

August 2017 | Issue #11

THE PERFORMANCE DIGEST

A review of the latest sports performance research



Strength & Conditioning

This month's top research in strength & conditioning.

ASYMMETRY BETWEEN LIMBS: DOES IT REALLY MATTER?

Chris Bishop, Anthony Turner & Paul Read (2017):
Journal of Sports Sciences.

HEAVY SLED PUSHES: ANOTHER TOOL IN THE TOOLBOX FOR IMPROVING SPRINT SPEED?

Seitz LB and Haff GG. A sled push stimulus potentiates subsequent 20-m sprint performance. J Sci Med Sport (2017).

CONCURRENT TRAINING: DOES RESISTANCE TRAINING AFFECT ENDURANCE DEVELOPMENT?

Kenji Doma, Glen B. Deakin and David J. Bentley. Sports Med. 2017.



[Abstract]

Heavy sled pushes: another tool in the toolbox for improving sprint speed?

OBJECTIVE

The aim of this study was to assess the potentiating effects of a heavy sled push (75 and 125% of body mass) on subsequent unloaded 20m sprint performance.

WHAT THEY DID

In a randomised crossover design separated by 7 days, 20 male rugby league players (18.4 ± 0.8 years; height: 180 ± 8 cm; body mass: 80.4 ± 6.8 kg; resistance training experience: 3.1 ± 1.8 years; number of weekly resistance training sessions: 3.0 ± 0.5) performed a two 20m unloaded sprints before and 15 secs, 4, 8 and 12 mins after a single sled push stimulus loaded with either 75 or 125% body mass. The fastest sprint times from before and after the intervention were used for the analysis.

WHAT THEY FOUND

For the 75% body mass sled push, sprint time was slower at 15 secs ($0.26 \pm 1.03\%$), but faster at the 4 ($-0.95 \pm 2.00\%$), 8 ($-1.80 \pm 1.43\%$) and 12 mins ($-1.54 \pm 1.54\%$; ES = -0.36) time points. For the 125% body mass sled push, sprint time was significantly slower at all time points after the sled push intervention ($1.36 \pm 2.36\%$ to $-2.59 \pm 2.90\%$). In conclusion, 20m sprint time can be improved (potentiated) 4-12 minutes after sled pushes loaded with 75% of body mass.

» Practical Takeaways

The results of this study are important for coaches who wish to temporarily improve sprint performance. This study also aligns with a paper we reviewed in last month's research digest (issue #10 - July 17), which found a potentiating effect on sprint performance using a sled towing drill loaded with 30% of body mass. In my conclusion of the study, I also suggested that using 80% of body mass may be more effective than 30% for inducing a potentiating effect, and that appears to be true given the results of this study.

In terms of hand position, previous research ([HERE](#)) has suggested that the hands should be at approximately 40% of standing height as this position produced the largest forces in the scrum associated with rugby.

Coaches should also understand how to equate the mechanical load, or training load, of sled work for programming purposes. This is done by using the following equation: Mechanical work = load $\times$ distance. For example: $75\text{kg} \times 15\text{m} = 1125$, which is the same as: $125\text{kg} \times 9\text{m} = 1125$

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Owen's Comments

"It is important to acknowledge that although no improvement in sprint performance was observed using 125% of body mass, this is likely due to the presence of fatigue which may have subsided at >12 mins, and thus, resulted in performance improvements. As such, athletes more trained with heavy sled work than those in this study may well be capable of experiencing a potentiating effect within 12 mins.

Whilst an improvement in sprint performance was observed using 75% of body mass, how this improvement was obtained was not assessed (e.g. increase in force production). As a result, and due to the current interest in the force-vector theory, it would be interesting to see if heavy sled work improves horizontal force production during short sprint tasks (e.g. 20m)."

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Strength & Conditioning

This month's top research in strength & conditioning.

GYM-BASED PRIMER SESSIONS 1-2 DAYS BEFORE A GAME: DO THEY WORK?

Tsoukos, A. et al., (2018) Journal of Strength and Conditioning Research.

THE NORDIC CURL VS. STIFF-LEG DEADLIFT: WHICH IS BEST FOR HAMSTRING MUSCLE ACTIVITY?

Hegyl, A. et al., (2018). Scandinavian Journal of Medicine and Science in Sports. (28): 992-1000.

POST-ACTIVATION POTENTIATION (PAP) FOR ENDURANCE SPORTS: A HIDDEN PIECE OF GOLD?

Boullosa, D. et al., (2018). European Journal of Sport Science.



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[Abstract]

Gym-based primer sessions 1-2 days before a game: Do they work?

OBJECTIVE

It has been suggested that a resistance training (RT) session performed 24-48h before a competition/game or a high-quality training session may enhance athletic performance. However, there is limited evidence regarding the effects of resistance training on subsequent explosive muscle performance. Hence, the purpose of this study was to investigate whether a low-volume, power-type RT session enhances neuromuscular performance of the legs in the following 24 to 48h.

WHAT THEY DID

17 national-level male power- and team-sport athletes took part in 4 different sessions (2 experimental and 2 control). Subjects were first familiarised and then tested for baseline measures on 1RM half squat (90 degree knee angle), CMJ, drop jump (RSI), isometric maximum force (leg press 90-100deg knee angle), and rate of force development from the isometric leg press at 0-100, 0-200, and 0-300ms. After the baseline tests, the experimental group performed a warm-up of 1x6 @15% 1RM and 1x4 @30% 1RM jump squats. Once warm, subjects performed 5x4 jump squats with 40% 1RM (approx. 65kg) with a 90-100deg knee angle. Explosive performance was measured 24 or 48h after the intervention for each group. The control group also had explosive performance measured at 24 or 48h, but with no intervention.

WHAT THEY FOUND

CMJ in the 24h condition was greater than baseline ($5.1 \pm 1.0\%$) as well as in the 48h condition ($3.0 \pm 0.7\%$) in the experimental trial, while there was no difference in the control trials. RSI in the 24h condition was greater than baseline ($10.7 \pm 2.1\%$), while scores in the 48h condition were not statistically different. No significant interactions were found between conditions or time to maximum isometric force. However, RFD 0-100, 200, and 300ms were significantly greater in the 24h condition compared to baseline ($18.3 \pm 4.1\%$; $10.2 \pm 3.3\%$; $9.7 \pm 3.4\%$, respectively). Only RFD 0-100ms was greater than baseline in the 48h condition ($9.8 \pm 3.1\%$).

» Practical Takeaways

This paper shows that a low-volume, power-type resistance training session results in moderate to large improvements in explosive performance 1 and 2 days later. In particular, CMJ, RSI, and RFD all experience significant improvements, however, no improvements in peak force were observed. The improvement in explosive exercises, but not peak force, could be due to the exercises performed in the intervention. Hence, 24-48h enhancements may be velocity specific, where the jump squat closely mimics the CMJ and DJ.

Based on this study, the use of the jump squat can be used as a "primer" 1 or 2 days out from competition to enhance neuromuscular performance. Other velocity-based movements could also potentially be used to enhance performance, such as sprinting or varying medicine ball throws. Since subsequent performance seems to be velocity specific, strength-based "primers" may be useful for sports that require high forces rather than high velocities; an example may be working up to a 90% 1RM squat or bench press.



James's Comments

"This performance enhancement effect lasted up to 48h in this study. However, performance enhancements can be seen in as little as 4-6 hours after training (see article linked below). This provides a large window where a "primer" could be used before competition and may depend on the individual athlete as to how they respond. Performance enhancements seem to be dependent on the exercises chosen during the "primer", so for velocity-based improvements, select velocity-based exercises. In contrast, for force-specific improvements, choose force-based exercises.

A tip taken from Nic Gill (New Zealand All Blacks S&C Coach) at a conference in New Zealand, is that primers should always remain the same from week-to-week as you don't want to create unnecessary muscle soreness each week."

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[Abstract]

Post-activation potentiation (PAP) for endurance sports: A hidden piece of gold?

OBJECTIVE

Post-activation potentiation (PAP) has been defined as the phenomena by which muscular performance characteristics are acutely enhanced by previous exercise. PAP has been traditionally focused on power exercises, however, PAP responses have also been observed in endurance-trained athletes after maximal voluntary contractions. Therefore, the aim of this study was to present the current evidence of PAP in endurance athletes, and to discuss the physiological basis and methodological aspects of this ergogenic mechanism for better practice.

WHAT THEY DID

Activities were considered as endurance-based if they lasted for longer than 1-min. The inclusion criteria for this review were: 1) participants should be endurance-trained athletes, 2) an endurance exercise should be present, and 3) pre- and post-exercise measures of muscle or motor performance. A total of 22 articles were included in this review. 2 articles used MVC as a conditioning activity, one used sub-maximal intermittent contractions, one compared different warm-up protocols, two assessed the effects of warm-up on subsequent simulated trial, 10 studied PAP using different exercise set-ups, and 8 studies looked at race simulations and competitions. Most output measures for assessing PAP were voluntary peak torque or evoked twitch peak torque and the countermovement jump (CMJ).

WHAT THEY FOUND

A couple of positive outcomes were found for PAP for warm-ups. National-level rowers that added 5x5-sec isometric contractions to individualised warm-up routines significantly improved mean power and performance time over the first 500m of a 1000m rowing ergometer time-trial. Despite this, their performance time did not significantly improve over the whole trial. Another paper found a 6% time reduction (i.e. positive improvement) in a 20km cycling time-trial after adding 4 sets of 5RM leg press to a 5-min sub-maximal cycling warm-up routine. This improvement showed a trend towards higher mean power output during the first 10% of the trial. PAP during training and competition has shown that a conditioning activity consisting of 10-mins of sub-maximal (50% MVC) intermittent contractions of knee extension can significantly improve the peak torque in endurance-trained athletes when they perform an entire endurance-based protocol. On the contrary, power-trained athletes experienced a significant reduction in peak torque through the 2nd half of the protocol.

» Practical Takeaways

The concept of using PAP after specific warm-up protocols for endurance performance has been an under-explored area. From the literature reviewed within this study, a key take-home message would be that caution should be taken when using this training method given the fact that a PAP effect is typically short-lived (i.e. PAP conditioning activities used during warm-ups only seem to last <12-mins). As a result, the positive influence of PAP may only be expected during the first minutes of the subsequent exercise (as shown above), with limited application in long-duration competitive settings. Having said that, the acute effects of PAP would therefore be more important in efforts of a shorter duration (e.g. 1500m race).

The authors also suggest that higher exercise intensities could induce more fatigue than potentiation on subsequent exercise (i.e. more bad than good), in comparison to prolonged endurance activities. This potentially means that the type of "primer" used may depend on the individual or the sport being prepared for (e.g. endurance sports using an endurance-primer or power sports a power-primer). Future research should investigate the influence of different modes of exercise (e.g. cycling and running) on PAP given the variability of PAP responses and their effect on subsequent exercise.



James's Comments

"This current review suggests that endurance athletes can experience the existence of PAP during and after endurance performances; though the benefits may be short-lived (<12mins). The priming exercise used for long-lasting endurance sports should be different than a typical primer used for team- or power-based sports. Based on the research reviewed, an endurance primer may involve sub-maximal intermittent isometric contractions as to keep the potentiation/fatigue balance in favour of PAP. While jump potentiation has been observed after long-duration endurance exercise, performing long-duration exercise as a primer isn't practical before a competition. Future research is needed to verify the effectiveness of different training interventions in both PAP responses and endurance performance."

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