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EXPLORING DIFFERENCES AND FACTORS AFFECTING CYCLING EFFICIENCY IN MALE VS FEMALE CYCLISTS

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Introduction. In road cycling, there are three major factors which define rider's performance. They are maximal oxygen consumption (O2max), lactate threshold (LT), and cycling efficiency (CE) (2,7). Most of studies related to CE have involved only male participants analyzing differences between trained and untrained riders (3). Hopker et al., (2010) was the only one to analyze gross efficiency (GE) differences between male and female competitive cyclists at 4 different intensities (150W, 180W, relative power to LT and 60 % of maximal aerobic power (MAP) finding a higher GE in 150W and 180W in female cyclists compared to male cyclists. Authors discussed that leg volume could have an influence in GE (4). Strength seems to have an important role in GE, improved maximal strength has been associated with improved cycling performance (7). However, factors determining GE differences in gender are still unclear. Coyle et al. (1992) showed in his study that fiber type I percentage could be an important factor related to CE. It seems that a higher fiber type I percentage is associated to a higher CE. Rothschild et al. (2022) suggests that women have a higher percentage of fiber type I compared to men which can explain why women have a higher GE than men. This study will focus on the analysis and comparison of GE between well trained men and women cyclists. Fiber type percentage and muscle strength will be analyzed as possible variables influencing GE.

Goal/Task. To determine the differences in cycling GE in males and females and how differences in fiber type percentage and knee extensor (KE) muscles peak torque (PT) affect it.

Methods. 15 trained male cyclists (CYCM) and 15 trained female cyclists (CYCF) were tested. To calculate GE participants performed a steady state protocol which consists in 4 stages of 5 minutes at 160W, 45 % VO2max, 55 % VO2max and 65 % VO2max where gas exchange was analyzed. Maximal voluntary contraction (MVC) of knee extensor muscles was obtained using Biodex System 4 isokinetic dynamometer chair apparatus. Myosin heavy chain isoform type I percentage (%MHC–I) was estimated from data obtained from TMG test (6).

Results. Statistical analysis showed a significant difference in GE at each intensity; 120–160W ($p < 0.001$); 45 %VO2max ($p < 0.001$); 55 %VO2max ($p = 0.005$); 65 %VO2max ($p < 0.001$) with higher mean GE percentage in CYCF at 120W (21.08 ± 0.92); 45 %VO2max; (21.41 ± 0.98); 55 %VO2max; (21.88 ± 1.09) and 65 %VO2max; (22.30 ± 1.20) compared to CYCM; 160W (19.73 ± 0.70); 45 %VO2max; (19.95 ± 0.82); 55 %VO2max; (20.64 ± 0.70) and 65 %VO2max; (21.18 ± 0.80). Results showed a significant difference in%MHC–I ($p = 0.017$) with higher mean%MHC–I in CYCF (39,97 ± 11.17) than in CYCM (31.02 ± 7.86). Results show significant difference in PT ($p < 0.001$) with higher PT (Nm) mean in CYCM (302.5 ± 54.70) than in CYCF (230.81 ± 37.43).

Conclusion/Discussion. Results related to GE agree with previous studies from Hopker et al. (2010) that found higher GE in female than in males at 150W and 180W. Moreover, higher%MHC–I was higher in female cyclists, this can relate to the research of Coyle et al. (1992) which affirmed that%MHC–I has relation with GE. Lastly, higher PT was found in males. When comparing amateurs with elite athletes, strength seems to have an important role in GE (7), but it seems not to have the same effect in gender comparison since, in this study, female have higher GE even when PT is lower. As conclusion, this study suggests that main factor that can affect GE in gender comparison is%MHC–I, while PT does not seem to have an effect. It would be interesting to compare other

factors related to energy expenditure during exercise to find more possible factors affecting gender differences in GE.

Keywords: gross efficiency, peak torque, fiber type, gender, cyclists.

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