

Oxygen uptake in One and Two Skate Cross Country Skiing At Increasing Grades

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Abstract

Skate skiing is a unique form of quadrupedal locomotion utilizing a sliding pair of skis and a fixed pair of poles. Skiers tend to use the two-skate technique at slow speeds, the one-skate at intermediate speeds and then, surprisingly select the two-skate again at very high speeds. In a previous study on a flat terrain, we have shown that this strange behavior seems to minimize oxygen consumption since the two-skate technique had a lower oxygen consumption at both low and high speeds than the one skate technique. In the two-skate, poles are planted with every second skate stride while in one-skate, poles are planted simultaneously with every skate stride (Smith, 2000). However, skiers are not limited to flat terrain; therefore, in this study we measured the oxygen consumption of the one- and two-skate techniques at a constant speed while changing the slope. We hypothesized that the one-skate would require less oxygen consumption from 0 to 2% slope (at 12km/h) while two-skate would be more economical on 4 to 6% slopes. Eleven nationally competitive cross country skiers were asked to perform an incremental test on a rollerski treadmill. The speed was constant at 12km/hr and the grade was increased from 0% to 6% grade by increments of 2%. At each grade, the skiers reached metabolic steady state for both techniques. During the test oxygen consumption was continuously collected. No difference was found in steady state oxygen uptake for one- and two-skate for the grades tested. This result suggests that the oxygen cost of the one- and two- skate techniques is independent of slope at 12km/h. We suspect that if the slope is increased to grades beyond 8%, the 2-skate will become the more economical technique, however achieving steady state at slopes higher than 6% is exceedingly difficult.

References

1. G. Smith, Handbook of Sports Medicine and Science: Cross Country Skiing, H. Rusko (Blackwell Publishing), 2002, pp. 32-60.