September 2019 | Issue #35

THE PERFORMANCE DIGEST

A review of the latest sports performance research

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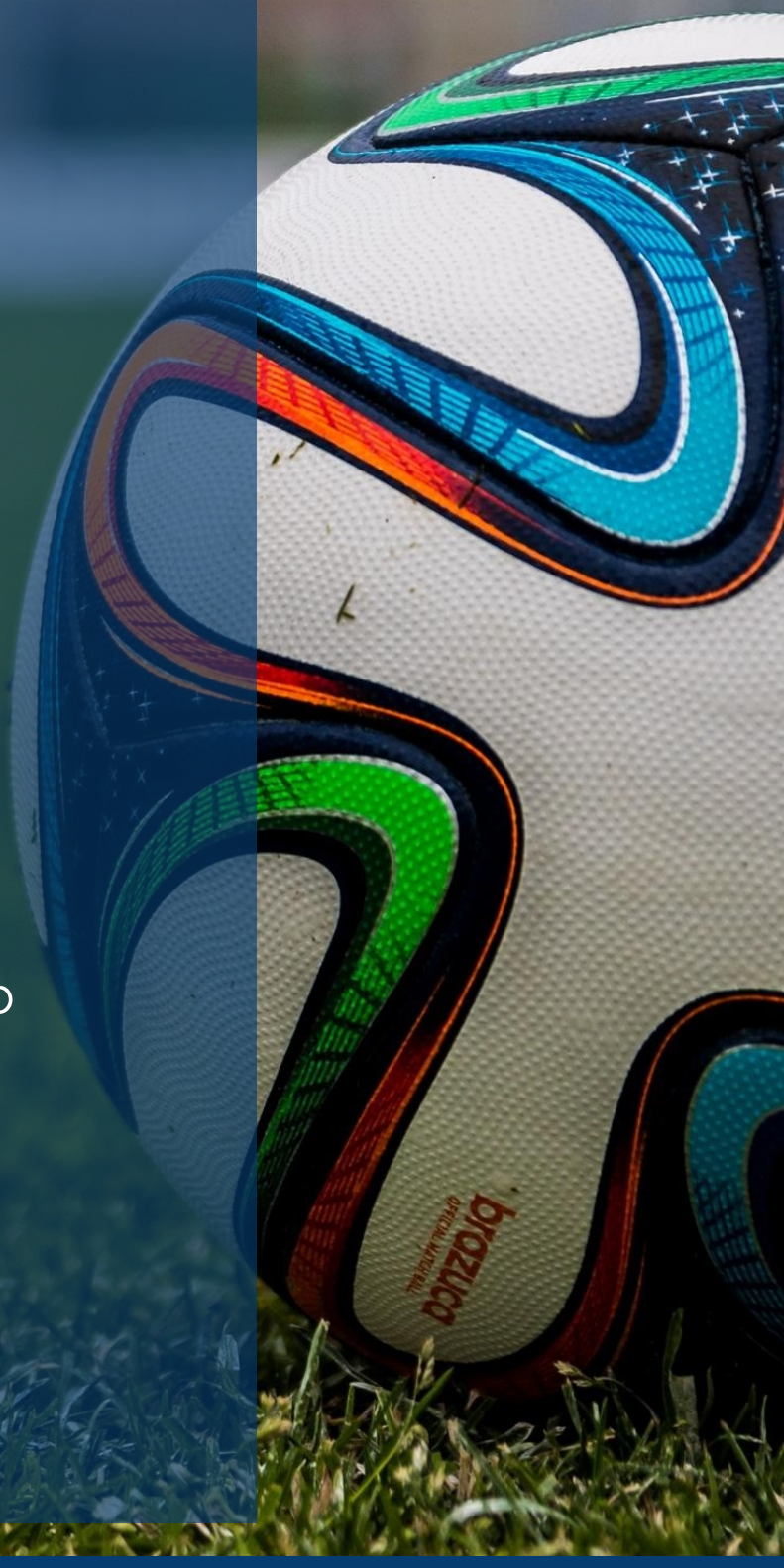

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Audio
REVIEW

Warm-Ups

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

with James de Lacey

WHAT WE DICUSS

In this episode of the "Audio Review", James discusses warm-ups.

In this episode, you will learn:

- What you want to achieve with a warm-up.
- The structure of a warm-up.
- Links between the warm-up and main part of the session.
- Games within the warm-up.
- Answering member questions from the members-only group.

Episode length = 47 min

A bit about **James**

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.

Listen Now

The Science of
COACHING

[Abstract]

Team tactics using small-sided games

How can we change rules during training to improve team tactics?

INTRODUCTION

Before the use of formal learning environments children used unstructured practice and play developed by themselves to learn the game of soccer. This way of learning has been shown to enhance the cognitive skills of the players (see **HERE**) and, therefore, an important place to help teach and learn the game. Researchers have proposed player-centred and game-based approaches for effective learning in these more formal environments (see **HERE**), but it is important to try and understand how player's best learn different tactical behaviours in these scenarios.

Very few studies have looked at how different game conditions impact teams' performance, and how these rules affect tactical behaviour. As such, this study examined how teams tactical behaviours varies between age groups and also how different small-sided and conditioned games affect style of play.

Twenty non-elite male soccer players (10 x U15s, 10 x U17s) took part in a combination of 36 small-sided and conditioned games consisting of a 3v3 and 4v4 with the following rules included:

⇒ Normal games with no offside line.

⇒ Possession games, with the aim of keeping the ball.

⇒ Progression to a target games, where the teams were rewarded for playing forward passes.

WHAT THEY FOUND

U15s

⇒ Better at maintaining possession, more comfortable with ball circulation, and attacking dynamics in the 4v4 games compared to the 3v3 games.

⇒ Better at attacking in the target games compared to the U17s group, however, attacks were performed for shorter times.

U17s

⇒ Worked better as a team in the 4v4 games compared to the 3v3 games, however, they had more individual effectiveness in 3v3 games, characterised by more individual ball touches and ball circulation.

⇒ Were more direct in their playing style in the 3v3 games, compared to the U15s, due to more individual ball touches and a higher rhythm of ball intervention. This could highlight that the older players could deal with more complex rules and set-ups.

It was also reported that when looking at the rules and configurations as a whole:

⇒ Possession games allowed more players to be involved, and more passing exchanges.

⇒ The more rules that were applied caused the players to have less variability in their attacking actions, which could limit the team's exploratory behaviour to solve tactical problems.

WHAT THIS MEANS

Changing the rules in different small-sided and conditioned games can greatly affect the tactical behaviours shown by players, and should be planned carefully when looking at training sessions. If a coach wants a more attacking and direct style of play, different rules would be needed compared to wanting more possession-based tactics. If a coach changes the rules excessively, it can be harmful to younger teams, preventing their ability for exploring different attacking patterns.

It is important for coaches to understand their tactical game model, the level, and age of players they are working with, and then carefully use rules, numbers of players, and pitch sizes to ensure the players can perform what is being asked of them tactically.

Practical Takeaways

Coaches wanting to develop certain tactical behaviours, should pay close attention to the rules and constraints they put on the different small-sided and conditioned games in their training sessions.

Changing the rules too much, or putting too many rules on each practice can prevent the players from developing the tactical outcomes desired by the coach. 4-a-side games can be used to improve the team's tactical performances, whereas the smaller games can encourage more varied attacking patterns of play.

Adam Kerr

Adam is the Head of Physical Performance for Scunthorpe United FC and has previously worked at Middlesbrough FC, Arsenal FC and the Professional Golfers Association.

Strength & Conditioning

This month's top research in strength & conditioning.

REVERSE HYPEREXTENSION OR HYPER EXTENSION MACHINE: WHICH ONE FOR WHAT PURPOSE?

Lawrence, M. A. et al. (2019) The Journal of Strength and Conditioning Research.

HOW SHOULD YOU TAPER TO MAXIMISE PERFORMANCE?

Hermassi, S. et al. (2019) BioRxiv.

HOW CAN A NEWLY PROPOSED CHANGE OF DIRECTION DEFICIT FOR TEAM-SPORTS INFLUENCE YOUR TRAINING?

Cuthbert, M. et al. (2019) The Journal of Strength and Conditioning Research.

[Abstract]

Reverse hyperextension or hyper extension machine: which one for what purpose?

OBJECTIVE

The reverse hyperextension was originally developed to increase muscular strength of the posterior chain. Despite these claims of posterior chain strengthening and lower back traction, there have been no scientific investigations to determine the efficacy of the reverse hyperextension.

Therefore, the purpose of this study was to determine whether there are differences between the reverse hyperextension (RHE) and the back hyperextension (HE) in terms of muscle activation, range of motion (ROM), and low back extension moments.

WHAT THEY DID

Twenty healthy subjects (Ten men, ten women; age: 26.8±7.8 yrs) performed 2 sets of 10 reps on each of RHE and HE machines. Muscle activity of the erector spinae, gluteus maximus, and biceps femoris were recorded. A force transducer was used to measure the force and both exercises were loaded equally. Subjects were asked to keep a 1 sec up and down cadence with 2 min rest between sets. Peak, mean, and integrated (area under the curve) muscle activity were calculated for each repetition. Total ROM (right thigh to trunk), isolated ROM (trunk to pelvis), and peak, mean, and integrated extension moment at the lower back were also calculated.

WHAT THEY FOUND

A number of key findings were reported within this study:

⇒ Integrated muscle activity was significantly greater during HE in both biceps femoris (+19.2%) and gluteus maximus (+23.2%).

⇒ Similar integrated muscle activity was found for the erector spinae.

⇒ Maximum and mean muscle activation were not different between exercises across all muscles.

⇒ Isolated ROM was significantly greater during HE compared to RHE (+10.7°).

⇒ Total ROM was significantly greater during RHE compared to HE (+10.9°).

» **Practical** Takeaways

Interestingly, the greater peak low back moment during RHE did not coincide with greater muscle activity. This may have been due to the way the RHE is performed where the pendulum allows for momentum. However, RHE produced greater hip ROM with less angular lower back stress while providing equivalent erector spinae activity.

There are a few possible practical implications from the results of this study:

⇒ Those with lower back pain or needing lower back rehabilitation where large degrees of ROM through the lower back are likely to cause pain would potentially benefit from the RHE over the HE.

⇒ Greater biceps femoris activity was seen during the HE which may be useful for general hamstring strengthening of the bi-articular muscle often susceptible to injury.

⇒ The greater gluteus maximus activity during the HE may provide a hip extension variation to overload the posterior chain, especially when loaded. This can also be performed in a post-activation potentiation protocol to enhance horizontal force development (e.g. hyperextension deadlift + broad jumps).

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

James' **Comments**

"There were a few limitations to this study which the authors listed, such as subjects not requiring any previous experience with the exercises, not controlling for the amount of swing during the RHE, and the loads for RHE were substantially lower than what is reported anecdotally. However, one limitation that wasn't mentioned, that in my personal experience makes a large difference to how these exercises "work" different areas, is the way they are performed. Bret Contreras really changed the way I perform and prescribe the HE (as seen in the video below).

When you push your hips through the pad, it creates greater activation through the glutes than the lower back, whereas, just raising your shoulders up seems to give you greater lower back activation. Similarly with the RHE, you can really squeeze your glutes to move the weight or you can just swing it with a lot of lower back movement. I prefer emphasising the glutes and the hip extension rather than making it a pure back extension. If you load it heavy enough, you'll also feel your lower back anyway. With these exercises, I like to use a range of loads and go from 6–20 reps depending on the goal of the exercise."

[Abstract]

How should you taper to maximise performance?

OBJECTIVE

The aim of tapering is to decrease the adverse physiological and psychological stresses imposed by heavy daily training which is designed to optimise competitive performance. Tapering can be carried out in many ways, including progressive and step reductions in training volume, intensity, and frequency.

No previous study has investigated the effects of a two-week step-tapering period on physical performance of handball players undergoing resistance training. Thus, the aim of this study was to analyse the effects of a two-week step-taper on upper- and lower-limb muscle power, ball throwing velocity, jump performance, and sprinting ability.

WHAT THEY DID

Twenty male First National League Handball players who had previous strength training experience (experimental (age: 20.9±0.7 yr) and control groups (age: 20.6±0.5 yr) participated in a ten-week intervention. The experimental group (EXP) replaced part of their technical-tactical development with a resistance training program twice per week which included the snatch, bench press, half squat and clean and jerk for 3 x 5-10 reps. The control group (CON) maintained their normal training which consisted of 60% technical-tactical and 40% strength and conditioning. This was spread over six, 90 min training sessions per week. A two-week tapering period followed for the EXP only with approximately two-thirds decrease in volume and 50% decrease in frequency along with a decrease in intensity.

Testing was performed before the intervention (T0), after the intervention (T1), and after the taper (T2) and included, anthropometry (body fat), power (squat jump, countermovement jump), force-velocity test (cycle ergometer), speed (15 m, 30 m sprint), strength (1RM bench press, snatch, clean and jerk, and half squat), throwing velocity (3-step running throw and jump throw), and agility (T-half test).

WHAT THEY FOUND

T0 – T1:

⇒ Greatest gain in performance seen in 15 m sprint and 1RM snatch of the EXP.

⇒ Half squat showed the largest difference between groups with EXP increasing 1RM (155 – 177kg) while CON decreased (136 – 129kg).

⇒ SJ, force, and velocity for upper- and lower-limbs showed no significant interaction effects.

⇒ CON group showed decreases in performance for maximal power and force for lower limbs and the snatch.

T1-T2:

⇒ Largest difference between groups was the running throw.

⇒ Largest gain in performance seen in 15 m sprint for EXP group.

⇒ EXP group reduction in upper-limb velocity and T half test.

⇒ Other variables continued to increase throughout tapering period in the EXP group but increases were smaller than the T0-T1 period.

» Practical Takeaways

Comparing the results between tapering studies can be difficult due to a taper not only being influenced by how the taper is implemented, but what training precedes it. This is something we noted in my study (see **HERE**), where the large improvements seen during a taper seem to be those qualities which are trained heavily previous to the taper. Based on previous research, here are some helpful tips when it comes to implementing a taper from my Masters Thesis:

⇒ Generally, intensity should be kept high (>80% 1RM) and volume dropped as low as possible (41-60% volume reduction is generally recommended for step tapers).

⇒ Based on previous research (see **HERE**), you can reduce strength training volume to once a week - which is enough to maintain previous gains. You can push out to approximately 10 days, if necessary.

⇒ Sprinting and jumping respond optimally to a tapering period of 7–14 days where training load and intensity is reduced.

⇒ Step tapers are most effective for short tapering periods (less than 14 days). The longer the tapering period, the slower the reduction in volume should be.

⇒ Normal technical/tactical training and conditioning work doesn't seem to interfere with the tapering process, meaning you can reduce overall workload while still refining other areas of performance.

⇒ Detraining and tapering refer to two different things. Detraining is cessation of training (generally when looking at Type IIX muscle fiber overshoot), whereas a taper is a reduction in training load as defined above.

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

James' Comments

"In my opinion, it is difficult to extrapolate the results of the current study due to: 1) the amount of strength training that had been performed previous to the intervention, and 2) the taper protocol itself. Subjects were strength training once per week, performing (according to the study) only half squat and bench press. If they were well-trained, perhaps the tapering period would have had an even greater impact on performance.

Secondly, the tapering period mainly reduced intensity (from 60-80% 1RM to 50% 1RM) while keeping much of the intra-session volume with a set/rep scheme they hadn't performed before, potentially leading to some small gains (2 sets x 12 repetitions) while decreasing overall volume. In the short-term, decreasing volume and intensity may be a way to successfully taper when training focus is on other areas of performance."

[Abstract]

How can a newly proposed change of direction deficit for team-sports influence your training?

OBJECTIVE

Change of direction (COD) deficit was created and popularised by Sophia Nimphius (**HERE**). Nimphius found that COD deficit strongly correlated with 505 performance but not 10 m sprint time, indicating the COD deficit can quantify an individual's COD ability. However, 180° turns are not common in many team sports (i.e. soccer, rugby).

A test to evaluate cutting ability using a single cut might therefore be more useful for certain sports where most CODs are reported between 0-90°. As such, the aim of this study was to examine the application of the COD deficit to a 90° cut test to see whether the COD deficit provides an evaluation of an individual's cutting ability.

WHAT THEY DID

Thirty-six male collegiate team-sport athletes (twenty-three rugby union/league, thirteen soccer, age: 18-22 yrs) performed three 20 m sprints with 5 m, 10 m, and 20 m split times with 1 min rest, as well as two COD tests (505 and 90° cut tests), performed for three trials each.

For the 90° cut test, timing gates were placed at a starting point 5 m away from the marked turning point with two sets placed a further 5 m away at a 90° angle. The 505 test had a 10 m run in, then a 5 m 180° COD. All tests were performed on the same day.

WHAT THEY FOUND

Sprint times and 90° cut test:

⇒ Significant moderate to large correlations for left and right cuts.

⇒ Insignificant trivial to small correlations found between sprint times and 90° COD deficit.

⇒ Significant large to very large correlations found between 90° cuts and 90° COD deficit.

Sprint times and 505 test:

⇒ Significant moderate to large correlations for left and right turns.

⇒ Only one significant moderate correlation found between 10 m sprint and right 50 COD deficit.

⇒ All other correlations between sprint times and 505 COD deficit were trivial to small.

⇒ Significant moderate to large correlations

» Practical Takeaways

Based on these findings, the COD deficit can be applied to the 90° cut test to isolate COD ability. Practically, most team-sports don't require many 180° turns (e.g. cricket the exception) so the 90° cut test may provide greater validity to your COD testing. It is important to note that both legs should be tested and perhaps on a novel level, an asymmetry value could be attained to further influence your programming. Here's an example of how you could put this into practice:

1. COD deficit = 10 m sprint time – 505 or 90° Cut test time.
2. Rank each athlete by Z score for each athlete (lathlete score – group mean)/group SD).
3. Identify athletes that are slower than average (positive Z-scores) and rank the severity of the deficit. For example:
    - ⇒ 0.1-0.9: small deficit
    - ⇒ 1.0-1.5: moderate deficit
    - ⇒ 1.6+: large deficit.

It doesn't have to be ranked like this, but it will likely be easier when you have less groups. Then, rank by asymmetry using the arbitrary 10% difference rule.

From these groups, you can have athletes with greater deficits spend more time on the field performing COD instead of linear speed work. Further, they can have a mediolateral emphasis in the gym with exercises such as skater jumps, lateral lunges, and lateral sled runs. The athletes with large asymmetries can potentially perform 1-2 more reps on the weaker leg in the gym and on the field.

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

James' Comments

"The one thing you need if implementing this kind of analysis in your team-sport, is time to test and staff. As stated in a previous COD deficit paper I reviewed in of the Performance Digest Issue #29, one way to organise the training in an easy manner with a large squad would be to have all players perform the same warm-up and first 1 or 2 sprints. From there, the selected COD players perform sprint 3 and 4 with your selected COD task, while the rest of the players continue with linear sprinting. This allows you to keep an eye on everyone and not have to set up a lot of equipment.

With individual sports, this is a very easy test to implement and influence training with. What would also be interesting is comparing the COD deficit between tests and if athletes have greater or lesser deficits depending on the manoeuvre they have to perform."

Technology & Monitoring

This month's top research on technology and monitoring.

HOW GOOD IS A SMARTPHONE APP AT MEASURING CHANGE OF DIRECTION?
Balsalobre-Fernández, C. et al. (2019) Journal of Sports Sciences.

THE YO-YO TEST: WHAT DOES RESEARCH SAY ABOUT TEST-RETEST RELIABILITY?
Grgic, J. et al. (2019) Sports Medicine.

ASSESSING FORCE-VELOCITY RELATIONSHIP USING TWO DIFFERENT SQUAT JUMPS
Janicijevic, D. et al. (2019) European Journal of Sport Science.

[Abstract]

How good is a smartphone app at measuring change of direction?

OBJECTIVE

Video-based smartphone apps have proven to be reliable and valid at measuring vertical jump and sprinting performance. Beyond these measures, though, the ability to change direction quickly, in both directions, is vital to performance in many sports like soccer, rugby, and basketball. This is typically measured using specialised equipment or using very simple (and unreliable) measures like a stopwatch, which may limit the reliability of the information gained.

The aim of this study, therefore, was to test the concurrent validity and reliability of a novel iOS app (CODTimer) against timing-gates using a standard change of direction (COD) test.

WHAT THEY DID

Twenty adolescent soccer players were familiarised with the 5 + 5 180˚ COD test before performing a total of six trials (planting with each leg three times) on an artificial grass surface, during the same time of day, and with similar temperature and humidity conditions. A single-beam photocell (Witty gate) was used as the criterion measure and the CODTimer app was used simultaneously during each test to record the time to complete each trial.

The information gathered from the criterion measure and app were compared to perform validity and reliability analysis.

WHAT THEY FOUND

Primary findings in the study:

⇒ The CODTimer app is highly valid and reliable for the measurement of the total time in the 5 + 5 180˚ COD test in adolescent soccer players.

⇒ Very high reliability between the CODTimer app and the timing-gates when analysing the reproducibility of the measurement between trials.

⇒ Similar inter-limb asymmetry scores were obtained with the app in comparison to the timing-gates

Practical Takeaways

Much of the validity and reliability with utilising the CODTimer app comes from the user's standardisation of procedure. As the authors did in this study, it is important to set the athlete up to be successful with a surface and footwear that provide proper traction and confidence to complete the test. In addition to this, practitioners must also standardise the starting position, lane size, and their instructions, as well as securing the smartphone to a tripod 2 m away and perpendicular to the starting/ finishing line.

The app utilises the smartphone's high-speed video to record the trial and slow-motion frame-by-frame inspection allows the practitioner to identify the exact moment the athlete crosses both the start and finish line. Following these steps provides the athlete with a reliable measure to monitor performance within training, as well as identify a potential asymmetry between using the left or right leg to decelerate and redirect. If you wish to download this App and trial it for yourself, it is available **HERE**.

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

Cody's Comments

"Although it seems plausible to use the 5 + 5 180˚ COD test to identify asymmetry between lower limbs, research suggests the use of total time as a metric to detect inter-limb difference is poor (see **HERE**). It is suggested that a metric called 'change of direction deficit' could serve as a more sensitive and useful tool in profiling an athlete's between-limb difference. The change of direction deficit subtracts an athlete's linear speed time (e.g. 10 m sprint test) from a COD speed time of equivalent distance (e.g. 5 + 5 test), and research suggests that this provides an improved isolation to the COD component involved (see **HERE**).

Lastly, one limitation of this is the time it takes to obtain the measure by analysing the video. Although, the CODTimer app provides a reliable measure at a practical price, I'm not sure that the time required is practical in a large team setting. In the proper situation (i.e. with either one specific athlete, or even a small group during an off-season period), this application could be a very useful tool."

[Abstract]

The Yo-Yo test: what does research say about test-retest reliability?

OBJECTIVE

The Yo-Yo test variants have been heavily researched across numerous sports and populations, continuing to show high validity, as well as test-retest reliability for assessing fitness. Coaches should be confident in long-term changes and utilise the plethora of research and evidence for support in practical use.

This systematic review examined the test-retest reliability of the Yo-Yo test and supports the results for further implementation.

WHAT THEY DID

Authors searched numerous databases (e.g. CINAHL, ERIC, PsycINFO, PubMed/MEDLINE, Scopus, SPORTDiscus, etc.) for research performed on Yo-Yo test reliability, repeatability, or reproducibility. The inclusion criteria included:

⇒ Was published in a peer-reviewed journal.

⇒ Investigated test-retest reliability of the Yo-Yo test,

⇒ Presented intra-class correlation coefficients (ICCs) and/or coefficient of variation (CV) values.

Data was further examined based on the sample, Yo-Yo variant, days between tests, and ICC and/or CV values. Lastly, studies were evaluated for methodological quality using the COSMIN checklist (see **HERE**). At the end of this process, nineteen studies from 2003-2019, with over 800 participants were reviewed.

WHAT THEY FOUND

Primary findings in the review:

⇒ The majority of studies examined the reliability of the Yo-Yo Intermittent Recovery Level 1 test.

⇒ Of the studies reviewed, eleven used Association Football players as participants.

⇒ In most cases, the Yo-Yo test has good-to-excellent test-retest reliability.

⇒ The reliability of the test is consistent regardless of the variation used (i.e. intermittent recovery test or intermittent endurance test; levels 1 or 2) and irrespective of the participants' familiarity with the test.

» **Practical** Takeaways

Based upon the results of this review and in efforts to save time, a familiarisation session with the Yo-Yo test may not be necessary to achieve high test-retest reliability. The best thing that a practitioner can do to support test-retest reliability is to minimise the factors that affect performance. This would entail creating an environment that is consistent for the athlete based on environment (e.g. time of day, surface, and temperature), procedures (e.g. equipment used, warm-up protocol, or whether encouragement is provided), or athlete readiness.

Readiness is influenced by the sleep duration the night before testing, as well as nutritional strategies prior to testing. The more consistent and controlled these factors are for testing, the more reliable and comparable the results will be. With a strong test-retest reliability, confident conclusions and decisions regarding training intervention can be made.

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

Cody's **Comments**

"In terms of measures of test-retest reliability and better between-study comparison, this review highlights the need for using ICC or CV values within data analysis, as both may provide relevant and valuable information. Further, within research there should be specific mention of the type of ICC being used. In the case of the current systematic review, the ICC for single measurement would be preferred as this would reflect the specific test results as opposed to an average of multiple tests.

Just as it is with testing procedures, there is a need for consistency in reporting data for practitioners and researchers alike to better compare and interpret. Lastly, more research in the Yo-Yo Intermittent Recovery Level 2 and Yo-Yo Intermittent Endurance Level 1 and 2 tests, as well as in a range of sports other than Association Football is needed, before we over-simply these results across all Yo-Yo variants and too many sport disciplines."

[Abstract]

Assessing force-velocity relationship using two different squat jumps

OBJECTIVE

The Samozino (SAM) method (see **HERE**) is a way to evaluate power output during a squat jump (SJ), and was developed as an alternative to the "gold standard" force plate (FP) device.

Standardisation of jump assessments is needed to ensure that results are reliable, and the aim of this study was to compare starting positions in SJ variations, as well as two- and three-point FP and SAM methods when assessing force-velocity (F-V) relationships.

WHAT THEY DID

Twelve physically active participants completed a SJ familiarisation session to determine an external load associated with a jump height of about 10 cm. Participants performed a 2 sec static SJ with light, moderate, and heavy loads on two separate sessions. The sessions differed on starting position, 90° knee flexion (SJ90) vs. a self-selected depth (SJpref).

All SJs were analysed with a FP and the SAM method, where jump height was estimated using the validated MyJump2 mobile application. Statistical analysis was performed on the different SJ types, procedures, and methods for measure of reliability.

WHAT THEY FOUND

The key findings of the study were:

⇒ The SJ90 is preferable to determine the F-V relationship with the FP procedure compared to SJpref method.

⇒ No difference in reliability were identified between both SJ types using the SAM procedure.

⇒ The SJpref can be confidently used to determine the F-V relationship using the SAM procedure provided that an individual's push-off distance is a specific and consistent value for calculation with system mass and jump height.

⇒ The two- and three-point methods provided the F-V relationship parameter with comparable reliability, with nearly perfect correlations and trivial differences in magnitude.

» **Practical** Takeaways

Based on the results of this study, when comparing SJ methods to examine the F-V relationship, practitioners can save time and allow athletes to squat to a preferred depth prior to testing, as opposed to taking time to mark and measure an exact squat depth of 90° for each individual. Provided that depth is consistent, and the squat is held for a standardised time period (e.g. 2 sec).

The SJpref technique paired with the SAM method is a cost-effective alternative procedure when utilising a FP is not an option. If in fact, a FP is an option, results appear to be more reliable if the practitioner takes the time to mark and measure a consistent 90° for each individual.

Lastly, performing a light- and heavy-loaded SJ (i.e. two-point method) is sufficient and reliable in showcasing an athlete's F-V relationship compared to an additional moderate load (three-point) method. Ultimately, providing an accurate F-V relationship comes from normalising procedures for consistency.

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

Cody's **Comments**

"Monitoring in an athletics and team-sports setting must be practical, which is a balance of being time-efficient while maximising the resources available from a financial standpoint. Force platforms are able to capture a lot of valid and reliable data, but they can be a cost-prohibiting option. This study supports the use of a testing method (i.e. SJpref and SAM method) that is accomplished with limited resources and minimises the time required to execute testing. Profiling F-V relationships provides direction with training intervention based upon potential weaknesses in force or velocity outputs.

Thinking further ahead, the preferred squat depth with SJ assessment provides a measure that is specific to the athlete based upon their preferred position and not forcing a depth or position that the athlete may be uncomfortable in. In this instance, what makes the procedure more standardised and consistent across the group, may not be specific to the individual. Ultimately, the goal is to create specific purpose and individualise training, providing the most effective and productive training strategy."

Fatigue & Recovery

This month's top research on fatigue and recovery.

SLEEP BUT NOT ALERTNESS IS AFFECTED BY A PROFESSIONAL RUGBY MATCH

Dunican, I. C. et al. (2019) Journal of Human Kinetics.

SPRINT PERFORMANCE AND RATING OF PERCEIVED EXERTION ARE AFFECTED BY PITCH DIMENSIONS

Castillo, D. et al. (2019) Sports.

AN ACUTE INTENSIFIED TRAINING DAY MAY LEAD TO ACUTE CHANGES IN SLEEP AND DIETARY INTAKE

Saidi, O. et al. (2019) European Journal of Applied Physiology.

[Abstract]

Sleep but not alertness is affected by a professional rugby match

OBJECTIVE

Sleep is a determinant for recovery following athletic performance and to adapt from training. On the night of competition or match-play, sleep can be somehow affected due to factors like late starts, nutrition strategies (e.g. caffeine intake), and the stress of the match.

For these reasons, it is essential to monitor how a player's sleep is affected to help practitioners design training schedules and sleep strategies. This study investigated how sleep and alertness were affected by an elite rugby match.

WHAT THEY DID

The sleep patterns and alertness of thirty-three elite rugby players were monitored for those who played (PL; n=20) and didn't play (NPL; n=13) over 7 consecutive nights (3 nights before and 4 nights after a match).

Using a wrist-activity monitor, the following measures were obtained: time the athlete initiated sleep (TSO), sleep latency (SL), sleep duration (SD), wake after sleep onset (WASO), time at wake (TW), and sleep efficiency (SE; percentage of time spent asleep whilst in bed: sleep duration/time in bed minus sleep latency and WASO).

Measures of alertness were also calculated using the SAFTE algorithm (read about the SAFTE algorithm **HERE**).

WHAT THEY FOUND

The main findings of this study are:

⇒ The PL progressively increased sleep duration leading into the game.

⇒ The PL went to bed ~3 h later on the night of the game, resulting on a decrease of 2.5 h in SD.

⇒ 4 players didn't achieve any sleep after the game.

⇒ Sleep gradually returned to pre-game sleep patterns on the nights after the match.

⇒ Alertness remained >90% during all training sessions and >95% during the game.

» **Practical** Takeaways

Although players naturally increased sleep duration in the nights prior the game, practitioners can provide education to reinforce that an increase in sleep can lead to an increase in alertness.

Due to the reduced sleep duration on the nights after the match, practitioners are advised to delay the start of the first training session of the week. For example, in this study the sessions commence before 8 AM. If they started at 10 AM, it would give an extra 2 h for players to sleep.

Monitoring sleep is essential to detect cases of little to no sleep amongst athletes, as this can lead to alterations on training responses (e.g. decreased capability to produce high power outputs) and adaptations (e.g. maladaptations). These cases should be approached individually providing education to enhance sleep (e.g. nap on the day after the match to catch-up with some extra sleep).

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

Francisco's **Comments**

"This is a very interesting study demonstrating that players sleep is affected in the night and following nights of the game. It is also interesting to find that players adjust their sleep by increasing sleep duration in the nights leading into the game.

From self-experience with professional rugby, it is typical to find players who can't sleep on the night of the game. The pre-game nutrition strategies such as caffeine intake, media commitments, recovery sessions, socialising, persisting game-related increases in cortisol levels, and mood disturbances are factors that can be responsible for such a delayed or no sleep. Apart from education, practitioners can rely on changing the training schedule by delaying the start of the sessions of the first training days to increase sleep duration.

Interestingly, the alertness of the players was slightly increased in the game in comparison to training sessions. The tendency for game alertness to increase might be attributable to increased sleep in the days before the game. Therefore, promoting sleep in the nights prior to the game can also be an area for practitioners to explore."

[Abstract]

Sprint performance and rating of perceived exertion are affected by pitch dimensions

OBJECTIVE

Small-sided games (SSG) are widely implemented in football as a form of fitness training, whilst also promoting specific technical and tactical advantages. In order to design the weekly training cycle, practitioners need to have an understanding on how different training drills/sessions (e.g. SSG) affect performance/fatigue (e.g. neuromuscular fatigue).

To date, little research has investigated the effects of different SSG pitch dimensions on sprint performance in youth footballers. The aim of this study was to compare different SSG in sprint performance.

WHAT THEY DID

Ten U15 soccer players performed 4 SSG (5x5 players + goalkeeper) with at least 72 h between each SSG. The 4 SSG variations were:

⇒ SSG1: 4 x 6 min (37 x 22 m).

⇒ SSG2: 4 x 6 min (57 x 31 m).

⇒ SSG3: 6 x 4 min (37 x 22 m).

⇒ SSG4: 6 x 4 min (57 x 31 m).

Players rested for 2 min between each repetition.

10 and 30 m sprint times were obtained before and after each variation. Session rating of perceived exertion (sRPE) was calculated by multiplying the duration of the SSG with the RPE, which was obtained before and after the SSG.

WHAT THEY FOUND

The main findings of this study were:

⇒ RPE ranged between 5 and 6.5 with no differences observed between the SSG on RPE or sRPE.

⇒ Neuromuscular performance measured by the 30 m speed performance was negatively affected by all variations of the SSG.

⇒ Neuromuscular performance measured by the 10 m speed performance was negatively affected by SSG1 and SSG4 .

Practical Takeaways

Given the observed decrease in sprint times, practitioners should implement these SSG formats in the central days of the training week, refraining to use them close to match day (e.g. 2 days before the match), as it may lead to training-related fatigue in young soccer players.

Practitioners should opt for different types of SSG based on the type of stimulus they want to promote and the physical contents of the subsequent training day. For example, if a practitioner wants to have a large number of high-intensity actions (e.g. accelerations and decelerations) he or she needs to be aware that the following day the training should target a low-intensity training session.

An example of a training week with a game on Saturday that overload different mechanical outputs while allowing for players to recovery from training can be seen **HERE**. As can be seen in the picture, on Monday training loads are low-moderate, on Tuesday moderate-high, on Wednesday day off or low-load, on Thursday moderate-high loads and Friday low loads.

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

Francisco's Comments

"SSG are widely implemented as part of practice in many team-sports as they can mimic technical and tactical aspects of a particular sport, as well as, stimulating specific fitness (e.g. intermittent fitness with different running intensities and physical actions).

Although I'm a big fan of SSG and other sport -specific fitness training, I'm aware that as any other method of training, these methods need to be carefully planned in order to fulfil the training principles (e.g. overloading, progression). For example, it is commonly observed that football players train with moderate-high loads, specially the number of accelerations and decelerations for many subsequent days. This is not only a limiting factor to overload as the players accumulate fatigue from training session to training session, but also leads to an increased risk of overload injuries. If a decrease in training load is allowed in the middle of the week, the day before can target a high training load as the players will have the time to recover from that session. Furthermore, after a day off or lower-load day, players readiness to perform will be higher. "

[Abstract]

An acute intensified training day may lead to acute changes in sleep and dietary intake

OBJECTIVE

Current research which has reported on sleep, dietary intake, and performance after acute increase in load is controversial, with some studies demonstrating beneficial and other studies demonstrating harmful effects of such increases in training load in sleep, dietary intake, and performance.

This study investigated the acute effects of an additional intense rugby training session on subsequent sleep, dietary intake, and physical performance in young rugby players.

WHAT THEY DID

Twenty French International U17 rugby players performed two programs on the same day of two consecutive weeks:

⇒ Regular (REG): 90 min training in the morning

⇒ Intense (INT): 90 min training in the morning and another 90 min in the afternoon

Both groups were required to perform a submaximal rectangular test (5 min at 70% of the maximum heart rate), a Wingate test, and a spatial awareness task on the morning after the program.

Athletes wore an accelerometer to record physical activity (number of steps and caloric expenditure) and sleep (total time in bed (TTB), total sleep time (TST), sleep latency (SL), wake after sleep onset (WASO), and sleep efficiency (SE)). Dietary intake (caloric input and distribution of macronutrients) was obtained in the morning after the training.

WHAT THEY FOUND

The main findings of this study were:

⇒ The INT resulted in a significant increase in the time spent completing vigorous and very vigorous activities compared to REG.

⇒ Athletes in INT had a higher TST (26 min) and SE (8.5%), and a lower SL (4%) and WASO (39%) compared to REG.

⇒ No differences in caloric intake were observed but there was a higher intake of protein in the INT.

⇒ VO2max and heart rate decreased in the submaximal rectangular test in the INT in comparison to REG.

⇒ No differences between groups were observed for the Wingate and spatial awareness tests.

» **Practical** Takeaways

The findings from this study suggest that young athletes self-regulate sleep (duration and quality) and macronutrients (protein) intake after an acute day of intensified training. Practitioners need to keep in mind that although these responses occur in the acute training phase, it doesn't necessarily mean that if acute intense training is conducted over a longer period of time, athletes will maintain a positive caloric intake and sleep. For these reasons, it is highly recommended that sleep and nutrition are monitored. More importantly, when working with young athletes, education about sleep hygiene, recovery, and nutrition needs to be provided.

In academies with different age groups, it is important to develop a training education pathway. Between other topics, this education should include the aforementioned topics: sleep, recovery, and nutrition.

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

Francisco's **Comments**

"Although this is an observational study, I found the main findings very interesting as it reinforces some fundamental concepts that sometimes are underestimated, such as the natural need for a change in habits (e.g. sleep and nutrition) after an acute increase in training load.

On the other hand, when athletes are exposed to chronic high loads, the body can start off an alarm process which can lead to a deterioration in a player's sleeping and eating patterns, as well as their performance. In this scenario, the training background of the players (including good knowledge about recovery) will play a massive role, reinforcing the need for education. Monitoring players is also vital, not only for an individual approach and to ensure that they are properly responding to each of the acute training stimulus (i.e. training days), but also adapting properly to a training phase."

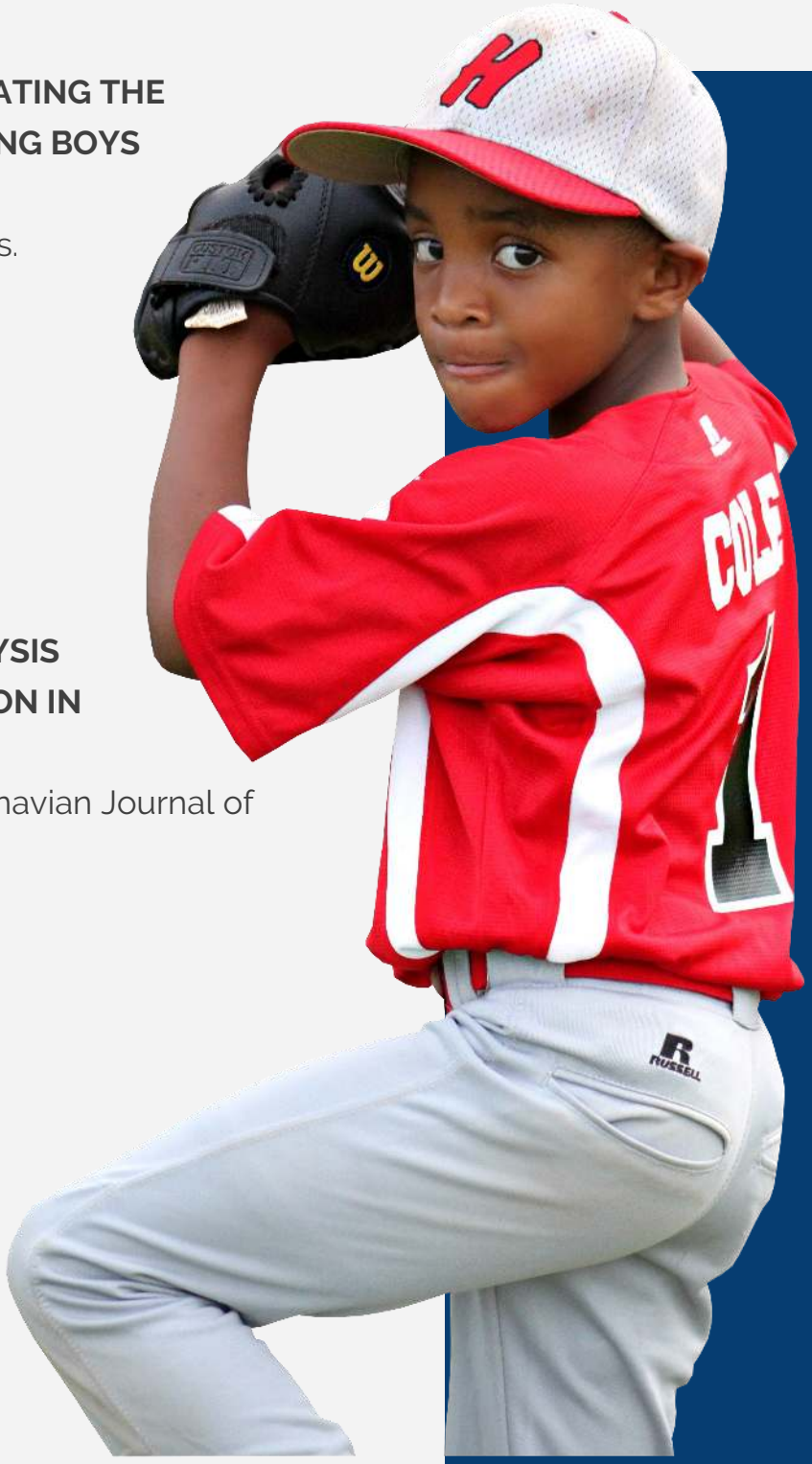
Youth Development

This month's top research on youth development.

WHY DO THEY DO IT? INVESTIGATING THE MOTIVES FOR EXERCISE IN YOUNG BOYS AND GIRLS.
Galan-Lopez, P. et al. (2019) Sports.

THE MODULATING EFFECT OF MATURATION AND RECOVERY DURING PLYOMETRIC ACTIVITY
Ramirez-Campillo, R. et al. (2019) Journal of Sports Sciences.

IT'S ALL IN THE BACK: AN ANALYSIS ON TRUNK AND PELVIS FUNCTION IN ADOLESCENT ATHLETES
Arampatzis, A. et al. (2019) Scandinavian Journal of Medicine and Science in Sports.



[Abstract]

Why do they do it? Investigating the motives for exercise in young boys and girls

OBJECTIVE

Physical activity has long been associated with health and well-being in youth, yet the decisions that influence individuals to partake in physical activity remains relatively misunderstood, particularly within the youth population.

This highlights an opportunity for further exploration and, as such, this study investigated the motives of adolescents who participate in physical activity and further understand the associations, if any, with body composition.

WHAT THEY DID

To determine the motives for physical activity, the Self-Report of Reasons for the Practice of Physical Exercise questionnaire (AMPEF) was used. The questionnaire consists of 48 items grouped into 11 subscales and was administered to 387 students (54% boys and 46% girls) with a mean age of 13.38 yr. These subscales were weight management and appearance, revitalisation and enjoyment, ill-health avoidance and positive health, competition, affiliation, strength and endurance, social recognition, stress management, nimbleness, challenge, and health pressure.

From this, the data was presented as means and standard deviations, whilst frequency and percentages were used for qualitative variables. The Kolmogorov-Smirnoff test was used to independently analyse the differences between boys and girls.

WHAT THEY FOUND

The main findings in this study included:

⇒ The main motives for sports participation in these youth participants were the experiences, feelings, and emotions that they perceived during training.

⇒ The weakest motives for engaging in physical activity were health pressures, weight management, appearance, social recognition, and stress management.

⇒ Boys were more concerned about their body image compared to girls.

In summary, the participants in the present study participate in sport because they feel satisfaction, enjoy practice, and feel better. Consequently, the reasons for participating in this study appear to be intrinsic in nature.

» **Practical** Takeaways

⇒ Soft skills (e.g. supporting an athlete through a difficult athletic period) prove to be very important, with children reporting that enjoyment and "how they feel" being the biggest motive for participation in sport. With this in mind, the article below highlights the role that the S&C coach should play and how factors such as age and gender can affect this.

⇒ According to the authors, participation in sport for weight management and appearance has historically been attributed to girls. However, this study found the opposite, with boys showing more concern. Therefore, we must monitor and discuss this openly to avoid any negative health connotations. The video below discusses the issues that we currently face with young boys.

⇒ A positive attitude towards physical activity based strictly on appearance can be related to disturbing attitudes about eating habits and body image. Therefore, it is essential that we encourage children to engage in physical activity for the right reasons such as strength, power, and health rather than focusing on imperfections.

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

Tom's **Comments**

"When working with children, negative associations with body image and excessive attitudes towards physical activity can become a problem. I have personally seen multiple incidents where children are obsessed with the way they look and engage in unnecessary amounts of physical activity. In the podcast below, Renee Jain and Ed Crasnick discuss the role that modern life can have on body image and offer some strategies such as role-play, games, and mindfulness to teach body respect, with the aim of diluting the negative connotations regarding body image.

On a more positive note, I think it is really refreshing that the biggest motive for participating in sport was the experiences, feelings, and positive emotions experienced. As coaches, scientists or teachers, a large part of our roles require us to ensure that children remain engaged in sport and enjoy themselves. Such skills ensure that children reduce their likelihood of disease (e.g. obesity, blood pressure, cardiorespiratory issues), whilst developing the psychological and social skills to overcome life's obstacles. To ensure that your lessons are enjoyable, I would look to include children in the decision -making process, provide opportunities to lead, and support your development by understanding their preferences through open and reciprocal conversation."

[Abstract]

The modulating effect of maturation and recovery during plyometric activity

OBJECTIVE

Plyometric training has been shown to improve physical fitness in youth soccer players. However, there have been conflicting studies published on the effects of maturation status combined with inter-set recovery protocols and plyometric effectiveness.

Based on this, the current study investigated the role of maturation and the response to a plyometric training plan with different rest intervals on performance.

WHAT THEY DID

This study investigated twenty-six youth soccer players (aged 10-17 yr). All participants completed countermovement jump with arms, horizontal counter-movement jumps, drop jumps from a height of 20 cm, and maximal kicking velocity. Participants were randomly assigned to one of four groups based on their maturity offset scores. Participants were identified as either pre- or post-peak height velocity (PHV). The four groups were:

⇒ T0 = After a 6 week control period (regular training).

⇒ T1 = After 6 weeks of plyometrics.

⇒ T2 = After 6 weeks of washout (withdrawn from the study).

⇒ T3 = After an additional 6 weeks of plyometrics.

Within these groups, recovery periods between sets were randomly assigned to either 30 or 120 sec.

WHAT THEY FOUND

In all of the test measures, performance scores were seen to improve in all participants, irrespective of maturity status with small to moderate improvements. In the older players, the performance benefits were improved after 120 sec of rest ($p<0.001$) compared to 30 sec of rest.

Greater kicking velocities were seen in older players when afforded 120 sec of rest. In the pre-PHV group, the results were fairly different. This group achieved similar physical fitness improvements when using both 30 and 120 sec rest periods with similar findings in kicking velocities.

» Practical Takeaways

⇒ Maturity does appear to play a modulating effect on plyometric performance, with post-PHV benefitting from additional recovery time in plyometric activities.

⇒ Those who were pre-PHV recovered more rapidly than those post-PHV. This could be due to a lower intensity of training in younger boys due to their limited capacity to recruit higher-threshold/type II motor units. Some examples of high-intensity plyometrics can be seen in the video below.

⇒ A greater physiological profile was seen in those who were pre-PHV (lower muscle glycolytic activity and higher muscle oxidative capacity) lends to a more optimal inter-set recovery response.

⇒ The prescription of plyometric activity in those pre-PHV may not require as much consideration regarding recovery time as those who are post-PHV. In those post-PHV, coaches should consider competition schedules and timing since the last bout of plyometrics, with the attached article below providing some recommendations for this.

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

Tom's **Comments**

"From this study, I am definitely going to rethink how I design my sessions, with greater recovery periods being programmed for those post-PHV. In a group with mixed stages of PHV (pre and post), I would most likely band players to work with those at a similar stage. I think that it is important with older players, that they are aware of the need to adapt inter-set recovery intervals so that their programmes do not only give them an optimal response, but educate them through the process.

In future studies, I'd like to see a similar study with females to see if these differences are still present. In addition, tracking injuries and reactive strength index scores could prove useful to see the long-term adaptations to plyometric task. In my opinion, rest durations could fluctuate based on different stages of the season (i.e. pre-season being more voluminous) and where different training ages are present, less recovery time may be needed. In the attached podcast, JB Morin provides a fantastic insight into plyometric training, and draws attention to the MyJump app which can be downloaded on most phones/tablets as a reliable and cheap method to measure jump performance variables."

[Abstract]

It's all in the back: an analysis on trunk and pelvis function in adolescent athletes

OBJECTIVE

Well-developed trunk muscle strength and coordination is essential to combat lower-back pain and deconditioning of the lumbar muscles which occurs through sports participation. Strength training can support this, by ensuring that there is adequate spine strength and alignment.

The main objective of this study was to investigate the effects of age and sex on trunk muscle strength, sagittal lumbo-pelvic alignment, and lumbo-pelvic ratio in adolescent athletes.

WHAT THEY DID

Fifty high-level adolescent athletes from varied sports took part in this study. The inclusion criteria for this study required participants to be between the ages of 13-19 yr with no acute lower-back pain or restrictions during training. The athletes were divided into two groups based on their age:

⇒ Early adolescent (1315 years, n = 22, 10 females, 12 males) and;

⇒ Late adolescent (1619 years, n = 28, 14 females, 14 males).

In both groups, trunk extension and flexion moments during maximum voluntary isometric contractions (MVIC) were collected with a dynamometer. In addition, lumbo-pelvic kinematics in an upright position during forward trunk bending was examined with two 3D accelerometers.

WHAT THEY FOUND

In early adolescent athletes, greater imbalances between the flexor and extensor muscles were found in trunk muscle strength ($p<0.001$) when compared to late adolescents. More specifically, extensor muscles were found to be stronger than flexor muscles in both males and females.

Irrespective of age, sex-related differences were observed in both early and late adolescent females who presented greater lordotic posture (see video below) and pelvic rotation compared to male participants. Finally, males were shown to have a stronger trunk musculature compared to females.

» **Practical** Takeaways

⇒ Ratios between flexor and extensor muscles were not reported in this study, although extensor strength was found to be greater than flexor strength. In this study, the authors reported that normal ratios for adults are 78% for females and 82% for males in flexor:extensor strength ratios.

⇒ Trunk strength imbalances between the flexor and extensor muscles increases the risk of lower-back pain.

⇒ Greater lordotic posture also increase the forces required to control and stabilise the trunk. Due to this posture, and the increased prevalence in females, it could be suggested that females are at a higher risk of developing overuse related lower-back pain.

⇒ Reducing the risk for lower-back pain is important given the ailments of modern day living and improved career longevity. Therefore, programmes should look to implement specific exercises for muscle groups which contribute to lumbo-pelvic stability. In the attached article below, Alex Wolf has published one of my favourite papers on exercise prescription for the spine, which will no doubt serve useful.

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

Tom's **Comments**

"This study was really interesting, demonstrating the often unseen issues associated with sports participation. In the podcast below, Professor Stanley Herring discusses the role that adolescence has on lower-back pain, and some easy methods of monitoring this before it becomes an issue. The difficulty when working with youths is that the lumbar spine in particular can go through rapid phases of growth. During this time, there may be some pain associated with changes in lever arms and muscle function. It is therefore important to track peak height velocity (PHV) (see **HERE**) during this time to have a more educated guess regarding the issue.

On the topic of PHV, I would have liked to have seen the participants in this study split by maturation, rather than early- or late-adolescence. For example, a 15 year old in the early-adolescent group could be biologically more mature than someone in the late-adolescent group. I would personally use a pre-, circa- (during), and post-PHV method to analyse this data."

Nutrition

This month's top research on nutrition.

DO YOUR ATHLETES KNOW WHY THEY ARE TAKING SUPPLEMENTS?
Jovanov, P. et al. (2019) Journal of the International Society of Sports Nutrition.

THE USE OF CARBOHYDRATES TO IMPROVE PERFORMANCE IN SOCCEI PLAYERS
Rodriguez-Giustiniani, P. et al. (2019) International Journal of Sport Nutrition and Exercise Metabolism.

HOW CAN NUTRITION SUPPORT REHABILITATION FROM PATELLA TENDINOPATHY
Baar, K. et al. (2019) International Journal of Sport Nutrition and Exercise Metabolism.

[Abstract]

Do your athletes know why they are taking supplements?

OBJECTIVE

Worldwide, most professional athletes use sports supplements either during training and/or performance. With this, many young athletes (15-18 yr) who aspire to be professionals, also now take supplements, but do they really know why they are taking them?

Considering this is one of the fastest growing industries in food and beverage, with many companies paying athletes and offering sponsorship deals for young athletes, the authors of this study wanted to:

1. Determine the prevalence of sports supplements.
2. Determine the source of information regarding supplementation.
3. Assess beliefs and attitudes towards the use of supplements.
4. Estimate the level of knowledge with specifically defined survey questions and the reasons for taking supplements.
5. Identify trends or differences between categories of supplement users.
6. Obtain an insight into young athletes ethical dilemma about the misuse of sports supplements.

WHAT THEY DID

The survey was conducted between March and November 2018, with the inclusion criteria of athletes being aged 15-18 yr and who have competed at international level. In total 348 athletes from Serbia (39.4%), Germany (23.0%), Japan (20.1%), and Croatia (17.5%) took part in the survey representing 18 different sports. The survey included twenty questions which were split into four parts:

⇒ Simple demographic and personal information.

⇒ Information regarding the usage, importance, source of information, safety, and procurement of sports supplements.

⇒ Test the athletes knowledge about the correct timing, dosage, and reason for use of each sports supplements

⇒ Investigation of athletes' beliefs and attitudes towards the use of sport supplements and possible anti-doping rules violations.

WHAT THEY FOUND

The survey showed 82.2% of athletes used supplements, of which 60.6% were male. 82.2% of athletes used one-two different supplements at the same time, 62.1% two-three, 35.9% three-four, and 14.7% used four and more supplements, with kayak, swimming, and karate identified as the sports with the highest number.

Whey protein was the most popular supplement, with 54.5% consuming it among ten other supplements. Unfortunately, young athletes appear to lack proper knowledge about the use of creatine (11.1% of athletes responded correctly), beta alanine (20.0%), amino acids (20.0%), nitrate oxide (22.2%), glutamine (37.5%), protein (38.5%), and carbohydrates (48.3%). Yet they seem to have more knowledge about sports drinks (50%), caffeine (61.8%), and vitamins and minerals (71.0%).

The main reasons athletes wanted to take supplements was for an improvement in performance (35.3%), with 72.1% of athletes being aware of a certain health risk, 14.9% thought they were risky, and 12.9% of athletes considering them to be safe. Additionally, the coach appeared to be the main source of information regarding the use of creatine, carbohydrates, amino acids, caffeine, sports drinks, glutamine, nitrite oxide, protein, beta alanine, vitamins, and minerals.

Finally, this study revealed that 55.5% of athletes had access and were familiar with the regulations of the World Anti-Doping Agency (WADA).

» **Practical** Takeaways

⇒ Protein supplements are widespread among young athletes, and so education around the correct timing type and total amount should be provided to athletes.

⇒ The coach seems to be the main source of information about supplementation practices and, therefore, highlights the importance of us as practitioners knowing the right information

⇒ The enhancement of athletic performance is the main reason young athletes use supplements.

⇒ Young athletes show inadequate level of knowledge about the proper and intended use of sports supplements, thus highlighting how important it is to implement education strategies for our athletes.

⇒ Ongoing education to all coaches and athletes about sports supplements is necessary for improving performance and minimising the risk of positive doping results. This will result in a much safer environment when athletes take supplements.

⇒ Insufficient knowledge causes ethical dilemma about the misuse of sports supplements.

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

James' **Comments**

"Although this study utilised a survey, rather than implementing an intervention or mechanistic procedure, I really like it as it highlights some very important points for practitioners working with young athletes. Whether you like it or not, young athletes are taking supplements (which is discussed in the podcast below), and worryingly with not many of them knowing the complete reason why or how to take them properly.

In my own practice, I try to follow a - where possible - food first approach with all the athletes I work with, but inevitably with time constraints, world-wide travel, and ease of access, the results of this study have once again highlighted to me how important it is to educate those that will probably end up taking them anyway. In particular, it appears that the younger the athlete is, the more likely they are to listen to the guidance of the coach, which therefore underlines how important it is for us, as coaches, to know why and how to take each supplement. Follow the International Olympic Committee decision tree info-graphic for guidance (see below).

Finally, although this study was only performed across four countries and not in the UK, I do think we would see similar results in the UK to that which has previously been shown in UK junior national track and field athletes in the article below."

[Abstract]

The use of carbohydrates to improve performance in soccer players

OBJECTIVE

The demands of soccer require players to perform high-intensity movement patterns whilst executing high levels of skilful ball control, passing, and shooting. Such demands all result in a decrease in glycogen stores throughout training and match-play. It would seem prudent then for players to "top–up" energy levels utilising carbohydrates, although others may use other approaches as outlined in the video below.

The objective of this study was to assess the benefit, or not, of consuming a 12% carbohydrate -electrolyte beverage on soccer skill performance and high-intensity running capacity in professional youth academy soccer players.

WHAT THEY DID

Eighteen professional youth players representing seven midfielders, six defenders and five strikers took part in the study, attending two preliminary visits before undertaking two main trials. The carbohydrate-electrolyte and placebo beverages were administrated in a double-blind randomised, crossover manner, whilst nutrition provision leading into the testing was controlled for both groups and replicated in both trials 7-14 days apart.

Players then performed a 90-min soccer match simulation including six blocks of activity split across two 45-min periods. Skill was assessed via dribbling performance and passing accuracy, whilst sprint performance was assessed by players running as fast as possible through timing gates. Finally, players then performed a fixed high-intensity running capacity test to the point of volitional fatigue.

WHAT THEY FOUND

Dribbling speed and dribbling accuracy did not decrease in either trial, although passing accuracy was better in the carbohydrate-electrolyte vs. the placebo at certain time points during the trial, in particular 15 min and 90 min for the dominant foot and 60 min and 75 min for the non-dominant foot.

Passing speed was similar in both trials with the dominant foot, although, the non-dominant foot appears to be slower 75-min onwards without the ingestion of carbohydrate-electrolyte.

Overall sprints speeds did not differ between trails. Although, as expected, running distance was 11.8% better with the use of carbohydrate-electrolyte versus placebo.

» **Practical** Takeaways

The authors provide data to show that ingesting a 12% carbohydrate-electrolyte solution results in:

⇒ Increased passing accuracy in both the early and latter stages of a soccer match simulation protocol and,

⇒ Improved passing speed during the latter stages of the simulation

Practically, during crucial periods of matches, when retention of the ball and the ability of players to pass accurately and quickly may be a key determining factor to the overall outcome of each match, coaches and practitioners working with soccer players should look to utilise carbohydrates before the first- and second-half.

Further, although there was no benefit on dribbling speed, accuracy, or sprint speed compared to the placebo, the post-match high-intensity running capacity was improved. This suggests that in the practical setting, a 12% carbohydrate-electrolyte solution before and during a soccer match may benefit match-specific skill performance and anaerobic endurance capacity.

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

James' **Comments**

"In my own applied practice, this is an area that has been of great focus recently. There is extensive work on the benefit of carbohydrates for performance, especially soccer-specific performance, yet I still hear of players who do not want to consume them. I often wonder, is this down to gut issues, lack of taste, or simply because players have not been given the time of day to be educated on the evidence-based science, and thus, the beneficial effects of such supplements.

I would advise readers to ask their players if they like to take carbohydrates on-board before the match and at half-time. It's also important to remember that it does not always have to be a gel or supplement, carbohydrates come in liquids, gels, and foods, so creating an individual strategy for each player would be an ideal solution. If you would like to read more into this area, then other authors have done similar work as outlined in the related article and info-graphic below."

[Abstract]

How can nutrition support rehabilitation from patella tendinopathy?

OBJECTIVE

Patellar tendinopathy (PT) is a common musculoskeletal injury in those athletes from jumping sports. Interestingly in professional basketball, up to 52% of players have reported patella tendon pain that has limited performance.

The author of this paper discusses the advantages of stress relaxation within the tendon, however, for the purpose of this article, the focus is on the nutritional aspects of how collagen and vitamin C can support rehabilitation from patella tendinopathy.

As such, the objective of this study was to understand the beneficial effects of stress relaxation loading, combined with a nutrition intervention, on body composition, strength, and pain from a single basketball player who had experienced knee pain for ~5 yr.

WHAT THEY DID

In this case study, the authors identified a 21 yr old basketball player who had undergone an MRI scan and presented with PT. The player was still playing as part of an active team, although both player and support staff focused on stress relaxation loading consisting of leg extension, leg press, and Spanish squats progressively increasing over the 18 month programme.

The player reported following his normal nutritional intake throughout the programme, however, the intervention involved additional consumption of 15 g of gelatin with ~225mg vitamin C.

Body composition assessment was recorded via sum of seven skinfolds, whilst strength assessment was determined using an isokinetic dynamometer.

WHAT THEY FOUND

The main findings of the article included:

⇒ Bodyweight showed minimal change over the 18-month period, although there was a small decrease in body fat percentage from 8.4% to 5.9%.

⇒ Maximal single-leg isometric hamstring strength increased 196%, isometric leg extension strength increased by 156%, and leg press strength increase 187.5% over the course of the programme.

⇒ In regard to the PT, MRI images following the programme showed a progressive decrease in MRI reactivity and was supported by a blinded orthopaedic surgeon declaring the PT "normal" following a third and final scan 18 months after the programme. This was highlighted by decreases in the self reported pain and tenderness from the player. In additon to this, at the point of the final scan, the athlete was pain free and playing more than 25 min each game.

» **Practical** Takeaways

From the results of this case study and reading the authors reflections, it is evident that:

⇒ Providing the correct substrates (15 g gelatin with 225 mg of vitamin C) 1 h before loading maximises the ability of targeted area to increase collagen synthesis.

⇒ The success of the programme is only as effective as the buy-in from both the athlete and support staff as a multi-disciplinary team.

For the readers, this is a recipe that I have used before and adapted from the author of this paper:

⇒ 84 g Gelatin (Dr Oker) – any major supermarket in the cake isle

⇒ 50 ml of OJ or Ribena

⇒ Handful of mixed berries

⇒ 300 ml hot water

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

James' **Comments**

"Although this is a case study, the translational potential of this to any practitioner working in sport is huge and follows similar results as seen previously (refer to infographic below). The authors show a clear structured programme of combining both load and nutrition, to create a really positive outcome for an injured player who buys into the process. I have personally followed similar strategies with a rugby player coming back from an ACL rupture, using the recipe above, and saw a quicker than normal return-to-play.

Considering the research in this area is still in its infancy, there are going to be critics who are not fully convinced just yet. However, are there any negative effects to consuming gelatine and vitamin C and hour before exercise? Keith Barr (see video below) and the systematic review (see article below) would suggest not. My advice would be to use strategies outlined in the practical takeaways to prevent and protect soft tissues, before an injury actually occurs, especially with those high-risk athletes."

Injury Prevention & Rehab

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

EFFECTIVENESS OF A PREVENTION PROGRAM FOR THROWING INJURIES
Sakata, J. et al. (2019) The American Journal of Sports Medicine.

HAMSTRING REHABILITATION IN TRACK-AND-FIELD ATHLETES
Macdonald, B. et al. (2019) British Journal of Sports Medicine.

NATURAL GRASS VS. ARTIFICIAL TURF: WHICH SURFACE POSES AN INCREASED INJURY RISK?
Calloway, S. P. et al. (2019) The American Journal of Sports Medicine.

[Abstract]

Effectiveness of a prevention program for throwing injuries

OBJECTIVE

Current research has shown a 35% annual incidence of throwing-related shoulder and elbow injuries in youth baseball players. Players aged 6-12 yr have an average incidence of elbow injuries 1.5 per 1000 athlete exposures and an average incidence of shoulder injuries 0.6 per 1000 athlete exposures.

The purpose of this study was to investigate how effective an injury-prevention program was on the incidence of throwing-related shoulder and elbow injuries in the youth population.

WHAT THEY DID

A randomised control trial using sixteen Japanese youth baseball teams (age: 9-11 yr) was completed during an off-season period. The intervention group (107 players) completed an injury-prevention program called the Modified Yokohama Baseball-9 that consisted of 5 stretches, 5 dynamic mobility exercises, and 2 balance training exercises, to be performed at least once per week in the warm-up period of their workout.

All stretches were held for 10 sec and one set was performed. One set of 10 repetitions was performed for the other exercises. The control group (110 players), performed their usual stretching routine on their own.

WHAT THEY FOUND

The key findings in this study were:

⇒ Incidence of shoulder and elbow injuries in the intervention group was significantly lower than in the control group.

⇒ Over the 12-month follow up period, 24 players in the intervention group reported shoulder and elbow injuries of the throwing arm. Of these, 3 players had both shoulder and elbow injuries, 15 had elbow injuries, and 6 had shoulder injuries.

⇒ In the control group, 42 players reported shoulder and elbow injuries of the throwing arm. Of these, 4 reported both shoulder and elbow injuries, 25 reported elbow injuries, and 13 reported shoulder injuries.

⇒ The rate of shoulder and or elbow injury in the intervention group was reduced by 48.5% when compared to the control group.

» **Practical** Takeaways

This study shows us that an injury-prevention program performed at least once per week can reduce the incidence of throwing-related shoulder and elbow injuries in youth baseball players.

Shoulder horizontal adduction range-of-motion deficit, hip internal rotation range-of-motion deficit, and increased thoracic kyphosis angle have been found to be risk factors for shoulder- and elbow-related injuries. These risk factors also improved with the implementation of a prevention program.

This study suggests that youth baseball teams should implement an injury-prevention program for its positive effects in decreasing the overall incidence shoulder and elbow injuries. Taking pre-season and post-season measurements of the risk factors listed above can provide coaches and players with objective data that can be tracked over time to further assess the effectiveness of a prevention program.

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

Jordan's **Comments**

"This study shows us the benefits of a prevention program on shoulder and elbow injuries. It was interesting to see that the incidence of shoulder and elbow injury was lower in the low compliance players than in the high compliance players.

Two important factors to keep in mind when implementing any prevention program are duration and compliance. The shorter and more effective a program is, the more likely athletes will adhere to them. Further studies should be done to include larger sample sizes, as well as grouping athletes per position."

[Abstract]

Hamstring rehabilitation in track-and-field athletes

OBJECTIVE

Hamstring injuries are very common in most sports, especially those that require athletes to run and change direction at high speeds. They can also be career threatening if not managed and rehabilitated in the correct way. It has been shown that 41% of all injuries in track and field from 2007-2015 were muscle-related injuries, with the hamstring being the most injured muscle group.

This study aimed to provide a classification system and describe how British clinicians utilise the British Athletics Muscle Injury Classification (BAMIC) for hamstring rehabilitation in elite track and field athletes.

WHAT THEY DID

British Athletics is a governing body that (among other things) provides clinical support to elite-level track and field athletes. The BAIMC is an MRI classification system that classifies hamstring injuries based on site of injury as either:

a. Myofascial,

b. Musculotendinous junction,

c. Intratendinous,

d. The extent of the injury (graded 0-4).

The BAIMC also includes six management principles, as well as, specific hamstring injury rehabilitation guidelines for practitioners to follow that includes: clinical presentation, healing physiology, rehabilitation progression, and return–to-sport. Further classification of hamstring grades based on MRI findings can be found **HERE**.

WHAT THEY FOUND

The key points from this study were:

⇒ The BAIMC provides a sound clinical process to manage hamstring injuries with an injury audit, which has demonstrated a marked reduction in the previously published re-injury rates.

⇒ Criterion-based progressions are suggested to help with clinical decision-making and have a smooth return to sport process.

⇒ Initial exercise prescription is at higher volumes and lower load, with a gradual increase in load through rehabilitation as tissue tolerance improves.

⇒ Isometric strengthening is advocated in injuries when pain and disability are greater, to improve motor unit recruitment prior to implementing eccentric loading.

⇒ When improving fatigue resistance is the desired training adaptation, hamstring rehabilitation should include isometric strengthening in addition to eccentric strengthening to further condition the hamstrings.

» **Practical** Takeaways

This study presents us with a sound classification system for managing hamstring injuries. Based on the high re-occurrence of hamstring injuries, specific protocol and loading strategies based on the structure involved should be implemented in order to reduce re-injury.

The most commonly injured muscle group is the long head of the biceps femoris, so incorporating exercises such as the single-leg Romanian deadlift, 45˚ hip extension and glute-ham raise into rehabilitation may promote greater hypertrophy gains than other exercises.

Following the BAIMC system from diagnosis throughout rehabilitation has demonstrated a decrease in overall re-injury rates. Although there are different exercises that target specific parts of the hamstring more than others, eccentric strengthening should be considered gold-standard. However, including isometric strengthening specifically in the acute stage to keep musculature active and reduce atrophy can allow a quicker return-to-sport.

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

Jordan's **Comments**

"One takeaway from this article that should be stressed is the importance of collaboration. Communication between the physical therapist, athletic trainer, and coach is important from the start of care through to the end of rehabilitation. From my experience, when this is implemented from the initial injury encounter, the athlete's best interests are put into place and this allows a quicker and safer return-to-sport process.

With regards to hamstring injuries within my own practice, applying a treatment algorithm and criterion-based progressions based on the patient's presentation, as opposed to generic rehabilitation, has decreased re-injury rates among athletes returning to sport."

[Abstract]

Natural grass vs. artificial turf: which surface poses an increased injury risk?

OBJECTIVE

Artificial turf (AT) has a number of benefits over natural grass (NG), such as decreased maintenance costs, and increased usability across the elements, making it more common in professional sports. However, many athletes prefer to play on natural grass due to factors including perceived injury rate, discomfort, and fatiguability.

This study utilised the Injury Rate Ratio to evaluate data of injury occurrence on either artificial turf or natural grass playing surfaces.

WHAT THEY DID

Injury data from pre-season, regular season, and post-season for two Major League Soccer (MLS) teams was recorded over the course of four seasons (2013-2016), along with the playing surface:

⇒ AT

⇒ NG

The injury incidence rate ratio was calculated as incidence rate AT/ incidence rate NG to determine which playing surface had a higher injury incidence rate.

WHAT THEY FOUND

The key findings in this study were:

⇒ A total of 2174 in-game injuries were recorded during the study period, with 1.54 injuries per game occurring on AT and 1.49 occurring on NG.

⇒ Yearly injury incidence increased each year on both playing surfaces - 12.5% on NG and 26.3% on AT.

⇒ From 2013-2016, data analysis showed comparable injury incidence and overall injury rate between AT and NG surfaces, however, regarding specific injuries, a higher rate of Achilles injury and ankle fracture was found on AT.

» **Practical** Takeaways

Despite what other sports may show and what MLS players beliefs are, this study shows us that there was no statistical difference in injury rates among MLS players playing on AT vs. NG. Over the last few years injuries rates have increased in all sports, so the question of playing surface has become a popular topic. Other variables such as strength and previous injury, should outweigh playing surface.

Since ankle injuries were found to be the only body part with increased injury occurrence on AT compared to NG, further research should investigate data and association with type of footwear as well as contact vs. non-contact injuries on playing surface.

Strengthening and proprioception training have been shown to decrease the overall risk of ankle-related injuries. When teams are in a situation where AT is the only playing surface at hand, it is imperative that players run through a sound dynamic warm-up for injury-risk reduction.

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

Jordan's **Comments**

"The biggest indicator of future injury is previous injury, and one major limiting factor in this study was the failure to include player's injury history. This is important from an injury-prevention and rehabilitation standpoint because if the initial injury was not fully rehabilitated and the player did not go through a proper return-to-sport protocol, this could have skewed the rate of injury.

Other variables not included which impact the overall strength of this study was time missed and re-injury rates. However, it is important to note that a large amount of data was collected, all which showed comparable injury rates regardless of the playing surface."

Infographics

A round-up of our monthly research infographics.

TACTICAL STRENGTH & CONDITIONING

Solomon, M. (2019) Science for Sport.

VELOCITY BASED TRAINING

Solomon, M. (2019) Science for Sport.

@ScienceforSport

Tactical Strength & Conditioning

SCIENCE for SPORT

What is it?

Tactical S&C is the application of S&C principles in a tactical (e.g. military, law enforcement, etc.) training environment.

Importance

Not only is tactical S&C important for physically preparing the athlete for the high-operational tempo, but it also plays a role in protecting the athlete from injury.

Unique

There is often a misguided attempt to directly apply the traditional sport model of S&C principles to the warfighter. This may be inappropriate when preparing soldiers for today's organic and fluid battlespace and deployment schedule.

Goals

Tactical S&C can be thought of as a multidisciplinary approach to the repair, maintenance, and performance optimisation of the tactical athlete in order to maximise their effectiveness on the battlefield.

Periodisation

Tactical periodisation requires great creativity and adaptability.

Recovery

Strength and endurance are basic and linear, metabolic conditioning tends to be higher volume at lower intensities, rehab work is reactive.

Transition

A short phase where focus shifts from the previous deployment to preparing for the next one.

Base

Intensity is preferred to volume. Complex movements and/or circuits are introduced to address 'tactical' training (e.g. speed, agility, and work capacity).

Tactical

Programming becomes almost exclusively sport-specific. Volume and intensity should both be high.

Our summary

As the demand for high-level operators increases around the globe, and as high-operational tempo takes its toll on tactical athletes, the role of tactical strength and conditioning will only increase in the future.

For the full article check out the Science for Sport website

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VELOCITY BASED TRAINING (VBT)

SCIENCE for SPORT

What is it?

This form of training typically uses technology such as wearable accelerometers or linear position transducers to measure movement velocity during an exercise.

Why is it important?

Velocity based training (VBT) allows coaches to accurately measure the velocity of a lift, and therefore make alterations to their programming based on the results.

Uses of VBT

There are many potential uses of VBT which could enhance performance

Velocity vs % of 1RM

As strength (1RM) can fluctuate by as much as 18% per day, velocity could be used as an alternative measure of exercise intensity.

Exertion-Load Profiling

Using the mean concentric velocity of a lift can allow coaches to accurately predict the number of reps 'left in the tank'

Minimum Velocity Threshold

This 'failure speed' is consistent regardless of the number of repetitions performed.

Load-Velocity Profiling

It is possible to predict an athlete's 1-RM in various exercises using a linear regression.

Specific Training

As load increases, velocity slows. Therefore velocity can be prescribed to train specific goals e.g. absolute strength.

Feedback

Coaches can use the velocity data to direct feedback more accurately and also drive athlete's motivation.

Our Summary

Thanks to recent developments in technology, velocity based training has evolved strength and conditioning. Although this technology may benefit the industry, it may also do harm if it distracts coaches and subtracts from their session delivery.

For the full article check out the Science for Sport website

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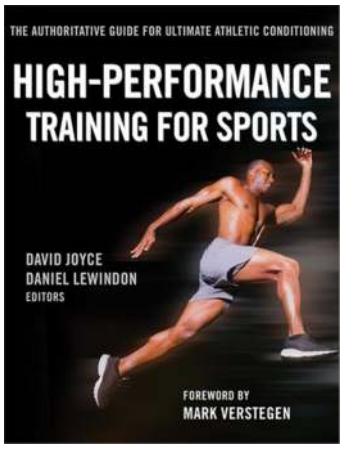

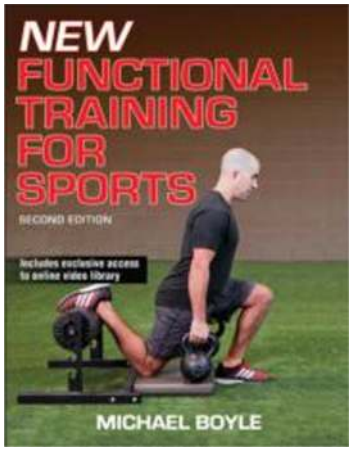

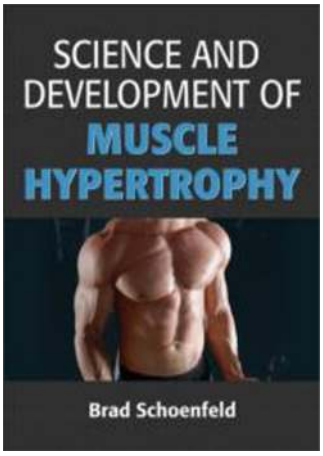

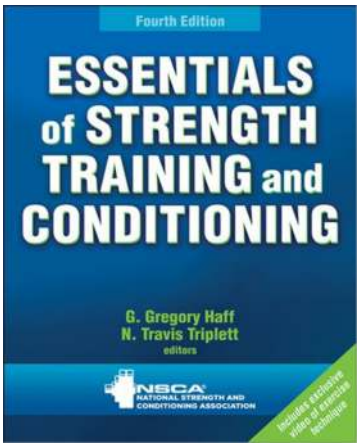

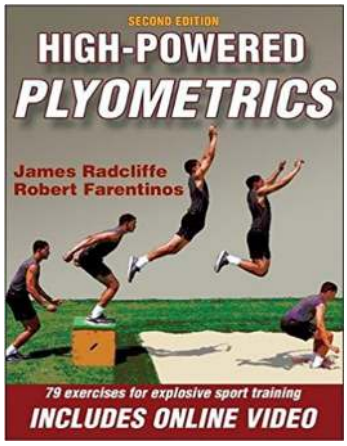

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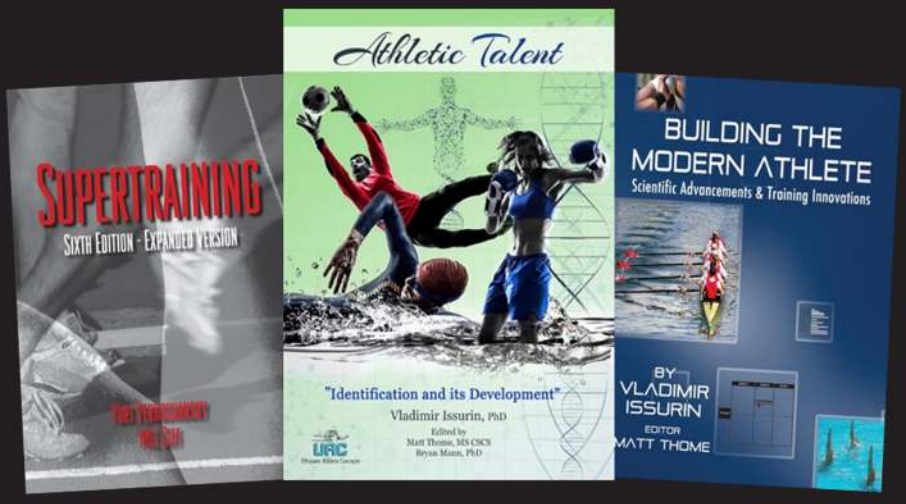

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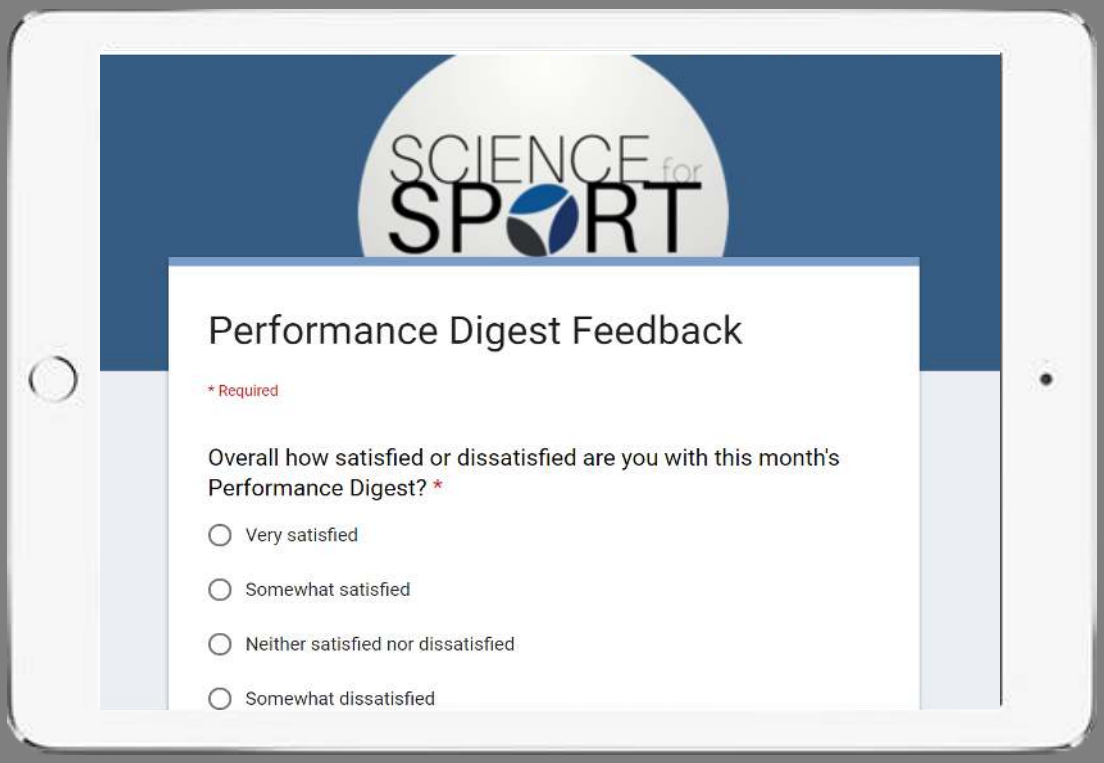

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Science for Sport