October 2017 | Issue #13

THE PERFORMANCE DIGEST

A review of the latest sports performance research

Contents

Click a topic to jump straight there

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Welcome to the **PERFORMANCE DIGEST**

OWEN WALKER
Founder and Director of
Science for Sport

Firstly, I'd like you personally thank and welcome you to the Performance Digest, it's honestly an absolute privilege knowing that you're a member and are taking the time to read this. I truly cannot extend my gratitude enough! Thank you.

Secondly, if you're wondering what the Performance Digest is, this should explain it nicely:

"These monthly issues are a gathering of the latest, and best, sports performance research published in that month from peer-reviewed journals. For example, research published within October 2017 will be included within the October 2017 issue - this ensures that you're fully up-to-date with the most recent and talked about research and information relating to sports performance; whether that be eccentric training, velocity based training, cold water immersion, early specialisation, or optimal protein intake for elite athletes. If there is not enough relevant research published in that month (extremely unlikely), studies published in the preceding month(s), or those "in press", will be used to supplement the topic. Each new issue will be published on the last day of the month (e.g. November 2017 issue will be published on the 30th November 2017)."

The sports performance industry is thriving, exciting, and growing at an extortionate rate every single day. As a result of the internet and social media, the amount of information being exchanged everyday is truly overwhelming and seems impossible to keep up. It is for this reason that we decided to develop the Performance Digest so that practitioners had a tool to stay up-to-date with everything that's happening—and do so with minimal effort and have assurance that you're getting a high-quality, trustworthy product.

I would also like to take this opportunity to sincerely thank our team of research reviewers (you can see them on the next page) for their monthly contributions, as for without them, this digest would not be such a phenomenal resource. It is an absolute pleasure working alongside such fantastic practitioners and academics, and I hope to see these relationships continue to grow and prosper.

So, what's new?

For those unaware, the Performance Digest is the new an upgraded version of the *Research Alerts*—may they rest in peace. With this comes some supple changes:

1. Improved design and readability.
2. Inclusion of "The Science of Coaching" (a topic devoted to evidence-based coaching).
3. Inclusion of the "Practical Takeaways" .
4. Expansion of the "Reviewers Comments".
5. Inclusion of "Learn More" links which provide you with additional, high-quality, content on the same topic if you wish to expand your knowledge further.
6. Removal of the "Team Sports" section.

I hope you're all happy with these changes and continue to invest in your education and career in this prosperous industry, and as a Performance Digest subscriber. That is all from me, so again, many thanks and I hope you enjoy!

Reviewers

The research reviewers for The Performance Digest.

Owen Walker
MSc*D CSCS

Chief Editor

Owen is the founder and director of Science for Sport. He was formerly the Head of Academy Sports Science and Strength & Conditioning at Cardiff City Football Club, and an interim Sports Scientist for the Welsh FA.

Dr. Will Vickery
PhD

The Science of Coaching

Will is a Lecturer of Sport Coaching at the University of Northumbria: Newcastle Upon Tyne. Prior to this he has worked with Cricket NSW and Cricket Australia in an array of roles ranging from a sport scientist, development coach and a strength and conditioning coach.

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Fatigue & Recovery

Fran is a strength and conditioning coach at the Glasgow Warriors, Scotland. He is also a PhD candidate at Waikato University, New Zealand, a performance consultant to the Portuguese Rugby Union, and a published author.

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Tim is the Head Strength and Conditioning Coach at the Sydney Rays Women's Rugby Sevens Team, and has assisted previously at the Australian Rugby Sevens. He has a Bachelor of Physiotherapy (1st Class Honours), Master of High Performance Sport and ASCA Level 2.

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Youth Development

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James de Lacey
MSc

Technology & Monitoring

James is currently the Head Strength & Conditioning Coach with Austin Elite Rugby. He has previously worked in professional rugby in Romania, and with the NZ Women's National Rugby League Team. He is a published author and has completed a MSc in Sport & Exercise Science from AUT, Auckland, NZ.

James Morehen
PhD Candidate

Nutrition

James is a SENr registered performance nutritionist, currently completing his PhD at Liverpool John Moores University. He is also a Performance Nutritionist for the English Football Association alongside the England national squads (men's and women's)

The Science of COACHING

How can a coach's behaviour impact their delivery?

[Abstract]

This study explored how different forms of feedback affect the physiological, physical, perceptual and technical performance of athletes.

INTRODUCTION

It is well-known that the behaviours and actions a coach uses during a training session can, for example, influence an athlete's motivation, effort and engagement. However, the influence of a coach on the physical and technical performance of athletes is something which has been underrepresented within coaching science research.

Considerable research has also identified factors which are likely to impact on the performance of athletes during small-sided games, namely the dimensions of a training area and the number of players involved during a specific activity. Evidence regarding the influence of the coach's behaviour on performance during these activities is also lacking, despite research suggesting that the coach's presence during training alone can influence the performance and training outcomes of athletes.

In this study, the influence of different forms of feedback (strongly pushed [SSSG-P] or mild [SSG-M]) provided by a coach on the physiological, physical, perceptual and technical demands of elite youth soccer players during small-sided soccer games was examined.

WHAT THEY FOUND

The type of feedback provided by coaches had little impact on the physiological demands of players, with minor differences in few heart rate measures reported between formats. The physical demands of players appeared to be slightly influenced by coach feedback, with players more likely to perform more sprints and have a shorter work:rest ratio during SSG-P.

A possible increase in the RPE responses of players was also reported during SSG-P when compared to SSG-M. Most interesting though was that for most measures of the technical demands associated with soccer performance (e.g. conquered ball, received ball, number of passes, successful shots on goal) the opposite was seen with players completing slightly less of each during SSG-P as opposed to SSG-M.

WHAT THIS MEANS

Although there is a lack of justification for the reported results in the current study regarding any of the coaching science literature which has been published in the last few decades, the underlying message still highlights the impact on performance that a coach can have on their players. Regardless of the type of feedback used, a coach may not have a considerable impact on the physiological demands of players.

The use of strongly pushed feedback though does appear to increase the perceptual responses of players combined with higher velocity movements and poorer game performance, which the authors suggest adds to the psychological stress of the players.

Practical Takeaways

The use of strongly pushed (or in other words highly instructive or demanding) feedback is nowadays seen as a more 'traditional' form of coaching behaviour, and is something which is not encouraged amongst much of the recent coaching science literature. Coaches and support staff within any sport (not just soccer) and discipline (e.g. S&C) are encouraged to provide minimal yet specific feedback to their athletes, as this is more likely to promote positive development, not just from a behavioural and social perspective, but also from a performance-based perspective; as the current study shows.

Dr. Will Vickery

Will is a Lecturer of Sport Coaching at the University of Northumbria in Newcastle Upon Tyne, U.K.

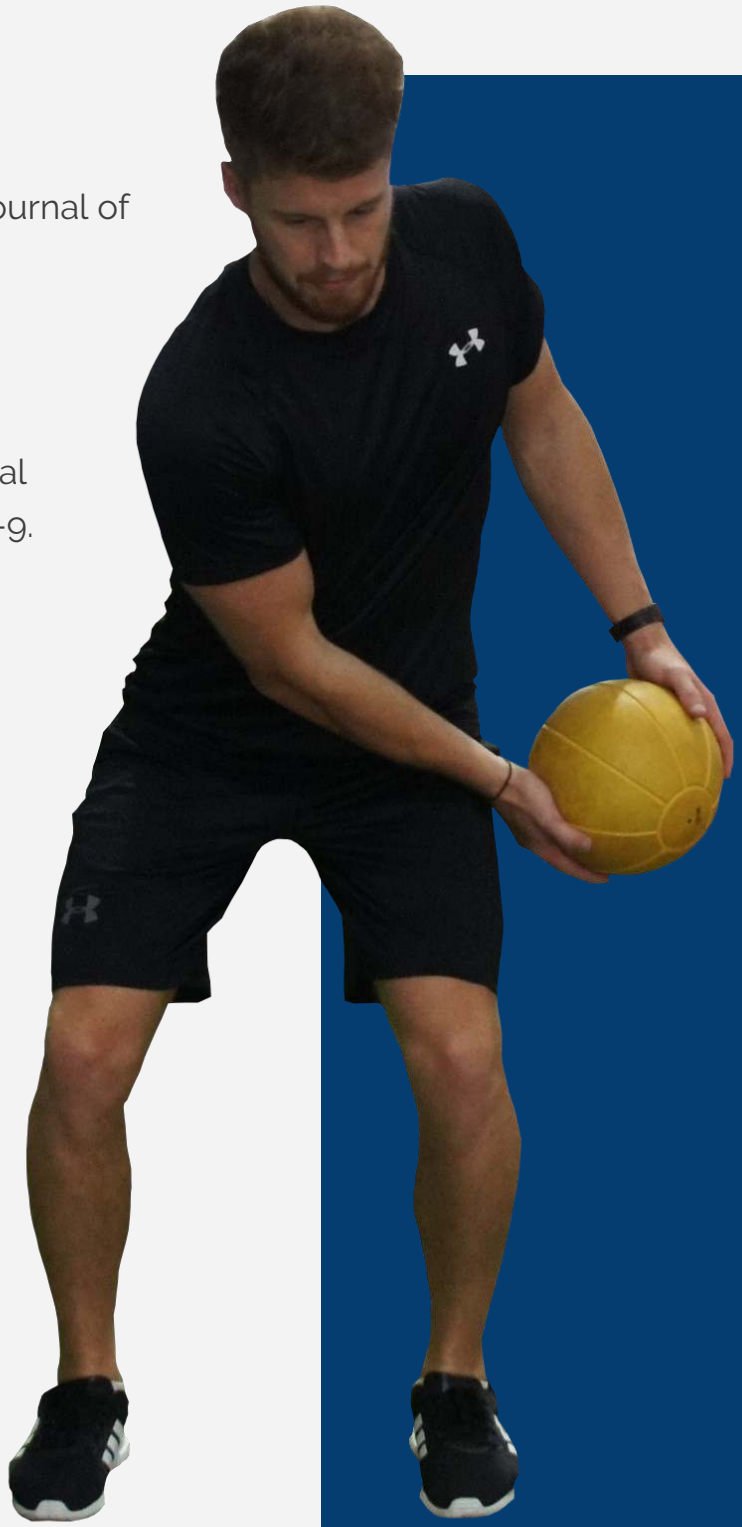
Strength & Conditioning

This month's top research in strength & conditioning.

CONCURRENT TRAINING: OPTIMISING PLANNING AND ADAPTATION
Murlasits Z, Kneffel Z and Thalib L (2017) Journal of Sports Sciences, 1-8.

VBT AND VELOCITY LOSS THRESHOLDS: DOES 10% VS. 20% EVEN MATTER?
Pérez-Castilla A, García-Ramos A and Padial P et al. (2017) Journal of Sports Sciences, 1-9.

KINESIO TAPE FOR ATHLETIC PERFORMANCE: HAVE WE BEEN WRONG ALL ALONG?
Reneker J, Latham L and McGlawn R et al. (2017) Physical Therapy in Sport.



[Abstract]

Concurrent training: Optimising planning and adaptation

OBJECTIVE
To assess the chronic effects of the sequence of concurrent strength and endurance training on important physiological and performance parameters, including lower-body 1-repetition maximum (1RM) and maximal aerobic capacity (VO2max/peak).

WHAT THEY DID
The authors conducted a systematic review and meta-analysis on this topic. Searches of PubMed, Google Scholar, Web of Science, Scopus and SportDiscus were conducted for studies that met the following inclusion criteria:

⇒ controlled randomised or matched chronic effect trials with at least eight weeks of follow-up duration.
⇒ studies comparing strength-endurance with endurance-strength training sequence in the same session (defined as one training mode immediately following the other, or with a short rest period of 5–10 min).

A total of 13 studies met the above criteria and were included for analysis.

WHAT THEY FOUND
The authors found that maximal strength improved more when strength training was done first, and interestingly, the effect on aerobic capacity was the same if endurance training was done before or after strength training. In terms of strength, the authors found a significantly different effect size of 3.96 kg (95% CI: 0.81 to 7.10 kg), indicating the superiority of the strength-before-endurance order. However, the training sequence had no impact on aerobic capacity with a pooled estimate of the difference between the sequences to be 0.39 ml/kg/min (95% CI: −1.03% to 1.81 ml/kg/min).

Practical Takeaways

The main takeaway from this study for strength and conditioning coaches is that programming strength training prior to endurance training appears to be beneficial for lower-body strength adaptations, while the improvement in aerobic capacity is not affected by training order. This has important practical implications, because maximal strength is a significant determinant of athletic performance. On the other hand, because the exercise order appears to have no impact on aerobic capacity adaptations, endurance athletes undertaking resistance training may sequence their training based on practical considerations or personal preference.

It is believed that when endurance training immediately precedes strength training, the accumulation of acute local fatigue interferes with the long-term strength adaptations. That is, attenuated responses are only apparent in the muscle groups that are the most active during the preceding aerobic exercise (e.g. running before strength training will impair lower-body strength more than upper-body strength). Therefore, strength and conditioning coaches should programme upper-body weights after hard running sessions to minimise any interference.

Furthermore, the separation of endurance and strength training by several hours (or even 1 whole day) whenever possible, could be a useful strategy to optimise concurrent training adaptations and avoid acute interference, as it has been demonstrated that strength training performance is compromised for at least 6-8 hours following endurance training.

Want to learn more?
Then check these out...

Tim's Comments

"On the surface, what this review tells me is that for sports requiring both strength/power and endurance, your best bet is to do weights first. That way you maximise the strength gains and the aerobic performance doesn't suffer in anyway. However, thinking this through further, there is a big reason why you wouldn't want to do strength training before field sessions – injury risk! While this study looked at doing strength training before fairly low-intensity general conditioning, field sessions often require athletes to sprint and perform other explosive activities. Performing weights before these sessions may place the athletes at high risk of soft tissue injury. Therefore, the decision to do strength training before your field sessions should be influenced by what's involved in the field session. If it's a fairly low-intensity session, then do your strength work first. If not, do the strength work afterwards. The slight drop in gym performance is worth the reduction in injury risk!

Overall, concurrent training is a complex topic with various contributing factors, such as exercise mode and intensity, muscle groups trained (upper- vs. lower-body) and subject characteristics (elite athletes vs. sedentary, young vs. old), along with inter-individual variations. Accordingly, more research is needed to clarify the effects these variables have on the effect of exercise sequencing."

[Abstract]

VBT and velocity loss thresholds: Does 10% vs. 20% even matter?

OBJECTIVE
To compare the effect of two velocity loss thresholds (10% vs. 20%) during a power-oriented resistance training programme with the same exercise intensity and repetition volume on the mechanical capacities of the lower-body musculature.

WHAT THEY DID
Twenty men (with > 2yr resistance training experience) were counterbalanced in two groups (VL10 and VL20) based on their maximum power capacity. They performed a resistance training programme twice a week for 4 weeks aimed at improving power, with every session including a loaded countermovement jump (CMJ) exercise at maximal intended velocity. Both groups used the same exercises, relative intensity and repetition volume, only differing in the velocity loss threshold of each loaded CMJ set (VL10: 10% vs. VL20: 20%).

Three unloaded CMJs, separated by 30 sec, were performed at the beginning (after warm-up) and the end (before cool-down) of each training session, and the CMJ height loss pre/post session was used to quantify the extent of fatigue induced by the training session. Pre- and post-training assessments included a countermovement jump incremental loading test (two trials per load with 0.5, 20, 40, 60, and 80kg), and a 15m linear sprint to assess the force-velocity relationships and athletic performance variables, respectively.

WHAT THEY FOUND
The VL10 group performed more sets and less repetitions within each set (13.3 vs. 18.1; $p < 0.001$) than the VL20 group. A very high between-participants variability was observed in the number of repetitions performed in the first set of the training session for both VL10 (20.0 repetitions; CV = 30.3%) and VL20 groups (26.6 repetitions; CV = 29.4%). Participants in the VL10 group performed more repetitions at high velocities ranges (i.e. mean propulsive velocity (MPV) > 1.10 m/s; VL10 = 114.9 vs. VL20 = 54.9; $p < 0.001$). Despite this, no significant between-group differences ($p > 0.05$) were observed for the force-velocity relationship parameters, the MPV attained against different external loads, or the 15m sprint time.

Practical Takeaways

The main takeaway from this study is that training with a 10% velocity loss appears to result in a similar training response to training with a 20% velocity loss. The high and variable number of repetitions completed in each group questions the feasibility of the velocity-based training (VBT) approach for prescribing and monitoring the repetition volume during a power-oriented resistance training programme conducted with the loaded countermovement jump exercise – which is a popular exercise in power-oriented training programmes. For instance, allowing even a 10% velocity loss far exceeded the number of repetitions per set commonly recommended to enhance muscular power (5-6 vs 13 reps in this study).

The study instead suggests that a combination of the traditional (i.e. fixed number of repetitions per set) and VBT approaches could be recommended for a more accurate prescription of the level of effort. In this regard, coaches can define the maximum and minimum number of repetition per set before training, and then use the recorded velocity to decide when the set should be stopped within the desired range of repetitions (i.e. create your own velocity loss thresholds).

Furthermore, the group that trained with a 10% velocity loss showed less fatigue (measured through pre- vs post-session unloaded CMJ height difference) than the group that trained with a 20% velocity loss. This is important to note, because to get the same impact on performance with less fatigue is a very desirable outcome for strength and conditioning coaches.

Want to learn more?
Then check these out...

Tim's Comments

"There is a paucity of evidence regarding the effect of different velocity loss thresholds on the neuromuscular adaptations following a power-focused resistance training programme. In the research that is available, ballistic performance improved more in the groups that used lower velocity loss thresholds, despite performing lower training volumes than the higher threshold groups. Therefore, it made sense that the authors in this study hypothesised that the training programme allowing a 10% velocity loss would result in greater short-term power performance improvements than a 20% velocity loss due to the greater number of repetitions performed at higher velocity. However, their hypothesis was rejected since the training group with a 10% velocity loss achieved a similar training response to the group with a 20% velocity loss.

Overall, this study is important as it further contributes to refining the VBT approach to prescribe the intensity and volume of power-focused training programmes."

[Abstract]

Kinesio Tape for athletic performance: Have we been wrong all along?

OBJECTIVE
To establish the effectiveness of kinesiology tape (KT) on sports performance compared to other tapes or no tape, with attention to the application methodology of the tape and the timeframe from tape application to the outcome measurement.

WHAT THEY DID
The authors conducted a systematic review on this topic. Searches of PubMed, Embase, and PEDro databases were conducted for studies that met the following inclusion criteria:

⇒ participants were healthy athletes
⇒ studies compared any brand of dynamic KT to other types of tape (sham or therapeutic) and/or no tape
⇒ studies measured some aspect of functional sports performance
⇒ study methodology involved randomisation

The PEDro scale was used to grade the risk of bias in these studies. A total of 15 studies met the above criteria and were included for analysis.

WHAT THEY FOUND
Across 193 comparisons made, only two significant effects were demonstrated in favour of KT to a no tape condition. The review revealed 11 significant findings: 2 in favour of KT, one in favour of no tape, and 8 effects favoured Mulligan's Tape over KT for measures of kinematics and kinetics at the hip and knee during running. Overall, KT did not produce significant effects on a wide variety of sports performance abilities. Furthermore, the time between KT application and testing did not impact its effectiveness. Finally, there was a wide variety in the quality of the original research on this topic, with PEDro scores ranging from 3-8 of 10 points.

» **Practical** Takeaways

The findings of this review demonstrate a lack of evidence to support the use of KT to enhance sports performance. These results are in-line with the findings of other systematic reviews on KT that show a lack of evidence to support its use for muscular strength in healthy adults, for pain in individuals with musculoskeletal injuries, and for preventing injury. Interestingly, Mulligan's Tape appeared to improve kinetic and kinematic measures at the knee during running, so endurance runners should experiment with this form of taping to see if it enhances their personal performance.

Finally, despite the unfavourable results in this review, there is still potential for KT to enhance sports performance if the athlete believes in the benefits of its use. These results are more likely attained if the athlete has had a previous positive performance experience while wearing KT.

Want to learn more?
Then check these out...

Tim's Comments

"Despite its widespread use, and strong marketing claims that it can improve performance, this review shows that KT does, in fact, not appear to increase sports performance. This review fills an important gap in the research, as no systematic review to date has focused on the effectiveness of KT on sports performance abilities. Unfortunately, a majority of studies in this review did not utilise blinding in any form for the participants or assessors. This lack of blinding cannot be discounted when interpreting these results.

Additionally, a subsequent review on the effectiveness of Mulligan's Tape for sport performance may be warranted to further explore this interesting finding. However, in terms of KT, it remains that most of the validation for the use of KT is through anecdotal endorsements and testimonials on social media."

Technology & Monitoring

This month's top research on technology and monitoring.

WHERE DOES THE SQUAT 1RM SIT ON THE FORCE-VELOCITY RELATIONSHIP?

Riviere, J et al., International Journal of Sports Medicine. Epub. 2017.

EXPLORING THE RELATIONSHIP BETWEEN TRAINING LOAD, FITNESS AND INJURY

Harrison, P, & Johnston, R. JSCR. 31(10): 2686-2693, 2017.

WHAT UNDERPINS A GOOD SPRINT PERFORMANCE? CONNECTING THE KINETIC DOTS

Nagahara R, Mizutani, M, Matsuo, A, Kanehisa, H, & Fukunaga, T. Journal of Sports Sciences. Epub (2017).

[Abstract]

Where does the squat 1RM sit on the force-velocity relationship?

OBJECTIVE
The aim of this study was to test whether the 1RM point of the squat is aligned with the linear F-V relationship obtained during the squat jump, and if so, to determine its position along the F-V relationship compared to F0 (theoretical maximum force).

WHAT THEY DID
10 healthy male subjects completed 2 sessions separated by 24 to 72 hours. The first session aimed to determine half squat 1RM and to familiarise subjects with loaded squat jumps. Furthermore, extended leg length and individual squat jump preferred depth were measured. The second session consisted of assessing individual F-V relationships during loaded squat jumps. Six loads were used for the squat jump trials ranging from 0 – 100% of bodyweight. Each load was performed twice and the highest jump was taken to compute the F-V relationship. Subjects were loaded with a barbell (like a back squat) and initiated the SJ with a downward movement to reach their individual starting position as measured on day 1. Once reached, the bottom position was maintained for 2-seconds before they were allowed to jump as high as possible with the loaded barbell.

WHAT THEY FOUND
Theoretical maximum force of the squat jump (maximum force that can be produced under null velocity; F0sj) was significantly correlated with the squat 1RM ($r = 0.78$; $p < 0.01$). As such, the 1RM squat can be considered aligned with the F-V relationship of the SJ. It should be noted that 1RM was positioned slightly under the curve by approximately 5%, hence the F-V SJ relationship may underestimate squat 1RM. The force developed during the 1RM squat was approximately 16% higher than during the highest loaded squat jump.

Practical Takeaways

While F0 and squat 1RM are highly correlated, they are not exactly similar. F0 is estimated from dynamic contractions and represents the limit towards the capacity of which the lower limbs can produce force. On the other hand, the 1RM represents the dynamic maximal force that the lower limbs can actually produce over an extension, but with a non-negligible velocity. This shows that 1RM performance is affected by velocity qualities and does not represent pure force capabilities—hence why minimal velocity thresholds appear to exist for back squat 1RMs.

Essentially, this means 2 athletes could have the same F0 but have differing 1RMs due to their differing velocity qualities. The athlete with the steeper profile (same force, less velocity) will have a lower 1RM compared to an athlete with a less steep profile (same force, more velocity), despite having the same F0. The F-V relationship can give you this information about your athletes, as a pure 1RM test would lead you to believe one is 'stronger' than the other, and to get them stronger, you must tackle the force end of the spectrum. However, the profile would show their 1RM is lower because they haven't developed their velocity qualities compared with the other athlete.

Want to learn more?
Then check these out...

James's Comments

"I love the use of F-V profiling, it gives so much more actionable data than just a simple 1RM strength test. Not only has F0 been correlated well with 1RM even though they are not exactly identical qualities, the F-V relationship or profile is able to influence your programming as a coach. With an easy app like MyJump, you can do a F-V profile quickly from your iPhone or iPad which also provides you with an optimal profile. This is able to show if an athlete is force-or velocity-dominant, and which side you should emphasise training to improve maximal take-off power output. In addition, 1RM testing can be taxing for an athlete to perform during a season when matches are played weekly or at an even higher frequency. The F-V profile allows an athlete to test their 'max' through the use of sub-maximal loads and, in turn, lessen fatigue."

[Abstract]

Exploring the relationship between training load, fitness and injury

OBJECTIVE
The aim of this study was to explore the relationship between training load, aerobic fitness, and injury over an Australian Rules Football pre-season in sub-elite players.

WHAT THEY DID
60 sub-elite (semi-professional meaning they worked during the day) players had their training loads tracked through a 14-week pre-season using session RPE. Session RPE was calculated as the duration of the session (minutes) x RPE. Players completed 3 to 4 training sessions per week, which generally included skills followed by conditioning; the players also had a 2-week break in the middle. Strength training programmes were also prescribed, but training loads were not tracked for those sessions as they were done in the athletes own time. Running programmes were also provided during the 2-week Christmas break, but training load was not recorded during this time.

Injury information was recorded by the clubs physio and were included if they were non-contact, lower-limb soft tissue injuries and could not complete at least 1 full training session. Aerobic fitness was tested at 4 time points over an 11-week period from a 2km time trial. Players were divided into 4 groups for analysis: "Low" (<1160 AU/week), "moderate" (1160-1599 AU/week), "high" (1600-2000 AU/week), and "very high" (>2000 AU/week).

WHAT THEY FOUND
Average weekly training load was 1758 AU. The "high" load group showed the greatest aerobic fitness improvements of 6.76% compared with "very high" load (4.20%), "moderate" load (2.26%), and "low" load (0.50%). There were a total of 34 lower-limb injuries recorded with the "low" load group sustaining the highest rate of injury, with 24.56 injuries per 1000 hours of training compared with "moderate" load (10/1000 hours), "high" load (15.92/1000 hours) and "very high" load (12.39/1000 hours). Players with 2 week loads exceeding 4000 AU had a significantly higher risk of injury the week after compared with players exerting 2 week loads between 2000-4000 AU. Players also displayed a significantly higher risk of injury when there was an increase of load between 15% and 49% from the previous week.

» **Practical** Takeaways

Training loads are a simple and easy way of quantifying stress that athletes undergo during training. It is also a low-cost option, so regardless of the level you are coaching at, it is something you can implement to make meaningful improvements to your team. Results of this paper suggest that "high" pre-season training loads significantly improve aerobic fitness compared to other training loads. However, it is important to avoid large spikes (> 10%) or excessive cumulative loads in weekly training loads to minimise injury risk. Individual training loads in this study may provide a guideline for other sub-elite athletes with loads >1600 per week appearing to be required for maximal fitness improvements. However, these classifications of "low" to "very high" training loads may only be applicable to this specific population of individuals (i.e. sub-elite Australian Rules Footballers).

Want to learn more?
Then check these out...

James's Comments

"Monitoring training loads through session RPE is a way for you as a coach to track training stress. Your weekly training loads may differ to the current study as these athletes were only semi-professional, whereas professional athletes will often train upwards of 8+ sessions a week. It should be noted that the athletes in this study had higher training loads than what was recorded, this was due to extra training sessions they were required to perform outside of scheduled training times. However, the training load parameters given may be useful guidelines when tracking on-field training loads, specifically for aerobic fitness improvements rather than global training load. Making sure to track the acute: chronic ratio as popularised by Tim Gabbett and co. is important to avoid large spikes in weekly training load and to minimise the risk of injury."

[Abstract]

What underpins a good sprint performance? Connecting the kinetic dots

OBJECTIVE

This study aimed to investigate the intra-individual step-to-step spatiotemporal (space and time) variables and ground reaction forces (GRFs) during the acceleration phase, which are associated with sprinting performance within a single session.

WHAT THEY DID

15 male athletes performed at least 3 maximal 60m sprints from the starting blocks with 10-mins rest between sprints. Athletes had personal best 100m times ranging from 10.88 – 11.71 seconds. The 60m sprints were performed over 54 force platforms covering 52m all connected to a single computer. The fastest and slowest trials of each athlete were selected according to the 60m sprint times. From this data, the authors measured GRF data along with sprint kinematics of step frequency, support time and step length.

WHAT THEY FOUND

Maximal speed in the fastest and slowest trials was reached at the 22nd step. Step frequency was possibly-likely higher for the fastest trial from the 2nd to the 22nd step. Support time was likely-very likely shorter for the fastest trial at all steps compared to the slowest trial. Propulsive impulse was possibly-likely greater at the 1st and 2nd steps and possibly-likely smaller from the 20th to 22nd steps in the fastest trial. Vertical impulse decreased until the 8th step in both the fastest and slowest trials, and was possibly-likely smaller for the fastest trial from the 4th to 21st steps. Effective vertical impulse reached maximum values at the 22nd step in both trials. Mean propulsive force was likely-very likely higher for the fastest trial up to the 4th step. Mean net anterior-posterior force was possibly-very likely larger for the fastest trial until the 17th step.

Practical Takeaways

These results demonstrate that better intra-individual sprints in a single session are attributable to a higher step frequency with shorter support time throughout the acceleration phase (except for the 1st step), as well as a greater mean propulsive force during the first 4 steps and greater mean net anterior-posterior force until the 17th step. The shorter support time in the fastest trial is likely responsible for the higher step frequency. A high step frequency itself does not contribute to increasing running speed, hence it is necessary to exert a greater positive net anterior-posterior force which were seen in this study.

Essentially, being able to create a greater mean propulsive force (either through physical training or a more forward orientated body position) is going to help improve sprint speed during the initial four steps. The smaller vertical force from the fastest trial appeared to result from a shorter support time, indicating that in the slowest trial athletes wastefully supported their body mass against the ground for a relatively long time; further decreasing step frequency.

Want to learn more?
Then check these out...

James's Comments

"While non-track athletes don't start sprinting from blocks, this research sheds some light on the variables that contribute to a fast sprinting performance. As shown in previous research (linked below), an athlete that can "push more" or create a greater mean propulsive force through the acceleration phase enhances sprinting performance. Other than improvements in technical sprinting ability, developing force and power in the horizontal direction can potentially enhance the athlete's ability to "push more".

Exercises such as heavy sled drags, diving med ball tosses and hip thrusts are one way of developing these traits in the horizontal force vector (more examples in the article linked below). Being able to exert sufficient vertical impulse to maintain sprinting during the short support times may come down to having well-developed lower-limb stiffness, especially at the ankle. Various ankle bounds, hurdle hops and bounding may be one way to develop these qualities."

Fatigue & Recovery

This month's top research on fatigue and recovery.

DO ELECTRONIC DEVICES BEFORE BED REALLY INFLUENCE PERFORMANCE?
Dunican, I. C., et al. (2017). JSCR, 31(10), 2832-2839.

SLEEP TIGHT: THE IMPACT OF WEARING COMPRESSION GARMENTS TO BED
Shimokochi, Y. et al.. (2017). JSCR, 31(10), 2816-2824.

SHOULD WE BE INDIVIDUALISING ICE BATHS? THE INFLUENCE OF BODY SIZE AND IMMERSION TIME
Godek, S. F., Morrison, K. E., & Scullin, G. (2017). Journal of Athletic Training, 52(7).

[Abstract]

Do electronic devices before bed really influence performance?

OBJECTIVE

The goal of this study was to investigate the use of electronic devices such as smartphones and tablets on sleep quality, physical and cognitive performance in elite judo athletes.

WHAT THEY DID

The researchers divided 23 elite judo athletes in two groups: electronic device restricted group (RES) and a control group. Sleep quality and quantity were monitor with an activity monitor during 6 nights. A questionnaire was implemented daily to obtain time in bed, electronic device use, and rate of perceived exertion from training sessions. The Cogstate (cognitive test) was implemented on days 2 and 4, and a single triple hop test was implemented every day.

WHAT THEY FOUND

No differences were found in sleep-related measures between groups. Moreover, athletes from both groups overestimated the perceptual sleep duration and underestimated time of sleep onset in comparison to the actigraph monitor data. No differences were observed between groups for the triple hop test and Cogstate.

Practical Takeaways

The findings from this study demonstrated that the removal of electronic devices prior to sleep did not affect sleep measures and performance in a short-term period. Although no differences between groups were observed, it is important to mention that athletes had a set wake-up time, therefore, athletes were not allowed to stay in bed longer, even if they felt like it. When athletes had a later start, the sleep time increased by ~40 minutes. The lack of opportunity to stay in bed during most of the morning in the study may have resulted in the lack of differences observed between groups. However, an important takeaway that was pointed out by the authors of this study, is that young athletes—such as the ones used in this study (~18 years) — may benefit from delaying the start of the training day, as it may provide the opportunity for an increased sleep duration.

Want to learn more?
Then check these out...

Francisco's Comments

"More than the brightness or light intensity, recent research has demonstrated that the spectral distribution or wavelength of the light from electronic devices are more related to sleep disturbances. Nowadays, electronic devices allow for the user to reduce the wavelength light. It is likely that some of the athletes in the non-restricted group were using such devices, therefore, this should be a limitation in the study. Moreover, elite athletes are exposed to a lot of information about the effects of electronic devices on sleep. It is likely that these athletes were previously educated about the usage of electronic devices, and therefore, the non-restricted group were naturally restricting the usage of such devices.

In my opinion, restricting the usage of electronic devices should be a last measure to apply. A proper education policy should be implemented to ensure that athletes are aware of the harmful effect of extensive hours using such devices on sleep. Reductions in the wavelength are recommended (see the App link button). Perceptual sleep monitoring (e.g. sleep duration and sleep quality) should be performed on a daily basis. Moreover, coaches should be constantly looking for signs of sleep disturbances such as yawning and/or sleepy eyes."

[Abstract]

Sleep tight: The impact of wearing compression garments to bed

OBJECTIVE

The goal of this study was to investigate the effects of lower-body compression garments (CG) worn during sleep on muscle fatigue recovery after eccentric and concentric knee extension exercises.

WHAT THEY DID

Seventeen active male college students performed two sessions of 10 sets of 10 repetitions of isokinetic concentric and eccentric knee extension separated by 1-week. The night of one of the sessions, the athletes wore CG, and the night of the other session, the athletes did not wear CG (NCG). Immediately before, after and 24h post-session, subjects' maximum knee extension voluntary isometric contraction (MVIC) were measured. Vastus lateralis and medialis and rectus femoris electromyography (EMG) data were also obtained during the isometric contraction.

WHAT THEY FOUND

No differences between groups were observed for the MVIC measured immediately after exercise. Nevertheless, the authors found that MVIC 24h after the fatiguing test was significantly greater (approximately 10%) when CG were used. Nevertheless, no differences between groups were found in the EMG signal of any measured muscle on all time points.

Practical Takeaways

The findings from this study demonstrate the beneficial effects of wearing CG for enhancing recovery from fatiguing exercise. The fact that no differences were observed in the EMG signal between groups may suggest that the mechanisms for enhanced recovery are muscle dependent (i.e. peripheral fatigue), rather than neural (i.e. central fatigue). As suggested by the authors, there is a potential bias as there might have been a placebo effect when CG were worn. Future research should consider this bias from placebo.

Compression garments provided an improved neuromuscular function (measured by MVIC) 24h after a fatiguing test. To date, the only possible harmful effect that has been pointed to CG is the effect it has on sleep. If CG do not affect an athlete's sleep, then they should be recommended to wear them during the night in order to improve recovery.

Want to learn more?
Then check these out...

Francisco's Comments

"The findings from this study are in agreement with the results from recent research on the effects of CG after exercise (see the linked articles). Although the authors did not measure muscle soreness or any marker of muscle damage, it is likely that the effects of CG enhancing neuromuscular performance are due to muscle recovery. Perceptual measures of muscle soreness are easy to implement and should be included in studies investigating the effects of recovery modalities. Moreover, the authors did not measure the pressure provoked by the CGs. Different pressures have been demonstrated to influence the effects on neuromuscular recovery. Therefore, it is possible that a greater difference could have been observed if adequate pressures were ensured (~15-20mmHg at the thigh and ~20-30mmHg at the calf).

Athletes should wear CG after exercise for an extended period of time (e.g. 8-48h after exercise), as long as it does not interfere with sleep quality. Research has demonstrated that higher pressures exerted by CG are more efficient in neuromuscular recovery than lower pressures. As I previously recommended in last month's issue of the Performance Digest (issue #12), I always suggest athletes buying their CG from brands which have been used for research, as they are more likely to apply a pressure that has been demonstrated to enhance recovery."

[Abstract]

Should we be individualising ice baths? The influence of body size and immersion time

OBJECTIVE
The goal of this study was to compare the effects of cold water immersion (CWI) in football linemen (i.e. small body surface area to mass ratio [BSA:BM]) and cross-country athletes (i.e. large body surface area to mass ratio [BSA:BM]) performed after a heating protocol.

WHAT THEY DID
The athletes were exposed to a heating protocol that consisted on 10-minutes of sitting in a heating chamber at a temperature of ~39°C and relative humidity of ~40°C followed by 20-minutes of exercise until the core temperature (Tc) reach 39.5°C or volitional exhaustion was achieved. After that, athletes were immersed in cold water tubs at a temperature of 10°C until the Tc achieved 37.5°C. Core temperature was measured every minute during the CWI and was obtained from a temperature sensor that was ingested by the athletes. The analysis was performed once the athletes' had reached a Tc of 37.5°C, which in this case, was after 7-minutes. Therefore, the first athlete was removed from the CWI tub after 7-minutes (e.g. achieved Tc of 37.5°C after 7-minutes).

WHAT THEY FOUND
Differences between the groups were found for the cooling time to achieve the Tc of 37.5°C (target Tc / time) and slope of lines of the Tc / time. The football linemen (FB) required significantly more time to reduce Tc to 37.5°C (~11 minutes) than the cross-country (CC) athletes (~8 minutes). As expected, the Tc / time was significantly lower in the FB (~0.156°C per minute) in comparison to CC (~0.255°C per minute). Strong correlations were found between the rate of cooling and body mass, total BSA, BSA/mass, lean body mass/mass and % of body fat.

Practical Takeaways

The main takeaway message from this study is that body composition affects the decrease in Tc when athletes are exposed to CWI. In particular higher measures of body mass, total BSA, BSA/mass, lean body mass/mass and % of body fat are associated to a decrease in the of rate of cooling of Tc.

Another important finding from this study is that cooling rates vary considerable between subjects, reinforcing the need to monitor individual rectal temperature during CWI.

Lastly, a CWI protocol of 11 minutes at the temperature of 10°C seems to be ideal to large athletes such as football linemen or other athletes such as rugby first rows.

Want to learn more?
Then check these out...

Francisco's Comments

The findings from this study demonstrate that decreases in Tc from CWI are highly correlated with different measures of body composition. Subjects with lower BSA:BM should be exposed to more severe cold protocols in comparison to smaller BSA:BM when reductions in the Tc are desirable.

While it can be difficult to have cold baths with different temperatures within the same environment, by increasing the duration of the protocol one can increase the intensity of the modality when individualisation is desirable. Given that strong correlations were observed between the rate of cooling and % of body fat, coaching staff can use % of body fat as a reference to individualise CWI interventions.

Although I have never used the BSA:BM to individualise CWI interventions, I have provided some individualisation based on two factors: 1) perceived effectiveness and belief in CWI as a recovery modality; and 2) the percentage of fat mass. In order to respond to these two factors, I use cold tubs at different intensities, categorising them as severe (~10°C) or less severe (~15°C) and use different immersion times (e.g. 8 or 10 minutes). With this I can have a combination of 4 different intensities:

Low: 8 minutes at 15°C;
Moderate – Low: 10 minutes at 15°C;
Moderate – High: 8 minutes at 10°C
High: 10 minutes at 10°C

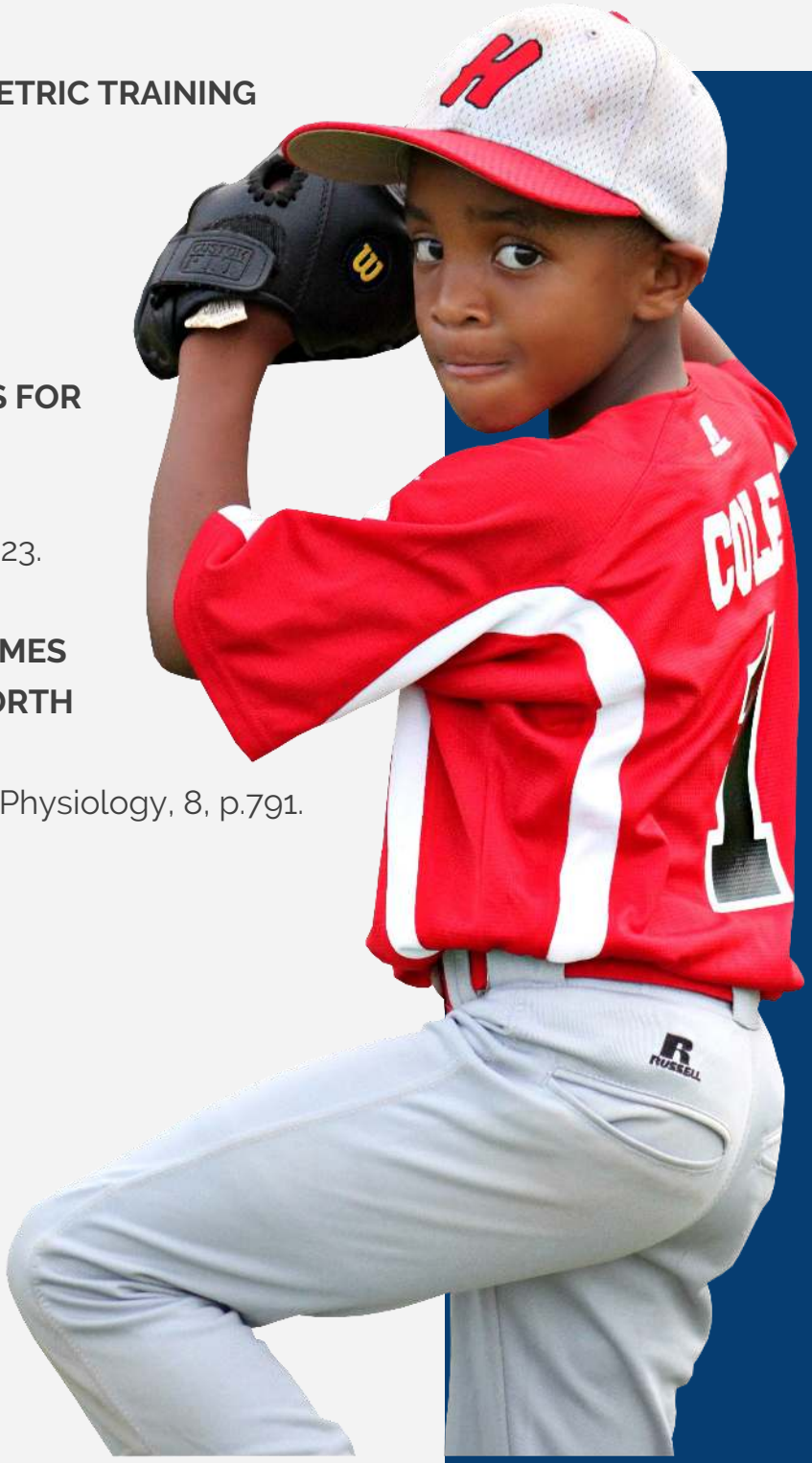
Youth Development

This month's top research on youth development.

LOADED VS. UNLOADED PLYOMETRIC TRAINING ON SPEED AND POWER
Kobal, R., et al., 2017. Frontiers in Physiology, 8, p.742.

EARLY SPORT SPECIALISATION: RISKS AND RECOMMENDATIONS FOR YOUNG FEMALE ATHLETES
Blagrove, et al., 2017. Strength & Conditioning Journal, 39(5), pp.14-23.

INJURY PREVENTION PROGRAMMES IN YOUTH SPORT: ARE THEY WORTH THE TIME AND EFFORT?
Faude, O., et al., 2017. Frontiers in Physiology, 8, p.791.



[Abstract]

Loaded vs. unloaded plyometric training on speed and power

OBJECTIVE

The purpose of this study was to compare the effects of either a loaded or unloaded plyometric sessions on speed and power in elite young soccer players (age 15.9 ± 1.2 Years).

WHAT THEY DID

All athletes were assessed (pre & post) on their sprinting speed over 5-, 10-, and 20-m, mean propulsive power (MPP) relative to player's body mass in the jump squat and squat and counter movement jumps. The athletes were pair-matched in two training groups; 1) loaded (8% of bodyweight) vertical and horizontal jumps and 2) unloaded vertical and horizontal plyometrics. The duration of this study was 6 weeks, with 12 plyometric sessions occurring during the soccer preseason period.

WHAT THEY FOUND

Both groups (unloaded and loaded) experienced improvements in their jumping ability after a 6 -week training programme at a 90% confidence level. However, both plyometric sessions failed to produce worthwhile changes in maximal speed and power performances. This suggests that both a loaded and unloaded plyometric session improved jumping qualities, but not power or speed.

Practical Takeaways

In previous editions of the Performance Digest, it has been suggested that youth athletes may be able to tolerate loaded Plyometrics under specific context. This study has somewhat answered our questions, by providing us with an analysis of unloaded vs. loaded jumps. Whilst this study has no conclusive benefits to adopting loaded-jump variations in practice, it neither refutes the addition of them. In other words, loaded jumps were 'safe' for the sample in this study, which will hopefully lead onto more investigations in this area.

In light of this study, the reader may look to incorporate loaded variations in their programmes. Some examples include augmented loading, which can be achieved with either a dumbbell or a medicine ball to a drop landing. Check out the video attached for an interesting variation of a jump that loads the landing phase and incorporates upper body control. It is important to remember that these variations should only really occur when landing mechanics are sound. This study has supported this by using a sample of 15+ years, indicative of emotional maturity, post-peak height velocity (on average) and technical competence.

Want to learn more?
Then check these out...

Tom's Comments

"This study mentions that the 'failure' of this programme to create worthwhile adaptations to both power and speed were possibly related to an interference effect of concurrent training methods. For example, this study had little control over the volume or intensity of these players external training (pitch-based, gym-based, other leisure activities). The authors of this study were honest and used high-levels of academic rigour to ensure reliability. I think if more studies employed the same standards of data analysis, many would come to a similar conclusion with regards to an interference effect.

I am surprised that improvements in jump performance did not correlate to either mean propulsive power or sprint speed. One of the mechanisms responsible in both sprinting and jumping is the stretch shortening cycle (SSC), where a powerful concentric contraction follows an elongated muscle tendon unit caused by an eccentric (lengthening) contraction. However, this may have again been dampened by additional training activity."

[Abstract]

Early Sport Specialisation: Risks and recommendations for young female athletes

OBJECTIVE
Early sports specialisation remains a large problem for females in sport, which is often characterised by intense training regimes that focusses on selective performance traits. Inherent within these sports, are highly voluminous and repetitive movements that can lead to injury and early retirement. This becomes more of an issue when we consider that adolescent females in sport generally have a higher incidence of injury.

WHAT THEY DID
Early specialisation may be considered as spending more than 8 months of the year in a single sport. The implications of participating in one sport are not fully understood, but have been suggested to:

⇒ Potentially affect growth rate and stature.
⇒ May alter menstrual function.
⇒ Can positively enhance bone mineral density, given substantial dietary intake.
⇒ Can negatively impact psychological health, leading to burnout and over training.

WHAT THEY FOUND
In this study, the authors adopted a holistic approach to supporting practitioners in their coaching practice with reference to adolescence. Puberty is a key period for females, where alterations in hormonal status, growth and development of sexual characteristics are significantly elevated. During this period, the researchers emphasise the need to avoid 'specialising' in one sport and to combat sub-optimal dietary intake during adolescence through education.

» **Practical** Takeaways

Physical activity during adolescence brings many benefits to the growing athlete. However, it is important that early specialisation is avoided by providing sessions that allow free fun and unstructured play, which encompasses the development of a diverse range of movements and motor skills. For example, sessions that are autonomy-centred and allows the athlete to explore their body through a mixture of movement games (obstacle courses, knee tag, balancing drills) and evasion games (bulldogs, agility shadowing drills or netball) may support enjoyment. Nothing stops you asking your athlete what they want to do.

To keep on top of player welfare, regular monitoring of growth, load and wellness may be useful to identify periods of intense physical and emotional stress. These results over time can then be used to shape training. For example, if the athletes are experiencing exam stress, a heavy cognitive task may not be helpful for them, whereas an aerobic based session or game such as volleyball may support their recovery and enjoyment.

Want to learn more?
Then check these out...

Tom's Comments

"During adolescence, coaches should provide education and guidance to young female athletes. However, this should not be strictly limited to the athlete, but should extend to the parents, carers and other disciplines in the sports science team. These conversations may address appropriate volume and intensity of training programmes, the impact of stage of maturation on exercise capacity, self-management strategies and the importance of nutrition.

Coaching education programmes must do a better job of preparing coaches with the skills to adapt training, incorporate multi-sport skills with the aim of developing fitness qualities in the main sport. For example, playing netball teaches agility, change of direction and movement on and off the ball, which may be similar to the demands of football."

[Abstract]

Injury Prevention Programmes in Youth Sport: Are they worth the time and effort?

OBJECTIVE
Injury prevention programmes (IPP) can significantly reduce injury rates in youth athletes. This research aims to explore neuromuscular IPP that incorporates balance, strength, power and agility to evaluate the effects on neuromuscular performance in youth sports. These models are important for young athletes, as deficits in neuromuscular control are considered relevant risk factors for injuries that may have long-term implications.

WHAT THEY DID
This study utilised both a systematic review and meta-analysis as its research methodology. A total of 704 participants were analysed varying from the ages of 10-20 playing in both recreational and professional settings. Those who had performed multi-modal IPP programmes were then compared to those who had not received structured, neuromuscular training

WHAT THEY FOUND
Multimodal IPP athletes showed greater levels of strength, sprint ability and hamstring to quadriceps ratio than those without regular and structured training. The study reported small effects for balance/stability measures as well as leg power and a medium effect for isokinetic leg strength at low movement velocities. For sprint abilities and sport-specific tests we found large effects. These improvements may support the preventative efficacy of IPP and should support the implementation of injury prevention programmes in the future.

Practical Takeaways

The implementation of IPP as part of a warm-up routine (15-20 minutes) can not only prepare athletes for the training session, but can improve performance and reduce the risk of injury. The following recommendations have been proposed: 1) the session must be effective with regards to injury prevention and performance enhancement, 2) it should be practical and realistic, 3) it should be specific for the context (athlete, sport, age, sex).

If you are unsure what an injury prevention programme looks like, I would recommend reading the FIFA 11+ (**HERE**), the PEP Injury Prevention programme (**HERE**) and the FIFA 11+ Goalkeeper edition (**HERE**).

Want to learn more?
Then check these out...

Tom's Comments

"The benefits of a structured strength programme and warm-up has been researched and discussed extensively in the literature. In my observations of warm-ups, I'm often left feeling slightly underwhelmed, particularly within a youth sample. The culture of 'lead your own warm-up' often leads to static stretching, with little application or progression in intensity. In the podcast link, Bill Knowles discusses some of the components that he incorporates during a soccer warm-up. When listening to this, it is important be critical and remember the athletes you are working with and their sport."

Nutrition

This month's top research on nutrition.

CARBOHYDRATE SUPPLEMENTATION FOR ENDURANCE EVENTS: WHAT'S BEST PRACTICE?

Rowlands, SD and Houltham DS. 2017. Medicine & Science in Sports & Exercise, 49(8), pp. 1734-1744.

COCONUT WATER AND HYDRATION: A PERFORMANCE BREAKTHROUGH OR A FAD?

Peart DJ et al., (2017). International Journal of Sport Nutrition and Exercise Metabolism, 27(3), pp.279-284.

WHOLE-EGGS VS. WHITES FOR PROTEIN SYNTHESIS: ARE WE LOOKING AT THE WHOLE PICTURE?

Van Vliet S et al. (2017). The American Journal of Clinical Nutrition, Oct 4.

[Abstract]

Carbohydrate supplementation for endurance events: What's best practice?

OBJECTIVE
Researchers sought to determine the effect of glucose/maltodextrin-fructose (GLUFRU) ingestion on triathlon performance when ingested with bars, gels and drinks. They examined whether GLUFRU ingestion had a greater effect on performance compared to ingesting only glucose/maltodextrin (GLU). Researchers also studied whether there were any differences in gut discomfort between the two conditions.

WHAT THEY DID
A double-blind randomised control trial was conducted in two ironman triathlon races held 3 weeks apart. 71 well-trained participants (aged: 18-60) all had over two years of triathlon experience. Nutritional intake was controlled and, therefore, equal among all participants in the 24h leading up to the race. Caffeine content was also controlled the morning of races and compliance was reported to be very high. Participants ingested either multiple-transportable carbohydrates (MTC) or a single-transporter carbohydrate (STC) both before and during the race, at the same rate and in the same quantities, split into bars, gels and drinks. Times for individual legs (run, swim and bike), as well as overall finish times, were collected as a measure of performance.

WHAT THEY FOUND
The principle finding shows that MTC's ingested in multiple formats provided a slight improvement in performance compared to a STC. The effect of GLUFRU on performance time was -0.53% with post-hoc analysis supporting GLUFRU as a condition that would be worthwhile in adoption. The effects on gut discomfort between the two conditions were negligible providing some practical application for the use of popular MTC products.

Practical Takeaways

The vast majority of those competing in modern endurance events, such as the ones in this piece of research, will use carbohydrate supplementation before, during and after a race in order to enhance their performance and subsequent race times. If athletes will be ingesting gels/bars/drinks anyway, then they should be the most efficient blend of carbohydrates, especially if there are no additional impacts on gastrointestinal comfort. Although the improvement in this study is small at 0.53%, translated into a triathlon time it has a big impact.

For example, a 0.53% improvement on a 4h30m time would be 86-seconds. For an alteration that has minimal effects both practically and financially, it should certainly be considered as a worthwhile supplementation option for those partaking in long-distance endurance events. This study has high ecological validity as it used actual triathletes that were taking part in actual triathlons, rather than laboratory exercise protocols.

Want to learn more?
Then check these out...

James's Comments

"The results of this study concur with previous research in this area that has also concluded that multiple-transportable carbohydrates have a positive effect on performance – although usually to a higher degree than seen in this study. As already mentioned, the ecological validity of this research is probably its biggest strength as well as the strict control of nutritional intake 24hr pre-race. More research is necessary in this area to determine the most efficient ratios and dosages, and especially more research on female participants considering many also compete in long-distance endurance events.

Until then, using GLUFRU is a worthwhile method to achieve small, but impactful, enhancements in performance during long-distance endurance events; especially considering the negligible relative financial and practical cost of such interventions to nutritional intakes."

[Abstract]

Coconut water and hydration: A performance breakthrough or a fad?

OBJECTIVE

The primary aim of the study was to observe the effects of coconut water (CW) on hydration during sub-maximal exercise and subsequent time trial performance compared to water (PW). A secondary aim was to assess palatability of coconut water during exercise and voluntary intake during intense exercise.

WHAT THEY DID

In a randomised crossover study design, 10 recreational active males completed 60-minutes of sub-maximal cycling following by a 10-km time trial on two occasions. During the trials, and in a randomised order, the participants consumed either a water or coconut 250 ml drink between 10-15 minutes, 25-30 minutes and 40-45 minutes and then to ad libitum from 55-minutes until the end of the time trial. A max minute power (MMP) test on a cycle ergometer was first initiated to determine the workload for these experimental trials. Body mass and urine osmolality were recorded pre-exercise and then after 30-min, 60-min and post-exercise. Blood glucose, lactate, heart rate, RPE as well as perceived ratings of thirst, sweetness, nausea, fullness and stomach upset were recorded during each drink period.

WHAT THEY FOUND

The authors found that the blood and hydration parameters measured during sub-maximal exercise were comparable whether participants consumed coconut or water drink, and the coconut water offered no ergogenic benefits for a subsequent time trial. Despite no significant differences between trials for any of the physiological variables, there were subjective differences between the beverages for taste and resulted in participants significantly reducing the volume of voluntary intake in the coconut water trial (~93ml).

Practical Takeaways

The findings show that hydration and physiological markers measured during sub-maximal exercise showed no significant difference whether participants consumed a CW drink or PW alone; which is in agreement with previous findings (see article #4). It was believed that CW may be more favourable due to its high palatability. However, the findings in this study suggest that CW has no ergogenic benefits when consumed during sub-maximal exercise.

Therefore, we would suggest asking your athletes what they would prefer to consume during exercise. Let's remember that water will always be a solid choice to consume during exercise. When exercising in extreme heat or humid environmental conditions, however, athletes may like something else to try to encourage them to consume extra fluid. If coconut water is to be trialled, then remember that fresh coconut water has a different taste compared to bottled.

Want to learn more?
Then check these out...

James's Comments

"As outlined in the study limitations, the sub-maximal exercise protocol may have contributed to the absence of any performance improvement with coconut water. Significant effects of carbohydrate ingestion on exercise durations of 60-90 minutes using a higher intensity protocol than current study have been previously observed. Furthermore, the amount of carbohydrate ingested may have not been adequate to see any beneficial effects in current study.

Participants ingested on average 43g carbohydrate for the combined sub-maximal and time trial exercises at an approximate rate of only 34g per hour, which is extremely lower than the recommended amount of 60g per hour or sometimes more depending on the intensity of exercise. However, the study provides evidence that CW may be no more beneficial than plain water, and is not necessarily as palatable as reported previously. It would be interesting to see how these findings would compare to team sport athletes and environmental conditions, whereby heat may play a part in an athlete's choice of fluid to match palatable desires."

[Abstract]

Whole-eggs vs. whites for protein synthesis: Are we looking at the whole picture?

OBJECTIVE
The aim of this study was to compare whole-body leucine kinetics and postprandial myofibrillar protein synthesis rates after the ingestion of whole-eggs with egg whites during recovery from resistance exercise in young men. In addition, the authors examined the skeletal muscle amino acid transporter protein content and the phosphorylation status of protein signal molecules that may regulate the change in myofibrillar protein synthesis rates.

WHAT THEY DID
10 participants followed familiarisation and measurement of a 10-repetition maximum trial for the leg press and leg extension. Participants received a continuous intravenous infusion of L- [ring-2 H5] phenylalanine and L- [1- 13C] leucine and performed 4 sets of 10 repetitions at 80% of 10-RM for both leg press and leg extension exercises. Immediately following exercise, participants consumed intrinsically labelled whole-eggs (18g protein, 17g fat) or an equivalent amount of protein from egg whites (18g protein, 0g fat). Repeated blood and muscle biopsy samples were collected to assess whole-body leucine kinetics, rates of myofibrillar protein synthesis and intramuscular signalling pre-exercise, and up to 300 minutes' post-exercise. Participants were instructed to record their dietary intake for 2 days before each trial, and subsequently follow their food diary as closely as possible during the 2 days leading into the second infusion trial. The time between crossover trials was 7-14 days.

WHAT THEY FOUND
Authors demonstrated the concept of dietary protein may show differential anabolic properties on skeletal muscle tissue when consumed within its natural whole-food matrix. Additionally, post-exercise myofibrillar protein synthesis rates were stimulated, to a greater extent, after the consumption of whole-eggs than the consumption of egg whites immediately after resistance exercise; despite being matched for the protein content. Yet, no differences were found between egg conditions in other regulators of post-exercise muscle protein synthesis rates, such as total postprandial plasma leucine availability and whole-body leucine oxidation rates.

Practical Takeaways

Although cholesterol from the diet may have a little impact upon total blood cholesterol, removal of the yolks when multiple eggs are consumed in a meal remains a popular practice. In addition, there is a potential tendency for weight-sensitive athletes or weight-conscious resistance-trained individuals to consume egg whites rather than whole-eggs in attempt to seek lower-calorie content meals.

However, yolk is nutrient dense and may provide a variety of essential bioactive compounds such as lipids, micronutrients, antioxidant carotenoids and microRNAs. The removal of the yolk and its associated nutrients from eggs may limit the stimulation of muscle protein synthesis rates, as well as overall human health. This study suggests that nutrient and protein-dense natural foods is a key factor to meet daily protein requirements in order to maximise muscle protein synthesis rates in resistance-trained individuals or athletes.

To this end, practitioners may want to educate their athletes on the importance of whole-egg consumption, and if the calorie or fat content of the daily intake is a main concern, then they should look at adjusting the macronutrient composition of other meals instead of avoiding whole-eggs.

Want to learn more?
Then check these out...

James's Comments

"The study supports previous literature that nutrient-and protein-dense food matrixes stimulate muscle anabolism differently compared with only protein-dense food matrixes. This information is important because other nutritional components may contribute to food protein requirements, particularly when dietary protein intake is in moderate amounts (~15-20g protein per meal).

Despite the fact the sample size was small, the consumption of whole-eggs or egg whites may depend on personal preference and body composition goals among healthy individuals. However, the benefits of consuming whole-eggs during recovery after exercise from resistance training is clear in these healthy young men. A final comment for this study would be the very tightly controlled use of leucine-labelled eggs produced by supplementing the diet of laying hens."

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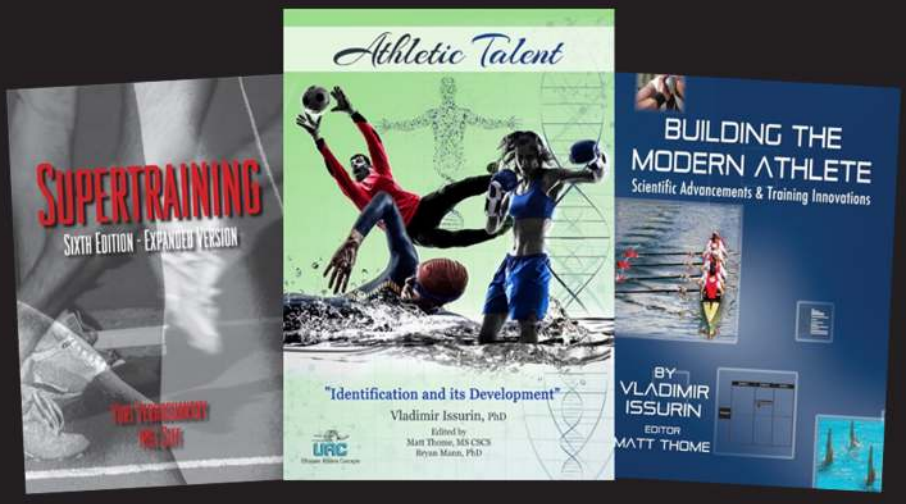

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