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THE PERFORMANCE DIGEST

A review of the latest sports performance research

Technology & Monitoring

This month's top research on technology and monitoring.

MONITORING FATIGUE: THE BEST METHODS FOR USING THE COUNTERMOVEMENT JUMP

Kennedy R and Drake D. (2018) Journal of Strength and Conditioning Research.

ACCELEROMETER-BASED PLAYER TRACKING DEVICE: WHAT'S THE RELIABILITY AND VALIDITY?

Nicolella D, Saylor K, and Schelling X et al. (2018) PLOS ONE.

CAN SCREENING PREDICT ATHLETES AT RISK OF OBTAINING GROIN INJURIES?

Mosler A, et al., (2018) The American Journal of Sports Medicine.

[Abstract]

Monitoring fatigue: the best methods for using the countermovement jump

OBJECTIVE
Testing vertical jumps and using force analysis has become more popular with sports teams over the past few years, mainly due to the commercial market improving the user experience with force plates. Currently, coaches need to know how to apply countermovement tests better and be educated on what measures are appropriate to determine true fatigue with athletes. The aim of this study was to determine a better statistical approach to scoring countermovement jump performance with rugby union players.

WHAT THEY DID
The two researchers used a single force plate to summarise leg power with 15 male academy players from a UK club. On average, each athlete was slightly under the age of 20, and were approximately 97 kilos in body mass, with a range of about 10 kilo range heavier and lighter. Each subject jumped 8 times and the researchers used excel to analyse the data, addressing for both coefficient of variation and smallest worthwhile change for the group of athletes. The six metrics analysed were Reactive Strength Index Modified, jump height, peak concentric power, peak velocity, peak concentric force, and the ratio of flight time and contact time.

WHAT THEY FOUND
The study found that increasing the amount of jumps reduced the noise, and peak velocity and jump height were the highest rated metrics with countermovement tests. In addition to the types of metrics, the use of best score and average score was compared, and overall the average of multiple trials was better statistically than a single score approach. The researchers were very firm on suggesting that more testing is recommended and the use of jump height may be more practical because it could be estimated by a contact mat or similar technology.

Practical Takeaways

From a coaching perspective, the necessary amount of jumps needs to be higher if the professional needs confidence that the data is actually representing the trend seen. The study reinforces the need for not only more jumps, but also the research explained what metrics have a stronger signal-to-noise ratio. Due to the convenience of tools that estimate jump height from air time, it makes sense to consider tools and protocols that can collect jump height with enough precision and reliability to flag fatigue. The short rest periods used in the study (1-minute) empowers coaches to test quickly, but teams may need to increase the amount of jumping stations to compensate for the increase of trials (i.e. jumps) from each athlete.

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Carl's Comments

"Many teams and organisations are investing a lot of money into jump testing, and to create sustainable approaches to monitoring fatigue over a season, the challenge of testing athletes weekly is difficult. My only concern with this paper or any paper that mentions biological variability of jumping is the fact that effort and motivation to jump height wasn't really addressed. In the future, more attention to the motivation to produce a maximal effort needs to be factored in, as athletes tend to lose interest into jump performance over time; especially if they're seeing little to no return on investment (i.e. no programme manipulation based on results/data)."

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MEDICINE BALLS WITH BUILT-IN ACCELEROMETERS: ARE THEY ACCURATE AND WORTH THE INVESTMENT?
Roe G, et al. (2018) J Strength Cond Res, 1.

ARE TYPICAL MUSCULOSKELETAL SCREENING TESTS SENSITIVE TO CHANGES IN TRAINING LOAD?
Esmaeili A. et al., (2018) Frontiers in Physiology, 1.

ARE WEARABLE SENSORS THE NEXT GENERATION IN SPRINT PERFORMANCE TESTING?
Setuain I. et al., (2018) Scandinavian Journal of Medical & Science in Sports, 1.

[Abstract]

Medicine balls with built-in accelerometers: Are they accurate and worth the investment?

OBJECTIVE
Elite sport requires valid and reliable technologies to monitor training or track performance. The market of velocity-based training equipment recently expanded with new options, and the need to ensure the new products are properly assessed is essential for coaches and sport scientists. Medicine ball training is a popular modality, so naturally a technology that enables coaches to measure the performance of throws is a tool that could be both practical and useful in testing. The goal of this study was to validate the 'Ballistic Ball' - specifically the 8 kg option - for chest throws compared to a research grade motion capture system.

WHAT THEY DID
Researchers focused on the reliability of the device with professional rugby athletes and the criterion validity with Qualysis, an optioelectronic system. Researchers recruited ten young professional rugby players (19.7 ± 1.1 years), roughly 100 kg body mass and approximately 186 cm in height. Those athletes performed 2 x 3 throws maximally while lying supine on the ground. The best throw of each athlete was collected and compared to a separate evaluation of the criterion measurement. Three subjects (unknown population) performed 25 throws with 5 reflective markers on the sensor-enhanced medicine ball.

WHAT THEY FOUND
Researchers found that the accelerometer-equipped medicine ball was reliable for chest throw velocity readings. The findings demonstrated a small typical error of 2.8% (2.0 to 4.6) with regards to between-day reliability. The investigators also found an almost perfect relationship between the Ballistic Ball and the criterion measure, proving the equipment has excellent validity. The medicine ball did overestimate velocity by 7.9% (Peak Velocity) and had a moderate standard error of 4.9%.

Practical Takeaways

Based on the reported data, the use of an accelerometer-embedded medicine ball is very practical way to track improvement in a chest throw. Due to the between-day assessment error being only small statistically, it's useful for applied environments needing to see significant improvements in upper-body performance. The sensitivity of the Ballistic Ball appears to be strong enough to see improvement of a training programme over long periods of time, but for weekly monitoring of the nervous system it may not be able to detect fatigue. Finally, the athletes were supine when they performed their throws to improve the repeatability of the throw, so coaches may want to consider using a wall if they are performing horizontal throws seated or standing.

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Carl's Comments

"Medicine ball training and testing still desperately needs hard quantification, and the Ballistic Ball offers a potentially useful approach to extracting data from common exercises. What is disappointing is that the researchers used an upper-body throw instead of a total-body throw vertically, as that exercise is far more common with speed and power athletes. The paradigm shift in medicine ball training and testing towards a velocity-based approach instead of a weight and estimated distance is a great idea, as instantaneous feedback is great for athletes. Future research validating other common throws would be invaluable to coaches."

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TIME TO COOL OFF! ARE COOLING GLOVES AND JACKETS USEFUL IN HOT/HUMID CONDITIONS?
Maroni, T. et al., European Journal of Sport Science. 2018.

HOW DOES THE VOLUME OF HIGH-SPEED RUNNING AND SPRINTING IMPACT INJURY RISK
Malone, S. et al., Journal of Science and Medicine in Sport. 2018.

MY JUMP 2 APP: A GREAT TOOL FOR MEASURING THE REACTIVE STRENGTH INDEX OR OVER-HYPE?
Bishop, C. et al. The Journal of Sports Medicine and Physical Fitness. 2018.

[Abstract]

My Jump 2 App: A great tool for measuring the reactive strength index or all hype?

OBJECTIVE
The reactive strength index (RSI) is one metric commonly analysed from the drop jump (DJ). It identifies an athlete's ability to quickly switch from an eccentric to a concentric contraction, and how much force the athlete is able to produce in the shortest possible time. RSI has also been correlated to change of direction speed, and attacking and defensive agility. Testing the drop jump is now easier than ever with the iPhone app My Jump 2. Therefore, the aim of the study was to analyse the validity and reliability of the My Jump 2 app for measuring RSI and DJ performance.

WHAT THEY DID
14 active male students with at least one year of jump training experience (including DJ) participated. Leg length was measured as per previous force-velocity-power studies to calculate force and power variables. After a standardised warm-up, subjects performed 3 DJ onto a force platform whilst simultaneously being recorded with a smartphone using the My Jump 2 app. Drop heights of 20cm and 40cm were used. Jump height, contact time, mean power, flight time, and RSI were recorded on both devices.

WHAT THEY FOUND
Near perfect levels of agreement were seen between the My Jump 2 app and force platform measures of RSI at 20cm and at 40cm (ICC = 0.95 and 0.98, respectively). Furthermore, near perfect agreement was seen in measures of jump height and contact time (ICC = 0.96 and 0.92, respectively). Mean power in both tests had a weaker agreement (ICC = 0.67). Near perfect correlations were seen in RSI measures at 20cm and 40cm (r = 0.94 and 0.97, respectively) between the My Jump 2 app and force platform. Furthermore, near perfect correlations in both jump height and contact time between measuring devices (r = 0.96 and 0.98, respectively). Conversely, mean power showed weaker correlations (r = 0.66). My Jump 2 showed good intra-session reliability when measuring RSI at 20cm and 40cm (CV = 6.71% and 10.32%, respectively).

Practical Takeaways

The near perfect agreement seen between the My Jump 2 app and force platform for RSI, jump height, and contact time all support the validity of the app as a valid tool for measuring drop jump performance. These findings suggest that even though the take-off and landing frames are manually selected, the app can still accurately measure contact time and jump height. Mean power was the only variable which did not correlate well between the two devices. This could be due to the app's calculation of power, as the force plate measures force directly, whilst the app uses contact time, flight time, and body mass to estimate power. The slightly larger variation in RSI measurements (RSI at 40cm) could be due to the fact that RSI is multi-factorial, with the error on flight time being compounded by error on contact time. Similar findings in this study and previous research show the My Jump 2 app is able to reliably measure DJ performance in a wide range of populations from recreational to elite-level athletes.

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James's Comments

"I use My Jump 2 pretty extensively with my rugby guys. The DJ measurement is a quick and easy test to get accurate RSI measurements, as well as CMJ, SJ, and force-velocity profiling. Not only does the app give you RSI, but also contact time, flight time, jump height, and stiffness. The easiest way to test a team of players is to record all jumps in slow-motion and analyse the jumps later due to the time-consuming nature of manually selecting ground contacts. It is for this reason that using the DJ as a measure of "readiness" with this app isn't practical in a team setting. Furthermore, when testing the DJ, it will take a few sessions for the athletes to learn how to DJ correctly. Often, athletes newer to the DJ struggle to land with both feet at the same time which will skew your RSI and contact time results. As a result, test familiarisation is vital."

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