Abstract

Title:

The relevance of strength abilities and body composition in the context of specific performance of military personnel.

Objective:

To clarify the relationships between selected types of strength abilities, body composition, and performance in military-specific tests reflecting combat operational deployment.

Methods:

This theoretical and empirical work utilized quantitative methods. The research population consisted of 23 military students from Charles University and 8 randomly chosen candidates (22.5 ± 2.9 years, 181.5 ± 7.1 cm, 80.2 ± 10.4 kg,) who met the established criteria. Subjects underwent anthropometric data collection, body composition analysis using the DEXA (Dual-Energy X-ray Absorptiometry) system, determination of VO2 max values, determination of the level of various types of strength and endurance abilities using selected motor tests, and military-specific testing reflecting operational load. Multiple regression analysis was chosen to assess the relationship between strength abilities, body composition and performance in military-specific tests, which was achieved using six multiple regression models. For all six models, the following predictors were determined to be identical: deadlift, right and left hand grip, vertical jump, medicine ball throw, pull-ups, sit-ups, and lean mass (excluding head region). The following military-specific tests were chosen as different regressors for each model: fire movement, water can carry, repeated lift and carry, casualty drag, single max lift and loaded march. Models were subjected to tests of linear regression assumptions, which consisting of a test to determine multicollinearity between predictors (VIF < 5) , a Shapiro-Wilk test to determine the normality of residuals ($p > 0.05$), the Durbin-Watson test to detect autocorrelation in residuals (DW statistic ≈ 2), the Non-constant Variance Score Test (NCVST) ($p > 0.05$) to determine homoskedasticity of residuals, and Cook's distance to identify outliers (Max < 1) that could affect the regression models. The robustness and predictive ability of each model was assessed based on the coefficient of determination (R^2) and an adjusted coefficient of determination (adjusted R^2). Statistical significance of each predictor was determined by the p-value ($p < 0.05$) and the range of the confidence interval with a set value of 95 %.

Results:

The fifth model, ($R^2 = 0.712$, adjusted $R^2 = 0.596$), with the dependent variable single max lift, proved to be the most robust model with the greatest predictive ability, and met all the established criteria of the linear regression assumptions. This model contained a single statistically significant predictor ($p < 0.05$), which was the medicine ball throw ($\beta = 0.1122$ [0.0430, 0.1815]; $p = 0.003$). The second most significant model proved to be the first model ($R^2 = 0.609$; adjusted $R^2 = 0.453$) with movement under fire as the dependent variable, which also met all the criteria of the assumptions of the linear regression. This model contained one statistically significant predictor ($p < 0.05$), which was vertical jump ($\beta = -0.14324$ [-0.26092, -0.0256]; $p = 0.020$) and one predictor that approached statistical significance ($p = 0.05$), the right hand grip ($\beta = 0.11044$ [-0.00373, 0.2246]; $p = 0.057$). The adjusted R^2s of the second (water can carry), fourth (casualty drag) and sixth (loaded march) models indicated their weaker robustness (adjusted $R^2 < 0.300$), with heteroskedasticity identified for the fourth model ($p <$ 0,05) simultaneously with outliers that could significantly bias the results of this model (Max > 1). The third model (repeated lift and carry) showed the lowest explained variability compared to the other models after accounting for the number of predictors (adjusted $R^2 = 0.081$). The most significant predictors across all models were found to be vertical jump, medicine ball throw, lean mass and right hand grip. However, only the predictors vertical jump and medicine ball throw reached statistical significance ($p < 0.05$).

Conclusion:

This thesis demonstrates the significant determinant importance of strength ability and muscle mass within military tasks reflecting operational load, with the resulting model data demonstrating stronger predictive significance of strength ability and lean mass for tasks that are more short-term and explosive in nature (model one – fire movement) and for tasks where the load approaches 1RM (model five – single max lift). Vertical jump, medicine ball throw, lean mass and right hand grip proved to be significant predictors across models, with only vertical jump and medicine ball throw reaching statistical signifikance ($p < 0.05$). This demonstrates to us that explosive upper and lower body strength emerged as the most significant determinant of military performance during specific tasks across all six models. The results of this thesis can be used in the practical implementation of military physical testing, or in the reorganization and innovation of new training procedures within the military environment. The

results of this thesis could be of particular importance when applying the findings to the physical training of military specialists being prepared for foreign operations.

Keywords:

army, operational environment, physical readiness, military tasks, motor skills, multiple linear regression.