Do gender differences in upper body exercise among cross-country skiers increase with increasing intensity?

Ann Magdalen Hegge¹, Kenneth Myhre², Boye Welde², Hans-Christer Holmberg³, Øyvind Sandbakk¹

¹ Center for Elite Sports Research (Trondheim, Norway), ² Nord-Trøndelag University College (Levanger, Norway), ³ Swedish Winter Sports Research Centre (Östersund, Sweden).

Introduction

Upper body strength and endurance has become increasingly important in cross-country skiing and gender differences between male and female skiers have been shown to increase with increasing contribution from poling (Sandbakk et al. 2014). Furthermore, gender differences in strength are generally greater in the upper body compared to the legs. These findings indicate that the largest gender differences can be found in the upper body and that gender differences in upper body exercise may increase with increasing power demands. Therefore, the purpose of this study was to examine the effects of intensity on gender differences in upper body poling and to investigate possible explanatory factors such as body composition and training.

Methods

Eight male and eight female cross-country skiers, matched for age and performance according to FIS points, completed a 4-min submaximal test at low intensity, and a 3-min and 30-s all-out test during isolated upper body poling on a Concept2 ski ergometer. Work rate, cycle rate and physiological variables were measured for each test. Additionally, body composition was assessed from a DXA scan and training data from the six months before testing (May-October) based on training diaries were collected.

Results

Gender differences in work rate increased progressively with intensity, from 88% at submaximal to 95% at the 3-min and 108%, at the 30-s test. The main differences between genders were caused by differences in the work done per cycle (all P<0.001), but males additionally increased cycle rate more than females at higher intensities. The range of motion of the trunk was significantly greater for men than women during the submaximal and 3-min test. Men had approximately 60% higher oxygen uptake during both the submaximal and 3-min test, and relatively more of their body mass localized in their upper-body (61 vs 56%) (all P<0.05). There were no gender differences in the training-intensity-distribution, but men performed more than twice as much strength training and double poling; women did 50% more running than men (all P<0.05).

Discussion

Gender differences in upper body poling among cross-country skiers were greater than those previously observed for lower and whole body endurance exercise and increased with increasing intensity. The gender differences in maximal aerobic capacity could not explain all differences in upper body poling performance, indicating that maximal strength and anaerobic capacity further differentiate gender in upper body performance. This is supported by the greater work generated per cycle and larger distribution of mass in the upper body among male skiers. Additionally, male skiers reported to train larger volumes of upper body strength and endurance training. Furthermore, the larger range of motion of the trunk during upper body poling shows that men and women use different techniques to increase the work rate. Overall, our results indicate that female skiers have great potential to develop their upper body and would benefit from incorporating more upper body strength and endurance training into their training programs.

Table 1. Training data over the last six months before testing (May-October), mean ± SD.