EFFECTS OF POLE LENGTH ON ENERGY CONSUMPTION AND MUSCLE ACTIVITY IN NORDIC WALKING
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Several studies have shown that Nordic walking induces greater energy consumption than normal walking (e.g. Church, et al. 2002, Porcari, et al. 1997). The aim of the present study was to examine the effect of pole length on energy consumption and activation of upper and lower body muscles in Nordic walking.

Thirty healthy subjects were classified into three groups based on their gender and experience in Nordic walking (men, n=10, Women, n=10 and male skiers, n=10). The subjects underwent five 5 min Nordic walking bouts on a treadmill using 5 different pole lengths: the so-called recommended pole length (Pole-rec, 0.7*height of the subject) and +/-5 cm and +/-10 cm. Energy consumption (EC), oxygen consumption (VO2), average pole force (F-pole, strain gauge attached to the right pole), electromyographic activity (EMG) from triceps and biceps brachi, trapezius, pectoralis major, vastus lateralis, gastrocnemius and biceps femoris muscles, heart rate (HR) and lactate (La) were measured during each bout of exercise. The speed of the treadmill was 6 km/h and angle 1 degree for the inexperienced groups and 7 km/h and 3.5 degrees for the skiers.

In statistical analyses other poles were compared to the Pole-rec.

There were no significant differences in EC, VO2, La or HR between the different pole lengths. The men did not have any significant differences in the F-pole between the different poles. Women produced (p<0.05) less F-pole with the shortest (Pole-10cm 11.9 +/-3.6 N) and more force with the longest pole (Pole+10cm 15.8 +/-3.9 N) than with the Pole-rec (14.4 +/-3.3 N). Women also had a lower force impulse with the Pole-10cm (4.8 +/-1.7 vs. 6.2 +/-1.7 Ns, p<0.05). The competitive male skiers produced significantly less force with the Pole-10cm (23.8 +/-5.5 vs. 26.7 +/-7.4 N, p<0.05). All the groups had significant differences in EMG-activities between the poles. The women had a lower biceps activity with the Pole-10cm (28 +/-7 uV) and higher with the Pole+10cm (35 +/-9 uV) than with the Pole-rec (31 +/-8 uV, p<0.05). In women there was also a higher trapezius activity (p<0.05) with the Pole+5cm (43 +/-29 uV) and Pole+10cm (46 +/-31 uV) than with the Pole-rec (39 +/-29 uV). The male group had a higher biceps activity (32 +/-9 vs. 27 +/-5 uV, p<0.05) and higher trapezius activity (45 +/-16 vs. 39 +/-15 uV, p<0.01) with the Pole+10cm than with the Pole-rec. The skiers also had a higher triceps activity with Pole+10cm (113 +/-48 vs. 98 +/-38 uV, p<0.05). There were no significant differences in the EMG of the lower body muscles.

The results of this study show that different pole lengths do not change EC when the workload is kept constant. However, there were some increases in pole forces and EMG-activity with longer poles. Therefore, it could be assumed that there will also be an increase in EC with longer poles when walking on the track or terrain because of an increased speed.

References:
Keywords: Nordic Walking, Electromyography, Energy Expenditure