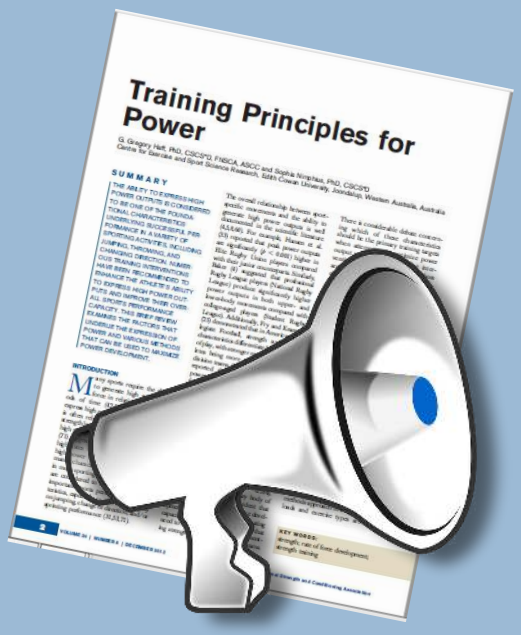
Research Alerts

NOVEMBER EDITION: ISSUE #2

Your monthly roundup of the LATEST RESEARCH across the following topics.

(click a heading to jump straight to the topic)



SCIENCE for SPORT

Foreword

An introductory word from the chief editor.

Issue #2 - November 2016

Welcome to Science for Sport's monthly *Research Alerts*. These monthly issues are a gathering of the latest, and best, research published in that month from peer-reviewed journals. For example, research published within October 2016 will be included within the October 2016 issue - this ensures you're up-to-date with the most recent and talked about research. When there is not enough relevant research published in that month, studies published in the preceding month(s) will be used to supplement the topic. Each new issue will be published on the last day of the month (e.g. December 2016 issue will be published on the 31st December 2016).

With hundreds of studies published every month across the realms of sports science, the primary motivation of the *Research Alerts* is to help students, practitioners, researchers and educators alike keep up-to-date with the latest peer-reviewed research—which otherwise is a seemingly impossible task. The secondary motivation is to facilitate education within the global sports science community by critiquing the studies and displaying the information in a refreshingly digestible format.

With so much positive feedback from the Science for Sport members regarding all the content (i.e. articles, videos, jobs, research and so much more) currently delivered, we felt these *Research Alerts* were a very important addition—and one we hope will be well received.

I would also like to take this opportunity to sincerely thank all the editors for their contributions and reviewing of these documents, as for without them, these would not be so valuable. It is an absolute pleasure working alongside such fantastic practitioners and academics , and I hope to see these relationships continue to develop and prosper.

Last, but by no means least, I hope you find these *Research Alerts* very helpful in your daily practice, and I'm sure you can appreciate just how much work goes into them every month. As a matter of courtesy, though we cannot always prevent you distributing these documents with other professionals, we kindly ask and hope for you to respect our work and refrain from sharing them freely.

Yours Sincerely,

Owen Walker

Owen Walker MSc*D CSCS

Founder, author and director of Science for Sport

Strength & Conditioning

This month's top research in strength & conditioning.

FEATURE

THE RELATIONSHIP BETWEEN DYNAMIC STABILITY AND MULTIDIRECTIONAL SPEED

Lockie, RG, Schultz, AB, Callaghan, SJ, and Jeffriess, MD. J Strength Cond Res 30(11): 3033–3043, 2016.

2

EFFECTS OF STRENGTH AND ENDURANCE EXERCISE ORDER ON ENDOCRINE RESPONSES TO CONCURRENT TRAINING

Thomas W. Jones, Glyn Howatson, Mark Russell & Duncan N. French (2016). European Journal of Sport Science.

3

THE DOSE–RESPONSE RELATIONSHIP BETWEEN RESISTANCE TRAINING VOLUME AND MUSCLE HYPERTROPHY: ARE THERE REALLY STILL ANY DOUBTS?

Brad J. Schoenfeld, Dan Ogborn & James W. Krieger (2016): Journal of Sports Sciences.

SCIENCE for SPORT

THE RELATIONSHIP BETWEEN DYNAMIC STABILITY AND MULTIDIRECTIONAL SPEED

OBJECTIVE: The aim of this study was to evaluate the relationship between dynamic stability and multidirectional speed.

WHAT THEY DID:

Sixteen male field sport athletes (age: 23.31 ± 5.34 years) were required to perform a series of tests consisting of a dynamic stability test and several linear and multidirectional speed tests. Participants were then sectioned into two groups—fast and slow athletes.

MEASUREMENTS:

- Modified lower-limb star excursion balance test in six directions (anterolateral, lateral, posterolateral, posteromedial, medial, and anteromedial)
- 40-m sprint test (0–10, 0–20, & 0–40 m intervals)
- T-test
- Change-of-direction and acceleration test (CODAT)

WHAT THEY FOUND:

- The faster group demonstrated superiority in dynamic stability for particular excursions.
- There was a significant positive correlation with 10-m sprint time and the difference in posteromedial reach distance between the legs, indicating a greater difference in excursion distance related to slower sprint time.
- There was a significant correlation between the 0- and 10-m time and the between-leg difference in posteromedial reach.
- Significant relationships between 0- and 40-m time, and the posteromedial and medial distances of the left leg.
- The correlation analyses documented significant positive interactions between functional reach and the change-of-direction speed tests.
- The T-test time correlated with the between-leg differences in anterolateral and lateral excursions, and the large relationships suggested that a slower time was linked to greater differences in between-leg dynamic stability.

Test	Fast Group	Slow Group	Effect Size
0–10 m (s)	1.74 ± 0.06	1.78 ± 0.03	0.84
0–20 m (s)	3.03 ± 0.10	3.14 ± 0.08*	0.96
0–40 m (s)	5.39 ± 0.18	5.64 ± 0.17*	1.43
T-test (s)	9.89 ± 0.35	10.95 ± 0.44*	2.67
CODAT (s)	5.79 ± 0.17	6.24 ± 0.38*	1.53

**Significantly ($p \leq 0.05$) different from the faster group.*

WHAT THIS MEANS:

The more difficult excursions (i.e. medial and posteromedial) significantly correlated to maximal linear sprinting and change-of-direction speed (i.e., medial, posteromedial, and anteromedial). Additionally, between-leg imbalances in dynamic stability (anterolateral, lateral, posterolateral, and posteromedial excursions) were also related to slower change-of-direction speed.

Overall, the results from this study suggest that dynamic stability, as measured by functional reaching, is related to multidirectional speed.

LIMITATIONS:

Perhaps the biggest limitation of this study is the tests used to measure change-of-direction speed. Its well-known, and particularly by the authors of this study, that tests such as the T-test and CODAT can be strongly influenced by linear sprint speed. This highlights a couple of notions: 1) caution must be taken when interpreting the results of this study; and 2) perhaps the relationship is even stronger than reported but was masked by liner sprint speed.

FUTURE RESEARCH:

Future research should further explore this relationship, but do so using newer and more accurate measures of change-of-direction speed (e.g. 5-0-5 change-of-direction deficit).

Lockie, RG, Schultz, AB, Callaghan, SJ, and Jeffriess, MD. The relationship between dynamic stability and multidirectional speed. J Strength Cond Res 30(11): 3033–3043, 2016. [Link]

SCIENCE for SPORT

ARTICLE TITLE

EFFECTS OF STRENGTH AND ENDURANCE EXERCISE ORDER ON ENDOCRINE RESPONSES TO CONCURRENT TRAINING

Reference:

Thomas W. Jones, Glyn Howatson, Mark Russell & Duncan N. French (2016): Effects of strength and endurance exercise order on endocrine responses to concurrent training, European Journal of Sport Science. [Link]

OBJECTIVE:

The aim of this study was to examine the effect of strength and endurance training order on endocrine factors associated with strength development and performance during concurrent training.

WHAT THEY DID:

30 recreationally resistance-trained males completed one of four training protocols; strength training (ST), strength followed by endurance training (ST-END), endurance followed by strength training (END-ST) or no training (CON).

Blood samples were taken before each exercise protocol, immediately after exercise, and 1 h post-exercise. Blood samples were then analysed for total testosterone, cortisol and lactate concentrations.

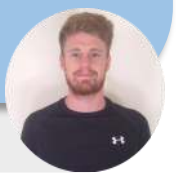
WHAT THEY FOUND:

Both ST and ST-END resulted in better performance during the strength loading than END-ST. Given the results of the performance maintenance and the blood sampling, the authors conclude that endurance training prior to strength training may result in acute unfavourable responses to strength training when strength training is conducted with high loads.

EDITORS COMMENTS:

"Though this study failed to measure hormonal responses any later than 1-hour post-exercise, gaining insight into acute endocrine responses following various concurrent training methods is still very useful.

This study now supports similar research which indicates that strength training prior to endurance training is more favourable. More justification to lift before ESD."



Owen Walker

ARTICLE TITLE

THE DOSE–RESPONSE RELATIONSHIP BETWEEN RESISTANCE TRAINING VOLUME AND MUSCLE HYPERTROPHY: ARE THERE REALLY STILL ANY DOUBTS?

Reference:

Brad J. Schoenfeld, Dan Ogborn & James W. Krieger (2016): The dose–response relationship between resistance training volume and muscle hypertrophy: are there really still any doubts? Journal of Sports Sciences. [Link]

OBJECTIVE:

The purpose of this article, not study, was to defend their previous systematic review and meta-analysis on hypertrophy training which was heavily criticised by Arruda and colleagues.

WHAT THEY DID:

Dr. Shoenfeld and his research team replied to all the critical points made by Arruda et al. (2016) in a well-structured manner. The points made included: methodological variations between studies, influence of other variables (e.g. frequency), analysis of the number of sets per exercise, inadequate reporting of training effort, training history of participants and the conclusive training guidelines proposed by Shoenfeld et al. (2016).

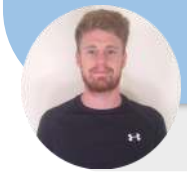
HOW THEY RESPONDED:

Overall, Dr. Shoenfeld's response to the critical, and fairly dismissive, review by Arruda and colleagues was very good. They discussed virtually all critiques made, bar the conclusive training guidelines, and provided solid evidence and justification for the concerns raised by Arruda et al. (2016).

EDITORS COMMENTS:

"I feel this was mainly a matter of misunderstanding as Schoenfeld and his colleagues failed to clarify a number of key points, which generated the confusion amongst some readers. All in all, I feel it's relatively safe to accept their original findings on hypertrophy training, which were greater muscle volume growth can be related to an increasing number of sets per muscle per week.

However, there are still some practical concerns with Schoenfeld's original review (e.g. training guidelines and use of untrained participants), but they should not be held accountable for this."



Owen Walker

Technology & Monitoring

This month's top sports science research on technology and monitoring.

FEATURE

CHANGE OF DIRECTION DEFICIT: A MORE ISOLATED MEASURE OF CHANGE OF DIRECTION PERFORMANCE THAN TOTAL 505 TIME

Nimphius, S, Callaghan, SJ, Spiteri, T, and Lockie, RG. J Strength Cond Res 30 (11): 3024–3032, 2016.

2

SPRINT PERFORMANCE AND MECHANICAL OUTPUTS COMPUTED WITH AN IPHONE APP: COMPARISON WITH EXISTING REFERENCE METHODS

Romero-Franco N, Jiménez-Reyes P, Castaño-Zambudio A, Capelo-Ramírez F, Rodríguez-Juan JJ, González-Hernández J, Toscano-Bendala FJ, Cuadrado-Peñafiel V & Balsalobre-Fernández C. (2016) European Journal of Sport Science.

3

THE USE OF REACTIVE STRENGTH INDEX, REACTIVE STRENGTH INDEX MODIFIED, AND FLIGHT TIME: CONTRACTION TIME AS MONITORING TOOLS

Martinez DB. J. Aust. Strength Cond. 24(5) 37-41. 2016.

SCIENCE for SPORT

CHANGE OF DIRECTION DEFICIT: A MORE ISOLATED MEASURE OF CHANGE OF DIRECTION PERFORMANCE THAN TOTAL 505 TIME

OBJECTIVE: To evaluate the relationship between linear speed, change of direction speed (COD) and COD deficit. Also, to identify if the COD deficit displayed a difference in performance when compared to the traditional COD total test time.

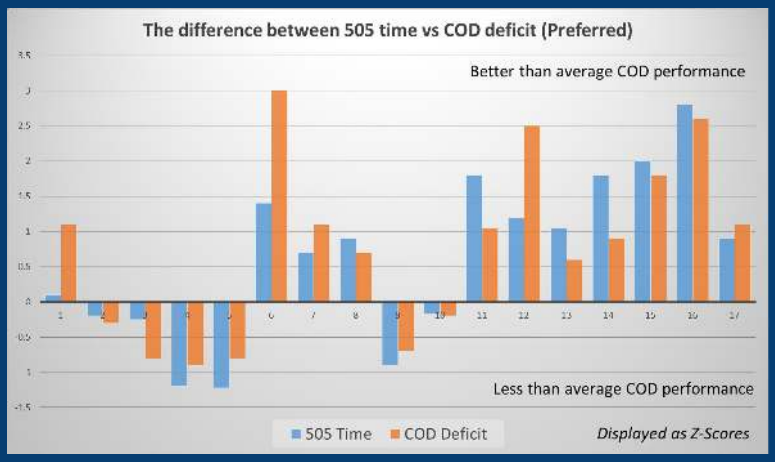
WHAT THEY DID:

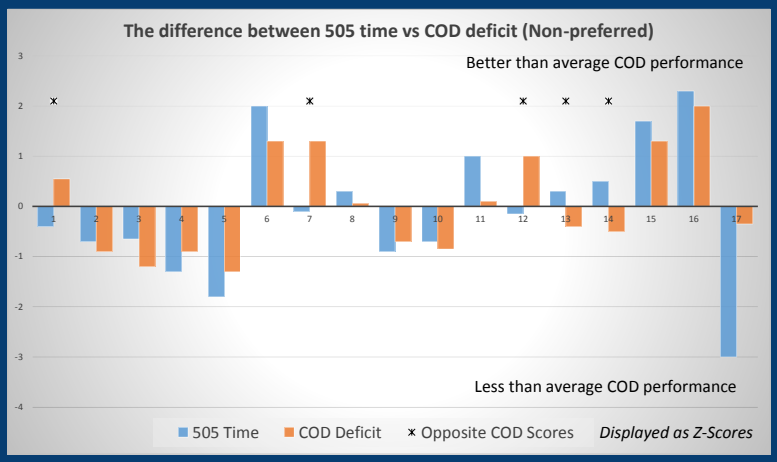
Tested 0-10m, 0-30m and 505 agility test time. They then used the mean 0-10m split time to calculate the COD deficit in experienced cricketers. COD deficit = mean 505 time — mean 10-m time.

MEASUREMENTS

- 0-10m time
- 0-30m time
- Preferred leg 505 time
- Non-preferred leg 505 time
- Preferred leg 505 COD deficit
- Non-preferred leg 505 COD deficit

WHAT THEY FOUND:





WHAT THIS MEANS:

Whilst both 505 times showed very strong relationships with linear speed, both the COD deficits showed no correlation with linear speed whatsoever. This simply means that the COD deficit may be a better measure of COD ability than total test time, as it appears to be uninfluenced by linear speed. Consequently, it may be suggested that we begin to move away from measuring COD ability using 'total time', and instead move towards the use of the COD deficit.

LIMITATIONS:

Cricketers were the only athletes analysed in this study. Also, only a 180˚ COD was investigated in this study. A COD deficit may be specific to the angle of the direction change.

FUTURE RESEARCH:

Future research should investigate the COD deficit using the 505 with athletes from different sports and using different COD angles (e.g. 120˚).

Nimphius, S, Callaghan, SJ, Spiteri, T, and Lockie, RG. Change of direction deficit: A more isolated measure of change of direction performance than total 505 time. J Strength Cond Res 30 (11): 3024–3032, 2016. [Link]

ARTICLE TITLE

SPRINT PERFORMANCE AND MECHANICAL OUTPUTS COMPUTED WITH AN IPHONE APP: COMPARISON WITH EXISTING REFERENCE METHODS

Reference:

Romero-Franco N, Jiménez-Reyes P, Castaño-Zambudio A, Capelo-Ramírez F, Rodríguez-Juan JJ, González-Hernández J, Toscano-Bendala FJ, Cuadrado-Peñafiel V & Balsalobre-Fernández C. (2016) Sprint performance and mechanical outputs computed with an iPhone app: Comparison with existing reference methods. European Journal of Sport Science. [Link]

OBJECTIVE:

The purpose of this study was to assess the validity and reliability of a iPhone application used to measure sprint velocity (named: *MySprint App*).

WHAT THEY DID:

12 highly trained male sprinters performed 6 maximal 40-m sprints during a single session which were simultaneously timed using 7 pairs of timing photocells, a radar gun and the newly developed iPhone app based on high-speed video recording.

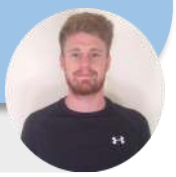
WHAT THEY FOUND:

There was an almost perfect correlation between the values of time for each split of the 40-m sprint measured with MySprint and the timing photocells (r = 0.989–0.999, standard error of estimate = 0.007–0.015 s, intraclass correlation coefficient (ICC) = 1.0). The present study showed that sprint performance can be evaluated in a valid and reliable way using a novel iPhone app.

EDITORS COMMENTS:

"Given the cost and accessibility of typical equipment used to measure sprint speed (timing gates or radar guns), the development and reliability verification of this app I'm going to say marks a significant day in sports science history.

Being able to accurately measure sprint speed using an common smartphone opens the door to a flood of measurement possibilities."



Owen Walker

ARTICLE TITLE

THE USE OF REACTIVE STRENGTH INDEX, REACTIVE STRENGTH INDEX MODIFIED, AND FLIGHT TIME: CONTRACTION TIME AS MONITORING TOOLS

Reference:

Martinez DB. The use of reactive strength index, reactive strength index modified, and flight time: contraction time as monitoring tools. J. Aust. Strength Cond. 24(5) 37-41. 2016 [Link]

OBJECTIVE:

The purpose of this article was to provide practitioners with an improved understanding of the reactive strength index (RSI), reactive strength index modified (RSImod), and the ratio of flight time to contraction time (FT:CT) and how they can be used appropriately for athlete monitoring and sports performance purposes.

WHAT THEY DID:

Martinez (the author) provided a very informative, but concise, literature review of the current research and practice for using these tests to monitor athlete readiness and for performance testing.

WHAT THEY FOUND:

All tests appear to be valid, reliable and sensitive to the smallest worthwhile change. Additionally, due to the complexity of neuromuscular fatigue, these tests may be more favourable for monitoring purposes than other jump tests such as the CMJ.

EDITORS COMMENTS:

"Though we have written a comprehensive article on RSI on Science for Sport, its nice to finally see a detailed review article published in a peer-reviewed journal.

RSI can be measured using a whole host of tests, and with the development of certain technologies (e.g. MyJump app), this test is becoming easier and cost-effective."

Owen Walker

Fatigue & Recovery

This month's top sports science research on fatigue and recovery.

FEATURE

THE NEUROMUSCULAR, BIOCHEMICAL, AND ENDOCRINE RESPONSES TO A SINGLE-SESSION VS. DOUBLE-SESSION TRAINING DAY IN ELITE ATHLETES

Johnston, MJ, Cook, CJ, Drake, D, Costley, L, Johnston, JP, and Kilduff, LP. J Strength Cond Res 30(11): 3098–3106, 2016.

2

POWER–DURATION RELATIONSHIP: PHYSIOLOGY, FATIGUE, AND THE LIMITS OF HUMAN PERFORMANCE

Burnley M & Jones AM. (2016) European Journal of Sport Science.

3

THE EFFECTS OF SKIN AND CORE TISSUE COOLING ON OXYGENATION OF THE VASTUS LATERALIS MUSCLE DURING WALKING AND RUNNING

Gagnon DD, Peltonen JE, Rintamäki H, Gagnon SS, Herzig KH & Kyröläinen H. (2016) Journal of Sports Sciences.

SCIENCE for SPORT

THE NEUROMUSCULAR, BIOCHEMICAL, AND ENDOCRINE RESPONSES TO A SINGLE-SESSION VS. DOUBLE-SESSION TRAINING DAY IN ELITE ATHLETES

OBJECTIVE: The aim of this study was to compare the acute neuromuscular, biochemical, and endocrine responses of a training day consisting of a speed session only with performing a speed-and-weights training session on the same day.

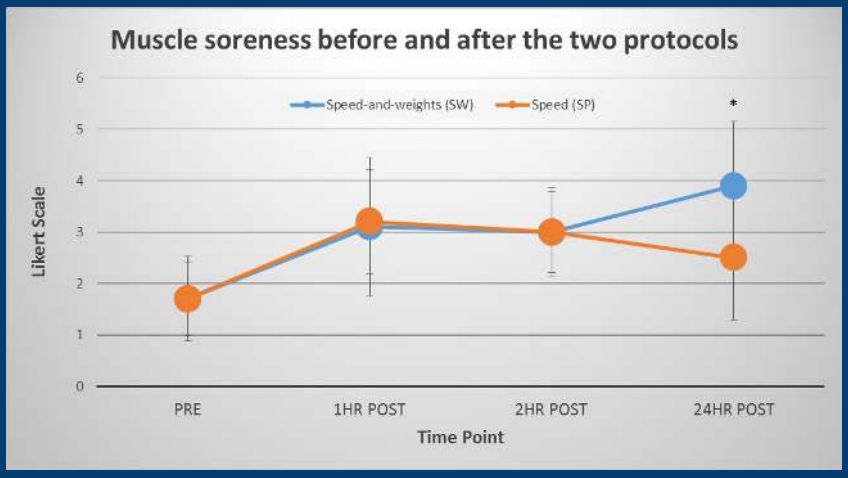
WHAT THEY DID:

15 male academy rugby players completed 2 protocols in a randomized order. The speed-only (SP) protocol involved performing 6 * 50-m sprints with 5-mins of recovery between each sprint. The speed-and-weights (SW) protocol involved the same sprinting session but was followed 2-hrs later by a lower-body weights session consisting of 4 sets of 5 back squats and RDL at 85% 1RM.

MEASUREMENTS:

- Testosterone
- Cortisol
- Creatine Kinase
- Lactate
- Perceived muscle soreness
- CMJ jump height
- CMJ peak power
- CMJ relative peak power
- CMJ average rate of force development

WHAT THEY FOUND:



Perceived muscle soreness was significantly higher after 24-hour in the SW group.

No other significant changes in any of the hormonal, biochemical or neuromuscular parameters were found.

WHAT THIS MEANS:

A double session, combining both speed and weights, separated by 2-hours of passive rest may lead to an increase in next day muscle soreness, but may not cause any additional decrements in performance or fatigue.

LIMITATIONS:

Two key limitations to this study were the lack of using a control group, and using the CMJ as a measure of neuromuscular performance. Not including a control group may have masked any circadian hormone fluctuations. CMJ is less sensitive to changes in neuromuscular performance than, for example, certain reactive strength index tests.

FUTURE RESEARCH:

Future investigations should certainly include the use of a control group, use more sensitive measures of neuromuscular performance, and also use a more realistic weight training protocol (i.e. 4*5 reps of squat and RDL is questionable for academy rugby players).

Johnston, MJ, Cook, CJ, Drake, D, Costley, L, Johnston, JP, and Kilduff, LP. The neuromuscular, biochemical, and endocrine responses to a single-session vs. double-session training day in elite athletes. J Strength Cond Res 30(11): 3098–3106, 2016 [Link]

SCIENCE for SPORT

ARTICLE TITLE

POWER–DURATION RELATIONSHIP: PHYSIOLOGY, FATIGUE, AND THE LIMITS OF HUMAN PERFORMANCE

Reference:

Burnley M & Jones AM. (2016) Power–duration relationship: Physiology, fatigue, and the limits of human performance, European Journal of Sport Science. [Link]

OBJECTIVE:

The purpose of this paper was to discuss the current evidence regarding the power-duration relationship (i.e. how long power can be maintained before the onset of task failure/fatigue).

WHAT THEY DID:

Provided an in-depth discussion on the physiological mechanisms which lead to task failure and thus the termination of exercise.

WHAT THEY FOUND:

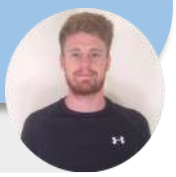
They discuss the four exercise intensity domains/zones: moderate-intensity, heavy-intensity, severe-intensity and extreme-intensity, and which physiological mechanisms underpin task failure for each. They also highlight how mechanisms of central or peripheral neuromuscular fatigue are intensity-domain specific and how these mechanisms combine to influence exercise performance.

A vital point to take from this study is that regardless of whether the participant wishes to continue exercising, task failure will occur if the compensatory adjustments made by the central nervous system fail to match the power demands of the task. They suggest that no amount of motivation or coercion will prevent the athlete from task failure/fatigue during severe exercise – meaning that task failure is purely physical and not psychological.

EDITORS COMMENTS:

"For anyone who takes their physiology seriously, and who wishes to understand the physiological feat of human performance, I highly recommend you read this one—but I warn you, its heavy.

Their conclusions that task failure is physical and not psychological should ring the bells in many coaches heads. But I will add the important point that some athletes still need to be motivated to reach physical task failure."



Owen Walker

ARTICLE TITLE

THE EFFECTS OF SKIN AND CORE TISSUE COOLING ON OXYGENATION OF THE VASTUS LATERALIS MUSCLE DURING WALKING AND RUNNING

Reference:

Gagnon DD, Peltonen JE, Rintamäki H, Gagnon SS, Herzig KH & Kyröläinen H. (2016) The effects of skin and core tissue cooling on oxygenation of the vastus lateralis muscle during walking and running, Journal of Sports Sciences. [Link]

OBJECTIVE:

The objective of this study was to examining the effect of skin and core cooling on muscle deoxygenation via two exercise modalities, walking and running.

WHAT THEY DID:

Eleven male participants walked or ran six times on a treadmill for 60-mins in ambient temperatures of 22°C (Neutral), 0°C for skin cooling (Cold 1), and at 0°C following a core and skin cooling protocol (Cold 2).

WHAT THEY FOUND:

Core tissue cooling, prior to exercise, induced greater deoxygenation of the Vastus Lateralis muscle during the early stages of exercise, irrespective of changes in blood volume. Skin cooling alone, however, did not influence deoxygenation of the Vastus Lateralis during exercise. These results suggest that pre-exercise total body cooling may increase muscle tissue oxygen uptake (muscle deoxygenation).

EDITORS COMMENTS:

"The results of this study are interesting as they are based upon some pretty complex physiology—that being, decreasing core temperature may result in an increased oxygen uptake within the working muscles.

However, I'm not sure I'm convinced on this method of enhancing performance yet as we know lower muscle temperatures can result in a decrease of other components such as contractility and force production."

Owen Walker

Youths

This month's top sports science research on youth populations.

FEATURE

EXPLORING THE HIGH REINJURY RATE IN YOUNGER PATIENTS UNDERGOING ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

Kate E. Webster and Julian A. Feller. Am J Sports Med 2016.

2

CARDIORESPIRATORY FITNESS CUT POINTS TO AVOID CARDIOVASCULAR DISEASE RISK IN CHILDREN AND ADOLESCENTS; WHAT LEVEL OF FITNESS SHOULD RAISE A RED FLAG? A SYSTEMATIC REVIEW AND META-ANALYSIS

Ruiz R, Cavero-Redondo I, Ortega FB, Welk GJ, Andersen LB, Martinez-Vizcaino V. Br J Sports Med 2016;50:1451–1458.

3

ACADEMIC OUTCOMES IN HIGH-SCHOOL STUDENTS AFTER A CONCUSSION: A RETROSPECTIVE POPULATION-BASED ANALYSIS

Russell K, Hutchison MG, Selci E, Leiter J, Chateau D, Ellis MJ (2016) PLoS ONE 11(10): e0165116.

SCIENCE for SPORT

EXPLORING THE HIGH REINJURY RATE IN YOUNGER PATIENTS UNDERGOING ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

OBJECTIVE: The purpose of this study was to determine the rates of ACL graft rupture and injury to the contralateral native ACL in young athletes. The authors also sought to explore the influence of sex and age groupings (< 18 vs. 18-19 years at the time of surgery) on the risk of subsequent ACL injury.

WHAT THEY DID:

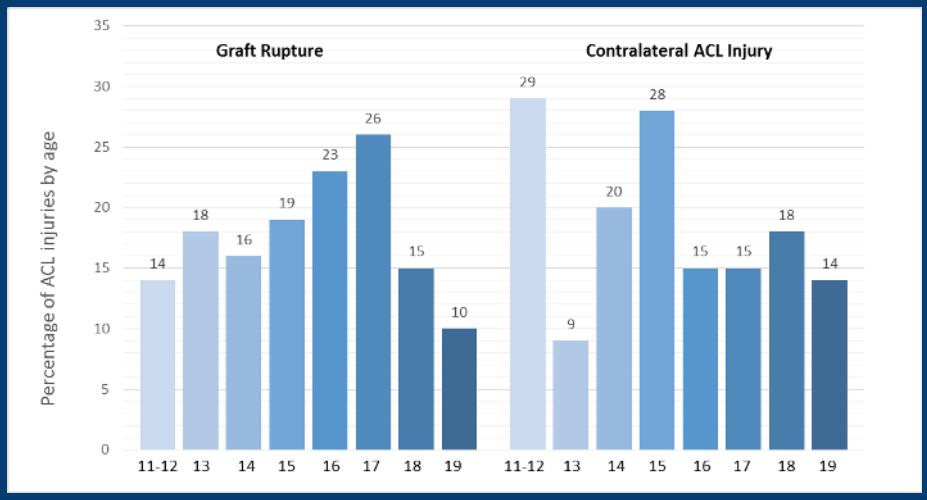
354 patients under 20 years old (229 males, 125 females) who underwent their first primary hamstring tendon autograft ACL reconstruction were included. The number of subsequent ACL injuries (graft rupture or a contralateral injury to the native ACL) was determined at a mean follow-up of 5 years.

MEASUREMENTS:

- 5 year follow-up
- Subgroup analysis included sex and age (<18 years vs 18-19 years at the time of surgery) comparisons.

WHAT THEY FOUND:

- The overall rate of second ACL injuries was (35%).
- 22.6% re-injury rate in female patients aged between 18 or 19 years.
- Young males were at greatest risk of a second ACL injury (44.3% re-injury rate) compared to females.
- Graft rupture rate was similar to that for contralateral ACL injuries, but the timing of these second injuries was notably different.



WHAT THIS MEANS:

The results from this study demonstrate that re-injury rates of graft ACL are unacceptably high and is a significant concern from both sport participation and injury prevention perspectives, as well as for long-term knee joint health. It also highlights that whilst young females may be at higher risk of sustaining an initial ACL rupture, young males are actually at a higher risk of sustaining re-injury to the ACL graft.

LIMITATIONS:

The lack of post-operative information with regards to rehabilitation protocols, achieving any return-to-play criteria or the nature of re-injury (contact vs. non-contact) masks our understanding of the effectiveness of well-structured rehabilitation strategies.

FUTURE RESEARCH:

Future research should attempt to analyse the post-operative strategies (i.e. rehabilitation protocols and return-to-play criteria) and their impact upon re-injury rates.

Kate E. Webster and Julian A. Feller Reconstruction Exploring the High Reinjury Rate in Younger Patients Undergoing Anterior Cruciate Ligament. Am J Sports Med 2016. [Link]

SCIENCE for SPORT

ARTICLE TITLE

CARDIORESPIRATORY FITNESS CUT POINTS TO AVOID CARDIOVASCULAR DISEASE RISK IN CHILDREN AND ADOLESCENTS; WHAT LEVEL OF FITNESS SHOULD RAISE A RED FLAG? A SYSTEMATIC REVIEW AND META-ANALYSIS

Reference:

Ruiz R, Cavero-Redondo I, Ortega FB, Welk GJ, Andersen LB, Martinez-Vizcaino V. Cardiorespiratory fitness cut points to avoid cardiovascular disease risk in children and adolescents; what level of fitness should raise a red flag? A systematic review and meta-analysis. Br J Sports Med 2016;50:1451–1458. [Link]

OBJECTIVE:

The objective of this systematic review and meta-analysis was to identify if there is a relationship between poor cardiorespiratory fitness and cardiovascular disease risk in children and adolescents from several countries.

WHAT THEY DID:

The authors conducted a search of any studies published between 1980-2015 that determined a cardiorespiratory fitness cut point that predicted cardiovascular disease risk in children and adolescents. After the filtration process, 7 studies totalling the inclusion of 9280 children and adolescents (49% girls) aged 8–19 years from 14 countries were chosen for review.

WHAT THEY FOUND:

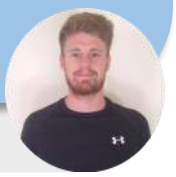
Despite cardiovascular disease risk already being present in boys (6–39%) and girls (6–86%), boys with low fitness levels (<41.8 mL/kg/min) had a 5.7 times higher risk of developing cardiovascular disease. In comparison, girls with low fitness levels (<34.6 mL/kg/min) had a 3.6 times higher risk of developing cardiovascular disease.

Youths with fitness levels below 42 and 35 mL/kg/min for boys and girls, respectively, should indicate a potential cause for concern.

EDITORS COMMENTS:

"Considering cardiovascular disease is one of the biggest killers in developed countries, prevention is key.

The consistency of findings within this study provide strong evidence to support these cut points as red flags. These cut points (42 and 35 mL/kg/min) can serve as standards for cardiovascular disease risk in youths. This should also prompt discussions for assessing youth fitness levels in the likes of schools and other institutions alike, similar to the Fitnessgram assessment is the USA."



Owen Walker

ARTICLE TITLE

ACADEMIC OUTCOMES IN HIGH-SCHOOL STUDENTS AFTER A CONCUSSION: A RETROSPECTIVE POPULATION-BASED ANALYSIS

Reference:

Russell K, Hutchison MG, Selci E, Leiter J, Chateau D, Ellis MJ (2016) Academic Outcomes in High-School Students after a Concussion: A Retrospective Population -Based Analysis. PLoS ONE 11(10): e0165116. [Link]

OBJECTIVE:

The objective of this study was to determine if academic performance was lower in the academic calendar year that students sustain a concussion compared to the previous year when they did not sustain a concussion.

WHAT THEY DID:

8240 (1709 concussed, 6531 non-concussed students) grade 9-12 students (14-18 years) were included in this study. The authors gathered retrospective data comprising of the students' pre- and post-concussion grade point averages (GPAs). The GPAs of the academic year prior to the concussion (pre-concussion) was compared to the GPAs of the academic year in which the concussion was sustained (post-concussion).

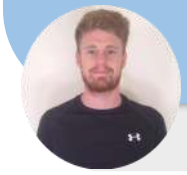
WHAT THEY FOUND:

The results from this study concluded that concussion had minimal long-term effects on academic performance on high school GPAs.

EDITORS COMMENTS:

"Given the prevalence and severity of concussion injuries, this is a very important topic not only for return-to-play criteria but also on a young athletes academic success.

Previous research has not only shown post-concussion recovery rates appear to be slower in youth populations, but that they may also effect academic performance—hence the rationale for this study. Though this study has provided some promising results, much more research is needed."



Owen Walker

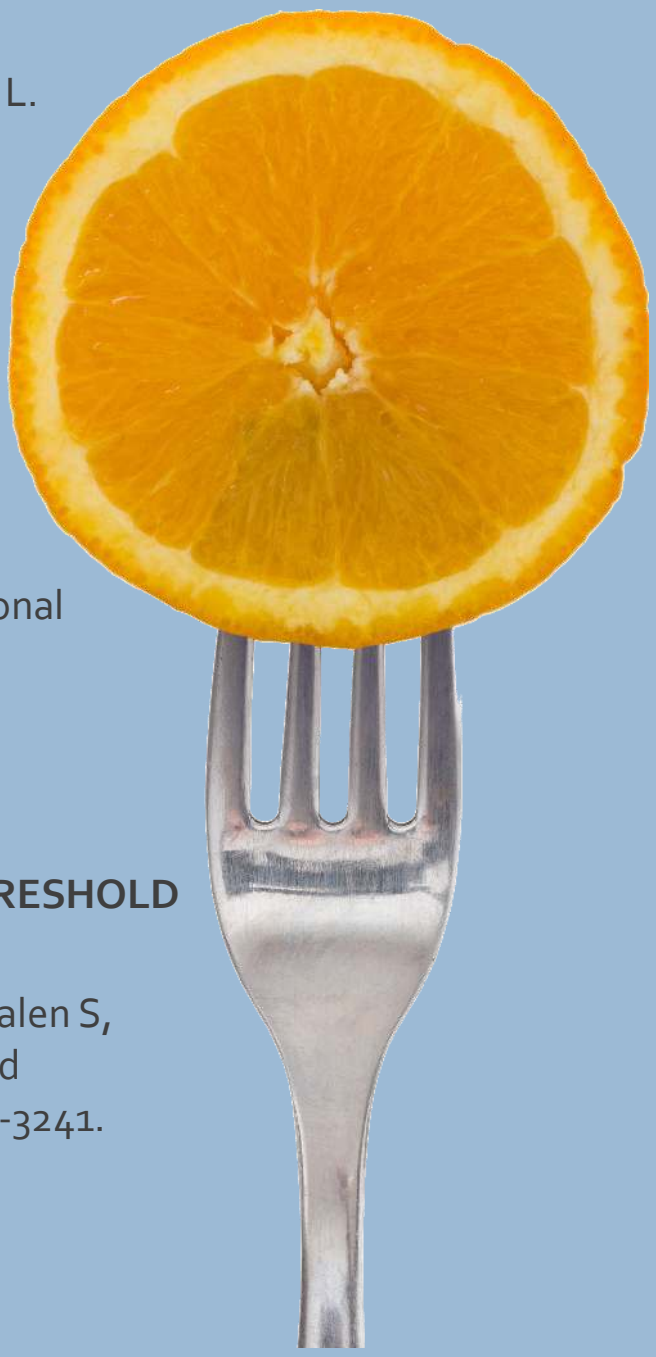
Nutrition

This month's top research on nutrition.

FEATURE

PRE-SLEEP PROTEIN INGESTION DOES NOT COMPROMISE THE MUSCLE PROTEIN SYNTHETIC RESPONSE TO PROTEIN INGESTED THE FOLLOWING MORNING

Wall B, Burd N, Franssen R, Gorissen S, Snijders T, Senden J, Gijsen A, van Loon L. (2016). Am J Physiol Endocrinol Metab.



2

EFFECTS OF ACUTE CARBOHYDRATE INGESTION ON ANAEROBIC EXERCISE PERFORMANCE

Krings B, Rountree J, McAllister M, Cummings P, Peterson T, Fountain B, Smith J. (2016). Journal of the International Society of Sports Nutrition, 13(40).

3

ACUTE LOW-DOSE CAFFEINE SUPPLEMENTATION INCREASES ELECTROMYOGRAPHIC FATIGUE THRESHOLD IN HEALTHY MEN

Morse J, Pallaska G, Pierce P, Fields T, Galen S, Malek M. (2016). Journal of Strength and Conditioning Research, 30(11), pp. 3236-3241.

SCIENCE for SPORT

PRE-SLEEP PROTEIN INGESTION DOES NOT COMPROMISE THE MUSCLE PROTEIN SYNTHETIC RESPONSE TO PROTEIN INGESTED THE FOLLOWING MORNING

OBJECTIVE: To determine if protein ingestion prior to sleep modulates the postprandial muscle protein synthesis (MPS) response to protein consumed the subsequent morning.

WHAT THEY DID:

Sixteen healthy active young men (24 ± 1 years) performed unilateral resistance-type exercise at 8:00pm. Participants ingested 20g protein immediately after exercise, plus either 60g protein or carbohydrate pre-bed. The following morning all participants consumed 20g protein after which measurements of MPS were taken in the rested and exercised leg.

MEASUREMENTS:

- Postprandial myofibrillar protein synthesis rates
- Dietary protein digestion and absorption kinetics

WHAT THEY FOUND:

- Exercise increased myofibrillar protein synthesis rates the subsequent day ($P<0.001$), with no differences between the protein and carbohydrate group.
- Protein ingested in the morning increased myofibrillar protein synthesis in both the exercised- and rested-leg ($P<0.01$), with no differences between groups.

WHAT THIS MEANS:

Eating large amounts of protein before sleep does not blunt MPS rates the next morning. Therefore, night-time protein supplementation may be an effective nutrient timing strategy to augment skeletal muscle growth.

On the whole, this study suggests that every meal is a unique opportunity to stimulate MPS, and all meals work additively to optimise MPS rates in a day.

LIMITATIONS:

- Relatively small sample size (8 in each group).
- Long time between pre-bed protein dose and protein ingestion subsequent day (~12hrs) may limit external validity.
- Whey protein is not commonly consumed pre-bed (mixed meal or casein protein more likely options).

FUTURE RESEARCH:

- Do results differ when consuming casein protein/ mixed meal pre-bed, and when performing resistance training earlier in day?
- Long-term effect of pre-bed protein on muscle growth and strength (protein intake equated between groups)

Wall B, Burd N, Franssen R, Gorissen S, Snijders T, Senden J, Gijsen A, van Loon L. (2016). Pre-sleep Protein Ingestion Does Not Compromise the Muscle Protein Synthetic Response to Protein Ingested the Following Morning. Am J Physiol Endocrinol Metab. [Link]

SCIENCE for SPORT

ARTICLE TITLE

EFFECTS OF ACUTE CARBOHYDRATE INGESTION ON ANAEROBIC EXERCISE PERFORMANCE

Reference:

Krings B, Rountree J, McAllister M, Cummings P, Peterson T, Fountain B, Smith J. (2016). Effects of Acute Carbohydrate Ingestion on Anaerobic Exercise Performance. Journal of the International Society of Sports Nutrition, 13(40). [Link]

OBJECTIVE:

The purpose of this paper was to examine the effects of various levels of intra-workout carbohydrate supplementation on performance during a strength and conditioning training session.

WHAT THEY DID:

Nine highly trained males (age 21.9 ± 1.6 years) performed an exercise protocol consisting of a series of short sprints, full body resistance training exercises, jumping, and shuttle running (total time ~71min) while consuming an amino-acid electrolyte control or control plus carbohydrate at a rate of 15, 30, or 60 g/h. Performance measurements were taken for sprint times, repetitions until failure for each resistance training exercise, summation of total repetitions for all repetitions until failure, repetitions in a set time for two-foot line jumps, and 137-m shuttle times.

WHAT THEY FOUND:

Carbohydrate ingestion rates of 15–30g/h with ~500 mL of fluid likely lead to the greatest overall performance compared to supplementing only amino acids during strength and conditioning training sessions.

EDITORS COMMENTS:

"This study is important as most of the research on carbohydrate intake during exercise has looked at the effect on endurance performance. Furthermore, because the study was designed to simulate a collegiate football training session, the findings are very applicable to the type of training sessions designed by many strength and conditioning coaches for field sport athletes.

It is also interesting to note that a carb intake of 30-60g/hr did not provide superior overall results to 15g/hr, which is likely beneficial for people with digestive issues during exercise."

Tim Rowland

ARTICLE TITLE

ACUTE LOW-DOSE CAFFEINE SUPPLEMENTATION INCREASES ELECTROMYOGRAPHIC FATIGUE THRESHOLD IN HEALTHY MEN

Reference:

Morse J, Pallaska G, Pierce P, Fields T, Galen S, Malek M. (2016). Acute Low-dose Caffeine Supplementation Increases Electromyographic Fatigue Threshold in Healthy Men. Journal of Strength and Conditioning Research, 30 (11), pp. 3236-3241. [Link]

OBJECTIVE:

The purpose of this study was to determine whether consumption of a single low-dose caffeine drink will delay the onset of neuromuscular fatigue in the superficial quadriceps muscles.

WHAT THEY DID:

On separate occasions, ten healthy recreationally active college-aged men (age = 23.0 ± 0.4 years) performed incremental single-leg knee-extensor ergometry one hour after caffeine (200mg) or placebo consumption. Participants began on the ergometer at 5W for 2 minutes, and the power output was then increased by 5W every 2 minutes throughout the test until participants reached volitional fatigue (cadence was maintained at 70 revolutions per minute throughout). The electromyographic fatigue threshold (EMG_{FT}) was then determined for each participant for both conditions.

WHAT THEY FOUND:

There was a significant increase for both maximal power output (15.8%) and EMG_{FT} (45%) during the caffeine condition compared with the placebo.

EDITORS COMMENTS:

"These findings suggest that an acute low-dose of caffeine 1-hour before endurance exercise may have ergogenic effects for exercises using isolated continuous muscle action for the quadriceps muscles. Such supplementation may therefore provide benefits in cycling, running and rowing which heavily involve the quadriceps.

Interestingly, this study found an ergogenic effect of caffeine with a much lower dose (2.5mg/kg) than most other studies. This is important as moderate to high doses of caffeine may potentially cause health issues."

Tim Rowland

Team Sports

This month's top sports science research in team sports.

FEATURE

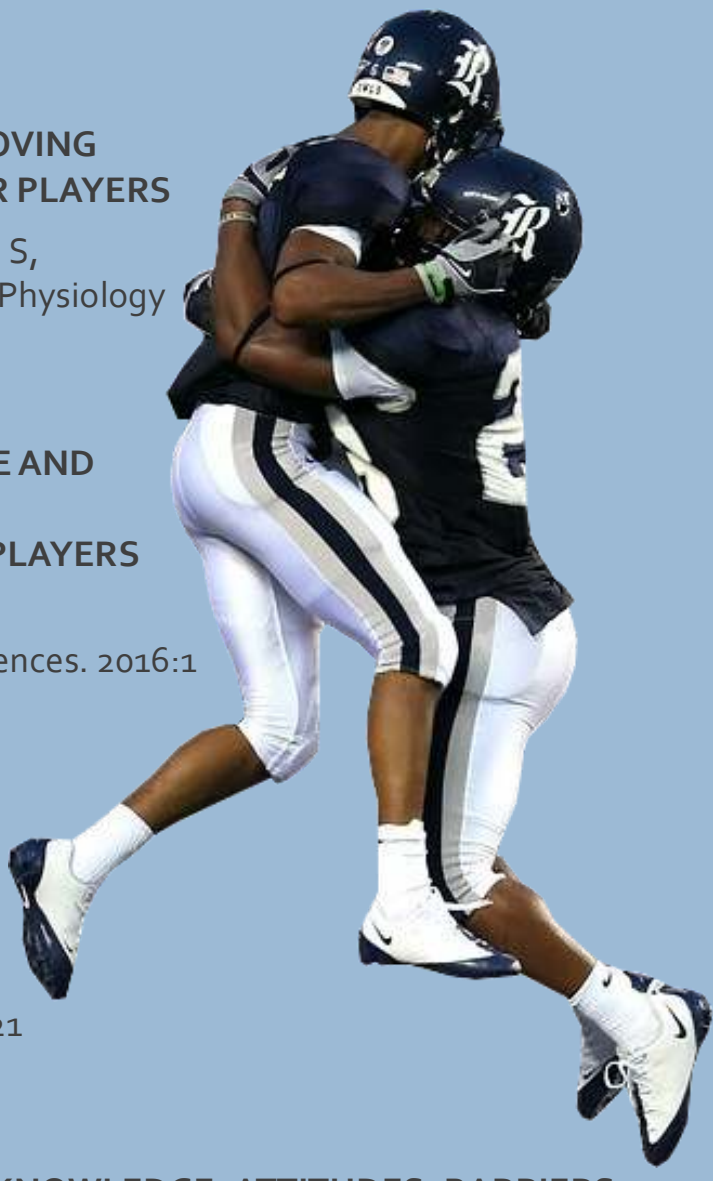
MOVEMENT DEMANDS OF ELITE UNDER-20S AND SENIOR INTERNATIONAL RUGBY UNION PLAYERS

Cunningham DJ, Shearer DA, Drawer S,Pollard B, Eager R, Taylor N, Cook CJ, Kilduff LP. PLoS One. 2016;11(11):1–13.

2

VERY-HEAVY SLED TRAINING FOR IMPROVING HORIZONTAL FORCE OUTPUT IN SOCCER PLAYERS

Morin, JB, Jimenez-Reyes, P, Randall-Brown, S, Samozino, P. International Journal of Sports Physiology and Performance, 2016.



3

THE EFFECTS OF FAST BOLWING FATIGUE AND ADHESIVE TAPING ON SHOULDER JOINT POSITION SENSE IN AMATEUR CRICKET PLAYERS IN VICTORIA, AUSTRALIA

Weerakkody N, Allen T. Journal of Sports Sciences. 2016:1 -9.

4

IS THERE A RELATIONSHIP BETWEEN HIP ADDUCTOR STRENGTH AND GROIN INJURIES IN AUSTRALIAN FOOTBALL LEAGUE FOOTBALLERS?

Turk, P. J. Aust. Strength Cond. (2016) 24(5) 21 -28.

5

HYDRATION AND FLUID REPLACEMENT KNOWLEDGE, ATTITUDES, BARRIERS, AND BEHAVIORS OF NCAA DIVISION 1 AMERICAN FOOTBALL PLAYERS

Judge, LW, Kumley, RF, Bellar, DM, Pike, KL, Pierson, EE, Weidner, T, Pearson, D, and Friesen, CA. J Strength Cond Res 30(11): 2972–2978, 2016.

SCIENCE for SPORT

MOVEMENT DEMANDS OF ELITE UNDER-20S AND SENIOR INTERNATIONAL RUGBY UNION PLAYERS

OBJECTIVE: The aim of this study was to compare the positional movement demands of elite international Under-20 age grade and senior international rugby union players during competition.

WHAT THEY DID:

Measured the movement demands using 10Hz global positioning systems (GPS) during 15 elite international under-20 (U-20) and 8 senior international (senior) rugby union matches.

MEASUREMENTS:

- Distance
- Velocity at different speeds
- Accelerations and decelerations
- High metabolic load (HML) distance and Efforts
- Number of sprints

WHAT THEY FOUND:

The senior forwards covered greater HML distance and performed more severe decelerations compared to the U-20, but they also performed less moderate and high accelerations, relative HSR and sprints·min^{-1}.

Senior backs covered a greater relative distance, HML distance and efforts and heavy decelerations than the U-20. U-20 backs performed more relative HSR and sprints·min^{-1}.

Some differences exist between the U-20 and senior players for different positional groups, especially between first rows and midfielders. Moreover, in some positions, the U-20 have substantial lower body -masses.

WHAT THIS MEANS:

Given the differences between groups, certain positional groups may require more time to be able to match the movement demands required at a higher playing level than others. In order to increase the success of younger athletes to play at a senior level, coaches must aim to maintain or improve match movement capabilities while increasing muscle mass in some positions.

LIMITATIONS:

Investigate differences in other age-groups and incorporate measurements of various physical qualities in order to provide more information to the practitioners.

FUTURE RESEARCH:

Comparing the differences between development-level groups and senior athletes will help sport scientists and coaches to understand what should be the training course of the younger athletes in order to succeed at a senior level. The data from this study demonstrates the importance of analysing the movement demands between different age levels.

Cunningham DJ, Shearer DA, Drawer S,Pollard B, Eager R, Taylor N, Cook CJ, Kilduff LP. Movement Demands of Elite Under-20s and Senior International Rugby Union Players. PLoS One. 2016;11(11):1–13. [Link]

SCIENCE for SPORT

ARTICLE TITLE

VERY-HEAVY SLED TRAINING FOR IMPROVING HORIZONTAL FORCE OUTPUT IN SOCCER PLAYERS

Reference:

Morin, JB, Jimenez-Reyes, P, Randall-Brown, S, Samozino, P. Very-Heavy Sled Training for Improving Horizontal Force Output in Soccer Players. International Journal of Sports Physiology and Performance. 2016. [Link]

OBJECTIVE:

The aim of the study was to examine if very-heavy loaded sled (VHS) sprint training would induce an improvement in horizontal force production, mainly via a more effective ground force application, in amateur soccer players.

WHAT THEY DID:

Sixteen amateur football players participated in this study. The players were randomly assigned to the VHS or control group. Both groups trained twice weekly over 8 consecutive weeks (16 sessions). During each session the control group performed 2 blocks of 5x20m sprints with no resistance (2-min recovery between sprints and 5-min recovery between the two blocks). The VHS group performed the same sprint protocol, except they ran towing a resisted sled attached to their waist, with a load corresponding to 80% body mass (BM).

WHAT THEY FOUND:

The authors concluded that very heavy sled training (80%BM) was effective at improving 5-m and 20-m sprint performance, mechanical effectiveness and maximal horizontal force capabilities in soccer players.

EDITORS COMMENTS:

"The current study challenges present guidelines which suggests that the use of lighter loads (<20% BM) are more favourable when programming resisted sprint exercises.

However, while this research is promising and may offer another evidence-based training approach for the development of acceleration, more research is needed to quantify the optimal resistance. It may be reasonable to suggest a mixture of both light and heavy resistance is necessary to develop acceleration over multiple distances."

Liam Mason

ARTICLE TITLE

THE EFFECTS OF FAST BOLWING FATIGUE AND ADHESIVE TAPING ON SHOULDER JOINT POSITION SENSE IN AMATEUR CRICKET PLAYERS IN VICTORIA, AUSTRALIA

Reference:

Weerakkody N, Allen T. The effects of fast bowling fatigue and adhesive taping on shoulder joint position sense in amateur cricket players in Victoria, Australia. Journal of Sports Sciences. 2016:1-9. [Link]

OBJECTIVE:

To identify the effects of muscle fatigue on active position sense, bowling accuracy and force production at the shoulder joint, with and without taping.

WHAT THEY DID:

Fourteen amateur fast bowlers participated in two separate testing sessions, one with the bowling shoulder taped, one without. Initially, participants completed pre-testing, followed by an 8 over bowling spell intended to induce fatigue, and finally post-testing was completed. Pre- and post-testing included position sense, and maximum isometric extension and flexion contractions at the bowling arm's shoulder joint, respectively. Bowling accuracy was also recorded throughout the 8 over spell as a measure of performance.

WHAT THEY FOUND:

Shoulder taping reduced errors regarding positional sense during post-testing. However, this was not shown to have an influence upon bowling accuracy (performance) or influence strength losses. Interestingly, irrespective of taping fast bowlers experienced 22-26% and 7-12% decline in isometric shoulder extension and flexion strength, respectively.

EDITORS COMMENTS:

"While perhaps not the primary objective, this study highlights the importance for practitioners to ensure fast bowlers have appropriate overhead shoulder extension strength, to cope with the physical demands of fast bowling."

Samuel Callaghan

ARTICLE TITLE

IS THERE A RELATIONSHIP BETWEEN HIP ADDUCTOR STRENGTH AND GROIN INJURIES IN AUSTRALIAN FOOTBALL LEAGUE FOOTBALLERS?

OBJECTIVE:

The aim of this study was to assess the link between adduction strength in AFL players and groin injury. They also used this study to assess the predictive capacity of their adduction assessment.

WHAT THEY DID:

Fifty-four players from one club, over two seasons participated in this study. Players hip adductor strength was monitored weekly, in season by using two hand held dynamometers mounted to a unique purpose built stand. The health and injury status of each player was also collected each week over both the AFL seasons.

WHAT THEY FOUND:

Over the two seasons, seven players sustained groin injury with all seven showing a significant reduction in hip adduction strength in the week of onset of groin injury when compared to baseline strength scores established prior to the season. Players were also found to have a significant reduction in hip adduction strength in 2 weeks preceding groin injury. Results were able to support the hypothesis that there was a reduction in hip adduction strength preceding groin injury in AFL footballers.

Reference:

Turk, P. Is there a relationship between hip adductor strength and groin injuries in Australian Football League footballers? J. Aust. Strength Cond. (2016) 24(5) 21-28. [Link]

EDITORS COMMENTS:

"Nothing too surprising when you look at the numerous research studies out there looking at adductor strength as an injury predictor, although it is nice to see it implemented into a practical setting.

The data itself is a few years old, and only having 7 injuries may be seen as limitation of this study, and the Journal of Australian Strength and Conditioning does not have an impact factor so does limit the quality of research published."

Lachlan Wilmot

ARTICLE TITLE

HYDRATION AND FLUID REPLACEMENT KNOWLEDGE, ATTITUDES, BARRIERS AND BEHAVIOURS OF NCAA DIVISION 1 AMERICAN FOOTBALL PLAYERS

OBJECTIVE:

This study assessed the knowledge, attitudes, behaviours and practices of NCAA Division 1 American football players in regards to hydration and fluid replacement before, during and after exercise.

WHAT THEY DID:

A total of 100 athletes from 2 NCAA Division 1 universities participated in this study. Each participant completed a previously validated survey containing demographic information; questions on knowledge, attitude and behaviour about hydration and fluid intake; sources of nutrition; dietary information; and barriers to fluid intake. From the survey a hydration knowledge score, hydration attitude score and hydration behaviour score was calculated according to methods outlined in previous research.

WHAT THEY FOUND:

The results highlight several misconceptions relating to hydration strategies amongst collegiate football athletes. In particular, four key misunderstandings were revealed from the survey: (1) participants indicated, when exercising for more than an hour athletes should drink water rather than sports drinks; (2) participants disagreed that sports drinks are better than water for glycogen restoration; (3) athletes indicated that salt tablets be used to prevent dehydration; and (4) that thirst is the best indicator of dehydration.

Reference:

Judge, LW, Kumley, RF, Bellar, DM, Pike, KL, Pierson, EE, Weidner, T, Pearson, D, and Friesen, CA. Hydration and fluid replacement knowledge, attitudes, barriers, and behaviors of NCAA Division 1 American football players. J Strength Cond Res 30(11): 2972–2978, 2016. [Link]

EDITORS COMMENTS:

"Overall, this study showcases that collegiate football athletes have inadequate knowledge of proper hydration strategies. I find this interesting as many NCAA Division 1 colleges have nutritionists/dieticians to assist and educate student-athletes on proper hydration and diet.

Ongoing education, screening and monitoring of fluid intake and hydration status is warranted to not only improve performance and recovery, but to also avoid potential heat related illness."

Toby Edwards

Editors

The column editors for the Science for Sport monthly Research Alerts.

STRENGTH & CONDITIONING

TECHNOLOGY & MONITORING

FATIGUE & RECOVERY

YOUTHS

Owen Walker MSc*D CSCS

Owen is the founder, author and director of Science for Sport. He was formerly the Head of Academy Sports Science and Strength & Conditioning at Cardiff City Football Club, and an interim Sports Scientist for the Welsh FA U17s. He also has a master's degree in strength and conditioning and is a NSCA certified strength and conditioning coach.

NUTRITION

Tim Rowlands MSc ASCA L2

Tim is the Colts Head Strength and Conditioning Coach at Asquith Rugby League Football Club , and currently assists at the Australian Rugby Sevens. He has a Bachelor of Physiotherapy (1st Class Honours), Master of High Performance Sport and ASCA Level 2.

FOOTBALL

Liam Mason BSc CSCS

Liam is currently the Senior Athletic Performance Coach at Blackburn Rovers Football Club for the U23's. He also has a bachelor's degree in sport and exercise science and is a NSCA certified strength and conditioning coach.

RUGBY

Francisco Tavares MSc CSCS PhD Candidate

Francisco is a PhD candidate at the Waikato University. He is also the Head of S&C at the Portuguese Rugby Union, a S&C Coach at the Chiefs Super Rugby in New Zealand and a guest lecturer for various universities in Portugal and Waikato University.

CRICKET

Samuel Callaghan PhD Candidate

Sam is a PhD Candidate at Edith Cowan University, investigating the influence of strength training upon the biomechanics and performance of cricket fast bowlers. Sam is currently a strength and conditioning coach at the Western Australian Cricket Association.

AUSTRALIAN FOOTBALL

Lachlan Wilmot BSc MSc (pending)

Lachlan is the Head Strength & Power Coach at the GWS Giants and has been for the past 6 years. He is also completing his MSc at Australian Catholic University.

AMERICAN FOOTBALL

Toby Edwards PhD Candidate

Toby is PhD candidate at the University of Notre Dame, Australia. His research focus is on quantifying training load and fatigue in collegiate American Football. Toby has bachelor in exercise and sport science with honours and is an ASCA accredited strength and conditioning coach.

SCIENCE for SPORT