LANDING KINETICS CAN BE PREDICTED WITH LOWER EXTREMITY MUSCULAR POWER TESTS
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Context: Female collegiate athletes continue to incur injuries to the Anterior Cruciate Ligament (ACL) at reportedly increasing rates. Prediction of ACL injury risk is possible through evaluation of landing kinetics. This process however requires equipment or expertise that prohibits implementation on a large scale. The utilization of field-based tests to predict ground reaction force (GRF) at landing would create a practical and cost-effective risk identification method. Objective: To develop predictive models for GRF from the results of several muscular power tests. We hypothesized linear regression models would explain a substantial amount of the variance associated with landing kinetics. Design: Descriptive laboratory study. Setting: University research laboratory. Patients or Other Participants: Twenty-nine female, NCAA D1 college athletes (age= 19.03±1.09 years; weight= 66.56±13.47 kg; height= 171.16±7.92 cm) from the sports of soccer (n=14), basketball (n=3) and lacrosse (n=12) participated. Interventions: Participants performed five unilateral lower extremity (LE) landings with their dominant LE from a 35cm (13.78in) platform onto a force plate (Bertec Corporation; Columbus, OH). LE kinetics during the landing trials were interfaced with motion analysis software (Innovative Sports Training; Chicago, IL). Then in a randomized order, participants performed three trials of three standardized field-based tests of LE power: single-limb triple hop (SLTH), countermovement vertical jump (CMVJ) and the Margaria-Kalamen (MK) test. The kinetic trials were signal averaged. Data were then entered into a commercial statistical software package where descriptive statistics (SPSSv22, IBM, Armonk, NY) and two separate linear regression models were created to predict the body mass normalized vertical GRF (nGRFz) and body mass normalized posterior GRF (nGRFy) from the LE power test results. Main Outcome Measures: The multiple linear regression analysis produced two separate models to predict the dependent variables of nGRFz and nGRFy. Additionally, the coefficient of determination ($r^2$) and analysis of variance of regression from each model were examined along with an analysis of residuals and outliers. Alpha levels were set a-priori at $P=.05$. Results: Mean nGRFz was 2.735±0.404 (range 1.499 to 3.504) while mean nGRFy was 1.337±0.200 (range 0.833 to 1.690). Mean values for the three power tests were SLTH 536.98±48.41cm, CMVJ 42.79±5.08cm, and MK 1035.92±193.26 Watts. The linear regression model to predict nGRFz was significant ($r^2=.651$, $P<.001$) as was the model to predict nGRFy ($r^2=.407$, $P<.001$). Conclusions: The results from our investigation show a significant amount of variance for nGRFz and nGRFy may be explained with the three field power tests using a linear regression model. The nGRFz model indicates a moderate to large effect size was explained by the equations. A small to moderate effect size is seen with the nGRFy regression model. Additional study is necessary to establish validity and reliability of this models before these may be recommended for clinical use.

Word Count: 449