

February 2019 | Issue #28

THE PERFORMANCE DIGEST

A review of the latest sports performance research



Want to
WIN a FREE
book of your
choice every
month?

Enter our
“Picture of the Month”
competition each
month to be in with a
chance.

All you have to do is:

1

Take an awesome
picture of yourself
reading the
Performance
Digest.

2

Post it to Instagram
and use the hashtag
#performancedigest
to enter the
competition.



3

We'll then pick
our favourite
picture each
month. If that's
yours, YOU WIN!
Simple as that!

Check out
these
awesome
examples!



Contents

Click a topic to jump straight there

05 Reviewers

The brains behind the brilliance

06 Audio Review

A topic recap on all the research reviewed

07 The Science of Coaching

The doctors diagnosis

08 Strength & Conditioning

Performance-enhancing science

12 Technology & Monitoring

The tech revolution

16 Fatigue & Recovery

You can't adapt without recovery

20 Youth Development

Their future is in our hands

24 Nutrition

You are what you eat

28 Injury Prevention & Rehab

Minimising injury and maximising recovery

32 Infographics

Our very latest infographics

35 Offers

Exclusive, members-only discounts



YOU'RE INVITED



MEMBERS ONLY GROUP

CHAT WITH OUR EDITORS AND OTHER MEMBERS

JOIN NOW



Research Reviewers



Dr. Will Vickery

PhD

Chief Editor

Will is a former Senior 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 CSCS ASCA L2

Fatigue & Recovery

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



Adam Nichol

PhD Candidate

The Science of Coaching

Adam is an Associate Lecturer/PhD Researcher at Northumbria University: Newcastle upon Tyne. His research focuses on how athletes receive, interpret, and are influenced by coaching practice. He is an experienced coach, operating within representative youth level cricket and with soccer referees. Adam also has experience in shaping national sport policy and delivering research-informed consultancy activity.



Tom Green

MSc UKAD Advisor

Youth Development

Tom is the Head of Athletic Development at St. Peter's R.C High School in Gloucester, England. He has an MSc in Applied Strength and Conditioning from Hartpury College. He has also worked with Gloucester Rugby Club as an Academy S&C Assistant and in professional boxing, semi-professional football, and GB Equine.



James de Lacey

MSc

Strength & Conditioning

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



James Morehen

PhD Candidate

Nutrition

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



Carl Valle

BSc

Technology & Monitoring

Carl is currently the lead sport technologist for SpikesOnly.com, and focuses his time on testing elite athletes and using technology to maximise human performance. Carl has coached Track and Field at every level, and also has significant expertise in performance data, including the practical application of equipment and software.



Dr. Stephanie Allen

PT, DPT, OCS, CFSC

Injury Prevention & Rehab

Stephanie is a Physical Therapist who graduated from Ithaca College and is working at Boston PT & Wellness. She is passionate about strength & conditioning and how it plays into rehab, and is also a member of the Strength Faction program.



Audio REVIEW

Monitoring & Modelling

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

with Carl Valle

WHAT WE DISCUSS

In this episode of the "Audio Review", Carl discuss the latest research and application of athlete monitoring and modelling and what you can do to implement it into your practice today.

In this episode, you will learn:

- What monitoring and modelling are and how they interact.
- Why monitoring & modelling are important.
- How we can use monitoring and modelling to impact our science in coaching.
- Case study.
- Bullet point conclusions on how you can use this information in your practice.

Episode length = 35 minutes



A bit about Carl

Carl is currently the lead sport technologist for SpikesOnly.com, and focuses his time on testing elite athletes and using technology to maximise human performance.



Listen Now

The Science of COACHING

How is 'coaching knowledge' formed?

Tools to support coaches' on-going development through critical reflection

[Abstract]

INTRODUCTION

It might seem strange to suggest that there are no 'true' methods of effective coaching. What this means (in the context of this paper), though, is that there are no effective ways of coaching that exist outside of the way in which we (collectively) think and know about effectiveness. In other words, we as humans create the very standards to which we feel we have to live up to when coaching. Importantly, this provides a powerful position for us to understand that in order to advance the effectiveness of our practice as coaches, we need to carefully consider which standards we coach to, how these standards have been created, and if they are indeed most effective for our athletes. The purpose of this article, then, was to critically explore methods which have come to be more widely 'accepted' as effective coaching, and how this might shape or influence our practice as coaches, as well as the broader impact experienced by our athletes.

WHAT THEY FOUND

In exploring the standards of effective S&C coaching, the authors came to understand that due to the evolution of sports science over recent times, athletes and their movements have started to become viewed as 'mechanical systems' or 'machines' which can be split into parts (i.e. levers) to perform exercises. Further, disciplining athletes has come to be viewed as an effective coaching strategy (e.g. using controlled spaces, exercises, and timings, or giving punishments for poor performance/effort). The authors argue that these standards influence the way in which we behave as coaches, even if we sometimes do not want to behave in this way. This is mainly so that we can be seen to 'fit in' and coach effectively in the eyes of others.

Our behaviour and actions in aiming to achieve standards of 'good or effective coaching' can sometimes have negative consequences for our athletes, which we did not originally hope them to have. For example, by thinking we are helping athletes through controlling every single aspect of their training (e.g. training programmes, rest and recovery, nutrition, tracking activity intensity) we might actually be producing athletes who become unable to think for themselves, or worse, athletes who are burned out/disinterested.

WHAT THIS MEANS

Without knowing what has shaped their understanding of what 'good or effective' coaching looks like, coaches might fall into the dangerous trap of repeating practice because a lot of other (sometimes high profile) coaches coach in a particular way (and therefore that it must be effective), without considering if it is actually the best approach to use. For example, splitting the body into separate parts for training (e.g. through using specific types of lifting) might be the practice that many other coaches use, but, at the same time, it might ignore how the body fits together and how parts of the body are related in a fluid way in the realities of performance. We might also hear common effort or tough sounding words in S&C settings: "beat down", "keep pounding", "hammer and chisel", "smash em", and use words in a similar way to fit in with the expectations of others in S&C, but what influence might these terms be having on our individual athletes; what might they be suggesting?

Practical Takeaways

Coaches could benefit from carefully considering how they have come to understand what effective coaching looks like in their context - who and what has influenced this? Also, understanding whether, deep down, coaches really consider what they do to be effective and why, or if they just behave in that way to impress and please others around them/to fit in with what other coaches do, is highly important.

Perhaps of most importance is the need to critically reflect upon how what we do as coaches has an influence on our athletes, sometimes in ways that we hadn't hoped for, even if we set out with good intentions. Is what we are doing as coaches in our athletes' best interests and is it supporting them in a rounded way? For instance, in providing lots of technical feedback we may in fact be overloading or confusing athletes, restricting their creativity.



Adam Nichol

Adam is an Associate Lecturer/PhD Candidate of Sport Coaching at the University of Northumbria in Newcastle Upon Tyne, U.K.

Strength & Conditioning

This month's top research in strength & conditioning.

HOW TO IMPROVE REPEAT SPRINT PERFORMANCE IN FOUR SESSIONS

Beard, A. et al. (2018) International Journal of Sports Physiology and Performance

CAN YOU GET MORE POWERFUL BY TRAINING IN WATER?

Sporri, D. et al. (2018) PLoS ONE

CAN PRIMING EXERCISES 2 HOURS BEFORE COMPETITION ELICIT POSITIVE PERFORMANCE?

Marrier, B. et al. (2018) International Journal of Sports Physiology and Performance



[Abstract]

How to improve repeat sprint performance in four sessions

OBJECTIVE

Many team sports have small (1-2 weeks) transition periods from national clubs to international games which can pose problems for coaches and S&C practitioners in adequately preparing players. Repeated sprint ability in hypoxic conditions (RSH) has shown superior results when comparing to similar training in normoxia (RSN). This being the case, the aim of this study was to assess the effectiveness of a small number RSH sessions in the context of "real" high-level competition schedules.

WHAT THEY DID

As part of their normal national squad training for the Six Nations tournament, nineteen international-level rugby players completed two testing sessions (pre and post two-week intervention) which consisted of 6 x 10 sec maximal sprints, with a 20 sec passive rest on a watt bike in normoxia. Peak power output, mean power output, and sprint decrement score (%) were recorded. The intervention involved two sessions a week (2 weeks total) consisting of 3 x eight 10 sec sprints with 20 sec passive recovery and 2 min between sets on a watt bike. One group performed this intervention in hypoxia (RSH, 3000m, inspired oxygen fraction = 13.8%) while the other group performed the intervention in normoxia (RSN, 3000m, inspired oxygen fraction = 20.9%).

WHAT THEY FOUND

Those in the intervention part of this study were exposed to a total 96 min in hypoxia over the 2-week intervention. The main findings included:

Peak Power Output (pre-post):

- ⇒ RSH significantly enhanced (12.84–13.63 W/kg),
- ⇒ RSN no significant change observed.

Mean Power Output (pre-post):

- ⇒ RSH significantly enhanced (11.15–11.86 W/kg),
- ⇒ RSN remained unchanged.

» Practical Takeaways

The main findings were four RSH sessions over 2 weeks resulted in a greater improvement in lower-limb repeated power output on a watt bike than similar training in normoxia (RSN). One cannot rule out the influence of motivational factors as players were able to view their power outputs during all training sessions creating a very competitive and intense environment. The question that could be asked is whether these improvements in repeated sprint power on the watt bike would translate to improved performance on the rugby pitch?

Previous research ([HERE](#)) has reported that improvement in power output during cycling ergometer whilst in hypoxia corresponded to an eventual enhancement in over-ground repeat running sprint performance. This protocol may also be beneficial when using an upper-body dominant exercise for sports that require high repeated-sprint/power abilities in both lower and upper limbs.

Want to learn more?

Then check these out...



James's Comments

"This study provides a solution to those that have limited time to make improvements in lower-limb repeated power output. However, it is rare for facilities to have hypoxic chambers due to the cost. Potentially a "block" periodisation schedule could be an alternative as covered in last month's Performance Digest Issue #27. By prioritising a certain quality (in this case repeat sprint/power) over a week while maintaining other qualities, faster improvements are likely to be seen. However, if you are adding sessions and loading to your week schedule, something must be removed. Perhaps it would be necessary to identify a key area that would influence on-field performance to attack in this manner if there is only a short window of opportunity."

[Abstract]

Can you get more powerful by training in water?

OBJECTIVE

Aqua plyometric training programs have significantly increased athletic performance such as muscle power, vertical jump, isokinetic torque and sprint performance whilst concurrently reducing muscle soreness. Despite these improvements, stiffness has not been concurrently measured in the studies. Therefore, the aim of this study was to investigate modifications in stiffness levels following the use of dynamic training programming in water.

WHAT THEY DID

Twenty male sub-elite team-sport athletes were randomly allocated either in an aqua plyometric group (APG) or control group (CG). The APG performed three sessions per week over eight weeks in a pool that was 1.2 m deep where they performed various unilateral and bilateral movements (e.g. jumping, hopping and bounding), progressing from 2 x 8 to 3 x 15 (reps x sets) per exercise with session ground contact totals ranging from 56-138. Testing was performed before and after the aqua plyometric session and consisted of:

- ⇒ Vertical leg stiffness (Kvert) through unilateral hop test on force plate
- ⇒ Countermovement jump (CMJ), squat jump (SJ), and drop jump (DJ)
- ⇒ 5 and 10 m sprint

WHAT THEY FOUND

The use of aqua plyometric training did not affect mean Kvert, but a tendency for moderate to large reductions in Kvert asymmetry and dominant leg Kvert were found. Agility and 5-bound test performance both significantly improved before and after testing in the APG, with no change in the CG. SJ peak power, peak velocity and CMJ height also significantly increased before and after testing in the APG with no significant change in CG. The APG yielded superior results for 10 m sprint performance compared to the CG.

» Practical Takeaways

An absence of change in mean Kvert may be a consequence of the buoyancy of water reducing ground reaction forces upon landing, leading to lower eccentric loading when hopping or jumping in water. The reduction in contact time during the amortisation phase potentially allows for improved stretch-shortening cycle performance and enhanced power output. This may explain why no changes in mean Kvert were found, the reduced ground reaction forces may have mitigated any neuromuscular changes that affect Kvert.

Acute aqua plyometric training may be a way to enhance athletic performance without the associated ground reaction forces that occur on land. This can be beneficial for injured athletes or busy periods in a season where introducing more intense loading is not an option, meaning that the pool provides another way to improve athletic performance markers. An example session might look like:

- A1) Double Leg Ankle Bounds 4 x 20 (reps x sets)
- B1) Vertical Jump 3 x 5
- C1) Bounding 3 x 10
- D1) Bounding Left/Left/Right/Right 3 x 4

Want to learn more?

Then check these out...



James's Comments

"Aqua plyometrics provide a tool to enhance certain athletic properties without the associated impacts of plyometrics on land. However, plyometrics on land not only improve performance but can also be used to too lessen the chance of injury within athletes, particularly those who perform constant jumping and sprinting actions. Training underwater does not prepare you for these tasks as landing impact forces are significantly reduced. So, whilst training in water acutely reduces the risk of injury during the task in the long-term, injury risk may increase due to the body not receiving the stimulus of landing on the ground. If planned correctly, aqua plyometrics can play a role in improving lower-body power in athletes that can't perform jumping/plyometric tasks on land."

[Abstract]

Can priming exercises 2 hours before competition elicit positive performance?

OBJECTIVE

On competition day in Rugby 7s, most teams perform a physical session 2-3 h before their first match often termed as the "blow-out". A "blow-out" may act as a primer for subsequent match performance. The aims of this study were to (1) assess the effects of competition type "blow-out" session on repeated sprint performance and physical activity during a simulated rugby 7s match, and (2) investigate the psychophysiological responses associated with this strategy.

WHAT THEY DID

Fourteen elite male Rugby 7s players from the French U18 team completed two different pre-load interventions: no intervention (control) or blow-out (experimental), with the blow-out group completing 30 min of small-sided games and 2 x 50 m maximal sprints. Following a 2 h break, players from both pre-load groups performed 6 x 30 m sprints with 25 sec rest between. Following this, a Rugby 7s match was played with no contact. Saliva samples were collected before blow-out session, immediately after the blow-out session, before the testing session, and after the Rugby 7s match. A recovery and stress scale questionnaire was used as a psychological assessment.

WHAT THEY FOUND

Between the experimental and control groups, the difference in repeated sprint performance was very likely trivial and for each individual sprint, performance was possibly to very likely trivial. Total distance covered in the match were possibly lower for the experimental group compared to the control group. The difference in mean heart rate was also likely trivial between conditions. Any differences in relative distance, sprint distance, maximal speed and acceleration between the groups were unclear.

The experimental condition induced a possible and small increase in testosterone immediately after the blow-out session, while any control changes were unclear. Additionally, a likely to very likely improvement in physical performance capability, activation balance and overall stress just before the testing session was found in the experimental condition.

» Practical Takeaways

The results found in this study contrast with previous research in male rugby union players which has reported beneficial effects of prior exercise on high-intensity actions (see Performance Digest April #18 2018). Perhaps this was due to how close the pre-conditioning strategy was implemented (2 h) where previous research has used 5-6 h and beyond. Furthermore, high-levels of blood lactate concentration and high RPEs were observed after the pre-conditioning strategy which may explain the small reduction in total distance covered.

However, psychological observations tend to describe a favourable context for match performance following pre-conditioning. Pre-conditioning strategies seem to be force-velocity dependent. So for "priming" speed, higher velocity movements should be used, however the opposite is true for force-based movements. For example, force-based movements that don't elicit great fatigue may be maximal isometrics and "heavy" loaded jumps. Whereas high-velocity movements may consist of various throws, jumps and assisted jumps at very low volumes such as 3 x 2.

Want to learn more?

Then check these out...



James's Comments

"Primers can be used from 4-6 to 48 h prior to competition with positive outcomes on performance variables. However, in my opinion, a "blow-out" type session 2 h before the first match of the day isn't a great idea. While you may enhance a player's mental state and potentially future performance, the volume of work seems too high, especially when there are multiple games to be played throughout the day. Rather, a lower volume approach looking to prime the nervous system would seem to fit better in this 2 h window. Due to Rugby 7s games starting in the morning, a 4-6 h pre-competition primer may not be practical. Perhaps performing a primer the previous day may be better suited and on competition day performing a well-structured warm-up."

Technology & Monitoring

This month's top research on technology and monitoring.

HOW VALUABLE IS OBJECTIVE SLEEP MONITORING FOR IMPROVING HEALTH AND PERFORMANCE?

Peacock, P.A. et al. (2018) Acta Sports

A PRACTICAL WAY TO MONITOR FATIGUE

Garrett, J. et al. (2018)
International Journal of
Sports Physiology and
Performance

CAN SPORTS MEDICINE PROFESSIONALS USE TECHNOLOGY TO TRACK ACHILLES TENDINOPATHY?

Morgan, G.E. et al. (2018) BMJ
Open Sport & Exercise



[Abstract]

How valuable is objective sleep monitoring for improving health and performance?

OBJECTIVE

Coaches are interested in the quality and quantity of sleep for growth and recovery (see [HERE](#)) and often use sleep monitoring as a way to improve this. A consistent pattern of sleep is hypothesised to improve the recovery of athletes, and an objective evaluation of both sleep and physical performance could determine the value of a good schedule for a combat sport participant. Thus, the goal of this study was to see how sleep patterns could improve physical performance during a fight preparation period.

WHAT THEY DID

The sleep patterns of eight professional Mixed Martial Arts athletes were monitored over six weeks using a wearable sleep tracker (see [HERE](#)). During this period, the performance variables such as vertical jump, aerobic capacity, and total body strength were also measured. Multiple correlational analyses were performed following the fight preparation period to determine relationships between sleep patterns, performance testing, and the health data (attendance and injuries).

WHAT THEY FOUND

In support of the hypothesis, consistency of sleep was associated with numerous physical performance and health measures. Due to the study design, it was not known how the actual training interacted with sleep over time, as no pre- and post-testing was performed. It was concluded that consistent scores of sleep latency, total sleep time, onset variances, and sleep efficiency demonstrated a positive relationship with a favourable performance profile to their battery of tests and a reduction of injuries and illnesses.

» Practical Takeaways

Sleep monitoring with reliable measuring devices add more objective granularity to the athlete surveillance process. Using a device, specifically the Fatigue Science Readiband (for validation information see [HERE](#)), is a simple way to measure and analyse sleep beyond duration and subjective quality ratings. If coaches are concerned about rates of injuries and impairments to performance, sleep monitoring may be able to determine if recovery is maximised. Coaches may wish to focus on adding sleep metrics that are focused on consistency, rather than just absolute scores or ratings of quality. Researchers in the current study specifically advocated to focus on sleep metrics (consistency) to help additional populations outside of combat sport, specifically the military or those with unorthodox schedules. While not mentioned, a schedule that is consistent for team-sports may prove just as valuable as individual sport populations such as mixed martial arts.

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



Carl's Comments

"Objective sleep metrics require the athlete or the athlete's bed to be monitored over time, thus many coaches complain of a lack of privacy and compliance. With the right education and simple solutions, such as a device that works with smartphones, coaches can bypass the use of subjective sleep data from questionnaires and focus on more mood-type measurements such as willingness to train. The strength of the technology is the ability to aggregate, analyse, and automate a process that is very cumbersome to do manually. Therefore, investing into wearable technology may prove to be a smart long-term solution."

[Abstract]

A practical way to monitor fatigue

OBJECTIVE

Coaches are highly invested in monitoring the neuromuscular system of their athletes, as fatigue is a useful metric to help manage training programs. Within the high-performance sport environment coaching staff typically have greater access to player tracking devices. Combining this access with a submaximal run test (SRT) that is quick and easy to perform would be especially useful for monitoring neuromuscular fatigue. Therefore, the purpose of this study was to take advantage of existing technology and explore the opportunity to use it more practically for monitoring neuromuscular fatigue.

WHAT THEY DID

Using a combination of metrics from the player tracking device (Catapult MiniMaxX) and the Gymaware Powertool system (Kinetic Performance), fatigue was measured over a period of 96 h post-match. Twenty-three elite Australian rules football players performed a stride test (submaximal run test) three times to profile their neuromuscular fatigue while comparing it to a countermovement jump (CMJ) assessment. Data was exported from the Catapult system and the SRT measurements were analysed to deduce if it was useful for detecting fatigue.

WHAT THEY FOUND

The researchers found that the SRT was an effective way to monitor neuromuscular fatigue, as the Catapult data was just as useful as conventional CMJ testing (for validation information see [HERE](#)). The time course of the recovery pattern from baseline and the correlation to the jump testing was sufficient to encourage coaches to use the novel test as a replacement or as an alternative to jump assessments.

» Practical Takeaways

Due to the minimal time take to complete the SRT, and the fact that it only requires athletes to perform at a submaximal effort, using the test after competition appears to be a safe and effective way to alternatively monitor fatigue. If coaches wish to add the test to their athlete's normal routine, it looks like the output of work would not be difficult to include in most training environments for team sports. Since athletes are likely to warm-up using submaximal striding patterns, this test is easily embedded into nearly all practices that incorporate drills or activities to prepare for training. Since wearable technology is usually simultaneously worn by all athletes, this novel test could dramatically improve workflow compared to research-grade force plates. What should be noted, though, was the test did not provide real-time feedback, so post-session analysis is required, making the SRT more useful for teams with enough technical support.



Carl's Comments

"While I like the test or any assessment that uses running data, sometimes athletes are injured and are not able to have their strides evaluated. A strong recommendation is to think about using inertial measurement units at the foot and or hip for teams that have less access to technology. Since the submaximal test is practical, it may make sense to automate the process with Athlete Management Systems (see review [HERE](#)) by customising the formulas based on auto-detecting the assessment, and tracking the unique rest, velocity, and timing of the runs.

Want to learn more?

Then check these out...



[Abstract]

Can sports medicine professionals use technology to track Achilles tendinopathy?

OBJECTIVE

Sports teams care about the wellbeing of their athletes, as they want productivity as well as longevity. Over the years, coaches have employed numerous monitoring and assessments to reduce injury, but most of the movement screens or athlete tracking methods are either too general or not reliable. One important part of the body which is paramount in the performance of many sporting activities is the Achilles tendons, which are at risk with many athlete populations. Therefore, something which would be beneficial for practitioners regarding Achilles health is a method which is objective, time-efficient and affordable.

WHAT THEY DID

To determine if symptomatic tendons responded differently to those that were healthy, the participants of the study included reportedly healthy (asymptomatic) populations as well as those with Achilles tendons injuries (symptomatic) using a MyotonPRO device. The MyotonPro allows for the stiffness and elasticity of muscle and tendon reliability to be assessed. The data collected from each of the subjects was compared based on a number of different factors (e.g. age, gender, BMI).

WHAT THEY FOUND

The results of this study would suggest that those with an Achilles tendon injury are likely to display a poorer performance in mechanical properties (e.g. tendon stiffness, relaxation rate) when compared to those with no injury. The findings of those with Achilles tendinopathy had lower stiffness qualities, demonstrating that the MyotonPRO (for validation information see [HERE](#)) could detect mechanical performance differences between healthy and unhealthy populations.

» Practical Takeaways

The MyotonPRO is considered a useful clinical tool to evaluate tendon health, specifically the Achilles tendon. The practical value of the instrument is that the readings are easily captured and the system is portable. The potential for teams to assess the health tendons and other tissues (see more [HERE](#)) is especially useful to sports for return-to-play environments. In addition to the speed and simplicity of the device, the system has other potential roles in recovery monitoring as well as sports performance, making it a solution for the larger support staff team rather than just to be used as a medical device. Coaches and sports medicine professionals may benefit from spending time collecting direct information, rather than make inferences with general estimations with risk from simple models.

Want to learn more?

Then check these out...



Carl's Comments

"A major gap in sports medicine is the objective evaluation and function of the body. While performance has an array of internal and external load and monitoring strategies, sports medicine technology is usually on average lagging behind. An objective way to monitor specific at-risk areas is especially useful for coaches and sports medicine professionals, as increases in injury are usually preceded by reductions in performance. Adding a very convenient tool into this scenario would help add a layer of objective data that could help reduce and manage athlete injuries."

Fatigue & Recovery

This month's top research on fatigue and recovery.

IMPACT OF TRAINING DAYS, PLAYING POSITION AND SQUAD INCLUSION ON TRAINING LOAD

Martín-García, A. et al. (2018) The Journal of Strength & Conditioning Research

THE IMPACT OF TRAINING AT NIGHT ON SLEEP PATTERNS AND HEART ACTIVITY

Costa, J. A. et al. (2018) International Journal of Sports Physiology and Performance

HOW ARE TRAINING LOAD, PERCEIVED RECOVERY AND WELLBEING, SLEEP AND FATIGUE RELATED IN YOUTH ATHLETES?

Sawczuk, T. et al. (2018) Pediatric Exercise Science



[Abstract]

Impact of training days, playing position and squad inclusion on training load

OBJECTIVE

Regardless of the sport, the training load of athletes is a major consideration for those responsible for training and coaching athletes. Limited information which compares the training load across a training week exists. Furthermore, little literature has been published which explores the differences between professional football players who are exposed to match time and those that are not. The aims of this study were to (1) investigate the external training load that each playing position is exposed to each day across a training week, and (2) measure the loading between the playing and non-playing squad.

WHAT THEY DID

490 individual global positioning system (GPS) observations were collected. Over 42 training weeks, the movement characteristics of twenty-four professional football players: Full backs (FB; n=6), central defenders (CD; n=3), one midfielder (MF; n=3), two offensive midfielders (OMF; n=5) and three forwards (FW; n=7) was measured using GPS devices. The measures used to determine the workload of these players included:

- ⇒ Total (TD; m)
- ⇒ High-speed running distance (HSR; m >19.8 km/h)
- ⇒ Sprint distance (SPR; m >25.2 km/h)
- ⇒ Number of intense accelerations/decelerations (ACC/DEC; >3m/s²)
- ⇒ Average metabolic power (AMP; W/kg) and
- ⇒ High metabolic load distance (HMLD; m >25.5 W/kg)
- ⇒ Following data collection, the differences for each position and training day were calculated. Additionally, differences between the playing and non-playing squad were calculated for match day (MD)+1.

WHAT THEY FOUND

The main findings were:

- ⇒ The non-match squad demonstrated greater external loads on MD+1 than match squad for most running measures;
- ⇒ A decrease in training loads was observed from MD-4 to MD-1;
- ⇒ ACC/DEC during training exceeded 50% of that performed in competition for all days except MD-1;
- ⇒ On MD-3 and MD-4, FB performed more high-speed running and covered a greater distance when sprinting than all other positions;
- ⇒ Coefficient of variation for training loads ranged from ~40% for MD-3 and MD-4 to ~80% for MS MD+1 then averaged across all load metrics and positions;
- ⇒ CV for training loads ranged from ~20% for TD and AMP to >85% for HSR and SPR when averaged across all training sessions and positions.

» Practical Takeaways

Increasing the knowledge of position-specific training loads is important for those involved in developing and leading training sessions as a load that is low for one position can be high for another. As the match provides an important stimulus in the training week, understanding the impact (e.g. external load metrics) that a match has on each position will allow for practitioners to design a compensatory training session for those who don't play. This way, athletes will be able to achieve the desirable training load for that week. Moreover, having match normative data allows practitioners to provide additional stimulus for those athletes who did not achieve typical match running loads, such as those who had limited game time. Gaining knowledge of the external loads from match-play allows for practitioners to design training sessions load relative to match intensity.

Practitioners are advised to conduct in-house research in order to define positional thresholds for different external load metrics. To account for individual differences (e.g. biological age, training age, playing characteristics) practitioners are encouraged to individualise these thresholds where possible. Lastly, the large variations of some of the measures in the current study demonstrate the need to carefully monitor external training loads in order to promote adaptation while reducing the risk of injury. On the other hand, practitioners need to be aware that these variations may also demonstrate the poor reliability of some metrics.

Want to learn more?

Then check these out...



Francisco's Comments

"This is a very interesting study as there are not many professional football teams currently sharing the training loads of their athletes. During the in-season period it can be hard to overload different physical aspects of a match (e.g. run more distance or have higher number of ACC/DEC than in any match), practitioners must look for opportunities throughout the season to complete this in order to promote a stimulus for adaptation to occur.

The decision to train the non-match squad on the MD+1 or MD/MD-1 is a topic of discussion between practitioners. In my opinion, this decision will be highly dependent on the training schedule. Should the compensatory training occur on MD+1, some considerations that practitioners should take note of include:

- ⇒ The next day training session needs to be reduced;
- ⇒ The compensatory training has a low intensity, and players will miss the stimulus;
- ⇒ The risk of injury and decreased performance are increased due to consecutive days with high-training load."

[Abstract]

The impact of training at night on sleep patterns and the activity of the heart

OBJECTIVE

It is well documented that sleep plays a major role in the recovery process of athletes. As a result of factors such as work and study, amateur and semi-professional athletes frequently train at later stages of the day and into the night, which may influence their sleeping patterns. This study aimed to understand if night-soccer training load was associated to changes in sleep patterns and nocturnal cardiac autonomic activity.

WHAT THEY DID

Internal training load, sleep, nocturnal cardiac autonomic activity, and well-being ratings of eighteen female semi-professional soccer players were collected for 3 consecutive weeks and comprised of 8 night-training days (~9-10h30 PM) and 8 rest days. When sleeping, each athlete wore a heart rate (HR) monitor which obtained hourly cardiac autonomic activity (RR interval data) as well as a wrist-worn accelerometer which measured: Total sleep time, time in bed, wake-up time, sleep onset time, wake after sleep onset, sleep fragmentation index, latency and sleep efficiency.

Session rate of perceived exertion (sRPE), Hooper's index (well-being ratings relative to fatigue, stress level, DOMS, and sleep quality/disorders in a 1-7 scale), training impulse (TRIMP), and exercise HR (HRex) were obtained for each training session.

WHAT THEY FOUND

In general, sleep and cardiac autonomic activity were affected by night training. The main findings of the study were:

- ⇒ Large effects for sRPE, Hooper's index, TRIMP and HRex between different training days;
- ⇒ When training days were compared with non-training days, moderate effects were observed for total sleep time and sleep onset time, and small effects were observed for wake-up time, time in bed, and sleep latency, demonstrating that sleep was negatively affected by night-training;
- ⇒ Moderate and large effects were reported for cardiac autonomic activity and mean HR during sleep, respectively.

» Practical Takeaways

The findings from this study reinforce that practitioners need to be aware that night-training may negatively influence sleep. Although, in this study, the athletes sleep time was within the recommendations for athletes (i.e. between 7-9 h), the differences found between the sleep time on non-training days vs. training days may demonstrate that these athletes may sleep longer, if possible. As mentioned by the authors, besides the effect of night-training on player's schedules (e.g. delayed bed time), the players exposure to light (>1200 lux) may also affect sleep.

Although changes in training schedule and light exposition are often impossible to change, practitioners are recommended to rely on sleep hygiene strategies to increase sleep quality and duration. In particular, these strategies should focus on a decrease on the sleep onset time and an increase in total sleep time.

Want to learn more?

Then check these out...



Francisco's Comments

"This is a very pertinent study investigating a real-world issue. I personally have worked with a semi-professional rugby team that used to train until 10:00/10:30 PM three times per week, so I was forced to find solutions for that group of players regarding the impact this had on their sleeping patterns. In these scenarios, sleep hygiene strategies should focus on the sleep onset time (that will ultimately lead to an increase in sleep duration) and on schedule routine strategies.

A routine of good sleep preparation and prolongation habits should be implemented:

- ⇒ Prepare sleep: Room temperature, tidy room and bed, "quiet room" (i.e. room is a place to sleep), reduce caffeine intake 6 h before bed time.
- ⇒ Before and during sleep: No noise or light, limit screen time before bedtime, bedtime routine (e.g. warm shower, read a book, meditation).
- ⇒ Prolong your sleep: Leave as many jobs done before bed time as possible (e.g. do your bag during the day, prepare breakfast)."

[Abstract]

How are training load, perceived recovery and wellbeing, sleep and fatigue related in youth athletes?

OBJECTIVE

A good balance between training stress and recovery is essential for athletes to adapt from training. To ensure that specific and effective training sessions are developed, practitioners typically collect various information regarding a player's load, as well as the impact of fatigue and recovery. However, up-to-date literature investigating the relationship between different measures in young athletes is scarce. Therefore, the aim of this study was to investigate the relationship between measures of load, recovery and fatigue in youth athletes.

WHAT THEY DID

Over a 7-week period, fifty-two young athletes (16-18 yr) participated in their typical training programs. During which the following data was collected during the first four days of each week:

- ⇒ Countermovement jump (CMJ);
- ⇒ Wellness questionnaire (WQ) comprised of five questions: Sleep quality, fatigue, muscle soreness, stress, and mood;
- ⇒ Perceived recovery status scale (PRS);
- ⇒ Sleep duration.

WHAT THEY FOUND

The main findings of this study were:

- ⇒ Small positive correlations between WQ and sleep;
- ⇒ Small negative correlations between training load and PRS;
- ⇒ Low training load demonstrated to have a small positive effect on PRS, and a high training load to have a small negative effect on PRS;
- ⇒ Small negative effect of low sleep duration on WQ;
- ⇒ No relationships were found between CMJ and training or sleep. No relationship was also found between WQ and training load.

» Practical Takeaways

The findings from this study demonstrate that different measures may need to be collected in order to have a good understanding of the recovery/readiness state of the athletes. In particular, the WQ and PRS can be implemented to monitor readiness. On the other hand, practitioners must be aware that performance tests, such as the CMJ, are often reported to be less sensitive for detecting fatigue/readiness.

It is recommended that practitioners choose metrics that can quickly provide meaningful information relative to the context in which they work. In most scenarios, it is pointless to collect measures that can't be accessed almost immediately. Lastly, when applying subjective questionnaires, practitioners are recommended to analyse the results individually as what may represent a small change for one athlete may be a large change for other. This can be utilised by using Z-scores (refer to the link below for more information on this).

Want to learn more?

Then check these out...



Francisco's Comments

"The longer my experience as a practitioner is, the simpler I become. I believe all practitioners go through a phase where they believe the more data collected from athletes, the better. By using a simpler approach, this not only reduces the focus towards more meaningful measures, but also to overload athletes and decrease the impact that data reporting has. Personally, I have used the same questionnaire (WQ) with success that was used in this study in both the applied and research setting. In elite rugby athletes, I observed that the WQ was more sensitive to training load than performance tests such as 10 m sprint, CMJ and other velocity measures obtained during strength and power training. Moreover, instead of collecting information from a single question of overall muscle soreness, I recommend practitioners collect soreness from several relevant muscle sites.

Interestingly, recently (Performance Digest #25), I reviewed a study that demonstrated the perceived recovery status (PRS) to be a reliable tool to monitor recovery status. Given its practicality, I am currently considering including the PRS in combination with WQ + soreness into my athlete monitoring toolkit. I recommend collecting the PRS on the day after every training day and WQ to be implemented in the morning of every high load training day/s (i.e. 1-2 times a week)."

Youth Development

This month's top research on youth development.

DOES THE PREVIOUS EXPERTISE OF PARENTS INFLUENCE THE EXPERTISE OF THEIR CHILDREN?

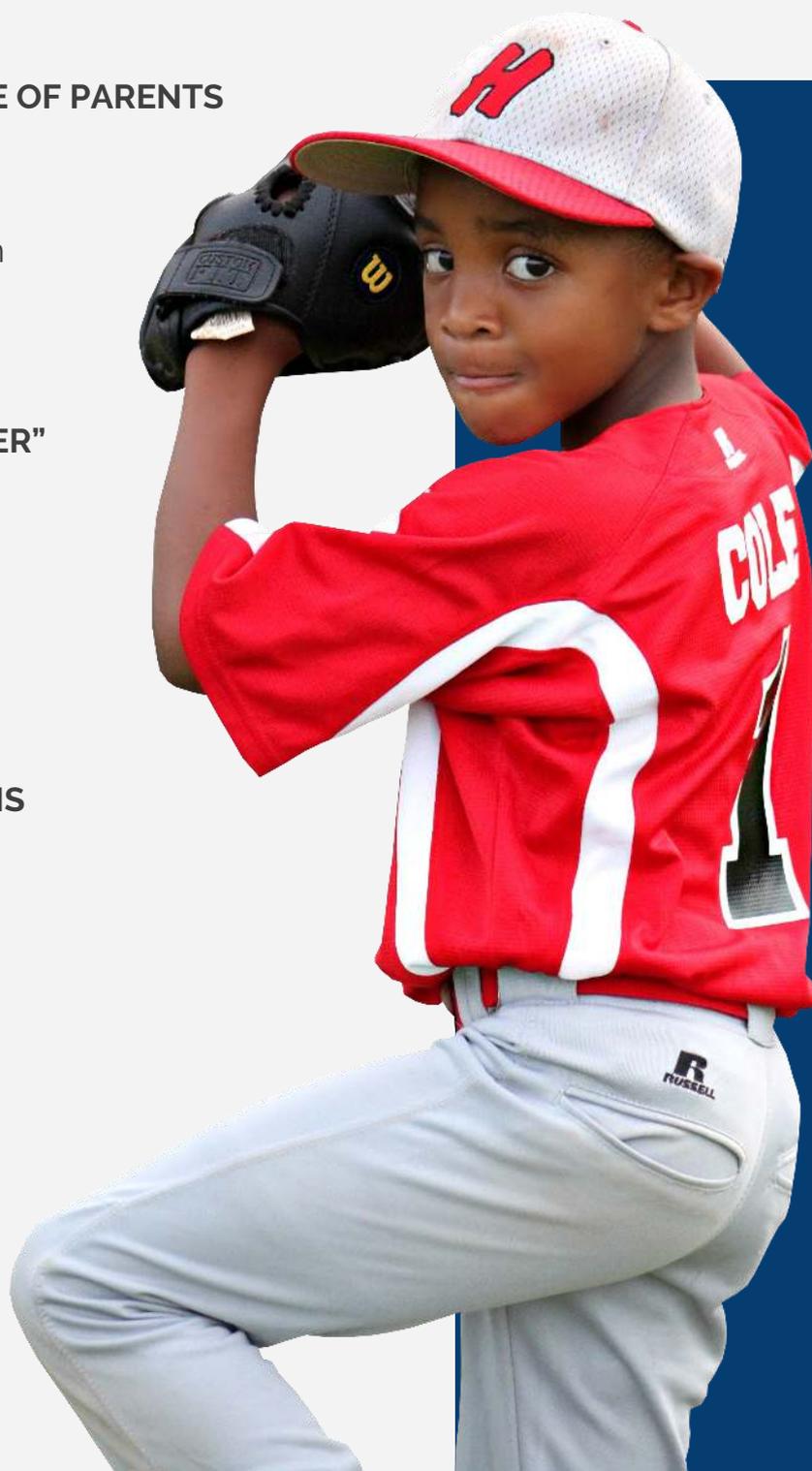
Wilson, S.G. et al. (2018) European Journal of Sport Science

POSTURE CONTROL: THE RELATIONSHIP BETWEEN "UPPER" AND "LOWER" BODY PARTS IN CHILDREN

Hill, M.W. et al. (2018) Frontiers in Physiology

BLOCK VS. UNDULATING PERIODISATION: HOW DOES THIS IMPACT ON PERFORMANCE?

Gavanda, S. et al. (2018) International Journal of Sports Physiology and Performance



[Abstract]

Does the previous expertise of parents influence the expertise of their children?

OBJECTIVE

Many believe that 'talent' runs in the family, but unfortunately, few studies have objectively examined this common belief. Whilst it is well-known that genetic factors provide the blueprint for a good athlete, there are many other factors such as opportunities, nurture, education, and health and wellbeing that also play a part. This study examined how a parent's previous involvement in sport as a child athlete is related to the eventual level of competitive sport attained by their children.

WHAT THEY DID

This study included a sample of 229 athletes which were split into the following skill categories (elite: n=139; pre-elite: n=33; non-elite: n=57) based on the peak competition level they achieved in their career. A Developmental History of Athletes Questionnaire (DHAQ) (refer to the article link below) was used and supported with semi-structured interviews with athletes, parents, and coaches to establish a valid and reliable account of athletic success. The level at which athletes had played and their parental involvement was then statistically analysed and compared across all skill categories.

WHAT THEY FOUND

This study reported that in comparison to non-elite athletes, parents of elite athletes were more likely to have performed or attained a higher level of competitive sport experience and success. Significant associations were found between parental support and factors such as travel, financial support, technical and tactical advice, and playing level. However, this was reported as a complex phenomenon. Finally, paternal characteristics (characteristics of the father) were more significantly associated with athletic skill level than maternal characteristics (those of the mother). Finally, elite athletes were more than 2.3 times more likely than non-athletes to have a father that has participated in one or more competitive sports.

» Practical Takeaways

To summarise the findings of this study, it has been shown that an athlete's development is highly influenced by their parents, in which the beliefs, behaviours, and attitudes towards sport can be partly determined by the parents' previous experiences and knowledge. As a coach, this can be a very supportive or equally frustrating experience depending on how they (the parents) support your practice. Dr. Camilla Knight of Swansea University has suggested some of the ways that parents can get involved in sports at a grass roots level over two short episodes (see below). I have no doubt that parent's with great intentions can become an invaluable asset in developing talent. However, dealing with parents can be a challenging experience, especially when the parents place real or perceived pressure on their child, or attempt to alter their training into a more 'old-school' approach based on their own interpretation of normal athletic development. In my opinion, it would be far too naïve to suggest that this is a linear process, where a highly successful sports parent would have the requisite skills to pass on knowledge effectively or impartially. Hopefully the podcast (see below) can alleviate some of these issues.

Want to learn more?

Then check these out...



Tom's Comments

"From an S&C background, it is definitely great to see studies like this published as we can use these experiences to shape and justify the use of parents during training. However, with a discipline which is as misunderstood as it is, it is important that we know where the line is between cooperation and role conflict. For example, in some of my experiences working with academy athletes, I have found that parents can be impatient, frustrated, and driven by their own career set-backs or expectations of their child. In addition, this study demonstrated a strong link between the level of competition attained by parents and previous access to formal and higher education. With education and socioeconomic status driving sports participation these days, which can impact on the development of young athletes, this can prove challenging as a coach to deal with. When handling these situations, I often refer parents to videos such as the one below, to remove myself from the situation by allowing them to interpret, reflect, and be mindful of their initial complaint. My hope is that such resources can educate, empower, and allow parents to "buy" back in to the process."

[Abstract]

Posture control: the relationship between “upper” and “lower” body parts in children

OBJECTIVE

Optimal extension of the ankle and hip helps adults to maintain an upright posture which is important in sports and daily life. There is growing evidence that a similar strategy is adopted by the upper body to support posture. Amongst children, though, few studies have analysed the contribution of the arm which is of particular importance considering that upper body function is still developing in children. Therefore, the aim of this study was to assess the functional and relevant role of the upper body in dynamic postural control in children.

WHAT THEY DID

Twenty-nine children (male=14, female=15; age, 10.6 ± 0.5 years; height, 1.48 ± 0.08 m; mass, 42.8 ± 11.4 kg; BMI, 19.2 ± 3.7 AU) were assessed for maturity using the Mirwald equation. Children were asked to complete three dynamic balance tests; (1) Y Balance test, (2) timed balance beam walking tests, and (3) transition from dynamic to static balance using the Dynamic Postural Stability Index Test. To assess dynamic postural stability, participants were instructed to jump over a 6-inch hurdle, land on a force platform on their dominant limb, stabilise as quickly as possible, and then balance for 10 sec. All tests were performed: (1) arms placed flat across the chest touching the contralateral shoulder, (i.e. restricted arm movement) and (2) arm movement without restriction (i.e. free arm movement).

WHAT THEY FOUND

This study reported that restricted arm use made a notable difference on balance tasks. More specifically, mean balance beam walking time increased by 1.5 sec when arm movement was restricted. Similar results were found in the Y Balance reach test, where all three “reaching” movements were not as good when performed with limited arm range of motion. From these tests, a composite balance score was calculated where composite balance score decreased by 9.6% (mean) in all participants. In contrast, results from the dynamic postural stability index test found no significant differences between free and limited arm use.

» Practical Takeaways

Optimal dynamic postural control is important in sports, allowing the athlete to interpret, respond, and perform in the ever-changing and unpredictable landscape that is sport. The article linked below explains this in greater detail, guiding the reader through the role of the central nervous system, theories of organisation, and their contribution to dynamic postural control.

From this study, taking both scores (with vs. without arms) may prove useful, allowing the coach to identify if a person uses either a lower or upper body strategy to support posture. For example, if an individual performs a balance task with small differences with and without arm use, they may be deemed to have better dynamic postural control and may be ready for more advanced balance progressions, like the ones seen in video below. To progress the balance task, moving from exercises that allow for free arm movement to restricted movement may serve as a first objective. This scheme may also work on those who are injured or returning to play and need to focus on a purely lower body strategy to develop hip, knee, and ankle coordinative strategies. Adding and removing upper-body use may serve as a great way to focus rehab on particular areas.

Want to learn more?

Then check these out...



Tom's Comments

“The role of the arms in maintaining balance and postural control is an important factor in sports. In my own programming, I make sure to programme exercises (acceleration and change of direction as examples) without arm use. This provides the child with a kinaesthetic method of learning and firmly cements their understanding of arm use in movements by “feeling” how hard normal task can be when constrained. In addition, randomly assigned exercise orders such as performing 3 repetitions with arms (set 1), without arms (set 2), and then again with arms (set 3) can speed up the learning process by movement association known as the ‘contextual interference effect’.

Some may believe that dynamic postural control isn't only important from a performance perspective, but may serve as a preventative factor for injury. In contrast, previous research has shown that there is no association between poor postural control measures and ACL injury risk in 838 handball and football players. This has also been discussed in the podcast below in greater depth considering both the merits and implications. In my opinion, I think the ability to quickly stabilise whilst holding strong positions is a fundamental requirement for youth athletes. This is something that would be great to see as a research theme develop over time.”

[Abstract]

Block vs. undulating periodisation: how does this impact on performance?

OBJECTIVE

Muscle strength and power are important for many athletic endeavours such as speed, change of direction tasks, tackling ability, and injury prevention. Developing these through a periodised approach, which could be described as a considered and progressive plan is important. This study compared the effects of a block periodised model (BLOCK), where the load is typically increased in a linear manner, versus daily undulating periodisation (DUP), where the load is more sporadic over numerous days, on both anthropometric and physical qualities.

WHAT THEY DID

Forty-seven subjects (M \pm SD age=17 \pm 0.8 yr; strength training experience = 0.93 \pm 0.99 yr) participated in a 12-week S&C programme. The following assessments were collected before and after this period to examine which model was better:

- ⇒ Anthropometric: body mass (kg), fat mass (FMkg), body fat percentage (relFM), fat-free mass (FFM), muscle mass (MM), muscle thickness (vastus lateralis (VL), M. rectus femoris (RF) and M. triceps brachii (TB).
- ⇒ Physical: 1RM (Back squat and bench press), countermovement jump (CMJ), peak power (W_{peak}), medicine ball put (MBP), and 40 yd sprint (sec).

Subjects were randomly assigned in either the BLOCK or DUP group prior to the 12-week intervention period consisting of 3 full-body sessions per week.

WHAT THEY FOUND

This study found that both the BLOCK and DUP periodised model to be a highly effective training method for adolescent football players over a 12-week period. More specifically, both training models displayed significantly higher BM, relFM, FFM, MM, RF, VL, TB, BS, BP, CMJ, wPeak and significantly lower sprint times. However, DUP was found to be more effective at reducing fat mass and body fat percentage. As such, both a BLOCK and DUP periodised model appear to be highly effective for increasing muscle mass, strength, power and performance in adolescent football players.

» Practical Takeaways

This study reported that there may be no clear differences between a BLOCK and DUP model when working with adolescent athletes which can support your coaching practice. Whilst those undertaking the DUP approach benefited from reduced fat mass and body fat percentages compared to BLOCK, this could be attributed to external factors, such as nutrition, which the researchers could not control. Nutrition can be a grey area for S&C coaches, so using external resources (such as the video link below) can be invaluable as an avenue for player/parent education.

With the findings of this study showing that no periodised model holds a distinct advantage over the other, the question is "should we periodise at all?" In the attached article, Grgic et al., (2018) (see article link below) makes a compelling argument for avoiding periodised training all together. As mentioned in the 'Objective' part of this study, BLOCK periodisation builds competence through repetition and gradual progression, whereas the theoretical basis for DUP lies in training variety for the stimulation of greater strength development and related characteristics. However, as stated by Grgic and colleagues, it could be argued that so long as strength training is challenging, safe, and progressive, the "what" and "how" of the programme may be irrelevant with regards to development. A balanced approach as seen in the video may prove to be a good starting point for any aspiring youth S&C coach.

Want to learn more?

Then check these out...



Tom's Comments

"Being a relatively new discipline, S&C coaches can be eager to please and provide evidence-based programmes for optimal development. I am not by any means suggesting that we should avoid such an approach, as conscious and considered practice will elevate our quality and produce more jobs in the future. However, as coaches, it may benefit us to stand back and read the cultural waves of a team to fill in the movement gaps that are left by childhood. An overly structured approach does not always take into account external factors such as school stress, fixtures, or personal issues which should be considered. If players are unpredictable in terms of their energy, competence, and attitude, we may need to get better as coaches at "reading" the social landscape and being pliable enough to move around their needs. At no point should this deter from the fact that they will need regular and progressive strength training to attain higher performance."

Nutrition

This month's top research on nutrition.

PEA PROTEIN PACKS A SIMILAR PUNCH TO WHEY PROTEIN

Banaszek, A. et al. (2018) Sports

CAFFEINE IMPROVES AEROBIC ENDURANCE AND NEUROMUSCULAR PERFORMANCE IN SOCCER-PLAYERS

Apostolidis, A. et al. (2018)
International Journal of Sports
Physiology and Performance

THE EFFECT OF LEUCINE METABOLITE SUPPLEMENTATION AND RESISTANCE TRAINING ON BODY COMPOSITION

Teixeira, F.J. et al. (2018) European Journal
of Sport Science



[Abstract]

Pea protein packs a similar punch to whey protein

OBJECTIVE

For various reasons, people are now shifting towards consuming plant-based food sources versus traditional animal sources, this includes protein intake in and around exercise training. Previous research has suggested some plant-based sources (soy protein) may not contain a full amino acid profile when compared to whey protein (see article link below). However, other plant-based sources exist, for example, pea protein. Despite this, limited evidence exists regarding its benefits following training. Therefore, the authors wanted to investigate the effects of whey versus pea protein following an 8-week training programme on physical adaptations.

WHAT THEY DID

Fifteen trained men and women performed an 8-week training block following screening, familiarisation and baseline tests. Body composition, strength tests (1 RM), muscle thickness, and workout of the day were all recorded before and after the 8 weeks. Each high-intensity functional training (HIFT) workout was led by a CrossFit trainer, which included both strength and metabolic training. Following group allocation, each participant followed dietary controls and consumed either a whey or pea protein supplement (24 g) twice daily throughout the intervention.

WHAT THEY FOUND

Both whey and pea protein groups experienced increases in strength for 1 RM back squat and deadlift following 8 weeks of training. However, there was no training effect found for body composition changes, muscle thickness, peak force, rate of force development or workout of the day performance for either group.

» Practical Takeaways

Although it is well-known that consuming protein peri-workout (before and/or after) will assist with training adaptations and recovery ([HERE](#)), the authors of this current research compared the effects of pea versus whey protein. The main takeaways from this study are:

- ⇒ There is no significant difference in the type of protein consumed on physical adaptations following the HIFT workout.
- ⇒ There is no significant difference in type of protein consumed on body composition or muscle size following the HIFT workout.
- ⇒ Both the amino acid profiles of pea and whey protein are similar, in particular the leucine content of supplements provided.
- ⇒ Therefore, pea protein may be a suitable alternative to whey protein for those exercisers who are following a plant-based nutrition strategy.

Want to learn more?

Then check these out...



James's Comments

"Although this study shows comparable results with whey and pea protein, the authors highlight this is only the second study to show similar effects within a small sample size. Further, it is interesting to note that although the amino acid profile (in particular leucine) of the pea supplement provided was similar to the whey supplement, other researchers show a clear profile difference between pea and whey ([HERE](#)). One reason for this may be that a proprietary blend supplement may have been used instead of a raw pea protein in this study.

In the practical sense, a pea supplement can provide athletes with a good protein source but just consider that you may need a larger quantity than an animal source protein and that they are higher in fibre, so it can be more challenging to ingest the appropriate quantities within the diet. For example, 1 ½ cup of bean would give you the same protein (21 g) as a palmful (3 oz) of chicken breast or fish. Other considerations are discussed in the podcast below."

[Abstract]

Caffeine improves aerobic endurance and neuromuscular performance in soccer-players

OBJECTIVE

Caffeine is commonly used as an ergogenic aid in sport settings. Inconsistent results among previous studies examining caffeine's effects on exercise performance have led authors to speculate whether this may be caused by inter-individual variation in biological responses to caffeine. Therefore, the aims of the study were to (1) identify high- and low-caffeine responders to caffeine intake, and (2) compare the influence of caffeine supplementation on exercise performance and biological responses between high and low caffeine responders during a prolonged simulated soccer-game protocol.

WHAT THEY DID

Prior to the completion of two simulated soccer-game protocols on a treadmill, twenty male professional/semi-professional soccer players with 5 years of experience categorised as either high caffeine (n=11) and low caffeine (n=9) responders based on their resting blood pressure, plasma glycerol, non-esterified fatty acid, and epinephrine responses to caffeine. Each player ingested either 6 mg.kg⁻¹ of caffeine (capsules) or placebo ingestion before completing the simulation during which exercise performance, cardiovascular responses, energy expenditure, fuel oxidation, and blood metabolites was measured.

WHAT THEY FOUND

Caffeine is effective for improving endurance and neuromuscular performance of well-trained male soccer players during a soccer-specific exercise protocol, irrespective of whether one is a high- or low-responder to caffeine. This suggests that caffeine is ergogenic, even in individuals who do not exhibit marked biological responses to caffeine ingestion at rest, at least under the dosage and exercise testing conditions employed in the present study. Performance improvements could be attributed predominantly to a positive effect of caffeine on the central nervous system and/or neuromuscular function since no differences in substrate utilisation were found between the caffeine and placebo trials.

» Practical Takeaways

Based on the findings of this study, when taken at a dose of 6 mg.kg⁻¹ body weight, caffeine is as an effective ergogenic aid in soccer for improving endurance and neuromuscular performance. It is, however, important to note that upcoming training or competition may influence intake of caffeine ingestion. Given that a half-life of caffeine is approximately 4-6 h, this may interfere with an athlete's recovery and sleeping patterns (see article link below) and, therefore, they may need to consider consuming less caffeine for an evening game when compared to a morning game. This would be especially important if there were numerous matches being played (e.g. weekend tournament), whereby reduced recovery following initial caffeine dose may impact subsequent exercise performance. Considerations of the possible side effects of caffeine ingestion such as high levels of caffeine can also cause nausea, anxiety, gastrointestinal upset, and accelerated heart rate should also be considered. Individual responses to caffeine vary, however, maximal benefits are usually achieved with intakes of 3-6 mg.kg⁻¹, whilst unwanted outcomes become more common 9 mg.kg⁻¹. For further information on current caffeine guidelines, please see the article linked below.

Want to learn more?

Then check these out...



James's Comments

"The current study was completed within a laboratory setting using a treadmill to simulate a soccer match which may limit the real-world applications of the results. However, this may have been due to the difficulties in controlling a number of factors typical of a competitive soccer match (e.g. individual players, opposition, weather, officials). What is most notable about this study, though, is the absence of difference in habitual caffeine consumption between high and low responders. For example, are caffeine naïve individuals more responsive to caffeine ingestion than habitual caffeine consumers?"

[Abstract]

The effect of leucine metabolite supplementation and resistance training on body composition

OBJECTIVE

Leucine is the primary amino acid for stimulating muscle growth, however, the efficacy of metabolites of leucine such as β -Hydroxy β -methylbutyrate (HMB) and α -hydroxyisocaproic acid (α -HICA) supplementation to increase lean body mass and improvements in performance remains unclear (see the meta-analysis link below). Therefore, the aim of this study was to compare the effects of several commercially available leucine metabolites (HMB-Ca, HMB-FA and α -HICA) combined with resistance exercise training on body composition.

WHAT THEY DID

Forty resistance trained men received either α -HICA, HMB-FA, HMB-Ca, or a placebo before completing a whole-body resistance training protocol, over a period of 8 weeks (3 sessions per week). Body composition was assessed by dual-energy x-ray absorptiometry (DXA) and total body water (TBW) by whole-body bio-impedance spectroscopy (BIS), at baseline, and at 4 and 8 weeks. Dietary counselling was provided by trained dietitians to assure sufficient energy and protein in order to allow for training-induced gains of lean mass. For an illustration of the protocol, see the infographic link below.

WHAT THEY FOUND

Following 8 weeks of whole-body resistance training combined with a high protein diet and an estimated positive energy balance, none of the leucine metabolite supplements when used resulted in an ergogenic effect on fat mass and fat-free mass. The findings do not support the use of any leucine metabolites to improve body composition in young adult trained men.

» Practical Takeaways

Although extraordinary results have been previously presented for HMB and its metabolites in increasing lean mass, these are surprising and are questionable, especially considering this research is in broad agreement with others showing a lack of marked effect of HMB on hypertrophy. The same group of authors also show that when consuming sufficient protein and energy, no advantage was evident with any leucine metabolite with respect to increases in muscle thickness.

Therefore, the take-home message from this study would be to focus on spending time and money with consuming a high protein diet combined with a positive energy balance, rather than to supplement with leucine metabolites. To support any resistance training programme, high leucine containing foods would be recommended. For example dairy products, milk and yoghurt and meat and eggs.

Want to learn more?

Then check these out...



James's Comments

"It is difficult to assess whether participants were in an estimated positive energy balance or consuming sufficient proteins due to a lack of information regarding the absolute values for dietary intake (energy and macronutrients). As such, the current study did control participant's diets in order to ensure sufficient energy and protein intake, and for variations in TBW, which may confound the DXA assessments. It is debatable whether a longer duration trial (i.e. >12 more weeks) might have led to a training effect, as is the case in previous studies. For further information related to the use of HMB on muscle growth and strength, refer to the article link below."

Injury Prevention & Rehab

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

ARE MALE RUNNERS AT SIMILAR RISK FOR BONE STRESS INJURIES AS FEMALES?

Kraus, E. et al. (2018) British Journal of Sports Medicine

WORKLOAD MONITORING: IT'S NOT JUST ABOUT THE RATIOS

Ahmun, R. et al. (2018) International Journal of Sports Physiology and Performance

RETURN-TO-PLAY AFTER REVISION OF PRIMARY UCL RECONSTRUCTION: WHAT DO WE KNOW ABOUT IT?

Glogovac, G. et al. (2018) American Journal of Sports Medicine



[Abstract]

Are male runners at similar risk for bone stress injuries as females?

OBJECTIVE

Bone stress injuries (BSI), often referred to as "stress fractures" or "stress reactions", are common in sport, particularly in runners. Most of the research surrounding these types of injuries (usually associated with the Female Athlete Triad) has focused almost entirely on the female population. This study investigated the risk factors for BSI in male runners from two NCAA division one cross-country and track and field-based programmes.

WHAT THEY DID

Two cohorts of male collegiate middle- and long-distance runners from two institutions were assessed using some of the same measures from the Female Athlete Triad Cumulative Risk Assessment. The "historic" cohort, was studied retrospectively via chart review over the previous 3 years (2010-2013). The "prospective" cohort completed annual questionnaires, physical exams (PPE), nutritional assessments, and dual-energy X-ray absorptiometry (DXA) scans.

WHAT THEY FOUND

Low EA and low BMI were uncommon in both cohorts at baseline and longitudinally. Seventeen percent of the athletes for which DXA scans were performed had a Z-score below -1 at baseline, indicating moderate risk. Also of note, 30.1% of the men had a history of prior BSI at baseline. Overall, 27% of the runners in this study suffered one or more BSI's over the course of 2 years, which translates to an incidence of 0.20 injuries per year. Their use of a modified Female Athlete Triad Cumulative Risk Assessment score appeared to be predictive of future BSI in male runners.

» Practical Takeaways

This study shows that it may be possible to use an adapted form of the Female Athlete Triad Cumulative Risk Assessment to screen male runners and determine their risk for developing a BSI which may allow for proper proactive management and/or treatment strategies to be employed as early as possible. It also raises awareness of the fact that females are not the only population at risk of these injuries.

The main takeaways include the following:

- ⇒ Low EA, low BMI, low BMD and history of previous BSI are all relevant risk factors for subsequent BSI in male middle- to long-distance runners.
- ⇒ Any combination of these risk factors (not any one alone) is predictive of future BSI.
- ⇒ These findings provide a way to quantitatively evaluate risk in male runners.

Limitations of this study:

- ⇒ They did not account for changes in coaching style, footwear, or training variables over the study period.
- ⇒ Not all participants had DXA scan data available, and both facilities used different scanners.

Strengths of this study:

- ⇒ Large sample size (156 runners).
- ⇒ BSI assessments were standardised at both locations and were performed by sports medicine physicians.

Want to learn more?

Then check these out...



Steph's Comments

"This study is unique in that it aims to consider males as readily as females in the world of running-related injuries. This is encouraging, as a considerable amount of the research surrounding such injuries has focused on females and the "clusters" of findings that seem to go along with it (e.g. amenorrhea, disordered eating, low energy levels, low BMI). What the research has fallen short in though, is considering some of these same "clusters" in males, which this study has done well in addressing.

Being that the identified risks seem to be cumulative in nature, coaches and clinicians can use these measures to more accurately determine which of their athletes may be at higher risk. This is also paramount in intervening early when appropriate, so as to reduce the chances of more serious injuries occurring down the road. When some of this medical information is not available, coaches may use subjective measures such as pain during running to "open the door" for conversation (refer to links)."

[Abstract]

Workload monitoring: it's not just about the ratios

OBJECTIVE

The following concepts have been proposed, yet found to be inconclusive within the literature:

1. The relationship between session rate of perceived exertion (sRPE) and injury risk.
2. Internal or external loads having a greater association with injury.
3. The effect of frequent touring on injury risk and self-reported wellness in athletes.

The aim of this study was to gain insight into the association between various measures of workload monitoring and injury whilst competing overseas.

WHAT THEY DID

The study sample was 39 male adolescent cricketers, and data were collected over a three year period, throughout five tours (1862 training days). Subjective wellness reports were collected every morning at breakfast using a 5-point scale for sleep quality and duration, muscle soreness, cold symptoms, and mood. Internal workload for each session was recorded using a 10-point RPE scale and daily training loads were calculated by multiplying session RPE by session duration in minutes (AU). A physiotherapist recorded injury status of each player daily on a scale from 1-4; 1 being fully available for play and 4 being unavailable to play due to injury or illness.

WHAT THEY FOUND

Overall, there were 98 injuries in 38 players. There was no relationship between wellness scores and injury risk, though there appeared to be trends in worsening sleep quality and cold symptoms in the week prior to injury. Both a high 3-day (>0.35) and 14-day (>0.67) workload z-score was associated with higher injury risk. The acute-chronic workload ratio itself was not definitively associated with injury. Most notably, there was a clear interaction between acute-chronic workload ratio and chronic workloads, in that chronic workloads had a much greater effect on injury risk in the low and high ACWR categories.

» Practical Takeaways

In the short-term, high workloads in cricket resulted in an increased risk of injury. This may be influenced by two things: inadequate rest between competition bouts, and/or an insufficient chronic workload built up due to younger age and less training experience. Therefore, these adolescent athletes may have inherently been less able to handle acute spikes in training load that come with the nature of touring and traveling. This indicates a need to establish an optimal balance of intensity and volume for these young athletes.

High chronic loads combined with a high or low ACWR can increase the risk of injury compared to moderate chronic loads. This suggests that a workload history/baseline be measured at the start of the cricket season (refer to article and podcast links below). Maybe, if we are able to quantify a baseline ACWR and/or chronic workload at the start of a season, we can better set the athlete up for success going forward as then we will have a fairly objective view of their ability to tolerate various chronic loads.

There did not seem to be a significant relationship between subjective measures and injury or illness, though there was a trend in less sleep and self-reported cold symptoms. This begs the question of whether or not the amount of sleep an athlete gets truly matters unless the athlete "feels" tired or "run down". Although it is difficult to prescribe individual loading for each athlete, these findings suggest that making sure all players loads are below 2125 AU will reduce their risk of injury.

Want to learn more?

Then check these out...



Steph's Comments

"I think what this study has done very well is take a step back from monitoring JUST the relationship between ACWR's/AU's and injury risk, and actually consider internal workloads, wellness, illness, and injury risk.

The major takeaway for me, was the finding that a high chronic load has a greater impact when the ACWR is either very high or very low. Diving into this a bit more, this translates to the following: when the ACWR is very low, meaning the athlete has essentially not exposed him or herself to enough load to build resilience, then he or she is unable to tolerate a subsequent high chronic load. Vice versa, when the ACWR is very high, meaning the athlete has been exposed to too much load and has not recovered sufficiently, then he or she is also unable to tolerate a subsequent high chronic load. This is where the concept of a "sweet spot" in the ACWR comes in, and where I believe further research is required."

[Abstract]

Return-to-play after revision of primary UCL reconstruction: what do we know about it?

OBJECTIVE

Previous research has demonstrated fairly high return-to-play (RTP) rates for elite and professional baseball players following primary ulnar collateral ligament (UCL) reconstruction. However, little exists in the way of examining rates of RTP following revision of UCL reconstruction in elite-level baseball players, which is what this systematic review aimed to synthesise. The authors hypothesised that RTP rates would be lower following revision surgery vs. primary reconstruction.

WHAT THEY DID

An electronic literature search was performed with specific terms. Five studies were included in the final analysis and were assessed for bias using the Methodological Index for Non-Randomised Studies (MINORS) scoring system. Data were extracted, with the primary outcome measure being whether or not the participant returned to play after revision of UCL reconstruction, and with secondary outcomes of career length after revision and pitching performance statistics. Due to significant heterogeneity and variation in methods among the studies, the authors took the outcomes that were reported in at least 3 studies and summarised them in tables with ranges, standard deviations, and weighted means.

WHAT THEY FOUND

All 5 studies had MINORS scores >75%, indicating low bias, and the majority of participants played baseball at the professional level (98%). The mean rate of return-to-sport at pre-injury level across all 5 studies was 62.8% (defined as participating in at least one game). The rate of RTP at ANY level was reported in 4 studies and the mean was 78.1%. The average time to RTP was reported in 3 studies and ranged from 1.3-1.7 yr and average career length following revision ranged from 2.6-3.2 yr.

» Practical Takeaways

Based on the data from this review, the authors were correct in their hypothesis that elite baseball players who underwent revision of a primary UCL reconstruction returned to sport at a lower rate than those who underwent primary UCL reconstruction only. The authors also found that career length following revision surgery, as well as pitching performance (measured via ERA and innings pitched) were also shorter and lower, respectively. What is also noteworthy, was the mean time to RTP found in this review, which ranged from 1.3-1.7 yr. This is a substantial amount of time for an athlete whose livelihood rests on his ability to play baseball and perform.

The authors were thorough in reviewing these "behind the scenes" impacts of such a surgery, highlighting some unfortunate realities which included:

- ⇒ Many pitchers migrated to a relief pitching role vs. starting role following surgery.
- ⇒ Few pitchers (only 35%) were able to resume their pre-injury workload.
- ⇒ Career longevity was negatively affected (only 29% of pitchers continued to play in the MLB for >2 yr post-surgery).

Limitations of this study:

- ⇒ Low evidence levels.
- ⇒ Small sample sizes (few participants in studies reflect rarity of the procedure).
- ⇒ Little/no information regarding rehabilitation procedures/protocols

Want to learn more?

Then check these out...



Steph's Comments

"Despite having low levels of evidence, small sample sizes, and little insight into the specifics of post-operative rehabilitation, this study brings up a fairly novel research question that warrants further investigation. Revision of a primary UCL reconstruction, though rare, is a reality for elite-level and professional baseball players, and having more information regarding this procedure can aide in setting realistic and optimal rehabilitation and RTP goals.

What is most helpful for the rehabilitation professional and coach is knowing that average RTP times are long for such a procedure (1.3-1.7 yr) and this should be communicated to the athlete, so he/she has the right mindset and expectations going into the process. On the positive side of this, we can also confidently let the athlete know that RTP is absolutely possible, if gone about the right way, and that with extra consideration for things such as pitch and inning count, they can likely play for another 2+ yr once they return. This can be instrumental in fostering intrinsic motivation and optimism on the part of the injured athlete."

Infographics

A round-up of our monthly research infographics.

BIOBANDING

Solomon, M. (2019) Science for Sport.

COACHING CUES

Solomon, M. (2019) Science for Sport.





What is it?

Bio-banding is the process of grouping athletes based on growth and maturation attributes, rather than age.



Importance

Maturation varies in children with the same chronological age, therefore physical, social, and psychological attributes may be extremely varied.



Application

Bio-banding could be a suitable way of addressing the issues in each of the following categories:

Training

Complementing age-group competition with bio-banding, can benefit both early and late maturing athletes in academy soccer.



Competition

It is possible that early-developers use their physical advantage and neglect technical and tactical skills.



Talent identification

Often early maturing athletes are favoured over their less mature counterparts.



Calculation

Using the percentage of predicted adult stature/height (PAH), at the time of observation, it is possible to group athletes into maturity categories:



Pre pubertal (<85% of PAH)



Early pubertal (>85-90% of PAH)



Mid-pubertal (90-95% of PAH)



Late pubertal (>95% of PAH)

Warning



Coaches must take into consideration psychological and technical skills of the athletes, before changing their grouping.



Our Summary

Growth and maturity play an important role in the development of young athletes. It seems that bio-banding may have an important part to play in the future if it continues to demonstrate positive outcomes.

For the full article check out the Science for Sport website



@ScienceforSport

COACHING CUES

SCIENCE
for
SPORT

Key information



Coaching cues are snippets of information, or task-orientated information, used to teach the athlete how to perform the task/skill.



Types of cues

Cueing can be broken down into 3 types.

Internal

Focus attention on the body movements associated with the skill, e.g. "bend from your hips."



External

Focus attention on the movement effect or the outcome associated with the skill, e.g. "absorb the floor."



Normal

An absence of instruction, it is instead athlete's normal focus when they are given no cue.



External cues

External cues appear more effective in improving the following:



Balance tasks



Force/velocity expression



Change of direction speed



Skills with an implement



Skills without an implement



Skill retention

Research has consistently shown that external cues are superior to internal or normal cues in terms of retaining the skill in question.

Our Summary

The type of coaching cue used appears to significantly influence both immediate performance and the retention of the skill/performance. More specifically, external cues, which focus the athlete's attention on the outcome of the task appear to be the most effective form of cueing in the majority of contexts studied.



For the full article check out the Science for Sport website

SCIENCE
for
SPORT

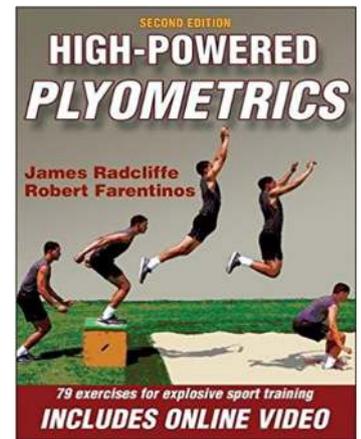
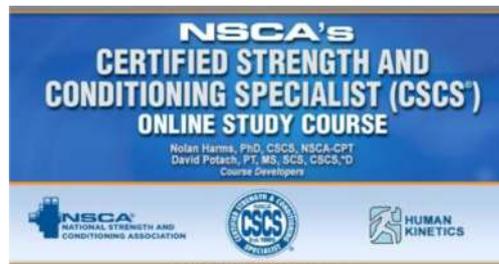
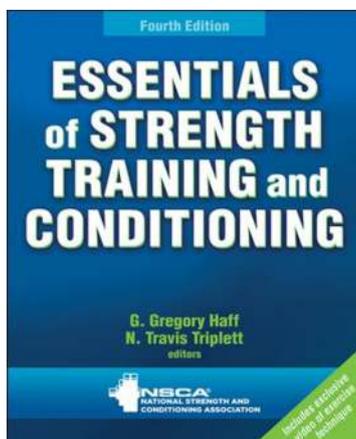
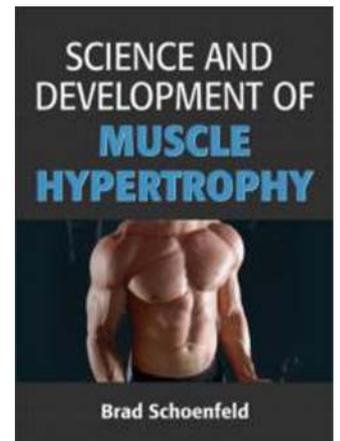
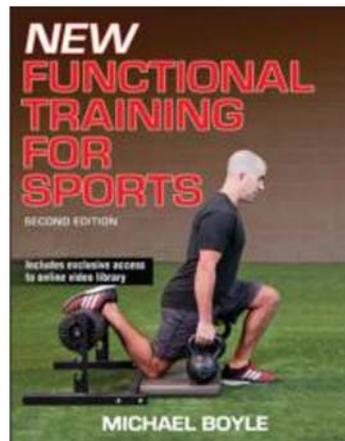
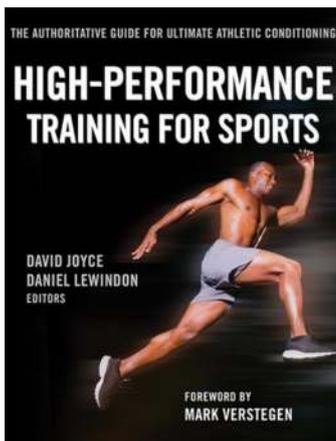
Special Discounts

An assortment of product offers only for Performance Digest subscribers.

These offers are constantly changing and may only be available for that particular month, so if you see one you like, don't wait!



Make great savings on some of the industry's
best selling and must read books



Save 20% using the discount code "**SFS20**"
Click on any book to purchase now.

The discount applies to any Human Kinetic books on their website, these are just examples.

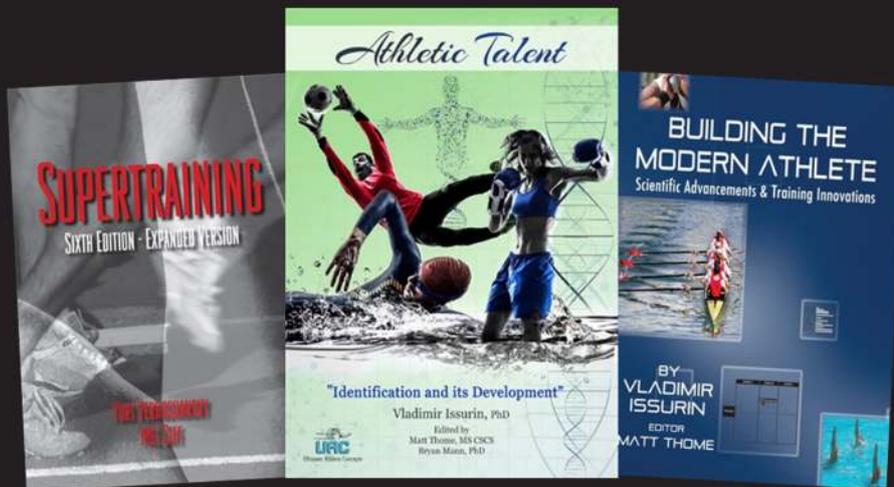
Discounts do not apply to Australian and New Zealand customers, sorry.



Ultimate Athlete Concepts

PROPEL YOUR KNOWLEDGE AND COACHING SKILLS

Ultimate Athlete Concepts has a large collection of books which focus on enhancing athletic performance.



Use discount code "**SFS10X**" and

SAVE 20%

Exclusive discount for Performance Digest members only.

[See what's on offer](#)

Network, learn,
share and
WIN a FREE
book every
month!

Enter our
“**Member of the Month**”
competition each month
to be in with a chance of
winning a free book every
single month.

All you have to do is:

1

Join the Members
-Only group on
Facebook.

2

Get involved in the
discussions, ask
questions, answer
questions, and simply
just add value.



3

We'll then pick
the member who
added the most
value to the
group. If that's
yours, **YOU WIN!**
Simple as that!

Winners are announced on the 20th of every month.

Get Started

Thanks for Reading!

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

**Did you like all the great content
in this issue?**

If so, then make sure you spread the
knowledge with your friends and colleagues!

Warm Regards
Science for Sport

