

28th ECSS Anniversary Congress, Paris/France, 4-7 July 2023

Criterion validity of performance tests and physiological characteristics in elite cross-country skiers

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INTRODUCTION:

Performance testing is an integral component of the training process for elite cross-country skiers. The performance determinants should demonstrate high criterion validity and reflect the physiological demands of on-snow competitions. This study investigated the validity of three aerobic-based laboratory performance tests utilized by Swiss national team athletes.

METHODS:

Twenty-nine elite cross-country skiers of the Swiss national team (19 men and 10 women, age: 24 ± 5 and 22 ± 3 years, VO_{2max} : 72.2 ± 2.2 and 60.8 ± 3.8 ml/kg/min, respectively) performed an incremental test to task failure in the classic diagonal technique to measure maximal oxygen uptake (VO_{2max}), a graded exercise test skating (GXT) to assess the second lactate threshold (LT2), and a 24-min double poling time-trial (24-min DP) all on a motorized treadmill using roller skis. Fat-free mass (FFM) was assessed using Dual-energy X-ray absorptiometry. Pearson's product-moment correlations were calculated to assess the relationships between laboratory performance determinants and on-snow sprint and distance performance as measured by FIS points (5th FIS points list 2022/23), with lower points indicating better performance. Correlation coefficients were categorized according to Hopkins (2002).

RESULTS:

Large and extremely large associations were found between 24-min DP performance and distance performance in men ($r = -0.55$, $p = 0.022$) and women ($r = -0.91$, $p < 0.001$), respectively. Moderate and very large correlations were observed between absolute VO_{2max} and sprint performance in men ($r = -0.49$, $p = 0.023$) and women ($r = -0.85$, $p = 0.003$), respectively. Relative VO_{2max} and distance performance showed a small correlation in men ($r = -0.28$, $p = 0.111$) and a large correlation in women ($r = -0.66$, $p = 0.268$). LT2 and distance performance demonstrated large to very large correlations in both sexes (men: $r = -0.55$, $p = 0.023$; women: $r = -0.74$, $p = 0.038$). FFM and sprint performance showed a moderate correlation for men ($r = -0.49$, $p = 0.021$) and a very large correlation for women ($r = -0.84$, $p = 0.008$). At the same time, FFM and distance skiing demonstrated a moderate, positive correlation in men ($r = 0.48$, $p = 0.030$) and a moderate, negative correlation in women ($r = -0.41$, $p = 0.403$).

CONCLUSION:

Laboratory-derived performance determinants and physiological characteristics such as 24-min DP, VO_{2max} , LT2, and FFM were associated with on-snow distance and sprint performance in male and female elite cross-country skiers, with generally larger correlations in women than men and stronger relationships with distance compared to sprint race performance. Furthermore, the scaling of VO_{2max} (absolute vs. relative) influences the predictive value for on-snow sprint and distance performance and could be utilized to distinguish typical sprint and distance skiers. Our results support the use of the current testing procedures for elite skiers.

Topic: Training and Testing

Presentation: Poster

European Database of Sport Science (EDSS)

Supported by SporTools GmbH



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