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Comparison of the effects of high-load versus low-load resistance training on sport-specific performance parameters in youth cross-country skiers and biathletes: a pilot study.

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INTRODUCTION:

In sports practice, cross-country ski athletes often incorporate maximum strength- or explosive strength training to their work-out routine. Hypertrophy training, especially in the upper body is generally recommended to be avoided, as increased bodyweight is thought to be detrimental for endurance performance. However, some authors indicated that peak oxygen uptake (VO_{2peak}) is considerably influenced by the active muscle mass during exercise (Larsen et al., 2016). Therefore, it seems reasonable that upper-body hypertrophy could increase VO_{2peak} double poling. The aim of the present pilot study was to compare the effects of two hypertrophy training regimes with high volume on sport-specific performance parameters in elite youth cross-country skiers and biathletes, one with high-load resistance and one with low-load resistance.

METHODS:

Fifteen elite youth cross-country skiers (16±2 years, VO_{2max}: 59±7 mL*kg⁻¹*min⁻¹) were assigned either to a high-load resistance training group (HL; n=9) utilizing a 10x 6-12 repetition protocol or a low-load resistance training group (LL; n=6) utilizing 10x 15-20 repetitions. Both groups performed upper body resistance training twice a week for 10 weeks in addition to their regular training routine. The effects on double poling (DP) peak oxygen uptake (VO_{2peak}), on DP power output, on VO_{2max}, and 1-repetition maximum (1RM) for bench pull and bench press were investigated. A two-way ANOVA with repeated measures was performed for data analysis.

RESULTS:

T-Test analysis showed significant differences (p<0.05) in pretest for maximum strength performances only. ANOVA with repeated measures showed significant increases for nearly all variables (except for VO_{2max} [Eta=0.052, p=0.415]) with a time effect of p<0.001, Eta=0.594-0.775 (HL d= 0.42 to 1.02 vs. LL d= 0.05 to 0.73). In both groups the ratio between VO_{2peak} and VO_{2max} was improved (HL: 0.76 to 0.86 and LL: 0.80 to 0.87). However, only for bench press a significant interaction effect [group*time] with larger improvements for HL was calculated (p=0.044, Eta = 0.276).

CONCLUSION:

Since no significant differences between the HL and the LL group could be observed, the presented results relativize the defensive position regarding hypertrophy training in elite cross-country skiing. In accordance with Larsen et al., 2016, a high-volume strength training routine led to a significant increase in the VO_{2peak} without a significant increase in VO_{2max}, independent on the intensity (HL vs. LL). The presented results indicate a beneficial influence on sport-specific performance parameters in both groups. However, studies with more participants are necessary to be conclusive.

References:

Larsen, R. T., Christensen, J., Tang, L. H., Keller, C., Doherty, P., Zwisler, A. D., Taylor, R. S., & Langberg, H. (2016). A Systematic Review and Meta-Analysis Comparing Cardiopulmonary Exercise Test Values Obtained from the Arm Cycle and the Leg Cycle Respectively in Healthy Adults. *Int J Sports Phys Ther*, 11(7), 1006-1039.

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