Research Review

Volume 1

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Welcome to *Research Review*, the place to be to get ahead of the game. With so many different sport and exercise journals now in publication, it's often difficult to keep up. Why not let us give you a helping hand? Research Review will be bringing you the latest developments in sport and exercise science research and providing expert commentary from researchers and practitioners at the *Performance website*.

The theme of power performance is central to this month's instalment, with biomechanical, physiological and psychological factors all covered. The studies featured investigate topics as wide-ranging as athlete deception, static stretching and attentional focus.

Remember: Train hard, train SMART!

Study 1

Concurrent training: a meta-analysis

Countless individuals regularly perform both strength and endurance training – so- called concurrent training – to try and reap the benefits from both forms of exercise. But is this method the best of both worlds or merely a weak compromise? Worse still, could it actually be detrimental to your training goals?

A recent meta-analysis, led by Dr Jacob Wilson from the University of Tampa, USA, revealed that gains in strength and hypertrophy were significantly less in groups performing concurrent training compared to groups performing strength training alone. It appears that power development, however, is most disadvantaged by the inclusion of endurance training. It's not all bad news for concurrent training, though: decreases in body fat were most pronounced in groups performing both strength and endurance work. Such improvements in body composition correlated to the intensity of the endurance activity utilised.

There are a couple of important caveats. The researchers found that power, strength and hypertrophy were all negatively correlated to frequency and duration of the endurance training implemented. Endurance modality may also be key – cycling concurrently with strength training did not appear to impair these qualities to the same extent as running.

- *Outcome*: long-duration, low-intensity cardio training stifles potential gains in power, strength and hypertrophy.

	Strength -only	Concurrent	Endurance -only(	Frequency r value)	Duration (r value)
ATTRIBUTE					
Power	0.91	0.55	0.11	-0.35	-0.29
Strength	1.76	1.44	0.78	-0.31	-0.34
Hypertrophy	1.23	0.85	0.27	-0.26	-0.75
VO2max	-0.11	1.41	1.37	/	/
Body fat	-0.62	-0.95	-0.75	/	/

Table 1. *The effect size for the development of each physical attribute, associated with the type of training performed; and their correlation to the frequency and duration of endurance training.*

Reference

Wilson JM, Marin PJ, Rhea MR *et al.* Concurrent training: a meta-analysis examining interference of aerobic and resistance exercise. *J Strength Cond Res*, October 2011 [epub ahead of print].

Study 2

Kinetic comparison of power clean variations

Olympic weightlifting movements are commonly used as a training modality because they are associated with the some of the highest-power outputs achieved in all of sport and exercise. Researchers from the University of Salford, UK compared different variations of the power clean exercise in an attempt to establish the best choice for training power development.

Sixteen elite rugby league players performed three variations of the power clean – cleans from the floor, from hang, and from mid-thigh – in addition to the clean-pull from mid-thigh. A load of 60% of subjects' maximal power clean was used for each lift. It was reported that peak power, peak force and rate of force development were all greater during both the lifts performed from mid-thigh. Differences in rate of force development were the most pronounced; this parameter was almost 50% greater during the mid-thigh lifts. No differences were observed between the mid-thigh power clean and mid-thigh clean-pull.

- *Outcome*: if seeking to develop force, power or rate of development, performing variations from mid-thigh would appear most advantageous.

Reference

Comfort P, Allen M, Graham-Smith P. Kinetic comparisons during variations of the power clean. *J Strength Cond Res*, 2011, **25**, 3269–3273.

Study 3

An acute analysis of incline plyometrics

An inclined surface increases dorsiflexion of the ankle which should, in theory, optimise length–tension relationships in the plantar flexors and increase energy storage in the Achilles. With this in mind, could performing plyometric drills on an incline surface increase their effectiveness?

Twelve active males performed a series of stiff-legged hops on both an incline (15°) and a flat surface in an attempt to test this theory. Jump height was an average of 10% greater during incline hopping, with greater dorsiflexion and knee extension angles exhibited at take-off. Additionally, electromyographic (EMG) activity of the soleus and tibialis anterior were higher during the propulsive phase.

THE SCIENCE:

Maganaris [1] investigated the length–tension relationships of the lateral (GL) and medial (GM) heads of the human gastrocnemius over a range of motion from 30° of plantar flexion to 20° of dorsiflexion. GL muscle fascicular length and force both increased linearly, from 30mm to 47mm and from 139N to 393N respectively. Similarly, fascicular length of the GM increased from 24mm to 39mm and force from 222N to 931N.

1. Maganaris CN. Force-length characteristics of the in vivo human gastrocnemius muscle. *Clin Anat*, 2003, **16**, 215–223.

- *Outcome*: incline hopping may be a more effective drill than plane hopping if seeking to develop explosive plantar flexion.

Reference

Kannas TM, Kellis E, Amiridis IG. Biomechanical differences between incline and plane hopping. *J Strength Cond Res*, 2011, **25**, 3334–3341.

Study 4

Short-duration static stretching does not impair muscular performance

With worries over reductions in strength and power performance, the inclusion of static stretching in a warm-up has fallen out of favour in many circles. A new systematic review of the research suggests that such concerns may be unfounded.

Considering a total pool of 106 studies, Kay and Blazevich revealed that stretches of less than 30 seconds, a typical duration for stretching prior to performance, did not impair performance. A pooled estimate of a -1.1% (±1.8%) effect on performance was calculated. Whilst a small handful of studies have reported detrimental effects when stretch duration is increased to 30–45 seconds (pooled estimate: 1.9% ±3.4%), the review calculated no overall effect. It is only stretches in excess of 60 seconds that appear to be harmful to performance. The review also demonstrates that impairments in performance are more pronounced in strength activities than in speed/power activities. For example, stretching for 30–45 seconds had a pooled estimate of -0.6% ±3.1% on speed/power performance and -4.2% ±2.7% on strength performance.

- *Outcome*: static stretches of under 30 seconds in duration do not appear harmful to speed or power performance.

Reference

Kay AD, Blazevich AJ. Effect of acute static stretch on maximal muscle performance: a systematic review. *Med Sci Sports Exerc*, 2012, **44**, 154–164.

Study 5

An external focus improves long jump performance

Where should we direct our focus if maximal power performance is the goal? Wu et al investigated whether an internal or external focus is better for maximising long- jump performance.

Twenty-one untrained subjects, both male and female, performed a baseline standing long-jump test before performing subsequent jumps with either an external or internal focus (subjects were told to focus on 'rapidly extending the knees'). Subjects jumped an average of 15% further when given instructions to focus their attention externally, despite no increase in peak force production. Instructions directing an internal focus had no effect on jump distance.

- *Outcome*: an external focus should be directed if seeking to maximise jump performance.

Reference

Wu WFW, Porter JM, Brown LE. Effect of attentional focus strategies on peak force and performance in the standing long jump. *J Strength Cond Res*, 2012, **26**, 1226–1231.

Study 6

Squatting with a forward lean reduces ACL load

Closed chain exercises, such as single leg squats, are commonly utilised during the rehab of anterior cruciate ligament (ACL) injuries. However, the extent to which trunk position alters ACL forces and strains in these exercises was previously unclear.

Twelve recreationally trained subjects performed two styles of single leg squat, one where they were instructed to minimise forward lean (~15%) and one with a 'moderate' forward lean (~40%). Squatting with a forward lean reduced peak ACL forces by 24% and ACL strain by 16%. Hamstring activity was also greater with forward lean.

- Outcome: performing single leg squats with a moderate forward lean may be preferable if seeking to minimise ACL forces and strains by improving quadriceps and hamstring co-contraction.

Reference

Kulas AS, Hortobágyi T, DeVita P. Trunk position modulates anterior cruciate ligament forces and strains during a single-leg squat. *Clin Biomech*, 2012, **27**, 16–21.

Study 7

'Tricking' athletes to improve their personal best

Is the body always the limiting factor in maximal exercise? Stone and colleagues looked into the role of cognition in such circumstances, testing whether giving athletes misleading information could improve their performances.

Nine trained male cyclists completed an initial 4km cycle race, to set a benchmark performance, before then completing two further 'test' races. During these subsequent races athletes competed against an avatar which they were informed represented their benchmark performance. Whilst one of these races represented a true reflection of their initial performance, the other was actually 2% faster. Performances were improved in both subsequent conditions – but to a greater extent when athletes were deceived. The improved performance was attributed to a greater anaerobic contribution during the final stages of the race.

- *Outcome*: the research suggests the existence of a metabolic reserve, even during maximal trials, and that deception could be a viable technique to access this in certain circumstances.

Reference

Stone MR, Thomas K, Wilkinson M *et al*. Effects of deception on exercise performance: implications for determinants of fatigue in humans. *Med Sci Sports Exerc*, 2012, **44**, 534–541.

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