ABSTRACT

Title:

The relationship of endurance tests and anthropometry to military–specific tasks within men

Objective:

The aim of this study was to analyze the relationships between selected endurance abilities, anthropometric data and performance in specific military tests simulating operational loads.

Methods:

The research sample consisted of 24 male military students at the FTVS UK and 7 healthy, young men with strength training experience (n = 31) with a mean age of 22.5 ± 2.9 years, height 181.5 ± 7.1 cm and weight 80.2 ± 10.2 kg. Participants completed a series of four measurements in two weeks, spaced at least 48 h apart. During the initial visit, probands underwent a body composition analysis using DEXA and laboratory measurement of VO_2max on a treadmill. The second visit included a maximal push–up test and Cooper's run. During the third visit, participants were subjected to tests of: a) push–ups, b) sit–ups, c) maximum vertical jump, d) medicine ball throw, e) deadlift (1 RM), f) 10 × 10 m shuttle run, and g) handgrip strength. The last visit included military–specific tests, which were conducted in a military outfit and ballistic gear, unlike the previous tests: a) loaded march, b) casualty drag, c) fire movement, d) moving the sandbag, e) maximum load lift, and f) water cans carry. Obtained datawere afterwards statistically processed into 6 statistical models using multiple linear regression and a generalized linear model. The independent variables used in the models were: Cooper's run, VO_2max test, shuttle run, weight, and percentage of adipose tissue excluding the head. Military–specific tests were entered as dependent variables. The significance level was set at 5 %. Pearson's correlation coefficient was used to determine the relationship between the prediction pattern of VO_2max from the Cooper run ((22.351 × distance in km) - 11.288) and the VO_2max test.

Results:

The VO_2max test was discarded due to the presence of multicollinearity (VIF = 8.56). Performance in the maximal load lift (M1) was best explained by weight (β = 0.908

[0.654, 1.172], $p < 0.001$), explaining 66 % of the variability (adjusted $R^2 = 0.662$). In case of carrying water cans (M2), statistical significance was again exhibited by weight ($\beta = 2.221$ [0.945, 3.498], $p = 0.001$) and Cooper's run ($\beta = 0.048$ [0.005, 0.091], $p = 0.031$), but with a predictive power of only 34 % (adjusted $R^2 = 0.337$). The sandbag moving test (M3) was best explained by performance in Cooper's run ($\beta = -0.061$ [0.087, -0.035], $p < 0.001$) and weight ($\beta = -0.958$ [-1.742, -0.173], $p = 0.019$). The independent variables in this model explained up to 59 % of the results variability (adjusted $R^2 = 0.593$). The predictor best explaining performance in the fire movement (M4) came out to be the shuttle run ($\beta = 0.810$ [0.170, 1.450], $p = 0.015$), with 30 % of the results variability explained (adjusted $R^2 = 0.304$). For the performance in the loaded march (M5), Cooper's run ($\beta = -0.233$ [-0.327, -0.140], $p < 0.001$) showed statistical significance, with the fitted independent variables explaining up to 50 % of the results variability (adjusted $R^2 = 0.593$). The final model was casualty drag (M6) with only 13 % predictive power (adjusted $R^2 = 0.130$). Weight was the statistically significant independent variable ($\beta = -0.577$ [-1.049, -0.105], $p = 0.019$), but results from this model lacked relevance and should not be interpreted. The relationship between the VO_2max test (57.5 ± 7 ml/kg/min) and the prediction formula for VO_2max (55.8 ± 7.4 ml/kg/min) was very strong ($r = 0.819$, $p < 0.001$).

Conclusion:

From the results obtained, it is important to realize that today's operational environment requires professional soldiers to undergo a complex movement training, therefore it is appropriate to include both strength and endurance elements in this training. Furthermore, it is evident that higher weight individuals are better to withstand the carried load, but conversely are not as efficient in endurance performances with low dead weight (body weight + external load). Therefore, the goal of future physical training within professional soldiers should be universal movement development with emphasis on aerobic, anaerobic and strength elements. As an undesirable example should be considered a soldier who is mainly focused on endurance or on the other hand strength abilities. The ideal soldier should be universal, capable of performing at a sufficient level all movement tasks encountered in the operational environment.

Key words:

army, endurance, operational load, test, VO2max, Cooper run