August 2017 | Issue #11

THE PERFORMANCE DIGEST

A review of the latest sports performance research

Contents

Click a topic to jump straight there

YOU'RE INVITED

MEMBERS ONLY GROUP

CHAT WITH OUR EDITORS AND OTHER MEMBERS

JOIN NOW

Welcome to the **PERFORMANCE DIGEST**

OWEN WALKER
Founder and Director of
Science for Sport

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

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

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

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

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

So, what's new?

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

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

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

Reviewers

The research reviewers for The Performance Digest.

Owen Walker
MSc*D CSCS

Chief Editor

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

Dr. Will Vickery
PhD

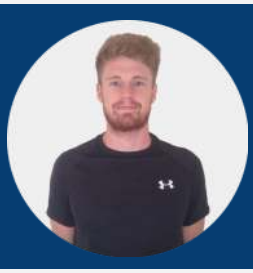
The Science of Coaching

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

Francisco Tavares
PhD Candidate MSc CSCS

The Science of Coaching

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



Owen Walker
MSc*D CSCS

Strength & Conditioning

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

Tom Green
MSc

Youth Development

Tom has an MSc in Applied Strength and Conditioning from Hartpury College, Gloucestershire. He previously ran the Hartpury Women's FC S&C programme for college and university athletes and supported the Great Britain Equine team.

James de Lacey
MSc

Technology & Monitoring

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

Tim Rowland
MSc ASCA L2

Nutrition

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

The Science of COACHING

Characteristics of coaches during training and match-play

[Abstract]

Observing the coach-created motivational environment across training and competition in youth sport.

INTRODUCTION

Coaches are expected to not only develop the physical and technical aspects of young athletes, but also the motivational, behavioural and social aspects of player development. A number of theories provide insight into the motivational strategies used by coaches in order to engage, empower, and develop their athletes, most notably the self-determination theory (SDT) and the achievement goal theory (AGT). The SDT focuses on the degree to which an athlete's behaviour is self-motivated. The AGT explains how an athlete defines or thinks about competence (i.e. ability). Depending on the type of motivational environment a coach is looking to create, this is typically linked with certain behaviours and characteristics which are, in turn, related with how these coaches communicate with their athletes, provide instruction, feedback, praise, for example. The current study looked to compare the characteristics of coaches during soccer training and matches from the perspective of these motivational theories, to determine if coaches of young athletes behaved in a different manner during training and match-play.

WHAT THEY FOUND

During training sessions, a more empowering environment which involves acknowledging the athlete's perspectives and input, engaging in non-instructional conversation, recognising and emphasising improvement, as well as encouraging initiative and intrinsic feedback, was created by coaches. This simply meant that the coaches encouraged more player input during training sessions, were more approachable towards their young athletes, and provided specific and individual feedback to players.

In comparison to this, coaches displayed more disempowering characteristics during matches. This included using controlling language, using extrinsic rewards, devaluing athlete's perspectives and encouraging inter-team rivalry. This meant that the coaches did not provide opportunities for each player to provide input into sessions or have choices, showed less concern for each player's development and well-being, and punished any mistakes that were made by players.

Overall, coaches provided more opportunities for autonomy-support, task/mastery goal orientation, supporting relatedness and structure during training. During matches, however, coaches were more controlling, focused more on ego goal orientation, and reduced/prevented the relatedness between the coach and the athlete.

WHAT THIS MEANS

Coaches tended to be more empowering during training, meaning they allowed for more player freedom whilst creating an environment which allowed athletes to focus more on mastering a skill or task. Creating an empowering environment can lead to more self-motivating behaviours amongst athletes, such as more enjoyment, and less resistance to training.

However, during match-play, coaches tended to be more disempowering which meant that they were more controlling in their behaviour and created an environment which focused on ability and rivalry amongst players. Disempowering environments are more likely to lead to higher levels of dropout amongst athletes, as well as a lack of self-motivation. This suggests that during training coaches were more inclined to allow athletes involvement within the training session to interact with the coach, whereas during a match, coaches were trying to regulate what was happening almost entirely.

Practical Takeaways

Ideally within a youth or development setting, coaches should look to create a similar environment both at training and during matches; however, this doesn't appear to be the case. The results of this research show the characteristics that coaches of young athletes should ideally look to display during both training and match-play if wanting to create self-motivated, empowered athletes who focus on mastering their skills. To make sure coaches are aware of the behaviours they use during training and match-play, coaches should be encouraged to regularly reflect upon their own coaching performance, and not just the performance of their players.

Dr. Will Vickery

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

Strength & Conditioning

This month's top research in strength & conditioning.

ASYMMETRY BETWEEN LIMBS: DOES IT REALLY MATTER?

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

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

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

CONCURRENT TRAINING: DOES RESISTANCE TRAINING AFFECT ENDURANCE DEVELOPMENT?

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

[Abstract]

Asymmetry between limbs: Does it really matter?

OBJECTIVE

The purpose of this review was to examine the effects of inter-limb asymmetries (i.e. differences between limbs) and their impact on physical (e.g. running and jumping) and sport-specific performance (e.g. swimming, kicking, and cycling).

WHAT THEY DID

In a classic systematic review fashion, the researchers conducted a preliminary search of Medline and SPORT Discus in order to locate published articles related to inter-limb asymmetries and physical performance. After the filtration process, 18 studies met the inclusion-exclusion criteria and were included in this review.

WHAT THEY FOUND

The results from this review suggest that inter-limb asymmetries in strength may be detrimental to jumping, kicking and cycling performance. Given the lack of available evidence, it is unclear whether jumping-based asymmetries have any effect on change of direction speed. Again, when assessing other elements such as anthropometry (e.g. muscle size), sprint speed, and dynamic balance, the results from various different studies are very mixed.

Further research, including randomised control trials - whereby training interventions which focus on increasing asymmetries or decreasing asymmetries and their effects on performance are administered - should be a focal point for improving our understanding of this topic.

Practical Takeaways

Current arbitrary guidelines for between-limb performances are often thought to ideally be less than 10% of one another. For example, if an athlete jumps 40cm in a single-leg countermovement jump, but only 32cm using their left leg, this would indicate an inter-limb asymmetry of 80% (32 / 40 * 100 = 80). So, the question here would be: should we attempt to reduce this asymmetry?

Some studies have shown that kicking accuracy and resultant ball speed is negatively affected by larger asymmetries, suggesting that reducing the asymmetry 'may' improve kicking performance. However, in my opinion, attempting to measure a complex skill such as kicking a ball and relating it to limb strength is always going to be problematic. Athletes are often better at kicking with their dominant leg due to several neurophysiological adaptations/skills which are specific to that movement (e.g. intra-musculature coordination and the magnitude and direction of force production). So to me, a score on a balance, or strength test, will have little validity with kicking a ball.

With regards to return to play parameters (e.g. ACL rehabilitation), I believe the context is very different, and I would most certainly be looking for a base level of symmetry in things such as balance, strength and power. And although there is minimal research supporting it, I believe symmetry of less than 10% is an acceptable range, in most cases.

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

Owen's Comments

"Although the findings of this study were not particularly sexy, it does provide you with a clear understanding of what we currently know, and don't know, about inter-limb asymmetries. For example, it's not uncommon for a rugby strength and conditioning coach to determine jump performances of both the right and left leg. If the coach observes a significant right vs. left leg difference (i.e. inter-limb asymmetry), do they concern themselves about reducing this asymmetry? And if so, what is an 'acceptable' level of asymmetry (e.g. <10% or < 20%)?

Well, that was the exact aim of this review paper, and the results really are a back-and-forth debate with no clear answer, at least for now. In certain circumstances, for example, ACL rehabilitation, I personally see great merit in gaining as much symmetry as possible for some basic parameters (e.g. isokinetic strength, balance, and power). For example, if an athlete can't perform simple tasks such as a Y-Balance test with an acceptable degree of symmetry, what sort of risk are they at if they're required to perform a highly-coordinated task - combining both speed and force - such as jumping and landing on one leg?"

[Abstract]

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

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

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

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

Practical Takeaways

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

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

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

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

Owen's Comments

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

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

[Abstract]

Concurrent training: Does resistance training affect endurance development?

OBJECTIVE

The primary aim of this study was to examine the impact of single, or multiple bouts, of resistance training and its effects on both acute and chronic endurance performance and development. The authors also examined the potential mechanisms which may be responsible for any reduction in endurance performance as a result of prior resistance training.

WHAT THEY DID

In a methodical manner, the authors fragmented the implications of resistance training on endurance performance into various sub-sections. In a literature review fashion, the authors reviewed the current body of research.

WHAT THEY FOUND

The conclusions of this study suggest that not only does resistance training impair muscular contractility via disruptions to various neurophysiological mechanisms (e.g. rate coding and glycogen depletion), but it also suggests that even a single bout of resistance training can negatively affect subsequent endurance performance as a result of residual fatigue. Consequently, resistance training-induced fatigue may reduce the quality of subsequent endurance training sessions, and ultimately, limit the degree of adaptation and improvement in endurance performance.

Practical Takeaways

For those working in an elite full-time environment, whereby athletes are training 1-2 times per day, the concept of them training with a certain degree of residual fatigue is probably something that has already crossed your mind. However, how much of an impact this has and what you're doing to mitigate it is another consideration altogether. If you're a coach working within a sport which has a high endurance demand, you may wish to consider which order your sessions are placed on any given day (e.g. session 1: resistance training; and session 2: endurance/technical), and even between days (e.g. Monday vs. Tuesday); you may even cycle the daily session calendar based on the current training phase objective (e.g. work capacity or maximal strength).

If the primary objective of the training programme is to improve endurance capacity, practitioners should not only consider the order in which their sessions are planned, but also the between-session recovery modality (e.g. cold water immersion) and the content, volume, and intensity of the preceding session; as reductions resistance training-induced fatigue can last in the range of 72-hours. For example, conducting intense eccentric training before an endurance session is likely to have significant detrimental effects on the athlete's endurance performance. Likewise, between-session cold water immersion may help to reduce the negative impact of the residual fatigue.

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

Owen's Comments

"Whilst this article was not a systematic review or a meta-analysis, it does still provide a strong amount of insight into this topic. To add to this, it is also not suggesting developments in endurance performance are not still achievable when resistance training is performed before endurance sessions, it is simply highlighting that the amount of adaptation may be lower when resistance training precedes endurance training.

Research still has a long way to go before we can fully understand the 'interference effect' of concurrent training and the best way to deal with it, especially in the realms of how it may impact chronic endurance development, but all we need is time."

Technology & Monitoring

This month's top research on technology and monitoring.

CAN WE ACCURATELY ESTIMATE HOW MANY REPETITIONS WE HAVE LEFT IN THE TANK?

Hackett, D, Cobley, S, Davies, T, Michael, S, & Halaki, M. Journal of Strength and Conditioning Research, 2017, 31 (8):2162-2168.

WEARABLE RESISTANCE TRAINING: IS WEARING THE WEIGHT BETTER THAN LIFTING IT?

Marriner, C, Cronin, J, Macadam, P, & Storey, A. European Journal of Sport Science, 2017: 1-9.

NICOTINE AND PERFORMANCE: A FRIEND OR FOE?

Mundel, T., Sports Medicine, 2017.

[Abstract]

Can we accurately estimate how many repetitions we have left in the tank?

OBJECTIVE

To access the accuracy in estimating repetitions to failure (ERF) during resistance exercises, and if it is affected by training status, sex, or exercise type.

WHAT THEY DID

81 adults aged 18-60 (men = 53; women = 28) with a wide range of resistance training experience (<6 months to >3 years). Subjects performed up to 10 sets of 10 repetitions for the machine chest press and leg press at a 70% and 80% 1RM. After being familiarized with the ERF scale in a previous session along with 1RM testing, subjects completed 10 reps at each intensity, then paused and reported an ERF on a scale of 0 to 10. After the pause, subjects proceeded to actual repetitions to failure (ARF).

WHAT THEY FOUND

The lower the ARF, the more accurate the reporting of ERF. Greater accuracy was seen for the chest press vs. the leg press, and for men compared to women. The authors also concluded that resistance training experience didn't affect the accuracy of ERF, but this did not reach significance (p = 0.134).

Practical Takeaways

ERF is a tool that can be used by coaches or athletes alike with, or without, percentage based training. ERF could potentially be used to autoregulate training to alleviate fatigue or monitor physical exertion during certain exercises. Furthermore, ERF can be used to monitor individuals between sessions by giving an insight into how they are responding to the current training programme. It is important to note that the use of ERF takes practice and should be assessed periodically throughout the training program, potentially through repetition maximum testing as not to detract from the training program.

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

James's Comments

"I personally use ERF in the training programmes I prescribe for my rugby athletes, but in RPE form as per Zourdos, Helms etc. I find it's a perfect way to get athletes straight into training without performing 1RM testing, especially when athletes aren't ready for it. It can be difficult prescribing the same ERF for multiple sets due to fatigue in subsequent sets, meaning load has to be decreased. Prescribing ERF for the final set and allowing the first set to have a greater ERF can be a way to alter that. Alternatively, the coach could use a step loading method where ERF decreases throughout the sets."

[Abstract]

Wearable resistance training: is wearing the weight better than lifting it?

OBJECTIVE

To compare the effects of five weeks of traditional (TR) power clean training with training that redistributed loading via wearable resistance (WR) from the bar to the body on power clean and CMJ performance.

WHAT THEY DID

16 male subjects were randomly assigned to either a 12% body mass WR group, or a TR group. Both groups had 5 years of resistance training experience. The WR group wore a Lila Exogen suit instead of a traditional weighted vest as the Exogen suit could be worn without inhibiting movement during the power clean. Load was distributed evenly on the entire back, glutes, and hamstrings. An undulating periodised approach was used during the 5 week intervention where subjects trained 3x per week.

WHAT THEY FOUND

The WR group improved CMJ performance by 8.7% compared to a slight decrease in the TR group by 1.4%. The WR group also showed greater improvements in power clean performance of 4.2% compared to the TR group of 1.8%.

Practical Takeaways

Based on these findings, training with WR may be a great way to improve power clean and CMJ performance with a reduced load in the hands. This could be a way to improve an athlete's power clean if they struggle technically, simply by reducing the load on the barbell and redistributing it onto the body so loading is still maintained.

However, an Exogen suit is not a very practical piece of equipment to acquire for most coaches and wouldn't be practical in a team sport setting. More cost effective ways of improving lower body power and CMJ may be easier to implement when budget and number of athletes are a concern, such as various jumps and throws.

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

James's Comments

"I really like this concept of replacing barbell weight with wearable resistance. For players that have injuries or niggles, this can be a great way to reduce the weight in the hands while still maintaining the required loading. This seems most useful during the power clean as the wrists can take a beating, especially in athletes that don't have mobile wrists. Reducing the load in the hands can potentially spare the wrists while the loading benefits of the exercise can be maintained through WR."

[Abstract]

Nicotine and performance: a friend or foe?

OBJECTIVE
To document nicotine use across sports and athletes, discuss pharmacology and mechanisms, review studies that have performance as a measure, and to consider important issues that should dictate further research efforts. For the purpose of this review, the focus will be on nicotine and performance.

WHAT THEY DID
A narrative review was conducted whereby peer-reviewed articles were found using the PubMed database and Google Scholar search engine. Studies were excluded when interventions exclusively involved tobacco smoking or smokers. Overall, ten published studies have used 16 separate measures of performance; 3 studies assessed muscular strength/power, 5 assessed endurance and 4 assessed high-intensity exercise.

WHAT THEY FOUND
Athletes who use nicotine for sports performance believe that it prevents dry mouth, controls weight, improves reaction time and concentration, and helps with relaxation. Only 1 of the 3 studies observed an ergogenic effect on muscular strength and power with nicotine (peak leg extensor torque increase by 6%). Only 1 of 5 studies on endurance demonstrated an ergogenic effect with nicotine (improved endurance time by 17%) and only 1 of 4 studies on high-intensity exercise demonstrated a positive effect (improved pacing strategy).

Practical Takeaways

It is not uncommon for athletes in team/strength sports (e.g. American football, ice hockey, wrestling, bobsleigh, gymnastics, rugby, skiing) to consume smokeless tobacco in the form of chewing gum, snus (placed under the lip without the need for spitting), or snuff (inhaled through the nose) as it is believed to have psychostimulatory and sympathomimetic effects. However, the use of nicotine is currently prohibited by the World Anti-Doping Agency.

The majority of the research has demonstrated nicotine to have little, to no, effect on muscular strength and power, endurance and high-intensity exercise. Furthermore, two performance measures showed positive effects from nicotine, whilst the other two reported negative effects. Based on this review, it currently appears that nicotine is unlikely to significantly influence performance, and using it may have positive or negative effects.

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

James's Comments

"Based on this review, it appears that nicotine can potentially have either a positive or negative effect on performance, meaning it may be something to steer clear from; especially since it is on the World Anti-Doping Agency's prohibited list. There are many other proven supplements an athlete could use in order to enhance areas of performance when looking to seek out that extra 1 or 2%.

It is also worth noting that whilst the effects of this supplement currently appear to be minimal, there is still a significant lack of high-quality research in order for us to have any substantial knowledge of its impact, both from a performance and health standpoint."

Fatigue & Recovery

This month's top research on fatigue and recovery.

CLUSTER VS. TRADITIONAL SETS FOR PERFORMANCE MAINTENANCE

González-Hernádez, J. M., et al., (2017). The Journal of Strength & Conditioning Research.

ICE-BATHS VS. BODY FAT: WHO SHOULD STAY IN THE LONGEST?

Smith BE, Hendrick P, Smith TO, Bateman M, Moff att F, Rathleff MS, Slfe J, and Logan P. Br J Sports Med. 2017.

RECOVERY MODALITIES IN ELITE VS. AMATEUR SPORT: WHAT ARE THE DIFFERENCES?

Tavares F, Healey P, Smith TB, Driller M. Perform Enhanc Heal., 2017.

[Abstract]

Cluster vs. traditional sets for performance maintenance

OBJECTIVE

The goal of this study was to compare the mechanical, metabolic, and perceptual responses between two traditional, and four cluster, resistance training protocols on the full squat exercise.

WHAT THEY DID

Eleven men performed 6 different single resistance training set-protocols sessions using the full squat exercise. The set-protocols comprised of 2 traditional (TR1: 3x10; TR2: 6x5) and 4 clusters (CL1: 3x10 [10sec between rep]; CL2: 3x10 [15sec between rep]; CL3: 3x10 [30sec between rep]; CL4: 1x30 [15sec between rep]).

WHAT THEY FOUND

The TR1 lead to greater perceptual, mechanical, and metabolic markers of fatigue. Velocity was least affected by the CL2 and CL3 set configurations, whilst the CL3 demonstrated a lower level of lactate accumulation. No differences in fatigue perception were found between TR2, CL1, CL2 and CL3.

Practical Takeaways

Maintenance of mechanical output (i.e. force and velocity) is essential for training programmes designed to increase power. In this study, the authors compared different set-protocols and concluded that a set configuration consisting of 3x10 with 15- and 30-sec rest periods between reps were the best protocols for maintaining displacement velocity.

Moreover, the fact that the 3x10 with 15sec between-reps rest protocol resulted in a greater accumulation of blood lactate, indicates that it had a higher metabolic stress (one of the mechanisms that promote anabolic processes). In addition, the 3x10 with 15sec rest protocol resulted in a shorter training duration, therefore, increasing the efficiency of the training session. However, it is also important to mention that this protocol reduced the time under tension (another key mechanism responsible for promoting anabolic processes), therefore, it may be useful for maintaining velocity, but limited in its ability to increase muscle size.

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

Francisco's Comments

"This study was well designed, although the "strength-trained male students" is too vague to understand the training background of the subjects. As previously mentioned, when the goal is to increase muscle power, it is well accepted that mechanical outputs are a key marker of the quality of the session (i.e. one's ability to maximise and/or maintain velocity, for example).

The strong relationships between muscle size and maximal strength, and between maximal strength and power, are well described in literature. Adaptations in muscle size occurs from a combination of different mechanisms (read **HERE**) resulting from two key variables: 1) load; and 2) time under tension. Therefore, if the goal is to increase muscle mass (in order to increase maximal strength and power), a denser protocol may be more beneficial. In addition, the recruitment of larger motor neurons (that innervate muscle fibres with high potential for hypertrophy) during fatigue (e.g. TR1 vs. CL3) can also lead to a greater anabolic response.

I think it would be interesting to see another study replicate the design of this one, but also include measures of muscle activity and other markers of anabolic processes. Ultimately, this would enhance our current knowledge of different set configurations."

[Abstract]

Ice-baths vs. Body fat: who should stay in the longest?

OBJECTIVE

The goal of this study was to examine the influence of body composition (body mass and fat mass) on blood flow and core, skin, and muscle temperature responses to cold water immersion (CWI), hot water immersion (HWI) and control (CON).

WHAT THEY DID

The researchers divided 27 male participants into three body composition groups: low mass and low fat (LM-LF); high mass and low fat (HM- LF); and high mass and high fat (HM-HF). In a randomised counterbalanced order, all participants were exposed to the three experimental conditions (CWI, HWI, CON), each separated by 7 days.

WHAT THEY FOUND

The rate of decrease in muscle and core temperatures after CWI were greater in the LM-LF compared to HM-HF group. No differences in skin, core, or muscle temperature and blood flow responses were observed between the body composition groups for CON or HWI.

Practical Takeaways

The main findings from this study were that differences in body composition alter the thermal response to post-exercise CWI. The rate of decrease in muscle and core temperatures within subjects with higher fat masses are lower in comparison to subjects with lower fat masses. In other words, individuals with a lower fat mass appear to experience quicker drops in temperature than those with more body fat.

Although it is impractical and invasive to measure core and muscular temperature, practitioners can rely on the results from this current study to anecdotally adapt protocols. The intensity of cold water immersion protocols can be increased by the exposure duration and/or decreases in water temperature. Given that superficial tissues cool and re-warm faster than deeper tissue (e.g. skin, muscle, and core), one can use a greater total exposure duration while dividing the total time into 2 sets. For example, within a squad, the low-fat mass group can use a 1x15min protocol, while the high-fat mass group use a 2x10min protocol.

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

Francisco's Comments

"This study supports the idea that recovery modalities, in particular cold water immersion, need to be individualised according to athlete's body composition characteristics. This is particularly important in sports where differences in body composition characteristics are notorious (e.g. Rugby, American Football).

This study demonstrates that the relationship between body surface area and body mass, is an important factor as it influences thermal and physiological responses to CWI. Assuming that physiological responses from cold modalities are attributed to a decrease in the muscle and core temperature, the results from this study demonstrate the need for individualise cold water immersion protocols. For example, athletes with a higher percentage of body fat may require longer immersion times in order to obtain the same physiological effect as their counterparts with lower body fat. Unfortunately however, at this point – due to a lack of research – we do not know how much more they may require, if any."

[Abstract]

Recovery modalities in elite vs. amateur sport: What are the differences?

OBJECTIVE
The goal of this study was to compare the implementation frequency and perceptual understanding of different recovery modalities between elite and amateur Rugby athletes.

WHAT THEY DID
The authors surveyed 32 elite and 26 amateur Rugby athletes on the perceived effectiveness (1-5 scale) of 15 different recovery modalities (cold baths, active recovery, hot baths, massage, contrast baths, compression garments, sauna, pool recovery, cryotherapy, electromyostimulation, additional sleep, nonsteroidal anti-inflammatory drugs, stretching, hyperbaric oxygen therapy, peristaltic pulse dynamic compression), the number of athletes implementing each recovery modality, and the number of times each modality was used by the individual. In addition, athletes were also questioned (using a 1-5 scale) on how important they consider recovery for enhancing performance.

WHAT THEY FOUND
Both elite and amateur athletes perceive recovery equally important to enhance performance. However, the elite group perceive active recovery, massage, pool recovery, additional sleep, and stretching to be significantly more effective in comparison to the amateurs. Stretching, cold baths, active recovery, compression garments, massages and pool recovery are the most used recovery modalities in the elite group with >90% of the athletes using it.

In the amateur group, the most frequently used recovery modality is stretching, followed by cold baths – with 77% and 54% of the athletes using these recovery modalities, respectively. In comparison to the amateur athletes, elite athletes use significantly more recovery modalities and implement them more often during the week.

Practical Takeaways

The fact that both groups perceived recovery as being extremely important to enhance performance (Elite: 5.0; Amateur 4.9) reinforces the need to implement strategies and opportunities that promote recovery. However, as discussed by the authors, given the current research pointing to the potential harmful effects of some modalities (e.g. cold baths), recovery methods should be adequate to the needs of the players and to the training schedule.

In this study, the authors collected information from the training schedule of the elite and amateur group. Briefly, the amateur group have 6 training sessions (all PM) and one game during the week, whilst the elite group have 12 training sessions (AM and PM) and one game. The differences in the training volume, in particular on the Rugby training volume in the elite group (~3h15min higher), and the fact that elite athletes train in the evening followed by a next day morning session, results in a reduced time frame for recovery between training days. Therefore, the higher frequency and higher number of different recovery modalities implemented by elite Rugby athletes can be justified by the need to enhance recovery.

When the time to recovery is short and freshness (e.g. to compete, to produce higher power outputs, etc.) is needed, coaching staff should implement several recovery modalities.

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

Francisco's Comments

"This study reinforces the differences in the perception and implementation of recovery modalities between amateur and elite athletes.

In conjunction with the former review on body composition and CWI, this study highlights the individual responses (e.g. mechanical and physiological) to a given recovery modality. This, therefore, reinforces the need for an individual approach to recovery, rather than a "one fit all" programme. Perhaps, a study simultaneously investigating the individual responses to a recovery modality, with the perceived effectiveness, would demonstrate some degree of relationship between these variables. "

Youth Development

This month's top research on youth development.

PLYOMETRIC TRAINING FOR OVERWEIGHT CHILDREN: A GOOD OR BAD IDEA?
Nobre, G.G., de Almeida, M.B., Nobre, I.G., dos Santos, et al.. (2017) The Journal of Strength & Conditioning Research, 31 (8), pp.2091-2099.

USING AGE RESIDUAL SCORES TO REMOVE THE AGE BIAS DILEMMA
James, R.S., Thake, C.D. and Birch, S.L., 2017. The Journal of Strength & Conditioning Research, 31(8), pp.2100-2109.

ECCENTRIC TRAINING: DO CHILDREN RESPOND DIFFERENTLY TO ADULTS?
Deli, C.K., Fatouros, I.G., Paschalis, V., Georgakouli, K., Zalavras, A., Avloniti, A., Koutedakis, Y. and Jamurtas, A.Z., 2017. Pediatric Exercise Science, pp.1-26.

[Abstract]

Plyometric training for overweight children: A good or bad idea?

OBJECTIVE
The aim of this study was twofold: 1) to identify if a plyometric training programme would be successful at reducing the body composition of overweight/obese children; and 2) how this programme would affect motor performance in 7 to 9 year olds.

WHAT THEY DID
The sample was randomly assigned into 2 groups: 1) a plyometric training group (n = 40); and 2) a control group (n = 19). Training consisted of 2 sessions a week for twelve weeks with a duration of 20-minutes per session. Health related fitness qualities were measured by handgrip strength, standing long jump, curl-ups, sit and reach, square test, running speed, and a mile run test. Gross motor performance was evaluated using the Körperkoordinations test Für Kinder (KPK) for body coordination. Other measures, such as mass, stretch stature, BMI, and triceps and subscapular skinfold measurements were taken.

WHAT THEY FOUND
Those in the plyometric group showed an increase in fat free mass (p = 0.011) compared to the baseline values with a small effect size. Plyometric training improved other qualities, such as hand strength, sit and reach scores, curl ups, agility, and time in the mile run tests. The plyometric training group showed better performance in all tests that measured gross motor coordination results (balancing, single-leg jumping, lateral jump, and jumping side to side). Therefore, 12-weeks of plyometric training improved health related fitness and motor performance in 7 to 9 year old boys who were overweight.

Practical Takeaways

Children who are overweight or obese can safely benefit from jumping and hopping tasks when performed twice a week for 20-minutes over a 12-week period. Given our limited access to youth health and development, this relatively short time frame, coupled with improvements in strength, power, agility and aerobic ability is perfect to integrate into programmes with relative ease.

This progressive programme consisting of unilateral and bilateral jumps proved effective at improving body composition and physical performance, both of which are important for preventing long-term decrements in health associated with being overweight and obese. Repetitions moved from 50 to 60 in weeks 1-4, and subsequently increased by 10 repetitions every week, totalling 120 reps by week 12. Jump heights were also varied, from 10-40cm depending on the athlete's competencies and abilities.

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

Tom's Comments

"It is important to understand that alterations in height and seated height are most likely due to normal growth (around 3cm after 12 weeks) seen in both groups. Physical growth can be accompanied by an increase in performance, and so, the important message here is that it becomes difficult to directly link this intervention to the results when such intra -individual differences are present from pre- to post-test. Nevertheless, these results will be relatively 'global', supporting their use in practice.

In addition to being enjoyable, plyometric training has been consistently shown to be an effective training modality. As such, they can be integrated into games, warm-ups, and resistance training, making this an interesting study to support practice. I found this an enjoyable read, with a clear and systematic approach to youth programming with the 'why' most importantly reinforced throughout the study."

[Abstract]

Using age residual scores to remove the age bias dilemma

OBJECTIVE
The aim of the this study was to investigate the relationships between various physical performance criteria used in young soccer players (11-17 years), and to consider the effect using age residuals (age-independent measures) on those relationships.

WHAT THEY DID
Sixty male soccer players between the ages of 11-17 underwent measures of anthropometry (ISAK Guidelines), muscular power (CMJ), strength (hand grip strength), sprint speed (30m) and agility (T-Test). These scores were then evaluated using regression analysis to see the correlation between performance output and age, with the aim to create performance criteria for an individual based on their current age.

WHAT THEY FOUND
All performance and anthropometric variables measured in this study were found to be significantly correlated with greater age. One method identified to deal with this in the present study, was to look at the variation in an athlete's performance that is independent of age by converting each player's performance to an age residual score.

Practical Takeaways

By removing the age bias - as performed in this study - it is suggested that key talent would not be missed. This is important for coaches and talent development schemes, as it provides them with more information about their athlete's developmental context. Careful monitoring over time would allow the coach, or manager, to make more informed decisions regarding talent development and the likelihood of long term success. Although these measures may not guarantee that talent is identified, it may better equip practitioners to make more educated decisions in talent ID and selection processes.

As each variable (e.g. strength and speed) is significantly affected by age, the age becomes an influencing factor for any analysis of player performance. To combat this, this study recommends that the confounding effect of age can be eliminated by the use of age residuals. By converting each player's performance to an age residual score, it was clearer to the coach those who were 'better' or 'worse' than the score predicted using regression analysis for their chronological age. After doing this, coaches could highlight those who had a relatively high physical fitness for their age, a common selection method utilised by talent ID schemes.

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

Tom's Comments

"A key goal of national governing bodies and talent identification schemes is to find athletes who are most likely to excel in the future. However, current methods of identification are made challenging when factors such as maturity and the relative age effect are present. As this study didn't take maturity status into consideration, it may be worth considering this when previous findings (**HERE** and **HERE**) have shown a correlation effect in physical performance. Furthermore, this study did not evaluate skeletal age or aerobic ability, which can be a limiting factor in soccer and other sports.

In my opinion, coaches, teachers and parents often have busy lifestyles and work schedules and should be able to read an article and leave with a clear sense of 'what to do' and 'how to do it'. It took me several attempts of reading this study to truly understand its purpose. Furthermore, I believe that if a coach is collecting performance scores and maturity offset data, the same conclusion could be drawn if the coach has the luxury to analyse the data."

[Abstract]

Eccentric training: Do children respond differently to adults?

OBJECTIVE
A majority of research that has focussed on eccentric (lengthening) contractions often study an adult sample. However, this study aimed to evaluate the exercise-induced muscle-damage responses in adults compared with children to support our understanding of youth responses to lengthening muscle contractions.

WHAT THEY DID
This study investigated the response of 5 sets of 15 maximal eccentric knee extensor contractions on range of motion (ROM), delayed onset muscle soreness (DOMS), peak isometric, concentric and eccentric torque before, post, 24, 48, 72 and 96 hr post exercise between a youth (n = 11, age =10-12) and adult (n = 15, age = 18-45) sample. Creatine Kinase (CK) activity was also assessed via blood sampling before- and post-exercise (72 hrs).

WHAT THEY FOUND
After the data was normalised, both boys and men experienced a similar load (% body weight) to mitigate reliability issues. Muscle soreness (DOMS) was experienced in both men and boys after exercise. DOMS during the squat in men was greater and more extensive, peaking at 24-48 hours and persisted for 96 hours. In boys, DOMS peaked immediately (4-5 hours post) and remained for up to 24 hours. Similar to the above, men also experienced more soreness during walking than boys. Eccentric training limited ROM from pre-post in both boys and men, which declined immediately after exercise and lasted for 24 hours.

Absolute isometric peak force was greater in men than boys throughout the entire study, and decreased in both men and boys after an eccentric exercise protocol. Eccentric exercise affected mens', but not boys', absolute concentric peak torque. Men's absolute concentric peak torque decreased post and up to 48 hr following eccentric exercise; in contrast, boys' absolute concentric peak torque was not affected. The same results were reported for absolute eccentric peak torque.

Baseline CK was similar between men and boys, respectively. Eccentric exercise affected men's, but not boys', CK activity. Men's CK activity increased at 72 hr after eccentric exercise, while no significant changes were observed in boys. Furthermore, at 72 hr after eccentric exercise, men's CK activity was greater than that of boys.

Practical Takeaways

The results of the study indicate that age is a contributing factor to severe muscle damage in men compared to boys. Eccentric protocols create more intense and prolonged changes to muscle damage markers for several days following this protocol. This suggests that with regards to muscle soreness, there is a clear difference between adults and children. However, this study indicated that an eccentric training protocol may be ethical for children and could be utilised in physical activity or resistance training programmes.

For coaches, this suggests that acute soreness and limited range of motion may affect children more so than adults at 4 -5 hours after an eccentric training protocol. Therefore, children should be given adequate rest between training/ match sessions to ensure that the athlete is as 'fresh' as possible for their next performance. In addition, the current study indicates that body weight should be taken into consideration when assessing isometric, concentric and eccentric peak forces to prevent an overestimation of torque numbers produced by additional mass.

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

Tom's Comments

"As a coach who has worked with a vast array of youth athletes, these studies offer an interesting insight into the physiological responses to training. Contrary to recommendations made in youth literature, it may be evident that youth athletes can tolerate eccentric protocols, and so the question becomes: 'when is a good time to start?' Only one training session was performed in this study, so future research should focus on the effects of multiple sessions on the markers tested (e.g. DOMS).

Torque scores were higher in men, which may be explained by longer levers as a result of mature bone growth and adult skeletal structure. Another concern is the variation in the sampling age of adults (18-45). If age is a confounding factor in eccentric responsiveness as stated in this study, then this sample could have arguably been evaluated in itself (i.e. 18-25, 26-30 and 31-45). More studies need to be conducted to fully understand the programming needs for children. In addition, other studies should consider a female sample to help to shape practice across both genders."

Nutrition

This month's top research on nutrition.

THE IMPORTANCE OF A SPORTS DIETICIAN: ARE THEY WORTH THEIR MONEY?

Hull, M., Neddo, J., Jagim, A., Oliver, J., Greenwood, M. and Jones, M. (2017). Journal of the International Society of Sports Nutrition, 14(1).

"CALORIES IN, CALORIES OUT" AND MACRONUTRIENT INTAKE: THE HOPE, HYPE, AND SCIENCE OF CALORIES

Howell, S. and Kones, R. (2017). American Journal of Physiology - Endocrinology And Metabolism, pp.ajpendo.00156.2017.

KETONE SALTS: GOOD FOR WEIGHT-LOSS BUT NOT PERFORMANCE?

O'Malley, T., Myette-Cote, E., Durrer, C. and Little, J. (2017). Applied Physiology, Nutrition, and Metabolism, pp.1-5.

[Abstract]

The importance of a sports dietician: Are they worth their money?

OBJECTIVE
To examine differences between using a sport dietitian or a strength and conditioning coach as the main source of nutrition information on the dietary habits and practices of NCAA Division I baseball players.

WHAT THEY DID
This descriptive research study used a cross-sectional survey designed to assess dietary habits and nutrient timing practices in 99 male NCAA Division I baseball student-athletes from three different universities. Two of the three universities employed a full-time sports dietitian, whereas all three institutions employed a strength and conditioning coach. Descriptive statistics and Pearson X2 analyses were run on the results from these surveys.

WHAT THEY FOUND
Responses on dietary habits and nutrient timing items differed significantly between athletes who sought dietary advice from a sports dietitian (n = 36) versus those who consulted a strength and conditioning coach (n = 42). In terms of dietary habits items, the sports dietitian group ate more often before activity (92% vs. 71%), did not consume fast food (31% vs. 14%), caffeinated beverages (57% vs. 46%) or soda (56% vs. 37%) as much as the strength and conditioning group, prepared their own meals more often (86% vs. 73%), and took daily multi-vitamins (56% vs. 32%). In terms of nutrient timing items, the sports dietitian group ate breakfast before training/lifting sessions (67% vs. 37%), and had post-workout nutrition options provided (61% vs. 27%).

Practical Takeaways

The practical takeaways of this study primarily relate to the staffing or sporting organisations. If an organisation has room in their budget, hiring a sports dietitian is likely to help improve the athlete's performance. If this is not within budget limitations, it may be prudent to upskill the strength and conditioning staff to ensure they have a good understanding of the basics of nutrition, including concepts such as energy balance, macronutrients and micronutrients, pre-, intra- and post-workout nutrition, and supplements.

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

Tim's Comments

"This study shows that the sports dietitian is a valuable part of an intercollegiate athletics program. Athletes from the sports dietitian group consumed less high calorie/low nutrient-dense items, ate before exercise, and consumed healthier options post-exercise. Overall, the eating strategies and dietary plan provided by a sports dietitian may improve performance and enhance recovery, and therefore employment of a sports dietitian is certainly warranted in this setting."

[Abstract]

"Calories in, calories out" and macronutrient intake: The Hope, Hype, and Science of Calories

OBJECTIVE
To review the relationship between calories/energy balance and weight management, and critique the carbohydrate-insulin model of obesity. Furthermore, to review the determinants of energy balance and relationships to dietary macronutrient content.

WHAT THEY DID
The authors searched the literature to date on the topic of obesity in terms of its relationship to calories/energy balance and the carbohydrate-insulin hypothesis. They then presented a narrative literature review on these topics.

WHAT THEY FOUND
The carbohydrate-insulin hypothesis claimed that lowering dietary carbohydrate significantly should cause insulin levels to fall, leading to release of fat from adipocytes that would increase fat loss and increase energy expenditure to ≥350 cal/day. However, neither of these effects were observed in two recent and highly-rigorous metabolic ward studies.

Weight gain or loss is not primarily determined by varying proportions of carbohydrate and fat in the diet, but instead by the number of calories ingested. The effect of changes in energy expenditure and which metabolic pathways are used are quite modest when compared with caloric intake.

Practical Takeaways

Athletes who need to gain weight must ensure they are in a calorie surplus/positive energy balance (i.e. consume more energy than they expend). Athletes who need to lose weight must ensure they are in a calorie deficit/negative energy balance (i.e. consume less energy than they expend).

After protein intake is set (around 2g protein/kg bodyweight per day is an optimal target for most), the ratios of fat and carbohydrate in the diet to make up the remaining calories should be set according to personal preference, as long as there is adequate carbohydrate to fuel high-intensity exercise.

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

Tim's Comments

"This study highlights the importance of monitoring total caloric intake if weight management is a priority. Despite what is widely claimed (for example by proponents of ketogenic diets), it does not appear that the ratios of carbohydrate and fat intake have much of an impact on weight gain or loss. Because of this, carbohydrates and fats should be consumed in whatever ratios are preferable for the athlete. This flexibility will also help increase dietary adherence."

[Abstract]

Ketone salts: Good for weight-loss but not performance?

OBJECTIVE
To determine whether beta-hydroxybutyrate (β-OHB) ketone salts influence substrate utilisation during steady-state exercise, and to assess the impact of β-OHB salt supplementation on high-intensity exercise performance.

WHAT THEY DID
10 recreationally active males participated in two experimental trials involving pre-exercise consumption of nutritional ketone salts (0.3g/kg β-OHB; ketone) or flavour-matched placebo. Ketone salts were acquired from a commercially available ketone supplement (KetoForce). Supplements were consumed in the fasted state 30 min prior to cycling exercise consisting of three 5 minute stages at 30%, 60%, and 90% ventilatory threshold. Five minutes following steady-state cycling, participants completed by a 150-kJ cycling time-trial. A double-blind crossover design was employed, with trials separated by ~7 days. Respiratory Exchange Ratio (RER) was measured to determine substrate utilisation. Whilst for performance, time taken to complete time trial, and average power output (W) were measured.

WHAT THEY FOUND
RER was lower (indicating higher lipid utilisation) at 30% and 60% VT in the ketone compared with control condition. Total fat oxidation was greater in the ketone versus control. Average time-trial power output was 7% lower (−16 W) in the ketone condition, with the confidence interval ranging from a small to very large decrement in performance.

Practical Takeaways

For athletes competing in any sport or event requiring high-intensity efforts (practically all field-based team sports), exogenous ketone supplementation may not be a smart dietary strategy, as it appears to limit high-intensity exercise performance.

For these athletes, it is important to consume adequate carbohydrate in the lead up to the event to fuel these efforts. On the other hand, for athletes competing in long-duration endurance events such as marathons and triathlons, it is worth experimenting with exogenous ketone supplementation to determine the impact it has on performance.

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

Tim's Comments

"Exogenous ketone supplements are marketed to increase fat oxidation and enhance high-intensity exercise performance without having to induce ketosis through ketogenic diets. However, before this study, no research has examined the impact of ketone salts on high-intensity performance. This study shows that ingestion of ketone salts prior to exercise increases fat oxidation during steady-state exercise, but impairs high-intensity exercise performance. This decline in high-intensity performance is likely due to the transient inhibition of glycolysis that occurs following ketone supplementation."

YOUR OPINION MATTERS!

Tell us if you like the new Research Digest.

Answer 3 Quick Questions

Click Here