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Predict Failure: Muscle Oxygen Dynamics In Elite Climbers During Finger Hang Tests

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INTRODUCTION: Failure in elite sport climbing is associated with an inability to maintain isometric muscle contraction. The ability to supply and utilise oxygen is the primary bioenergetic contributor to muscle contraction and can be examined locally using near-infrared spectroscopy (NIRS). Examining changes in NIRS derived muscle oxygenation (SmO_2) have shown to be related to changes in performance output during gripping exercises.
PURPOSE: The aim of this study is to measure SmO_2 dynamics in a climbing specific test until task failure in varying conditions. Our prediction is that SmO_2 should be a good marker to predict task failure.
METHODS: Eight elite level climbers performed a finger-hang test with four different intensities maintaining grip until voluntary exhaustion. During each trial SmO_2 and time to failure (TTF) were measured. TTF was then compared to the minimally attainable value of SmO_2 (SmO_2min) and time to SmO_2min (TTmin).
RESULTS: Two-one-sided tests (TOST) resulted in SmO_2min equivalence for the high intensity conditions (M_1 = 21.9% SD_1 = 5.0%; M_2 = 25.4%; SD_2 = 6.5%; M_3 = 24.1%, SD_3 = 5.9%), $t(7) = 2.72$, $p = 0.015$; $t(7) = 3.85$, $p = 0.003$, but failed to show equality for the fourth and lowest intensity condition (M_4 = 32.4%, SD_4 = 8.8%), $t(7) = -1.01$, $p = 0.173$. Equivalence was also found between TTF and TTmin for the high intensity conditions.
CONCLUSION: The duration with which oxygen is extracted and utilised changes, while the attainable SmO_2min remains constant at high intensity conditions and is related to the ability to maintain task performance.

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Prediction Of 1rm Bench Press From Repetitions To Fatigue In Untrained, Trained, And Athletic Men

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Numerous prediction equations have been developed to estimate one-repetition maximum (1RM) bench press in various subject populations. While many of these equations have been validated on various groups, rarely have groups of various levels of training been combined to evaluate the accuracy of separate and combined equations developed on participants of differing strength levels and training backgrounds.
PURPOSE: To produce and evaluate 1RM bench press prediction equations developed on untrained, trained, and athletic men.
METHODS: Untrained college men (UT, n = 166), resistance-trained college men (RT, n = 170), and college athletes (ATH, n = 179) were measured for 1-RM bench press and repetitions-to-fatigue (RTF) on separate days. RT men had trained 3 days/wk for 12 wks using a linear periodization program. ATH had trained for several years using either linear periodization or autoregulatory progressive resistance training. Linear regression equations were generated on validation samples of each group (UT = 119, TR = 120, ATH = 131) using a weight (RepWt) that produced between 2 and 10 RTF.
RESULTS: All 3 groups differed significantly in 1RM (UT = 74.1 ± 15.5 kg, RT = 88.8 ± 21.7 kg, ATH = 136.2 ± 21.8 kg) but not in %1RM used for RTF (UT = 83.4% ± 7.4%, RT = 83.0% ± 5.5%, ATH = 83.4% ± 6.0%). Despite the nonsignificant difference in %1RM, ATH (6.7 ± 2.4) produced significantly more RTF than UT and RT men (6.1 ± 2.2 and 6.0 ± 2.1, respectively). Multiple correlations and standard errors of estimate (SEE) for group equations were similar for UT (R = 0.94, SEE = 5.7 kg), RT (R = 0.97, SEE = 5.3 kg), and ATH (R = 0.96, SEE = 6.1 kg). A global equation compiling all 3 groups had comparable results [1RM (kg) = 1.16 RepWt (kg) + 2.07 RTF - 9.4, R = 0.98, SEE = 6.2 kg]. Cross-validation of each equation on 25% randomly selected subsamples accurately predicted 89%-96% of each group within ±10% of actual 1RM. The global equation predicted slightly better in RT (94%) and ATH (96%) than in UT (87%).
CONCLUSIONS: A newly developed global prediction equation appears to have acceptable accuracy for estimate 1RM bench press in men with varying resistance training backgrounds.

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Lower Limb Kinematic Assessment to Predict Water Polo Performance

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Water polo requires leg muscle biosequencing that is different from weight bearing sports. The kinematics and forcefulness for each player could be optimized for different positions and help predict player success. Comparing vertical jump with kinematic biosequencing, and comparing each with athletic performance, may enhance training assessments.
PURPOSE: To test the effect of vertical jump and Sparta Science force plate technology outputs on in-season performance of women's water polo players.
METHODS: 14 Division 1 women’s water polo players were evaluated during two consecutive seasons: 2015-2016 and 2016-2017. Statistics tabulated for each season were: Games played, shots, goals, shooting percentage, assists, steals, exclusions (EX), and exclusions drawn (DEX). All players were tested for vertical jump once a week during conditioning prior to resistance training using Sparta force plate and proprietary outputs, which calculated "Load" (rate of eccentric force), "Explode" (power generation during concentric force output), and "Drive" (neural impulse on timing and range of motion). Linear regression tested Sparta data on in-season performance outcomes.
RESULTS: Athletes weighed 70.2 ± 8.6 kg, had a vertical jump of 30.7 ± 4.3 cm and Sparta Load of 45.4 ± 6.2, Explode of 34.8 ± 4.1, and Drive of 65.3 ± 10.0. On average, throughout each season, the athletes played 29.5 ± 6.3 games, took 92.7 ± 61.5 shots, scored 31.3 ± 8.1% of shots taken, had 24.3 ± 12.5 steals, and 16.4 ± 14.4 assists. Vertical jump predicted a higher shooting percentage (β=0.010; $p<0.001$), more steals (β=0.820; p=0.043), fewer assists (β=-1.324; p=0.005), and fewer EX (β=-1.466; $p<0.001$). Load predicted a lower shooting percentage (β=-0.003; p=0.001) and more EX (β=0.284; $p<0.001$) and DEX (β=0.219; p=0.002). Explode predicted a higher shooting percentage (β=0.003; p=0.009), more steals (β=0.642; $p<0.001$), and lower EX (β=-0.454; $p<0.001$). Drive predicted a higher shooting percentage (β=0.002; $p<0.001$), fewer assists (β=-0.221; p=0.007), lower EX (β=-0.099; p=0.017), and higher DEX (β=0.107; p=0.017).
CONCLUSION: These findings indicate that both vertical jump and force plate biosequencing data may be useful predictors of water polo performance and could be employed to identify athletic capacities that need improvement.

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Use of Traditional and Modified Functional Movement Screening to Predict Balance with Military Load

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