METHODS: Twenty-two healthy young adults (age = 25.75±3.05 years) participated in this study.We used 36 reflective markers, a 3D motion capture system, and force plates to collect kinetic and kinematic data during SJ. Subjects performed 3 successful maximal vertical jumps from a squat position (mean knee angle = 85°) after remaining static for 2 seconds with hands-on-hips. Subjects practiced all testing conditions and rested 60-second between trials. We calculated a) jump height (JHt) (m) from the greater trochanter marker and b) peak positive concentric SJPow (watts) of the hip, knee, and ankle during SJ. We normalized SJPow to body mass. We analyzed data using Pearson correlations and multiple linear regressions to determine the associations and variance between SJPow and SJ^{JHt}. Significance was set at $p < 0.05$.
RESULTS: Average SJ^{JHt} was 0.27±0.06 m. SJPow for hip, knee, and ankle were 11.41±4.41, 10.35±3.91, and 21.08±4.85, respectively. SJ^{JHt} was significantly associated with hip SJPow (r= 0.66, p= 0.001) and ankle SJPow (r= 0.69, p< 0.001). Only hip and ankle SJPow predicted SJ^{JHt} (p = 0.006; and p = 0.002; respectively), explaining about 62% (R^2= 0.62) of the variance in SJ^{JHt}.
CONCLUSION: Concentric SJPow was greater at the ankle, followed by the hip and knee joints. Concentric SJPow of the hip and ankle joints predicted SJ^{JHt} in young adults.

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Comparison Of Different Biomechanical Models To Calculate Take Off Velocity Of The Vertical Jump

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PURPOSE: The aim of this study was to compare different biomechanical models to identify the take-off velocity (TOV) of a vertical jump.
METHODS: Fourteen young adults (age = 24 ± 4 yrs) participated in this study. Participants did five maximal vertical jumps while swinging their arms during the jump. Kinematic data was recorded using a 17-marker whole body set and a 10 camera motion capture system. Kinetic data was recorded using a force platform. The data was then analyzed using two kinetic and two kinematic models for phase identification. Both kinetic models (K1 and K2) required the double integration of the ground reaction force to estimate the vertical movement of the center of mass (COM). One kinematic model used 14 markers to create a segmental model (S1) and the other model used 3 markers to create a sacral model (S2) to estimate the movement of the COM. All models defined the start of the eccentric phase as the point where the COM starts to move downward. Three of the models (K1, S1, & S2) defined end of the eccentric phase/start of concentric phase as when the COM starts to move upward. The 4th model (K2) defined the end of the eccentric phase when the velocity of the COM is zero and the start of the eccentric phase when velocity of COM becomes positive. The concentric phase ended when both feet had left the ground for all models. TOV was defined as the velocity of the COM at the end of the eccentric phase. A 1-way ANOVA was used to identify differences in TOV between the 4 different models.
RESULTS: There were significant differences between TOV for the 4 models (p < 0.001). Post-hoc comparisons show that the estimated TOV for S1 (3.21 ± 0.43 m/s) was significantly greater than K1, K2, and S2 (2.79 ± 0.43, 2.79 ± 0.43, and 2.67 ± 0.52 m/s respectively). The estimated TOV for S2 (2.67 ± 0.52 m/s) was significantly less than K1 and K2 (2.79 ± 0.43 and 2.79 ± 0.43 respectively).
CONCLUSIONS: These results indicate that a whole body kinematic model (S1) results in a greater estimated TOV when compared to kinematic model that doesn't account for whole body movement (S2). A whole body kinematic model also results in greater estimated TOV when compared to kinetic models.

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Vertical Jump Height And Mechanical Power: Association Is Much Worse Than Previously Documented

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Despite comments and warnings in different publications, jump height is widely used to predict power in humans. Training programs are designed and individual progress is often monitored on the basis of estimated power, but prediction equations are based on group data.
PURPOSE: to show that vertical jump performance (VJP) and mechanical power are poorly associated, particularly within individuals.
METHODS: Three young male subjects (VJP = 0.301±0.009m, 0.439±0.017m and 0.586±0.014m; mean±sd) performed 50 maximal jumps each on a force platform while kinematic data were collected at 60 Hz. Participants rested sitting for 1 minute after each jump. VJP was calculated for each jump from the kinematic data as peak body center of mass (BCOM) minus standing BCOM; peak and average mechanical power (PEAKPWR and MEANPWR, respectively) were calculated for the same jumps from the vertical ground reaction force. Regression analyses were performed using standardized VJP scores as the predictor variable and standardized PEAKPWR or MEANPWR scores as the resulting variable, expecting an identity function of y = x (intercept = 0, slope = 1 and r^2 = 1).
RESULTS: Individual PEAKPWR = 2079.3±56.6W, 3706.0±136.1W, and 4085.0±74.2W (mean±sd). Individual MEANPWR = 1313.6±52.8W, 2124.1±117.1W, and 2485.9±123.9W. Model *zPEAKPWR = k + s(zVJP) + subject + Error* showed an excellent r^2 = 0.96, but the slope (0.428) was significantly different from 1 (p=4.4E-5). Model *zMEANPWR = k + s(zVJP) + subject + Error* showed an excellent r^2 = 0.99, but the slope (0.201) was significantly different from 1 (p=4.3E-20). Individual models for zPEAKPWR all showed slopes significantly different from 1 (p<0.001): 0.274, 0.253, and 0.128, the latter not even different from 0 (p=0.43); corresponding r^2 = 0.16, 0.10, and 0.01. Individual models for zMEANPWR all resulted in slopes significantly different from 1 (p≤0.01): 0.307, 0.597, and 0.465, with only 0.597 being significantly different from 0; corresponding r^2 = 0.02, 0.21, and 0.08.
CONCLUSION: Regression analysis for individuals shows that VJP is a poor predictor of mechanical power. Whenever mechanical power results are necessary, they should be obtained directly with the use of a force platform. Jump height results should be reported, analyzed, and interpreted only as vertical jump performance.

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MODULATION OF THE CENTER OF MASS DURING AN AGILITY TASK

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PURPOSE: The control of the center of mass (COM) of the body may have implications for injury and performance in athletes. This study aimed to identify potential factors that modulate the COM during an agility task.
METHODS: Fifty college (n= 28) and high school (n=22) female soccer players had the displacement of retro-reflective markers placed over select bony landmarks recorded using a 20-camera motion analysis system while performing a modified T-test. Using the transverse plane positional histories of the markers, the peak change in the linear momentum vector (ΔLMV) of the COM of the pelvis and the angle (ΔLMVA) it formed with the laboratory X or Y axis entering and exiting the two 90 degrees turns performed at the center cone were obtained. The step pattern and extremity used to make the turns were determined. A linear mixed model was used to compare the effects of turn number, limb, step pattern and playing level on the peak ΔLMV and ΔLMVA.
RESULTS: An effect (p < .01) of turn number on the ΔLMV and ΔLMVA were noted. The ΔLMV entering turn 1 and 2 was -66.5 (± 3.5) and -8.7 (± 3.5) kg*m/s, respectively and exiting turn 1 and 2 they were 32.9 (± 3.4) and 40.8 (± 3.4) kg*m/s, respectively. The ΔLMVA entering turn 1 and 2 were 6 (± 2) and -24 (± 2) deg, respectively and exiting turn 1 and 2 they were 56 (± 2) and -67 (± 2) deg, respectively. An effect (p = .03) of step pattern on the ΔLMV exiting the turn was noted. The ΔLMV was 42.4 (± 3.8) and 34.1 (± 3.1) kg*m/s, for multi-step and single step patterns, respectively. Playing level and leg dominance did not influence the ΔLMV and ΔLMVA.
CONCLUSIONS: The initial inertial state of the COM appears to be the primary factor affecting the control of the COM entering and exiting a turn. When exiting a turn, the step pattern used entering the turn appears to also affect the control of the COM.

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Kinematics Of The Feet-out Rowing Drill On A Static Versus Dynamic Rowing Ergometer

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Rowing is a competitive sport contested at the high school, collegiate, and Olympic levels which relies heavily on technique for success in the highly aerobic sport. The feet-out rowing drill is a drill in which the rower does not strap feet into either the foot stretcher (on a rowing ergometer) or the built-in shoes (in a rowing boat) in order to improve technique, specifically in the drive