2344 Board #8 May 31 9:30 AM - 11:00 AM

Physiological Determinants of Peak Power Output in Elite Cyclists

Glyn Howatson, FACSM[1], Mehdi Kordi[1], Stuart Goodall[1], Nicos Haralabidis[2], Tejal Patel[2], Tom Maden-Wilkinson[3], Jonathan Folland, FACSM[4]. *[1]Northumbria University, Newcastle-upon-Tyne, United Kingdom. [2]University of Bath, Bath, United Kingdom. [3]Sheffield Hallam University, Sheffield, United Kingdom. [4]Loughborough University, Loughborough, United Kingdom.*
Email: glynhowatson@hotmail.com

(No relationships reported)

Despite the importance of peak power output (PPO) to many cycling disciplines, particularly in sprint events, little is known about the structural and functional determinants of PPO in elite cyclists.
PURPOSE: To determine the relationship and contribution, in elite cyclists spanning a range of disciplines, of putative neuromuscular determinants with cycling PPO during sprint cycling.
METHODS: Thirty-five elite male cyclists volunteered to take part in the study (mean ± SD age, 22 ± 4 yr; stature, 179.1 ± 5.9 cm; mass, 77.4 ± 11.3 kg) and conducted a series of isovelocity sprints to assess PPO on two separate occasions. Surface EMG (sEMG) of the gluteal, hamstring and quadriceps muscles were recorded during the PPO test. Muscle volume was assessed and quantified using MRI and muscle architecture of the vastus lateralis (pennation angle [PO_{VL}] and fascicle length [Fl]) were assessed with ultrasound. Bivariate correlation analyses were conducted to assess relationships; significant correlations were included in a step-wise regression to predict PPO performance.
RESULTS: Positive bivariate relationships were found for quadriceps volume (r = 0.87; P < 0.001), hamstring volume (r = 0.71; P < 0.001) and PO_{VL}(r = 0.81; P < 0.001) with PPO. The remaining measures (Fl, and sEMG) were unrelated to PPO. A step-wise multiple regression analysis was conducted with the three predictor variables; 87% of the variability in PPO between cyclists (P < 0.001) was explained by two variables, quadriceps volume (76%) and PO(11%).
CONCLUSION: These data provide valuable information on the characteristics of elite cyclists. Importantly, determinants of PPO in this elite population have been identified as muscle volume of the quadriceps and pennation angle of the VL. These data provide a basis that allows coaches and practitioners to understand the contributing factors to cycling PPO performance. Consequently, it is recommended that athletes, coaches and practitioners use this information to target these physical qualities to inform training programme design of elite cyclists to maximise pennation angle and quadriceps volume.

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The Influence of Fatiguing Exercise on Power Output

Lena K. Perry, J. Mark VanNess, William P. Lydon, Joey Rossi, Courtney D. Jensen. *University of the Pacific, Stockton, CA.*
Email: l_perry2@u.pacific.edu

(No relationships reported)

Physical fatigue impairs performance during high power, short duration activities. As technological developments permit new methods of measuring this effect, it is important to validate existing paradigms.
PURPOSE: To determine if kinetic measurements from vertical jump (VJ) tests are influenced by fatigue based on explosive power outputs.
METHODS: A sample of athletes (9 men, 26 women) from a Division I NCAA sports program completed testing. To establish baseline VJ kinetics, athletes performed a controlled warm-up and then completed 6 jumps on a SpartaTrac force plate, each separated by 15s rest. Sparta software computed 3 outputs: Load, Explode, and Drive. After baseline VJ calculation, all athletes performed an anaerobic fatigue protocol on a mechanically-braked cycle ergometer: 3 sprints lasting 15s separated by 10s rest. Peak and mean power were recorded from the cycle trials. Subjects then repeated the VJ protocol. This pattern was repeated until 6 sets of VJ were recorded. Repeated measures ANOVA tested differences between successive VJ performances.
RESULTS: Male athletes were 20.8 ± 1.5 years old, weighed 175.8 ± 14.0 lbs, had a baseline VJ of 46.9 ± 3.6 cm, Load of 53.6 ± 13.3, Explode of 49.4 ± 6.6, and Drive of 49.4 ± 11.9. Female athletes were 20.2 ± 1.2 years old, weighed 142.3 ± 13.2 lbs, had a baseline VJ of 32.7 ± 4.3 cm, Load of 49.8 ± 46.1, Explode of 40.7 ± 8.0, and Drive of 63.1 ± 49.7. The only differences between men and women were weight (p<0.001), VJ (p<0.001), and Explode (p=0.006). ANOVA found VJ height to decrease between baseline and trial 2 (p<0.001); there was no difference between men and women (p=0.210); between trials 2 and 6, VJ height was consistent (p>0.400). Load was not affected by the fatigue protocol across the total sample (p=0.418) or by sex (p=0.239). Explode was not affected by fatigue across the sample (p=0.233) or by sex (p=0.406). Drive was affected by fatigue (p=0.040), decreasing in successive trials; there was no interaction with sex (p=0.742).
CONCLUSION: VJ is more sensitive to fatigue than SpartaTrac force plate calculations. An initial fatiguing insult was sufficient to compromise performance, whereas accumulated fatigue did not have an additive effect. Drive was the only variable in SpartaTrac outputs that was affected by fatigue.

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Variations in Athletic Profiles Between Division I All-Girl and Co-Ed Competition Cheerleaders

Nia Y. Hicks, Michelle L. Eisenman, Emily L. Langford, Barry Munkasy, Ronald L. Snarr, Greg A. Ryan. *Georgia Southern University, Statesboro, GA.*

(No relationships reported)

On a Co-Ed cheer team, a female's primary role is a flyer. In contrast, an All-Girl team allows females to be either a flyer, base, or back spot. Although strength, power, and proprioception are required of all positions, these metrics, in addition to individual anthropometrics, may influence a coach's decision on squad placement.
PURPOSE: The purpose was to compare anthropometric and performance variables between All-Girl (AG) and Co-Ed (CE) Division-I female cheerleaders.
METHODS: Thirty-three (AG: n = 24; CE: n = 9) cheerleaders were assessed for: height (H), weight (W), body composition (BF%), vertical jump (VJ), upper body power (UP), and dominant (DHG) and non-dominant (NDHG) hand-grip strength. The greater of two trials for VJ, UP, NDHG, and DHG were used for statistical analysis. BF% was determined via air displacement plethysmography on the same visit to the laboratory. Due to unequal group sizes, non-parametric Mann-Whitney U Tests were run comparing the athletic profile between AG and CE.
RESULTS: Significant differences were noted in: H (median: AG: 63.5in, CE: 61.0in; p <0.01); W (AG: 135.0lb, CE: 121.0lb; p< 0.01); UP (AG: 89.5in, CE: 80.0in; p = 0.02); DHG (AG: 25.5kg, CE: 20.0kg; p = 0.04); and NDHG (AG: 24.0kg, CE: 18.0kg; p = 0.04). No significant differences were present in BF% (p = 0.14) or VJ (p = 0.42).
CONCLUSION: In addition to being taller and heavier, the AG team cheerleaders demonstrated greater upper body strength and power when compared to females on the CE team. These differences may be attributed to the variety and physical demand of positions available for females on the AG team. This information may be particularly useful to coaches when assigning squad placement or when designing training programs.

2347 Board #11 May 31 9:30 AM - 11:00 AM

Relationship Between Bone Mineral Density and Vertical Jump Performance in Collegiate Athletes

Sarah N. Lanham, Michelle L. Eisenman, Emily L. Langford, Ronald L. Snarr. *Georgia Southern University, Statesboro, GA.*
Email: sl03888@georgiasouthern.edu

(No relationships reported)

Resistance training has been shown to increase bone mineral density (BMD) in athletes due to the increased repetitive loading and stress applied to bone as compared to the general population. Furthermore, plyometric training, a common strength and conditioning modality in most sports, may enhance this loading and stressor effect on bone formation.
PURPOSE: To compare the relationship between BMD and lower body power, via vertical jump performance, in collegiate male and female athletes.