Competitive Performance Prediction of Elite Alpine Skiers

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Akademisk avhandling

som med vederbörligt tillstånd av Rektor vid Umeå universitet för avläggande av medicine doktorsexamen framläggs till offentligt försvar i Aulan, Vårdvetarhuset, torsdagen den 13 juni, kl. 13:00.
Avhandlingen kommer att försvaras på svenska.

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Abstract

Introduction The overall aim of this doctoral thesis was to identify physiological and anthropometric variables valid for prediction of competitive performance in alpine skiing (indicated by FIS points). Method Paper I-III in this doctoral thesis followed an experimental, hypothesis-generating design which included both junior and senior elite alpine skiers. In all papers, physiological and anthropometric test results (X-variables) were correlated with FIS points (Y-variables) in order to investigate the predictive power of physiological and anthropometric variables for competitive performance in alpine skiing. The significance of the included test results was examined using bivariate and multivariate data analysis. Results The results of Paper I show that included aerobic test results, neither alone nor in combination with anthropometric variables, could predict competitive performance of junior elite alpine skiers. Principal component analysis shows that male and female junior alpine skiers could be separated based on test results but that none of the included tests were important for sport-specific performance. The best multivariate models reached $R^2 = 0.51$ to 0.86 and $Q^2 = -0.73$ to 0.18. While several significant regression models could be observed, none of these met the criteria for valid models. The lack of predictive power of observed prediction models was confirmed by cross-validation. The results of Paper II show that included physiological test results from the test battery Fysprofien could not predict competitive performance of senior elite female alpine skiers. Principal component analysis shows that there is a high correlation between individual physiological test results and their corresponding Fysprofien score points, indicating that they can be used interchangeably. The Mann-Whitney $U$ test was not significant neither for SL nor for GS. This suggests that Fysprofien score points (summarized as Fysprofien Index) and competitive performance (indicated by FIS points) are independent. The best multivariate models for SL and GS reached $R^2 = 0.27$ to 0.43 and $Q^2 = -0.8$ to -0.17, indicating low predictive power for competitive performance (as confirmed by cross-validation). The results of Paper III show that included physiological test results from a novel test battery could not predict competitive performance of senior elite female alpine skiers on a group level. When data were analyzed on a group level, the best models for SL and GS reached $R^2 = 0.39$ to 0.40, $Q^2 = 0.15$ to 0.21, indicating low predictive power. In contrast, when data were analyzed on an individual level, valid models with high predictive power ($R^2 = 0.88$ to 0.99 and $Q^2 = 0.64$ to 0.96) were generated. A comparative analysis between individual OPLS models shows that the relative importance of different physiological qualities for athletic performance varies between skiers. Conclusion When applying tests on alpine skiers, a holistic approach should be considered. This because competitive performance in alpine skiing is the result of a number of interacting dimensions. Before applying physiological tests, the validity and reliability of the test protocols must be determined. Administering tests that do not meet these criteria will probably waste not only important resources for clubs and ski federations but also risk misleading coaches and athletes when planning and implementing preparatory training.

Keywords

Competitive performance, FIS points, alpine skiing, alpine skiers, physiological test results, anthropometric variables, multivariate data analysis, multivariate statistics, principal component analysis, orthogonal projections to latent structures, individual profiling