December 2018 | Issue #26

THE PERFORMANCE DIGEST

A review of the latest sports performance research

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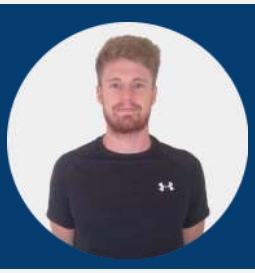

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Audio
REVIEW

Talent ID

A recap on what we know and hope to find out from future research.

with Dr. William Vickery

WHAT WE DICUSS

In this episode of the "Audio Review", Will discusses talent identification (ID), development, and transfer.

In this episode, you will learn:

- What talent ID is
- How talent ID occurs
- What talent transfer is
- How talent transfer relates to talent ID
- What the research says about talent transfer
- Case study
- Future research needed to take talent ID to the next-level

Episode length = 37 minutes

A bit about **Will**

Will is a former 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.

Listen Now

The Science of COACHING

[Abstract]

How do you feedback?

The impact of different forms of feedback on athletic performance.

INTRODUCTION

The impact of feedback on sporting performance is well known and documented. In particular, previous research (**HERE**) has reported that by providing feedback in the form of encouragement during small-sided soccer games, coaches had the greatest impact on the demands of the players when compared to changes in field size and player involvement. Feedback and encouragement can, however, come in many forms and not just that which is provided verbally from the coaching staff. In many cases, particularly in the current era of performance sport, many practitioners have access to a variety of tools (e.g. smart phones, tablets, specialised software and applications) which can provide visual feedback in real-time. There is also evidence that would suggest that the use of specific forms of feedback can improve the performance of athletes who display personality traits that would, at times, prove challenging or find it difficult to commit to achieving coaching objectives. As such, this study compared the performance of athletes during resistance exercise using different forms of feedback.

WHAT THEY FOUND

Twelve semi-professional rugby union players completed one set of 10 repetitions of the back squat at 75% of 3RM during four different conditions:

⇒ Verbal kinematic feedback (lead researcher stating the mean concentric barbell velocity).

⇒ Visual kinematic feedback (footage from tablet viewed by player).

⇒ Verbal encouragement (lead researcher providing encouragement (e.g. "Come on, push it!").

⇒ Control (no feedback provided).

The difference in average barbell concentric velocity was then compared across the four conditions. The conscientiousness of the players (i.e. the behaviour that is "responsible, dependable, persistent, and achievement-orientated) was also assessed.

The main results of this study were that:

⇒ A greater average concentric velocity existed during each of the feedback conditions compared with the control condition (6.6% improvement).

⇒ Some differences (ranging from possible to trivial) between the different forms of feedback and encouragement existed.

⇒ There was a small, inverse relationship between conscientiousness and the use of verbal kinematic feedback. However, a greater inverse relationship was reported when using verbal encouragement.

WHAT THIS MEANS

Although not surprising, the main finding of this study was that improvements in performance were present during a scenario when any form of feedback was used compared to no feedback at all. Despite this being a somewhat predictable result, it does send a clear message on the significance of feedback for small, but vital, improvements in athletic performance. Unfortunately, it is not clear as to which form of feedback provides the greatest impact on performance, meaning this could be an avenue for future research. The second part of the study does, however, highlight that the use of verbal encouragement appears to be of greater impact for those athletes that reported low levels of conscientiousness. As these authors suggest, this is important as it is these athletes that may also exhibit lower commitment and persistence during strenuous tasks.

Practical Takeaways

In an environment like performance sport, where the smallest improvement can have a significant impact on an outcome, the coaching team will use as many tools and tricks as they can to achieve this. In many cases, it can be as simple as providing the right kind of feedback to your athlete at the right time. From the results of this study, it is clear that it may not matter what type of feedback you are providing, as long as you are providing some. What should be considered by every coach, though, is what might be the best fit for your context and for individual athletes; it's not always a case of one type of feedback is the best fit for all athletes. Lastly, based upon this research, it's important to consider that those athletes with the lowest levels of conscientiousness appear to respond best to verbal encouragement.

Dr. Will Vickery

Will is a Senior 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.

SPRINTING ITSELF AS A CURE FOR HAMSTRING PROBLEMS?

Freeman et al. (2018). The Journal of Sports Medicine and Physical Fitness.

DOES USING BANDS INDUCE POST-ACTIVATION POTENTIATION?

Strokosch et al. (2018). International Journal of Sports Physiology and Performance.

WHY ARE TRACK AND FIELD SPRINT ATHLETES FASTER THAN TEAM SPORT ATHLETES?

Coyler et al. (2018). Scandinavian Journal of Medicine Science & Sports.

[Abstract]

Sprinting itself as a cure for hamstring problems?

OBJECTIVE
Hamstring injuries are common among junior and senior athletes participating in sports requiring high-speed running. Athletes with lower eccentric strength have been shown to be more likely to experience a hamstring injury compared to those with greater eccentric strength. The Nordic Hamstring Exercise (NHE) has been shown to increase eccentric strength and reduce the risk of hamstring strain. However, sprinting may provide an adequate load to the hamstrings which may potentially strengthen and protect them from injury. Therefore, the aim of this study was to compare the effects of both the NHE and sprinting on eccentric hamstring strength and sprint performance in an adolescent athlete population.

WHAT THEY DID
Twenty-eight adolescent athletes who all competed in either Australian rules football, soccer, cricket, baseball, or field hockey were randomly allocated to 2 training groups: 1) an eccentric training group (NHE), and 2) a sprinting training group. After familiarisation, one week of testing was performed prior to the 4 -week training intervention and following that testing was performed again after. The eccentric training group performed the NHE 2 x per week starting at 2 x 5 reps in the first session progressing to 3 x 6reps in the final week. The sprint training group started at 6 x 30 m sprints in the first session and progressed to 10 x 40 m sprints by the last session in week 4. Eccentric hamstring strength was assessed on a Nordbord and sprint performance by timing gates. Aside from the training intervention, subjects also completed two additional resistance training sessions and two sport-specific training sessions per week. The extra resistance training sessions consisted of self-myofascial release, squat variations, barbell rows, Romanian deadlifts, single-leg squats, as well as core exercises such as supine holds and prone walks. Resistance training sessions were completed following the exercises performed as a part of the study (sprinting or the NHE), or on a separate day.

WHAT THEY FOUND
Both groups observed small, significant gains in eccentric hamstring strength (9.8% and 6.2% for eccentric group and sprint group, respectively). Neither training group experienced a significant gain in acceleration performance. Eccentric training produced no change in max speed, however, the sprint group showed moderate (ES=-0.83) improvements in max speed (8.6%). The eccentric group experienced a moderate increase (ES=0.99) in soreness during the first week but then soreness moderately decreased and maintained this level for the rest of the intervention. The sprint group showed small-trivial increases in soreness progressively for each session, where significant soreness was found in the last session compared to the eccentric training group.

Practical Takeaways

Sprint training appeared to produce enough stimulus to produce a gain in eccentric strength amongst an adolescent athlete population. Whilst the eccentric training produced a bigger gain in eccentric hamstring strength, this improvement was not significantly more than the sprint group, which suggests that sprint training could be an alternative or complementary to the NHE in a training program. Furthermore, this study demonstrates that four weeks is enough time to develop improvements from the NHE in adolescent athletes. A careful balance is required when programming sprint training alongside eccentric hamstring exercise during a training microcycle.

As evidenced in this study, sprint training causes more soreness following a session compared to the NHE. Therefore, careful consideration should be taken when planning a training week. For example, sprint training should be performed the furthest away from the match as possible to avoid sore, "tight" hamstrings if moderate volumes are being used. Ideally, consolidating similar stressors on the same day may mitigate the constant soreness potentially caused by sprinting and eccentric hamstring exercise over multiple days. If matches are played Saturday to Saturday, potentially low-moderate volumes of sprint training (e.g. 5 x 20-30 m) along with eccentric hamstring exercise (e.g. 2-3 x 5-6 reps) could be placed on a Tuesday. This will provide the athletes with enough time to recover from the last game and enough time to recover for the following game.

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

James's Comments

"Very rarely will a well-developed training program only consist of only sprint training or NHE. Due to the greater risk of hamstring strain during sprinting compared to eccentric hamstring exercise, sprint training should be performed before eccentric exercise if performing both on the same day. If you are working with athletes that are new to eccentric hamstring exercise, then allowing a 1-2 week adaptation period may be necessary in order to reduce the risk of injury during sprinting. Sprint training during this adaptation period may only consist of 10 m sprints as to minimise the maximum velocity that is able to be reached."

[Abstract]

Does using bands induce post-activation potentiation?

OBJECTIVE
A post-activation potentiation (PAP) protocol has the potential to increase the power output of the subsequent explosive exercise, resulting in a greater acute and chronic training stimulus. It has been reported 5-8 min rest may be necessary before the explosive exercise elicits a PAP response in the broad jump. However, in an applied setting, longer rest periods (resulting in longer training sessions) may not be practical. Variable resistance training (VRT) through the use of bands and chains may be a solution to lengthy recovery times which has been shown to elicit PAP after only 90 s. Therefore, the purpose of this study was to investigate the effect of deadlifts and box squats, with a combination of traditional and accommodating resistance, as a potentiating stimulus for the broad jump

WHAT THEY DID
Twelve reserve grade Superleague (UK) professional rugby league athletes participated. Subjects were first assessed for back squat 1RM and anthropometry measures. The following week, subjects performed the first contrast PAP protocol. Two paused box squats at 70% 1RM + approximately 15% load from bands followed by 90 s rest. Subjects then performed two broad jumps with 10 s rest between followed by a 90 s rest before starting the contrast again. In total four sets were performed. One week after deadlift 1RM testing, the same protocol was used for the deadlift and broad jump contrast protocol. After the final 7 days of testing, a control protocol was performed of four sets of broad jumps. The PAP effect was determined by the percentage difference between the best broad jump during the PAP protocol and the baseline broad jump values.

WHAT THEY FOUND
Moderate improvements in broad jump were found in all sets for the box squat and deadlift protocols. The PAP protocol elicited an improvement of 6.01 ± 2.25% and 5.35 ± 2.20% in broad jump for the box squat and deadlift protocols, respectively. Any change in the control group was unclear.

Practical Takeaways

This is the first study to establish that deadlifts with bands can potentiate broad jump performance after only 90 s of rest. Furthermore, this study suggested that 90 s rest is enough time to potentiate broad jump performance in squat or deadlift protocols with accommodating resistance which is considerably less than the previously reported 5-8 min. This may be advantageous for practitioners who have large groups of athletes and have to balance the demands of the day with multiple training sessions. The deadlift protocol produced a more consistent PAP response over the four sets compared to a decrease in PAP across sets in the squat condition. This may have been caused by the eccentric portion of the squat which was not present in the deadlift. What is also important is that sub-maximal loads were able to induce PAP in these protocols. This makes performing multiple sets of the contrast (such as in this study) feasible with multiple athletes and, further allows the management of fatigue through reduced loading. In a team setting, perhaps grouping athletes with similar loads on the strength exercise could make a session run more efficiently. For example, in groups of 2, the first athlete lifts, waits 90 s then performs broad jumps while the second athlete lifts, they both rest 90 s and continually swap between the 2 exercises in the allotted time period. In this example, four sets are likely to take approximately 12 min making it a very time efficient way to train for explosive performance.

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

James's Comments

"Based on the research reviewed in past Performance Digests, there seems to be a multitude of ways to induce a PAP response. From optimal loading to performing at a higher intensity to accommodating resistance and French contrast, all these methods can have a positive influence on subsequent explosive exercise performance. The important thing to remember which was mentioned in the October issue is that adaptations to training will be velocity specific. Meaning the explosive exercise that is chosen following the initial exercise should represent similar loading to what the athlete encounters during competition. For example, athletes that jump for their sport can use jump variations at bodyweight to induce a PAP response, whereas athletes that throw implements may use a lighter load for their PAP induced exercise. Again, these are general thoughts and consideration to the athlete will always play a role in exercise selection."

[Abstract]

Why are track and field sprint athletes faster than team sport athletes?

OBJECTIVE
Accelerative sprint capacity is vital to success in athletic sprint events as well as team sports. It has been demonstrated that higher average antero-posterior (back to front) force production across the acceleration phase and the ability to maintain horizontally orientated force vector as velocity increases is crucial to performance. As running speed gets closer to maximal, the force vector inevitably becomes more vertical and a limiting factor for maximum velocity is the ability to exert high vertical force relative to body weight in short ground contacts. However, it remains unclear (from a ground reaction force perspective) why some individuals are able to continue accelerating beyond a given velocity, whereas others are unable to. Therefore, the aim of this study was to understand how specific aspects of ground reaction force (GRF) allow some individuals to continue to accelerate beyond the velocity plateau of others.

WHAT THEY DID
Twenty-eight male track and field athletes (sprint specialists with 100 m personal bests between 10.88- 11.96s) and twenty-four male soccer players participated in the study. Track and field athletes performed between 2-5 maximal 60 m sprints in spikes from their crouched block start position while soccer players performed 3 maximal sprints from a standing start in flat running shoes. Fifty-two metres of in-ground force platforms were used to measure GRF and timing gates were used to time the 60 m sprints. Horizontal velocities at the instant of foot strike were extracted and matched across subjects with velocities 8-, 8.25-, & 8.5 m/s used for comparison.

WHAT THEY FOUND
Absolute and relative net impulses (propulsive being higher and braking being less negative) were between 42% and 73% higher for sprinters compared with soccer players at matched velocities of 8.0 and 8.5m/s respectively. Mean forces across all ground contact periods at matched velocities (horizontal, vertical, ratio of force) were higher in the sprinters group compared with the soccer players. Contact times were similar between groups, yet average horizontal power was significantly higher in sprinters compared to soccer players (50% and 99% for 8.0 and 8.5 m/s, respectively). Higher GRF was reported in sprinters compared to soccer players from the late braking phase, through mid-stance and across the majority of propulsive phase. Sprinters also exhibited a more horizontally orientated force vector during late braking and propulsive phase at 8.5 m/s.

Practical Takeaways

Sprinters showed enhanced horizontal power generation as soccer players and can be explained as the result of higher forces in all force vectors being produced over similar ground contact times. The matched velocity also occurred at an earlier step in sprinters. The vertical component of force seems to be more performance differentiating as velocity increases. It should also be noted that athletes who were able to accelerate beyond the matched velocities in this study were those who generated a higher net horizontal impulse. A velocity increase in athletes, therefore, can be achieved by either generating higher horizontal net impulse (reducing braking or increasing propulsive forces) or by doing this in combination with higher vertical impulse (if flight times do not become excessively long). Based on this paper, in order to increase the maximum velocity of an athlete, athletes should aim to increase both overall force production and force orientation. For example, various bilateral and unilateral exercises in both the vertical and horizontal force vectors would fit this suggestion. Another consideration would be using exercises to develop leg stiffness as the ability to absorb and redirect force like a spring is vitally important to sprint performance. An example session might include:

A1) Low amplitude ankle stiffness work for multiple hops

B1) Maximal ISO Split Squat 3 x 6 s

C1) Quarter Squat 4 x 4

C2) Hurdle Hop 4 x 6-10 hops

D1) ISO or ECC hamstring

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

James's Comments

"This paper shed some light on the vast kinetic differences between soccer players and sprinters. It would be interesting to see if similar results would be observed if both groups started their sprints in the same stance and with the same or similar footwear. While sprinters are technically better at accelerating (as shown by sprinters reaching matched velocities quicker), having them start in a 4 point stance with spikes makes it "easier" to accelerate versus from a standing start in running shoes. As mentioned above, leg stiffness is an important quality to develop along with force production. Reactive ankle strength has been suggested to influence performance in the late acceleration phase and in my opinion, is something that should be trained often. The use of low amplitude hops is something that can be implemented multiple times a week without too much stress to the body."

Technology & Monitoring

This month's top research on technology and monitoring.

ADDING BARBELL DISPLACEMENT TO MONITORING LOAD IN THE WEIGHT ROOM - WORTH THE EFFORT?
Hornsby et al. (2018). Sports,

THE USE OF INDIVIDUAL AND COLLECTIVE ATHLETE MONITORING PRACTICES
Esmaeili et al. (2018). Frontiers in Physiology,

CAN COACHES USE THE PUSH BAND TO MONITOR JUMP PERFORMANCE ACCURATELY?
Lake et al. (2018). Sports,

[Abstract]

Adding barbell displacement to monitoring load in the weight room - worth the effort?

OBJECTIVE
Quantifying training loads outside of practice is especially important for coaches who want to manage strength and power development. Most monitoring calculations used for monitoring load within the weight room are either volume or barbell speed, however neither provides sufficient or precise enough information for coaches. The objective of this study was to see whether the inclusion of displacement of the barbell to the typical calculation of volume load added enough value to warrant the extra work associated with collecting the information.

WHAT THEY DID
The researchers tracked the volume load (VL) of eight national calibre weightlifters over five months using a V-scope, and a barbell displacement and tracing system which included each athlete's loads and repetition count. To determine the volume load with the displacement (VLwD) of the barbell, a calculation of sets x repetitions x load x displacement was used at the end of the training phases. The researchers compared simple volume load and volume load with distance to see how much value barbell stroke length tracking added to the monitoring process. Pearson's correlation coefficients were used to identify possible relationships between training variables.

WHAT THEY FOUND
The introduction of the barbell displacement measure appeared to improve the precision of the volume load calculations which suggests that its inclusion is indeed warranted and recommended for use in practice. Unfortunately, the value was only considered if time is available and the cost and extra work is likely to only be done with more coaching friendly equipment. Mechanical work is highly connected to distance with many exercises that use concentric and eccentric activities. For example, quarter squats and full range barbell squats are commonly used in training, and coaches will need exact measurements of each exercise to add more precision to their training.

Practical Takeaways

The most obvious challenge with barbell displacement is measuring it conveniently. Current technology, specifically velocity based training equipment (Review HERE), enables the path of a barbell as well as the distance it travels to be accurately measured with each rep, although some exercises can be modelled to save time. While most coaches do have a rough idea of how far displacement is with barbell exercises, objective measurement is worthwhile. The differences in precision between tall and short athletes for example, as well as styles of training can at times make it cumbersome to record exercise distance in team settings. To overcome this issue, athletes could be "fitted" during athlete screening and testing exercises so that when the athletes are prescribed workouts later the information is ready for analysis. One recommendation made by the authors of this study was to map out the exercises that are to be used before completing the session so they could be automated in excel, thus improving the monitoring process without manually recording each rep.

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

Carl's Comments

"In the previous Performance Digest issue (HERE) it alluded to modelling performance and training with simple variables, one of them being leg length to give context to relative evaluation when comparing between athletes. As exercises tend to be descriptive when prescribed to athletes, coaches should tag (annotate) training based on known barbell distances, using video analysis tools such as Dartfish or Kinovea. If exercises are more variable because of athlete style, barbell tracking can be done with linear encoder devices such as Gymaware."

[Abstract]

The use of individual and collective athlete monitoring practices

OBJECTIVE
As many coaches and practitioners are aware, using a load monitoring system is an effective way to reduce injuries if a sustainable and reliable approach is used. Due to time constraints that are typically associated with coaching in a sporting environment coaches are always looking for the best combination of effectiveness and efficiency regarding their load monitoring systems. In this study, a combined approach of merging multiple methods of load monitoring was used to see how non-contact injuries could be reduced. In addition to using a combination of load monitoring methods, individual methods were also evaluated separately to see their impact in risk analysis.

WHAT THEY DID
Over the course of two seasons, fifty-five Australian rules footballers were monitored using a range of monitoring systems and individual methods which included: internal training load (sRPE), external training load (GPS Player Load, total distance covered, and high-intensity running distance [>4.17 m/s]), musculoskeletal screening (once per week), subjective wellness (questionnaire related to fatigue, sleep quality, general muscle soreness, mood, and stress) and, Acute Chronic Work Ratio (ACRW) with rolling averages or exponentially moving averages.

WHAT THEY FOUND
Numerous individual monitoring predictors were indicative of an increased risk of injury such as high internal and external training loads, having previous injuries, longer playing career and reduced musculoskeletal performance. However, one of the more significant findings of this study suggest that a collective process for monitoring load as opposed to using individual predictors is recommended due to the greater number of possible predictors of injury that are used. These results though should be interpreted with some caution, as other important factors which are also related to injury prevalence such as genetics and return to play methods were not included in this study.

» **Practical** Takeaways

Those involved with training performance athletes should look to include a range of load monitoring measures. The combination of subjective and objective data, as well as statistical modelling of workloads is likely to be the gold standard. Using simple ratings of perceived exertion and external loading from player tracker technology, a unified model or commonly used ACWR charting, can help reduce injuries from fatigue. Due to the low cost of GPS systems and the simplicity of RPE monitoring (HERE), a coach with limited or no sport science support can easily repeat the techniques used to help guide sport coaches more accurately. What should be noted is that the orthopaedic assessment - specifically joint and muscle screening - of load monitoring was also included in this study. Coaches now have greater access and knowledge of this information due to the improvements in testing protocols and sports technology devices.

Want to learn more?
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Carl's Comments

"The most common question with regards to player load monitoring is how much is enough? Each individual method has value in spotting potential risk periods or training volume patterns on its own, however collectively it makes sense to build an algorithm or AI solution (HERE) that at least integrates a subjective load from the athlete and an actual workload externally with player tracking loads. Combining everything together isn't perfect and is prone to errors but doing so creates the best summary of what is happening with player training and competition."

[Abstract]

Can coaches use the Push Band to monitor jump performance accurately?

OBJECTIVE
Inexpensive and practical jump testing for monitoring athletic performance and load is popular for many reasons, mainly for the simplicity at which it can be used and performed as well as being safe for all types of athletes. If a low-cost solution that could measure vertical jumps were easily accessible for youth clubs and teams particularly those who are required to regularly travel, a velocity based training device would be very convenient. Therefore, the purpose of the study was to investigate the validity of the second-generation Push band.

WHAT THEY DID
The jumping data of twenty-two athletic individuals was compared using three different measures:

⇒ Gold standard force plates (Kistler)
⇒ Vicon motion capture system, and
⇒ The Push band which was attached to the waist, approximate the centre of mass of the athletes.

WHAT THEY FOUND
The second generation Push Band seemed to overestimate for measures of power calculated when compared to both the Kistler force plates and Vicon motion capture system however, it did appear to provide a valid measurement of mean and peak velocity.

Practical Takeaways

Mixed results were reported as the measures of velocity calculated using the second generation Push Band to be suitable however, measurements of peak power did not appear to be useful. This is not an issue for coaches who are mainly interested in comparing velocity of exercises, as most coaches find wattage numbers difficult to juggle in their heads on the fly but can sometimes be a creative way to keep athletes motivated (HERE). Velocity is very easy to use as the speeds are simple to comprehend, such as those during slow squats, fast power cleans, and very high speed jumps. Coaches should train using peak speeds as it's closer to take-off velocity of force platforms, but those scores are not synonymous with each other. If coaches plan to use the Push Band 2.0, they must think of it as a training tool rather than a testing device.

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

Carl's Comments

"In a previous study by Ripley and McMahon (HERE) the first generation Push Band device with loaded countermovement jumps was compared to a force plate. he results showed similar findings, that the reliability of the device was strong, but due to the accuracy of the information compared to lab grade instrumentation, the data was not interchangeable, so it could not be considered for normative purposes. What was surprising though was that the researchers in the current study did not compare a legacy Push device to see how the product changed from the first to second generation."

Fatigue & Recovery

This month's top research on fatigue and recovery.

COLD WATER IMMERSION, DOES ONE-SIZE-FIT-ALL?
Zandvoort et al. (2018). European Journal of Sport Science.

THE EFFECTS OF COLD WATER IMMERSION FOLLOWING A RUGBY UNION MATCH
Nunes et al. (2018). Applied Physiology, Nutrition, and Metabolism.

THE LINK BETWEEN TRAINING LOAD, SCHEDULE AND SLEEPING BEHAVIOURS AMONGST ELITE YOUTH SOCCER PLAYERS
Whitworth-Turner et al. (2018). European Journal of Sport Science.

[Abstract]

Cold water immersion, does one-size-fit-all?

OBJECTIVE
Cold water immersion (CWI) is frequently implemented by athletes to speed-up recovery. It has previously been identified that an athlete's characteristics such as body composition influence the effects of CWI. This study compared the effects of a customized CWI (CWIc) protocol, a standard CWI (CWIs) protocol and an active recovery (AR) protocol on different measures of fatigue.

WHAT THEY DID
Across three consecutive weeks, ten physical active male participants performed a fatiguing protocol (60 squat jumps and a 2 min and 30 s all-out cycling time-trial). After the fatiguing protocol, the participants were exposed to the CWIc protocol (12˚C, 10-17 min), CWIs protocol (15˚C, 10 min), or the AR protocol (60 W, 10 min). During the CWIc, participants were exposed to a fixed temperature of 12˚C with a variable immersion duration for each participant. The individual durations were calculated using the ProCcare software which is designed to predict the responses of an individual's body temperature to CWI.

Measures of fatigue were obtained on the day prior to the fatiguing protocol, as well as 0 and 24 h after the fatiguing protocol was completed. The measures of fatigue obtained included:

⇒ Heart rate variability (HRV) as HRVrecovery (HRVr): Difference between the HRV obtained after the fatiguing protocol and after the recovery protocol;
⇒ Muscle power (MP) as the mean power of all squat jumps performed over 30 s: Difference between MP obtained at the baseline and after the recovery protocol;
⇒ Muscle soreness (MS) on a scale of 1-10 obtained after recovery and 24 h after.

WHAT THEY FOUND
⇒ HRVr was significantly lower using AR in comparison to both CWI protocols. Although, HRVr was significantly greater in CWIc when compared to CWIs, no differences were obtained in HRV following the CWIc and CWIs.
⇒ The decline in MP was significantly greater in CWIs in comparison to CWIc. No differences were observed between CWI protocols and AR.
⇒ No differences between groups were observed in MS after following each protocol and 24 h following.

Francisco's Comments

"The authors found that CWIc can have a beneficial effect on HRVr and MP in comparison to CWIs. Although, no differences were observed on the HRV post-exercise between CWI groups, suggesting that CWI may have a limited effect on HRV. Interestingly, no differences were observed for MP between CWIs or CWIc and AR. Changes in muscle temperature are associated to differences in the environmental temperature (i.e. water) and duration of exposure. As individuals using the CWIc protocol in comparison to the CWIs protocol were exposed to lower temperatures (12˚C vs 15˚C, respectively) and longer durations (13.0 ± 2.7 min vs 10 min, respectively), it is expected that muscle temperatures were also decreased to a greater extent. Nevertheless, if objective measures of muscle temperature were collected, it would aid to understand the observed beneficial effects of CWIc in comparison to CWIs in MP.

Although the observed effects on CWIc are a consequence of the lower temperatures and longer durations, it would be interesting if one of the CWI variables, such as temperature or duration was controlled between CWI groups. Furthermore, understanding the effects of CWIc on greater levels of fatigue (i.e. rugby match) would likely lead to a more pronounced effect of the customisation of CWI protocol.

From a personal perspective, I had the chance to try the software used to individualise the CWI protocols (ProCcare) and itis great as it offers the possibility to generate an individualise a CWI protocol by entering basic body composition measures such as body weight, height and fat mass, but also allows you to enter more complex measures such as skin area.

As mentioned in the Performance Digest number 15 (HERE), from an applied stand point, a coach or practitioner can divide the squad in two or more groups, e.g. a high and a low-fat group, and create different CWI protocols, e.g. 8 min in the CWI bin for the low-fat group and 12 min in the bin for the high-fat group. This allows for a more individualised approach to the recovery process."

Practical Takeaways

The findings from this study suggest that a customized CWI protocol may enhance acute recovery in comparison to a standard CWI and AR. Typically, customizing a CWI protocol is conducted by increasing exposure time, water temperature or a combination of both. This though can sometimes be challenging as due to individualised body composition characteristics such as fat mass and body weight) athletes may be exposed to varying levels of CWI intensity. By using this model, practitioners can customize CWI protocols to each athlete, therefore increasing the effectiveness of the recovery intervention.

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

[Abstract]

The effects of cold water immersion following a rugby union match

OBJECTIVE

Cold water immersion (CWI) is the most common and frequently implemented recovery modalities used for the purpose of speeding up recovery following rugby practice and games. However, research which has previously investigated the effects of CWI using various measures of fatigue are limited, particularly within rugby union. Therefore, this study aimed to measure the effects of CWI on subjective and objective measures of fatigue after a professional rugby game.

WHAT THEY DID

Nineteen male, Brazilian professional rugby players were exposed to either a CWI (n = 11; 10 min at 10˚C) or a control group (n = 8; 30 min seated) after a friendly rugby match. The various measures were measured at various timepoint:

⇒ Throughout the match: external load (using GPS)

⇒ Following the match: internal load (sRPE)

⇒ Before and after the match (0 h, 24 h, 48 h and 72 h post) included:

- ⇒ Inflammatory markers (Interleukin-6 [IL-6], tumor necrosis factor [TNF-α])
- ⇒ Physical performance (10 m sprint, 30 m sprint, squat jump [SJ], countermovement jump [CMJ])
- ⇒ Subjective delayed onset muscle soreness (DOMS)
- ⇒ Subjective perceived recovery scale (PRS)

WHAT THEY FOUND

The different measures obtained (inflammatory, performance, subjective markers) were affected after the match in both groups, with a trend towards returning to baseline performance/measures within 72 h.

CWI had a beneficial effect on the TNF- α and jumping performance in comparison to CON, however this effect was not reported for sprint performance, subjective markers of fatigue and IL-6. Furthermore, while training loads affected all jumping measures, the effects of CWI were only evident in some of these measures.

Francisco's Comments

"I was very pleased to see a study investigating the effects of CWI in some markers of fatigue that are not typically observed in real-world research.

It is important to see that some measures were not affected by CWI and all measures return to baseline in both groups within the 72 hours period. In fact, only peak power output and stiffness during the SJ were affected by CWI 48 h post-match, with no effects being observed at the 72 h post-match.

These findings are important as a growing body of research has been suggesting potential harmful effects of CWI on muscle adaptations. Therefore, if athletes are not meant to perform high power outputs within 48 h after a match, this limits the rationale for the implementation of CWI.

These findings reinforce the fact that practitioners must have some control on the weekly training schedule to understand when athletes will be fresh to perform.

For example, athletes will have a training day within 48 h after the match, however, the requirements for lower body to be fresh are not high as the training session may simply be a technical session and walk through on the field, along with an upper body gym session. Given that the loads experienced by these players are low during that training day, it is unlikely that it will lead to increases in fatigue for the second training day of the week, where athletes are required to perform at a higher level (e.g. high acceleration and velocity actions in the field and lower body strength and power session in the gym)."

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

Practical Takeaways

This study has demonstrated that CWI enhances recovery following a rugby match. In particular, the recovery of one inflammatory marker (TNF-α) and some measures of jumping performance were enhanced when CWI was implemented. On the other hand, other measures (sprint performance, IL-6, DOMS, PRS) were not affected by CWI. These findings demonstrate the need to collect more sensible and specific markers when trying to monitor fatigue.

[Abstract]

The link between training load, schedule and sleeping behaviours amongst elite youth soccer players

OBJECTIVE
Sleep is well recognised to be one of the pillars for good recovery. In youth soccer, no changes in sleep between subjective high- and low-intensity training days have typically been reported. However, there is limited information regarding how different training loads of these players affect sleep. As such, this study aimed to measure how youth soccer players sleep is affected by training schedule and match load.

WHAT THEY DID
The sleeping patterns of ten elite, youth soccer players were monitored over 14-day in-season period using a wireless sleep monitor with Sleeping markers were obtained on the 3 days prior and one day after a game and included:

⇒ Time of lights out (TOLO)
⇒ Time in bed (TIB)
⇒ Total sleep time (TST)
⇒ Sleep onset latency (SOL)
⇒ Number of awakenings (AWAKE)
⇒ Time spent in wake after sleep onset (WASO) and;
⇒ Time of final awakening (TOFA)

WHAT THEY FOUND
Sleep duration was greater on the 2 nights prior to the game and the night after the game in comparison to the night of the day after the game. Increases in sleep duration in the 2 nights prior to game day occurred partially due to an early TOLO observed on those days. Furthermore, a greater training load (HSD and sRPE) were associated with an increased sleep duration and later TOFA.

Francisco's Comments

"I always appreciate studies that investigate athletes sleep characteristics as a good sleep duration and quality are essential for recovery and to promote adaptations. Moreover, sleep research in youth athletes can be used to promote sleep education within a team squad.

Athletes within this study voluntarily went to bed earlier on the nights before the match. This demonstrates that this group of athletes understand how sleep affects recovery and readiness. I prioritise education (e.g. athletes being educated on the importance of sleep) rather than setting rules (e.g. lights out at a fixed time) and this study is a great example how education has a role in a sports environment.

In the other hand, in the two nights after the match athletes went to bed later. This behaviour is normally called "social jetlag" as athletes try to catch up with friends, family, fans and social network followers after a match. Normally exposure to electronic devices is also increased which interfere with sleep. I believe this behaviour can be a "mental runaway" from the anxiety and stress emotions that athletes feel on the match day and days before the match.

The promotion of an effective sleep quality and quantity following a game must be promoted due to the great stimulus that occurs during a match. This though should not be at the neglect of quality social time. which may involve players family and friends being invited to the after-game meal or in other activities, such as singing or games.

Practitioners need to be aware of the sleep characteristics on different days. Sleep hygiene strategies should be implemented with a greater emphasis on days where sleep is more affected, such as the nights following a match."

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

Practical Takeaways

It appears that the sleep patterns of elite youth soccer players can be impacted on by the varying training loads they are subjected to. Understanding this, practitioners can adjust training schedules (i.e. avoid early starts or late training sessions in certain training days) and promote sleep hygiene strategies in some training days.

The findings from this study reinforce the need to monitor athletes sleep characteristics. Although it is not practical to monitor sleep throughout the year and/or monitor an entire squad, practitioners can select some athletes and collect data from different schedule templates.

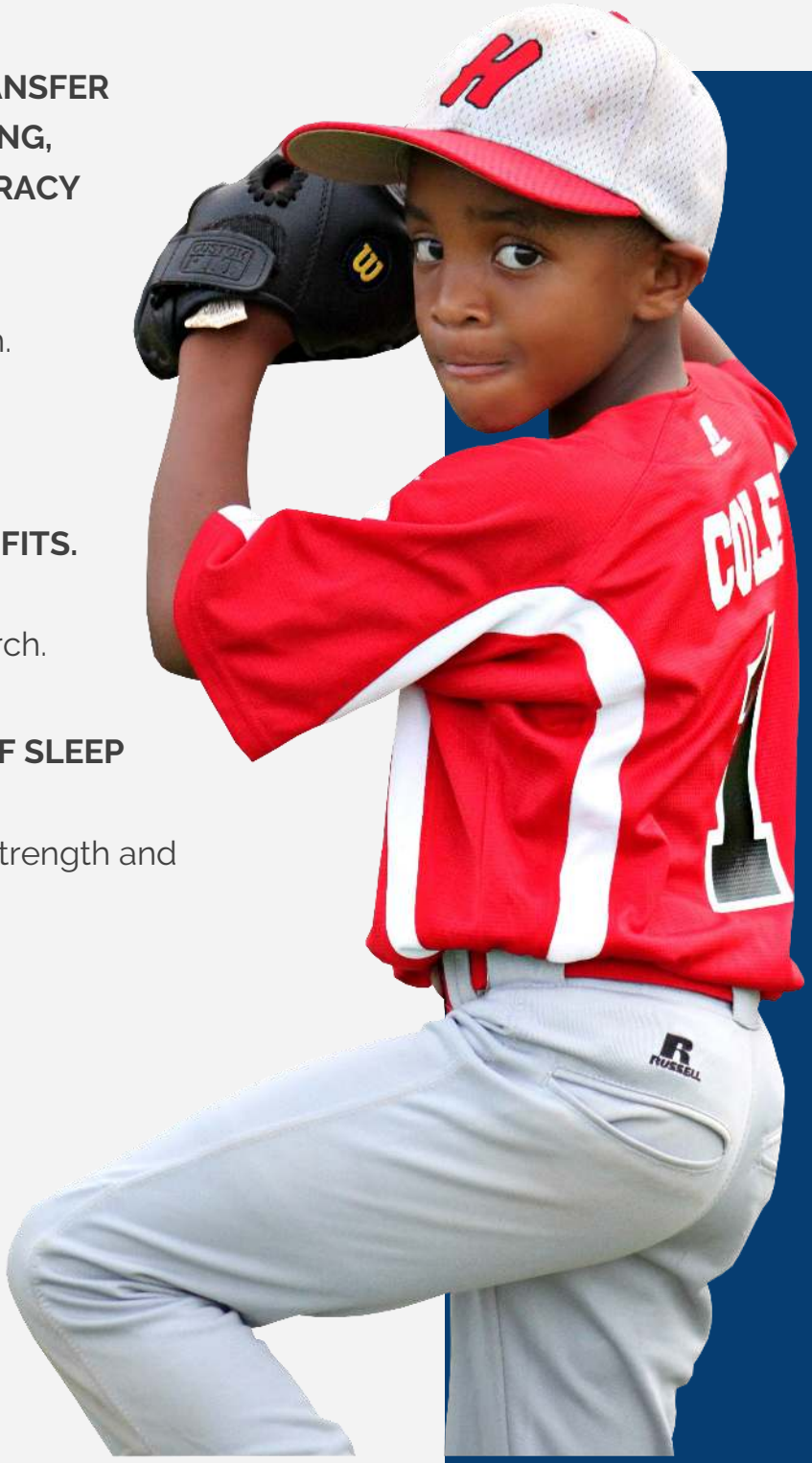
Youth Development

This month's top research on youth development.

BATTLING FOR HOOPS: THE TRANSFER BETWEEN BATTLE ROPE TRAINING, FITNESS, AND SHOOTING ACCURACY IN BASKETBALL.
Chen et al. (2018). The Journal of Strength & Conditioning Research.

IMPROVING NECK STRENGTH DURING ADOLESCENCE: RISK, RECOMMENDATIONS AND BENEFITS.
Wilson et al. (2018). Journal of Strength and Conditioning Research.

JUST GO TO BED: THE EFFECT OF SLEEP ON WELLBEING IN YOUTHS.
Sawczuk et al. (2018). Journal of Strength and Conditioning Research.



[Abstract]

Battling for hoops: The transfer between battle rope training, fitness, and shooting accuracy in basketball

OBJECTIVE

Basketball is characterised by sporadic bursts of both high and low intensity activity repeated over a prolonged period of time. To add to the complexity of this sport, athletes are required to perform with a strong understanding of the technical, tactical, and fine motor skill (i.e. shooting accuracy) demands which may decrease with fatigue. Developing fitness and skill-related attributes is therefore of maximum priority for coaches and collegiate players. As a result of this, Chen and colleagues investigated the effects of a battle rope training programme on shooting accuracy and physical fitness.

WHAT THEY DID

Thirty male collegiate basketball players were recruited for this study and were randomly assigned into a battle rope (BR) or shuttle run (SR) group. The BR group completed 3 sessions per week lasting roughly 30 min. These sessions grew progressively harder, for example during week 1 working for 15 s and resting for 45 s, to working for 20 s work and resting for 40 s after week 2. The exercises included; double-arm waves, side -to-side waves, alternating waves, in-out waves, hip toss, and double-arm slams. The SR group protocol was exactly the same as the BR group (3 sessions per week, same intervals); but involved a 15 m distance with a 180^{o} turn performed at 75-85% of maximum speed. The intensity of exercise in both groups was measured using heart rate. All groups were tested on several performance qualities both pre and post intervention.

WHAT THEY FOUND

The BR group responded far greater than the SR group in all the measures collected. Perhaps most surprising is that shooting accuracy improved, which is a determinant of basketball success.

Practical Takeaways

This study indicates that performing 3 sessions a week lasting roughly 30 min each can develop multiple-fitness qualities and game skills. Sets increased from 30 in weeks 1-5 to 36 in weeks 6-8 with 40-45 s rest between sets. These set and rep schemes can be used in your sessions, but it is important to remember that these athletes were highly trained and routinely participated in 3 basketball sessions a week and 1.5 h of resistance training. Individuals with a poor training age may present some of these faults (HERE), as battle rope training can require high levels of coordination, strength, and power to complete an allotted time with both quality and intent. Fortunately, the above video has you covered, including some corrections on commonly seen flaws in technique.

Due to the high levels of jumping and landing seen in Basketball, overuse injuries are a common issue. According to Weiss et al., (2016) (HERE), a total of 85% of basketball players reported four or more overuse injuries in the season. If training were to completely reduce intensity or volume, this could lead to more injuries as a result of poor conditioning. To support these athletes and develop their fitness, BR training may prove to be a perfect substitute as this can be a relatively low impact task on the ankle, knee, and hip that can impact multiple fitness qualities (aerobic, anaerobic, power, muscular endurance) and shooting accuracy.

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

Tom's Comments

"As a strength and conditioning coach, it is important that we remain aware of how young our discipline is and how our sessions can translate to practice. With this considered, Chen and colleagues' research compliments the work we do, showing us that the intricate differences in our training methodology can have a positive impact on decisive factors, such as shooting accuracy, which can be the difference between winning and losing. These messages have been echoed in the attached podcast (HERE), where Tim DiFrancesco discusses his evidence-based approach to fitness in his role as Head of S&C of the Los Angeles Lakers.

Moving forward, I would like to see the relationship between the volume of this training (battle ropes) and the relationship with long-term shoulder health. Whilst it may lessen the impact on the lower-body, it may inadvertently overload the shoulder joint. I would be cautious about prescribing battle-rope exercises for someone with a past of shoulder related injuries. Therefore, I would adjust the exercises/set and rep scheme for someone with these issues."

[Abstract]

Improving neck strength during adolescence: Risk, recommendations and benefits

OBJECTIVE
Complex movements require large muscle groups to work together and are often pursued in a resistance programme as they offer a high physical 'return to time' ratio. At times, strength programmes could be criticised for avoiding smaller muscle groups, such as those of the cervical spine, which are very important as a preventative measure for injury and concussion. Collision sports such as rugby and American Football have recently placed a high emphasis on neck related strengthening, due to the nature of the sport (head contact, neck/shoulder collision) and volumes of concussion. In football however, few authors have pursued this line of thought, which Wilson and colleagues have addressed in their investigation of a cervical strengthening programme over 6 weeks.

WHAT THEY DID
Eighty-three athletes (male and female) aged between 14 and 15 were assigned to either an intervention group (n = 50), or a control group (n = 33). The intervention group performed a web-based cervical exercise programme (HERE), progressing through a majority of isometric exercises in phase 1, concentric in phase 2, and eccentric contractions in phase 3 over a 6 week period. The webpage consisted of demonstration videos of the exercises and instructions for the warm-up. The control group received no specific cervical strengthening work, with the aim of seeing how the intervention group benefitted when compared to a 'typical' adolescent. To measure all variables, an Ergo FET Push-Pull Force Handheld Dynamometer was attached to a head strap, and measured isometric cervical strength, flexion, extension, right lateral flexion and left lateral flexion in Newton's (N).

WHAT THEY FOUND
In this study, the intervention group significantly increased left lateral flexion (24.1 [15.9-32.4 ± SD]), extension (27.9 [18.4-37.5]), right lateral flexion (18.8 [11.6-26.1]), and flexion (1.2 [1.1-1.2]). In comparison, the control participants did not reveal any significant changes in cervical neck strength. Interestingly, an increase in neck size (0.8-0.9 cm) was also found in both the control and intervention group. Despite this, only the intervention group demonstrated strength improvements. This was therefore attributed to normal growth patterns seen in adolescents, and not exclusively as a result of muscle hypertrophy from the protocol.

Practical Takeaways

This study suggests that performing 4-6 strength exercises over 3-7 days, depending on the phase can significantly improve cervical neck strength. Increasing cervical strength is important for youth athletes, as this decreases the risk of head/neck injury and concussion risk. The attached podcast (HERE) guides the listener through some of the mechanisms responsible for this. What is important to take away is that for every pound gained in neck strength (equivalent to 4.45 N) the risk of concussion decreases by 5%. According to this study, typical improvements can range from 8 to 50% when pursuing a neck strengthening protocol. As a result of this, players may wish to incorporate some neck related work in their sessions.

In addition to proving effective as an intervention, this protocol benefits from being a relatively cheap initiative, costing little, if anything to replicate. As a result of this, schools or clubs on a budget can have an immediate impact on performance and injury prevention for free. As a resource, please see this poster (HERE) that can be placed inside your gym/handed out to athletes to complete, with a series of pictures, cues, and progressions.

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

Tom's Comments

"When reading an article, I'm always looking to understand how this could look in practice. By following this protocol, the participants have clearly produced some impressive results, and considering the risk associated with concussion described in the attached video (HERE), it is not surprising that we'd want to reduce this risk. However, the following question has come to mind: 'Would an adolescent follow this routine unsupervised?'. I fear that 'buy-in' from grassroots players would prove challenging, with many struggling to adhere to this on a daily basis. In addition, paired work may prove challenging, as some adolescents may not manage this task maturely and could cause undue harm to a peer.

Hypothetically, if all of our athletes did complete this protocol 3 or more times a week, we would have to ask ourselves as practitioners if this is the best use of their time. In contact sports (rugby, Muay Thai, racing etc.), this may be considered an easy win on the athletic development journey, as the risk of concussion may be high. However, in football or athletics, the risk of an ACL injury, hamstring, or ankle injury may be far greater and worthier of their training time. Moreover, pursuing these qualities may support other athletic aptitudes (strength, power, speed as examples), which could also support performance and injury prevention. With limited time as a practitioner, it may be more beneficial to tackle areas where there is an increased likelihood of injury built on the sports need analysis. In my own practice, I'm going to include two isometric neck strengthening activities every session (3 times a week) for a few weeks as part of the warm-up to see how this goes."

[Abstract]

Just go to bed: The effect of sleep on wellbeing in youths

OBJECTIVE
Sleep plays a vital role in health, wellbeing, and growth whilst reducing the risk of injury, cardiovascular disease, cancers, and obesity. Good sleep also serves many cognitive functions, such as; processing speed, concentration, focus, and memory. In an athlete, these skills are vital for optimal performance. To date, a majority of research surrounding wellbeing has focused on training stress as a major factor. However, few have evaluated the relationship of sleep quality, with particular reference to sleep duration, sleep quality, and sleep index (sleep duration x sleep quality) on athletic performance in youth.

WHAT THEY DID
Forty-eight male and female athletes (age 17.3 ± 0.5 y, height 172.8 ± 122 18.3 cm, body mass 73.6 ± 12.8 kg) were recruited from an independent school and were members of the sports scholarship programme. This study lasted for a period of 13 weeks, where participants regularly completed an online Google Docs questionnaire before 11 am every morning. The form included a daily wellbeing section (DWB) related to sleep quality, fatigue, muscle soreness, stress, and mood. Other measures such as perceived recovery status (see Laurent et al., 2011 HERE), self-reported sleep duration, and the estimated time in bed method were reported.

WHAT THEY FOUND
The aim of this study was to investigate the influence of sleep duration and quality on daily wellbeing. The results of this study indicate that sleep duration and quality have a small effect on daily wellbeing. Furthermore, sleep quality and sleep index all exhibited a small influence on stress and mood, with all cases in this study assessing sleep quality and index independently from the estimated time in bed method. Sleep index refers to the interaction between two measures (sleep duration and quality) on wellbeing. The reason this measure is collected is 6 h of good sleep quality may be worth more than 9 h of broken and poor sleep.

Practical Takeaways

From this study, it is important to note that sleep quality and sleep index can be used as an input (a factor that affects wellbeing), and not an output (a factor effected by wellbeing) that contributes to overall health and wellbeing. This should be collected with other measures (training load, exposure to match play etc.) to build an overall profile of an athlete's holistic health. To support you in doing this, a fantastic example of a monitoring system can be seen (HERE) which is easy to replicate and can be adapted for your needs.

By tracking sleep, we also hold a responsibility as coaches to suggest that individuals seek further help if sleep patterns are irregular or broken. We can offer simple advice, such as; to limit screen time on electronic devices, provide advice on good sleep hygiene (bedding, clothing etc.), to read a book, or to practice meditation. However, in the case of sleeping that is "disordered" by nature, we may be better to refer out. Stacey Kelly who is the Digital Executive for The Association for Child and Adolescent Mental health defined disordered sleep, and has suggested that poor sleep can have a significant effect on overall development and wellbeing, which has been discussed in THIS podcast.

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

Tom's Comments

"As an S&C coach, loss of sleep or sleep deprivation can be a real issue. Irregular hours, long evenings, and busy weekends can put a huge strain on our own health. Finding time to socialise, relax, and wind down can prove challenging. After reviewing this paper, I made an extra effort to spend at least 30 min winding down but considered how I could help my athletes gain better sleep. Fortunately for us as coaches, both aerobic and anaerobic exercise support sleep, which may tick this box.

As I finish my sessions, I always end with a reminder to get plenty of fluids, good food, and a good night's sleep. I stress that all three are of equal importance, but that sleep plays a major role in growth and recovery. Moving forward, I plan to track sleep with my RPE measurements on training days. Unfortunately, many of the athletes will not report these daily, so I believe that when working with youth, we should track this on training days only. However, if these are less than 3 times a week, we may be collecting data that can't be used effectively or tell us much about the individual."

Nutrition

This month's top research on nutrition.

CAN A LOW-CARBOHYDRATE KETOGENIC DIET REDUCE BODYWEIGHT WITHOUT IMPAIRING PERFORMANCE IN STRENGTH ATHLETES? Greene et al. (2018). The Journal of Strength and Conditioning Research.

DOES PRE-WORKOUT NUTRITION HAVE AN EFFECT ON BODY COMPOSITION CHANGE AND EFFECT POST-WORKOUT ADAPTATIONS?
Pihoker et al. (2018). Journal of Science and Medicine in Sport.

ARE PROFESSIONAL YOUNG RUGBY PLAYERS EATING ENOUGH?
Costello et al. (2018). European Journal of Sport Science.

[Abstract]

Can a low-carbohydrate ketogenic diet reduce bodyweight without impairing performance in strength athletes?

OBJECTIVE
Rapid weight loss (RWL) strategies are frequently used among athletes from weight class sports. However, such methods are also likely to impair performance, compromise lean muscle mass, and increase the risk of negative health outcomes (e.g. headaches or nauseous) and poor immunity.

Previous studies have suggested that low-carbohydrate, high-fat nutritional intakes might be a useful strategy to reduce total body weight without compromising strength and power. Currently, however, this remains unexplored in sports that require strength and power outputs. Therefore, the purpose of this study was to determine whether a low-carbohydrate ketogenic-diet (LCKD) could be an effective weight loss strategy for athletes competing in weight class sports like powerlifting and Olympic weight lifting.

WHAT THEY DID
Fourteen intermediate to elite level powerlifters and Olympic weightlifters who competed at local to national level took part in this cross-over study design. Lifters were allocated randomly into two phases and consumed a usual diet (UD: >250g daily intake of carbohydrates) and LCKD (£ 50g or 10 % of daily intake with carbohydrates), each for 3 months with a 2-week washout. Participants received print and online daily meal plans, meal recipes, and lists of foods "encouraged to eat", "eat in moderation", and "foods to avoid", although no physical meals were provided. Lifting performance, body composition via DXA, resting metabolic rate, blood glucose, and blood electrolytes were measured at baseline, 3 months, and 6 months.

WHAT THEY FOUND
The LCKD diet resulted in a significantly lower body weight (-3.26 kg) and lean mass (-2.26 kg) compared with the UD diet. No other differences in primary or secondary outcome measures were found between dietary phases. Powerlifting and Olympic weight lifting athletes in this study decreased body weight and achieved lifting performances that were comparable with their UD when consuming a normal LCKD. Of particular interest, a reduction of lean mass in this study was not accompanied by decrements in lifting performance.

Practical Takeaways

Weight class sports require athletes to "make weight" ready for competition. Of which, long-term considerations are discussed in the podcast linked below.

It is well-known that energy restriction and RWL strategies used by athletes are associated with a number of negative performance and health implications (see video link below). However, this current study showed that a 12-week LCKD diet resulted in meaningful reductions in body weight without compromising training or strength performance and, therefore, may be safe and appropriate method to resistance trained athletes who desire lower body weight for weigh in.

Practically, this nutritional weight making strategy is applicable to athletes in power lifting and Olympic weight lifting athletes looking to reduce their body weight. Whether this strategy is, however, applicable to combat sport athletes remains questionable and needs to be explored further.

If you would like to read more about the current nutritional guidelines for strength sports, please see review by Slater and Phillips (see below).

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

James's Comments

"Despite participants consuming nutritional intakes in both dietary phases, they differed only in the relative proportions of macronutrients (i.e. proportion of carbohydrate, protein, and fats). Participants were specifically instructed not to engage in energy restriction, although this was not controlled. Furthermore, in agreement with authors limitations, a 2-week washout period may not have been adequate to eliminate carry-over effects of previous dietary phase. Indeed, the study includes many self-reported variables and minimal number of laboratory testing. As such, future studies should consider monitoring and testing participants at more time points to generate greater data and, as such, provide more information as to individual changes.

In summary, utilising a low carbohydrate ketogenic diet may assist with a total reduction in body weight, without compromising performance. However, of particular interest, although the authors report no negative outcomes with regards to the reduction in lean muscle mass seen, I would argue that reductions in lean mass should be avoided where possible. Practically, it would be interesting to postulate whether those athletes who managed to maintain lean mass during weight loss were able to improve their lifts more versus those who had lost lean muscle mass. Those who may be interested in strategies to lose total body weight whilst preserving lean mass, I would recommend reading the brilliant review article from Stuart Phillips linked below."

[Abstract]

Does pre-workout nutrition have an effect on body composition change and effect post-workout adaptations?

OBJECTIVE

Smith-Ryan and colleagues wanted to determine the effects of before and after workout nutrition on strength, body composition, and metabolism in trained females over 6 weeks of high-intensity resistance training. To realise their aims, they evaluated the effects of consuming protein and carbohydrate before or after resistance training, or not at all, for 6 weeks.

WHAT THEY DID

Forty-three trained females were randomly placed into three groups, all of which completed a block of high-intensity resistance training twice per week for 6 weeks.

⇒ Group 1 – 1:1.5 carbohydrate-protein supplement (16g carbs, 25g protein) Before training
⇒ Group 2 - 1:1.5 carbohydrate-protein supplement (16g carbs, 25g protein) After training
⇒ Group 3 – No supplement at all.

DXA was used to assess body composition (fat mass, body fat percentage, and lean mass). Strength was assessed using one rep max on a leg press and bench press, while metabolic variables (e.g. resting energy expenditure) were measured via a metabolic cart.

WHAT THEY FOUND

Following the block of training, no significant differences were seen for any changes in body composition variables or leg press strength for any groups. There was a small improvement in bench press strength for those females that consumed the carbohydrate-protein blend before training (+5.6 kg) versus after training (+4.8 kg) versus none at all (+2.5 kg). In regard to metabolic factors, no change was evident for resting energy expenditure between all three groups and only the "before training" group showed an increase in the utilisation of fat as a substrate 30 minutes after exercise.

Practical Takeaways

The main take-home message from the authors of this study are that peri-workout (i.e. before, during, or after workout) nutrition has no clear differences on body composition changes in trained females. These results are consistent with other research which show similar findings. In addition to the nutrition provided during this study, the authors agree with previous work that the novelty of the following would have a greater impact on body composition changes than just nutrient timing alone.

⇒ The training intervention
⇒ Combined with effective sleep habits
⇒ Overall dietary habits
⇒ Any training outside of the study

As an example, changes seen in the bench press, may have been seen due to the fact that it was a novel exercise for these women. Therefore, the above listed factors may be better variables to control and get right with your own athletes to gain greater adaptations.

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

James's Comments

"Nutrient timing is currently one of the hottest discussions in sports nutrition (see the podcast and video links below). This study shows, at least in trained women, that neither before nor after workout supplementation is superior to none at all in body composition changes or lower-body strength.

Having said this, the authors eluded to the limitation that nutrition outside of the study was not controlled for and, as such, this may be a key candidate in the adaptations seen between groups. For example, considering the inclusion criteria was for females who had been resistance training for a minimum of two times per week for 6 months, one would suggest that these women would also have a level of nutrition education above the normal non-training female and, as such, consume a diet with higher protein intakes to support adaptations from training. Without these nutritional intakes being tightly controlled, this may have had substantial effects on the data seen between groups. Further, the authors also recognise that the supplement provided was not supplied on a relative basis to each female's lean mass, but instead on an absolute basis, which would also affect the rate of changes between individuals. For example, a female weighing 54 kg versus a female weighing 75 kg would both receive 25 g of protein.

In summary, it would be suggested that those females participating in resistance training should consume adequate nutrition to support such training (outlined in the infographic and extra article link) but then also concentrate on other factors addressed above which would also help drive adaptations."

[Abstract]

Are young professional rugby players eating enough?

OBJECTIVE

Rugby league (RL) is an intermittent team-sport characterised by repeated high-speed collisions and wrestling bouts. Typically, players require low-levels of fat mass supported with high-levels of lean mass to support such demands. Previous work has assessed energy expenditure and intakes in senior players (see article and video link below), however, to date, limited studies have specifically investigated the energetic demands of professional young RL players across a physically challenging pre-season period. Therefore, Costello and colleagues wanted to simultaneously investigate the energy intake, expenditure, and potential balance of professional young rugby players across a 14-day, pre-season period.

WHAT THEY DID

Six healthy, professional young male RL players (16-18 years old) took part during a normal pre-season period. Total energy expenditure was measured using the gold standard method of doubly-labelled water over 14-days, whilst dietary intake was reported using Snap-N-Send (a method of collecting energy intake via WhatsApp pictures) alongside measurements of hydration and fasted body mass.

WHAT THEY FOUND

The mean difference between total energy intake (16.73 MJ.day−1) and total energy expenditure (18.36 MJ.day−1) measured over the non-consecutive, 10-day period was unclear. Or put simpler, 3995kcal on average being consumed versus 4385 kcal being expended, a difference of 390 kcal per day. This is associated with a marginal average decrease in body mass (-0.65 kg). Therefore, results in these 6 players showed that although they consumed large average dietary intakes, these intakes resulted in a negative daily energy deficit due to the high amount of energy expended throughout each pre-season day.

» **Practical** Takeaways

These findings have immediate translational potential to support the sport science practitioners and coaches who are working with young RL players across critical demanding periods (e.g. pre-season). To help achieve optimal body compositions (see link below) during the pre-season phase, coaches should attempt - where possible - to match energy intakes with energy expenditure. Practically, coaches could track body weight changes during the pre-season alongside measurements of body composition (e.g. skinfold assessment and girth measurements).

Although young RL players may meet a sufficient macronutrient profile, a negative daily energy deficit during in-season can result in negative outcomes such as impaired growth, health, and performance. Therefore, it is vital that practitioners and coaches first of all consider the energy costs of collisions during the in-season, followed by encouraging players to eat more, and change the environment to allow this behavioural change (See video link below).

Take home messages from this study:

⇒ Young RL players are currently not eating enough, at least in this study.

⇒ Practitioners and coaches need to consider the energy cost of collisions and ensure the players eat more during periods of high collisions (i.e. pre-season or in-season matches).

⇒ Coaches should encourage good eating behaviours and to support players adaptations and health throughout the season.

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

James's Comments

"The study provides novel insights into energy balance of young RL players during a pre-season. It did so using previously validated assessment methods or gold standard assessment techniques which increases the confidence in the study findings and useful for the applied field. Having said this, this study was only performed on 6 players from one club and, until performed on more players, caution should be taken when extrapolating this data to your own players.

Furthermore, the Snap-N-Send method for assessing the energy intake is not without its own limitations given its reliance on visual perception of food consumption (HERE).

Finally, energy intake is cited as one of the toughest physiological measures to get right. As such, working closely with your players to educate them on what fuelling and recovering from pre-season training looks like would be suggested at an individual rather than group level (see podcast below)."

Injury Prevention & Rehab

This month's top research on injury prevention and rehabilitation.

HOW MIGHT ATHLETES BE COMPENSATING DURING A SQUAT TO OFFLOAD QUADRICEPS FOLLOWING ACL RECONSTRUCTION?

Sigward et al. (2018). Journal of Orthopaedic Sports and Physical Therapy.

ARE STRONGER AND FASTER ATHLETES MORE RESISTANT TO INJURY?

Malone et al. (2018). Journal of Science and Medicine in Sport.

HOW TO IMPROVE FUNCTION IN INDIVIDUALS WITH A FEMOROACETABULAR IMPINGEMENT?

Newcomb et al. (2018). Journal of Science and Medicine in Sport.

[Abstract]

How might athletes be compensating during a squat to offload quadriceps following ACL reconstruction?

OBJECTIVE

Previous anterior cruciate ligament (ACL) research has shown that post-operatively, individuals tend to offload the surgical knee during bilateral tasks such as squatting. These compensations, both via shifting weight onto the unaffected side and/or utilizing greater muscle activation at the hip and ankle, seem to persist for months to years. This study analysed loading patterns during a bilateral squat in individuals 3- and 5-months post-op ACL reconstruction, and investigated how inter- and intra-limb compensations contribute to reduced knee extensor moments

WHAT THEY DID

Eleven individuals from a single physical therapy clinic were recruited and movement analysis with cameras, force plates and biomarkers were performed at 3 months (T3) and 5 months (T5) post-op. From these data, the authors calculated sagittal plane net joint moments at the hip and knee and calculated the following ratios: peak knee extensor moment between limbs (surgical limb divided by non-surgical limb), peak vertical ground reaction force (vGRF) between limbs, and hip extensor moment to knee extensor moment of the same limb. Finally, using regression models, the authors determined what effect, if any, the hip/knee and vGRF ratios had on predicting smaller knee extensor moment ratios.

WHAT THEY FOUND

The surgical limb exhibited significantly lower peak knee flexion angle, less peak knee extensor moment, lower peak vGRF, and greater hip/knee ratios. At 3 months, both a smaller between limb vGRF ratio and a greater within limb hip/knee ratio were predictive of a smaller knee extensor moment ratio. At 5 months, only a greater within limb hip/knee ratio was predictive of a smaller knee extensor moment ratio.

Practical Takeaways

The average decrease in surgical knee extensor moment compared to the non-surgical knee was 38% at 3 months, and 30% at 5 months. The average decrease in vGRF on the surgical side was 13%, and the average increase in hip/knee extensor moment ratio on the surgical side was 40%.

It is more straight forward to recognise the decreases in vGRF and knee extensor moment ratios on the surgical side, as those are direct measures of unloading and decreasing force. However, the increase in the hip/knee ratios on the surgical side is interesting, in that it indicates that the individual has shifted the demand from the knee to the hip musculature as a means, again, of unloading the knee.

Another notable finding was that, by 5 months, only the greater hip/knee extensor moment ratio was predictive of smaller knee extensor moment ratios. This suggests that as time goes on, and the individual becomes more comfortable loading the surgical limb (less inter-limb compensation), they may switch to relying more heavily on the same side hip musculature to off-load the knee (greater intra-limb compensation). This is important for the rehab specialist to note, as it may mean that even though the person is equally loading surgical and non-surgical limbs and exhibiting similar hip and knee flexion angles, he/she may still be compensating.

These study findings are somewhat limited due to a small sample size, lack of rehab standardisation, and short term follow up. However, they reveal important compensations that may go unnoticed and that may contribute to growing re-injury rates. This study also provides a new avenue for future studies to further investigate these and other compensations.

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

Steph's Comments

"These compensations appear to be present at a time during rehab when higher level tasks and progression to running become an area of focus. If this significant "unloading" of the surgical limb exists, in even submaximal tasks such as a body weight squat, how can we be comfortable demanding higher load or higher difficulty tasks from these individuals? To me, this study is a strong reminder of how important it is to coach and advocate for equal loading during bilateral tasks, beginning in the early stages of rehab. I also feel as though this study highlights the importance of an early focus on quadriceps strength, comfort with bearing weight on a flexed knee, and on landing with greater knee flexion on the surgical side in later stages of rehab.

Another area that peaked my interest, and that author Susan Sigward speaks to (see podcast link), is that they did not also measure relative moments at the ankle. This offers yet another avenue for future research on the dilemma of intra-limb compensation following ACLR."

[Abstract]

Are stronger and faster athletes more resistant to injury?

OBJECTIVE
There is a growing amount of literature that highlights the relationship between increased acute to chronic workload ratios (ACWR) and injury risk in team sports athletes. What we do not yet know, is what physical factors, if any, may influence the risk of injury in these athletes. Therefore, the intent of this study was to investigate the relationship between training loads, physical qualities and injury in team sports athletes.

WHAT THEY DID
The authors collected injury data on 40 amateur hurling players from a single team, across 2 seasons. Any injury that prevented a player from participating was recorded and ranked as low severity (out for 1-2 training sessions), moderate severity (out for 1-2 weeks), or high severity (out for 3+ weeks). Intensity of all training sessions were calculated in arbitrary units (AU) using rate of perceived exertion (RPE) multiplied by session duration (minutes). From this, the week 1: week 4 ACWRs as well as the week to week workloads were calculated. Lower body strength (via 3RM trap bar deadlift), max linear speed (5-, 10-, and 20-m), and repeated-sprint ability (RSA) were measured each phase of the seasons.

WHAT THEY FOUND
Overall, 93 injuries were reported over two seasons. Moderate weekly loads between ≥1400 AU and ≤1900 AU appeared to protect players from injury during both the pre-season and in-season. Larger week to week (absolute weekly) changes ^{3}1000 AU were shown to increase the odds of injury. Specifically, an ACWR between 0.90 and 1.30 demonstrated protective effects.

Athletes with greater relative strength and better RSA were at reduced risk of injury compared to those with lower relative strength and slower RSA, and were better able to tolerate both the given workload each week as well as spikes in workload. Faster athletes were also at lower risk of injury, and were better able to tolerate ACWRs of greater than 1.25.

Practical Takeaways

This study demonstrates that greater lower body strength, faster running speed, and greater RSA times may potentially moderate and/or decrease injury risk in team sports athletes. This is incredibly important for coaches to consider, as improving these factors with their athletes will also likely improve performance in addition to mitigating injury risk.

These findings also address a common struggle that coaches and clinicians may have in that they question how much and how fast to load their athletes and patients, and when it is appropriate to expose them to maximal speeds. The data show that, when the ACWR is kept at a moderate level and the training program includes targeted lower body strengthening, speed, and sprint training, one can be fairly confident that their players will be prepared for the demands of the season and any unexpected spikes in workload that come with it.

This study did not account for outside factors such as injury history, age, perceived muscle soreness, fatigue, mood, sleep, nutrition, and psychological stressors. These factors, amongst others, may help to explain more of the variance in the likelihood of injury, though this would be difficult to study all at once. Future research should include the influence of some of these factors, as well as be performed across different team sports.

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

Steph's Comments

"The previous association between increased workloads and injury may have more to do with acute spikes in workload and the athlete's preparedness for these spikes rather than simply due to a high ACWR. This study shows how we may very well be able to set our athletes up for success and reduce their risk by maintaining an adequate chronic workload while controlling acute workloads to safeguard their fitness levels and ensure their readiness (check out podcast link below). In addition, we can make them more tolerant to any unexpected or unplanned acute spikes in workload by focusing on lower body strength, linear speed, and RSA as part of their training.

Though this study collected data on a single team, I believe the findings can be helpful in planning for all team sports athletes. I think, as coaches, we can decrease our fear of exposing athletes to maximal velocity during training and have more confidence in its utility in building a more resilient individual."

[Abstract]

How to improve function in individuals with a femoroacetabular impingement?

OBJECTIVE

Femoroacetabular impingement (FAI) is a common cause of hip and groin pain, and can be very limiting in functional and sport specific activities. The purposes of this study were to:

1) Investigate the immediate effects of the Stability through External Rotation of the Femur (SERF) brace on hip joint angles and pain, and
2) Investigate the effects on hip pain and patient reported outcomes after 4 weeks of daily brace wear. (See SERF brace video below).

WHAT THEY DID

This was an observational study with twenty-five young adults aged 18-25 years old. Pain during the week prior and pain during testing was recorded at baseline. Each participant performed stair ascent and descent as well as a single leg squat with and without the SERF brace. Via a 12-camera motion analysis system, the following were measured: peak angles of hip flexion, adduction and IR as an average over 3 trials. Following the initial testing, 17 of the 25 participants agreed to wear the brace daily for 4 weeks (4 h per day) and assess outcomes following.

WHAT THEY FOUND

The authors found that the brace did, in fact, decrease hip impinging positions slightly during some functional tasks, though these changes did not translate to reductions in pain or improvements in patient-reported outcomes immediately or with 4 weeks of brace wear. The percentage of reduction in hip joint ranges of motion were large (18%-167%), however, the absolute changes in the range were small (2°-6°).

There were some limitations to this study, including a small sample size, and no long-term follow up. Though, a major limitation was that the population consisted mostly of individuals who had had persistent symptoms, therefore, slight changes in ROM may not be enough to elicit notable changes in pain.

Practical Takeaways

Aside from the above mentioned findings, this study also did not specifically assess the impact of the brace during sport and leisure activity; only stair ascent and descent and a single leg squat. If the brace did not appear to have significant impacts on pain or patient-reported outcomes in these lower impact movements or after wearing it for 4 weeks, then one could deduce that this holds true in higher impact/ athletic tasks as well. What is more, a recent consensus statement on FAI reported that there is no high-level evidence to support any one method of conservative treatment over another (see link below).

For the coach and clinician, this information is helpful for properly educating athletes and patients who are looking into bracing as a means of managing an issue that may be impacting their training and performance. For those that think it could be a "quick fix" during lifting and/or sport activity, you can be confident in informing them that the brace may help their body to avoid some of the positions that tend to aggravate their hip, but that it may or may not alleviate symptoms.

This is not to say that the SERF brace could not be appropriate for a subgroup of the population. For those individuals who perhaps only have symptoms with functional tasks such as squatting or stair climbing, the SERF may function nicely. This study was also the first to measure immediate effects of the brace on both kinematics and symptoms, where previous research has focused on effects over time only.

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

Steph's Comments

"I think that often we reach for techniques or equipment that we feel may quickly alleviate pain or injury or that will put us at an advantage in sport. However, such techniques and equipment do not exist. This study is a good example of where a medical device or piece of equipment can be intended to solve a problem that is likely not so simple. A quote from the discussion of this study really summarised the concept that FAI pain is multifactorial (as it is with most injuries), and I think it can be extrapolated to many injuries:

...although pain symptoms in FAI are well-characterized, the precise pathophysiological mechanisms of pain and functional limitation in FAI are not well-understood and as such might not be influenced by this biomechanical intervention. (pp. 4).

Regardless, studies such as this one help to direct future research and to continue the conversation among professions so that ultimately, a common ground and current best practice is agreed upon."

Infographics

A round-up of our monthly research infographics.

CHRONOLOGICAL, BIOLOGICAL, AND TECHNICAL TRAINING AGE

Solomon, M. (2018) Science for Sport.

COMPRESSION GARMENTS

Solomon, M. (2018) Science for Sport.

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CHRONOLOGICAL, BIOLOGICAL & TECHNICAL AGE

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Grouping

In most circumstances, particularly in team sports, athletes are grouped based purely on their chronological age. Though this is very common, it can be problematic for a multitude of reasons.

Chronological age

Chronological age is simply the age of the individual by date of birth.

Issue

There may be large variance between individual abilities, which is often exaggerated in young athletes due to differences in their biological and psychological maturity.

Application

Grouping by chronological age may limit the physical potential of the athletes by potentially increasing risk of injury, reducing inter-group competition and generating distractions. Alternative methods may be used in order to cater for each individual's own training necessities.

Biological age

Analysing the biological status of a young athlete is typically done by calculating the maturity offset of the individual.

Application

By measuring the maturity offsets, training groups can be structured according to their biological status.

Training age

Training age purely refers to the total training time/ experience the athlete has in that aspect of training.

Application

Some qualities may need to be further broken down, for example, an athlete may have 5 years of strength training experience, but no experience performing plyometrics.

Our Summary

Rearranging athletes' training schedules to suit their biological and training age may be a worthwhile investment, if it benefits the physical well-being and development of the athletes.

For the full article check out the Science for Sport website

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COMPRESSION GARMENTS

SCIENCE for SPORT

Key information

The current body of research into compression garments (CGs) is of low-quality and riddled with inconsistencies and therefore should be accepted with caution.

What are they?

Tight, compressive forms of clothing, often made out of elastin and nylon, which are designed to enhance recovery

Do they work?

Many theories as to how CGs may work have been suggested.

Inflammation

Applying external pressure is thought to reduce inflammatory response and the experience of pain. A lack of evidence means this theory remains uncertain.

Creatine Kinase (CK)

Large inconsistencies exist in the literature, some studies suggest CGs can lower CK concentrations, others do not.

Exercise perception

Studies show that CGs have little effect on ratings of RPE, suggesting that they may only have a limited placebo effect on recovery.

Cardiovascular

Evidence suggests that compression garments have no benefit on the delivery and utilisation of oxygen during exercise, however evidence does suggest they may improve sub-maximal running economy.

Proprioception

Compression bandages may improve proprioception by the external pressure acting upon receptors within the skin, however this theory has not been directly tested on compression garments.

Strength & Power

A 2013 meta-analysis concluded that CGs can improve chronic recovery of muscle strength and power between training sessions.

Our summary

CGs can have a positive effect on recovery and performance, with no evidence to suggest any negative side effects. There is currently no research on how to optimise CG.

For the full article check out the Science for Sport website

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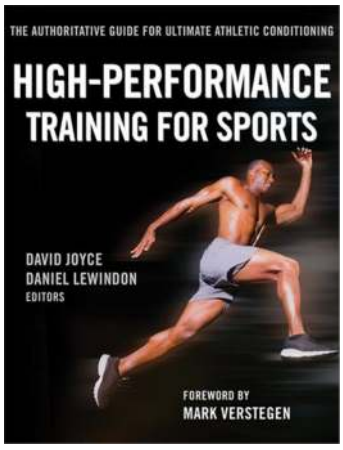

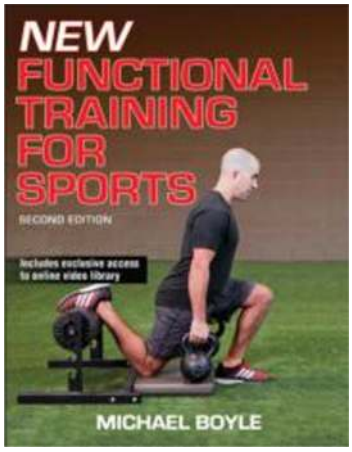

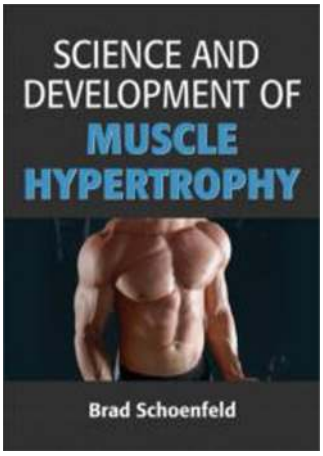

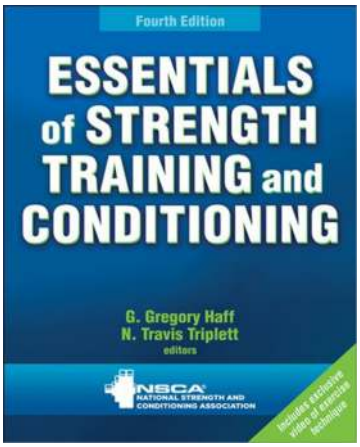

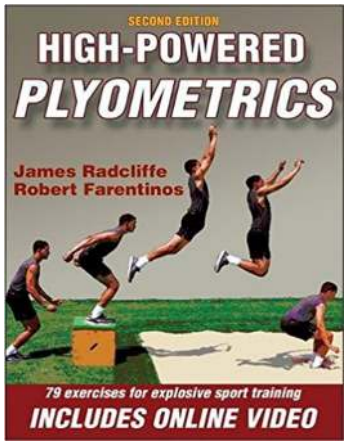

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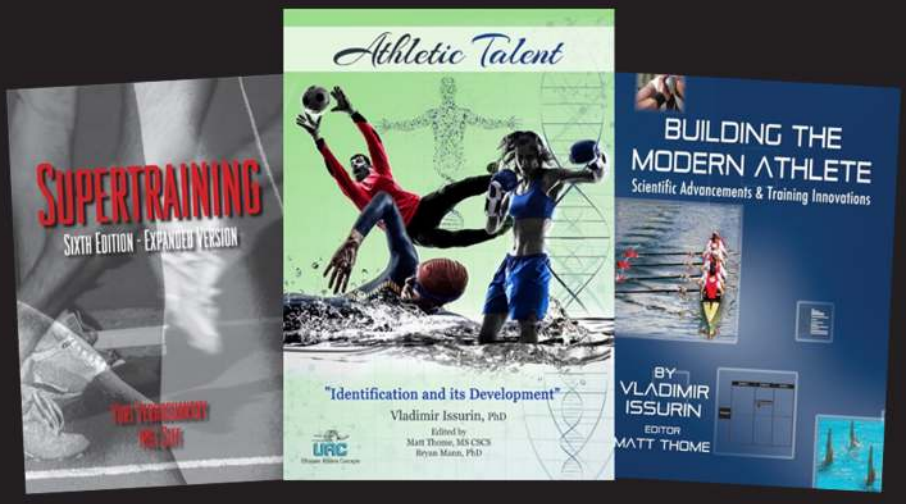

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Thanks for Reading!

The next issue will be published on
1st January, 2019.

Did you like all the great content in this issue?

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Warm Regards
Science for Sport