Higher VO_{2max} Delays Substrate Switching and Shifts the Crossover Point to Greater Oxygen Uptake during Incremental Exercise

Elvin Onarici Gungor
Eskisehir Technical University, Eskişehir, Türkiye

Dilek Yalız Solmaz
Eskisehir Technical University, Eskişehir, Türkiye

Celil Kacoglu
Eskisehir Technical University, Eskişehir, Türkiye

İzzet Kirkaya
Eskisehir Technical University, Eskişehir, Türkiye

Abstract

This study investigated the relationship between maximal oxygen uptake (VO_{2max}) and substrate crossover point during incremental exercise. The objectives of this study were to examine whether VO_{2max} is associated with the time to reach the crossover point and the oxygen uptake (VO_2) at crossover point. A total of 25 Physical Education students, 22 ± 2 years of age, were performed an incremental exercise test to assess VO_2, VCO_2 and substrate utilization patterns. The crossover point was identified based on the respiratory exchange ratio. The relationships between VO_{2max} and time to reach the crossover point, $\%VO_{2max}$ at the crossover point, VO_2 at the crossover point and heart rate at the crossover point were evaluated using Pearson correlation analysis. Linear regression analysis revealed a positive association between VO_{2max} and time to crossover point. Linear regression analysis revealed a negative association between VO_{2max} and $\%VO_{2max}$ at the crossover point. No significant correlation was observed between VO_{2max} and heart rate at the crossover point. Results demonstrated that higher VO_{2max} was positively associated with a delayed time to the crossover point and with higher oxygen uptake at the point of metabolic transition. These findings indicate that individuals with greater aerobic capacity maintain lipid oxidation for a longer duration and exhibit a rightward shift in substrate switching during incremental exercise. This suggests that VO_{2max} plays an important role in determining metabolic flexibility and the regulation of substrate utilization under increasing exercise intensity. Overall, the present study provides evidence that aerobic capacity is a key determinant of both the timing and intensity of the substrate crossover phenomenon during exercise.