Cycling is a very complex and demanding sport, which turns difficult the analysis of the skills improvement training as well as the analysis of physiological parameters. In the last years many works emerged using indoor simulators to study physiological parameters associated to cycling training and evaluation. However, the works reach different conclusions depending on the used methodology and the comparison made with a real road time-trial. Thus, the aim of this work was to compare the neuromuscular activity of lower limbs, oxygen consumption, aerobic capacity and heart rate variability in three different test situations: in a cycloergometer (graded maximal test), in a simulator and in a road time-trial.

In order to achieve our goals the study was performed in nine under-23 elite athletes with an intensive workload preparation during the week. We started to perform a maximal aerobic graded test in a cycloergometer (Monark®) in order to measure oxygen consumption, aerobic capacity (VO2max) and heart rate. This test was made at a constant cadence (60 rpm). All the athletes performed also a road time trial of 4.5 Km with continuous measurement of heart-rate, cadence and power. After that, in the laboratory the conditions of the time-trial were reproduced in a simulator (Tacx® Imagic) with a supplementary power output sensor (polar®) (used in the time-trial). All the athletes used the same bicycle in both performed tests (simulator and time-trial). During all the tests the electromyographic behaviour of Vastus lateralis and Gastrocnemius lateralis were recorded using a Megawin® (MEGA 6000) system. The mean power frequency (MPF) and amplitude (RMS-EMG) were analysed.

Our results showed that when we compared the time-trial and the simulator test all the physiological parameters tested were equivalents, such as the oxygen consumption and heart rate variability. The only difference observed (at a performance level) was a higher cadence and lower power when cycling simulator was used and compared with time-trial.

Concerning the neuromuscular activity the MPF and the amplitude (RMS-EMG) the values of Gastrocnemius lateralis MPF were higher than those obtained for the Vastus lateralis. These values have been similar in all the tests performed and did not show alterations with power or warm up intensity. The amplitude values presented a direct relationship with power in the time-trial and simulator test. When cadence was higher (about 100 rpm) an asymmetry of the lower limbs was observed.

In conclusion, our results suggested that a graded maximal aerobic test was the best indoor method for studying the neuromuscular activity of lower limbs showed similarity with the real time trial. However, when the study of physiological parameters are the goal of the comparison the cycle-simulator showed the best results.

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