than during the climb (flexing of the knee), which corresponds to the knees muscles abilities to push. In this study we propose to analyze the metabolic efficiency of the Rotor system in comparison to the conventional crank system in professional athletes.

Eight professional athletes participated in the study (Kelme Cycling Team), each of whom gave their consent to participate in the study after a detailed explanation of the work protocol. A maximum, incremental test was completed with the same bicycle (placed in a cycle-simulator Cateye GS-1000), but with different crank systems (Conventional in comparison to the Rotor). The tests were completed in two consecutive days, realizing each day half of the racers with one system and the other half with the other system. The cyclists were monitored with a Polar Pulse Monitor, and in different moments of the test (32, 40, 48, 54 y 62 Km/h) blood samples were obtained via the ear lobe to measure lactic acids (YSI model 1500 Sport). The results obtained show that at the same speed, the heart rate (3.5%) as well as the lactic acid (13.5% at the end of the test) were lower when the Rotor system was used, with greatest differences at levels where the force applied was nearest to the anaerobic threshold of the cyclist.

In conclusion, we believe that the Rotor system is a mechanism that improves the metabolic efficiency of the cyclist and produces less physical wear for the same amount of work.