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# *The Journal of* Sport & Exercise Science



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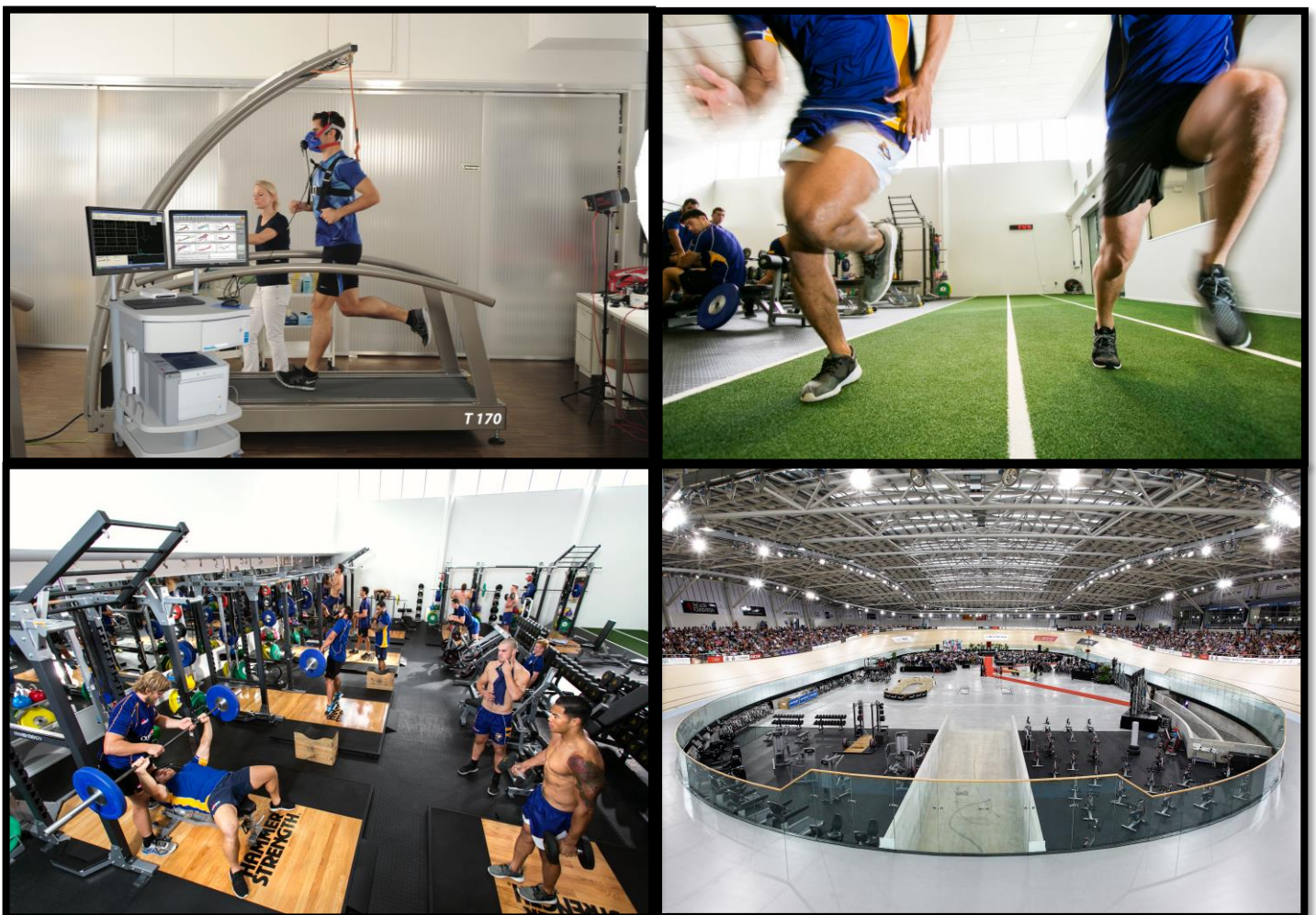
SPORT & EXERCISE SCIENCE

— NEW ZEALAND —

## **SESinNZ: reconnecting Academics and Practitioners**

Sport and Exercise Science New Zealand Annual Conference, 13-14 October 2017,  
Avantidrome, Cambridge

Proudly in association with ICPAFR (International Council for Physical Activity and Fitness Research)



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## Welcome

Welcome to the 2017 Sport and Exercise Science New Zealand Annual Conference! After the success of the 2016 Conference we decided to hold the conference here at the Avantidrome for 2017 as well and look forward to catching-up with colleagues during the 13<sup>th</sup> and 14<sup>th</sup> October. Don't forget to join us for a drink at Alpino in the evening on Friday if you are free, from 7pm onwards.

We would like to take the opportunity to thank all of you as delegates for attending, whether you are presenting or attending to enjoy some of the excellent presentations that will be made during the two days. Good luck to all the presenters and don't forget, if you are a student, to register for the student prizes – for the best oral presentation and poster presentation, which will be awarded on Saturday afternoon. A big thank you also goes to our sponsors who include: GBC Biomed, Wintec, Australian Catholic University, Mr Tim Massage and Recovery Tools, Routledge Publishing and VX Sport.

This year has been a busy and positive one for SESNZ and has seen a number of important developments that will, we believe, serve all of us as members of SESNZ well for the future. We have signed an MOU with ESSA and only this week, as writing this welcome, I had a skype call with ESSA CEO Anita Hobson-Powell to further developments in regard to accreditation and reciprocal rights between our two organisations. We hope to complete this work during 2018 as this will be significant development for members of SESNZ and make more straightforward the ability to work and transfer between our two countries. In addition, we launched our Fellowship scheme and welcomed our first Fellows to SESNZ which is a great development and mechanism for the recognition of the excellent work of colleagues in the SES field within New Zealand.

Under the leadership of Dr Glynis Longhurst we have now completed a restructuring of the SESNZ accreditation system and set in place the key mechanisms through which this will work. We are also working with key individuals to develop the specific criteria for each discipline area and are delighted that Drs Mel Bussey and Lynnette Jones from Otago University have joined us on the Board to support Glynis with this important work.

In 2018 we intend to launch a New Zealand Journal of Sport and Exercise Science, further develop the accreditation system and strengthen our relationships with ESSA and look to develop similar understandings with BASES and ACSM.

Lastly, it is always a team effort to make a conference run, so thank you to everyone involved for their work behind the scenes to getting things ready for our annual get together. A warm welcome to all and please do not hesitate to contact any of the Board with feedback suggestions or ideas for the future. If you would like to get involved with the direct work of SESNZ and the Board we would be delighted to hear from you as well.

SESNZ Executive Board

Vanessa, Glynis, Kim, Rich, Matt, Mel, Lynnette and Nick

# Programme

Day One: Friday 13 <sup>th</sup> October (Level 2 Avanti Rooms)	
8:00 onwards	Registration and refreshments
	Welcome
9:00-10:00	Keynote Speaker: <b>Associate Professor Nic Gill</b> : All Blacks Strength and Conditioning Coach and Assoc. Prof at Auckland University of Technology - The Integration of Sport Science into the Performance Jigsaw.
10:00-10:30	Oral Presentations 1. <b>Beaven CM</b> Biomechanics of successful versus unsuccessful place kicking in Rugby Union 2. <b>Pieters T</b> Using Global Positioning System Analysis to Quantify the Movement Characteristics of Sub Elite Rugby Union Players in Training and Match Performance
10:30-11:00	Morning Tea
11:00-12:00	Keynote Speaker: <b>Dr John Hellemans</b> : Sports Medicine Practitioner with High Performance Sport New Zealand and SportsMed Christchurch, Former National Triathlon Coach, The Netherlands will discuss the sports scientist and the coach: working together.
12:00- 13:00	Lunch and Poster Session I
13:00-14:00	Panel Discussion – Reconnecting academics and practitioners Chair: Dr Matt Driller Panel Associate Professor Nic Gill Dr John Hellemans Dr Daniel Plews Shaun Owen
14:00-14.15	Walk and Stretch
14.15 – 15.45	Oral Presentations & Invited Speakers <b>Dr. Peter Lamb</b> , University of Otago, Visualising and Clustering Playing Styles in Elite Rugby and Netball Match Data <b>Dr Brett Smith</b> , University of Waikato, Examination of the Validity and Efficacy of GPS Generated Metabolic Load Measures. 3. <b>Sims ST</b> Myths and Methodologies: Scientific design for sex difference studies 4. <b>Kissling L</b> Effects of Resistance Exercise on Peripheral Artery Blood Flow
15:30-16:00	Afternoon tea
16:00-17:30	Oral Presentations and AGM 5. <b>Best R</b> Menthol mouth rinsing evokes mixed responses in trained runners. 6. <b>Gaffney K</b> Whey Protein Supplementation Improves Insulin-Mediated Microcirculation After 10 Weeks in Exercising Men with T2D 7. <b>Goodhew C</b> Energy Drink Consumption Rates and Influences in Extreme Sport Enthusiasts 8. <b>O'Donnell S</b> Match-day napping on perceived energy and performance in elite female athletes 9. <b>Shambrook P</b> Does varying exercise intensity during the post-prandial period affect glucose regulation? 10. <b>Swanwick E</b> The effects of pre-exercise blood glucose on responses to short duration high intensity exercise
18:30-19:00	Time at leisure
19:00-onwards	Informal social function at Alpino Cucina & Vino, Cambridge



Day Two: Saturday 14 <sup>th</sup> October (Level 2 Avanti Rooms)	
08:00-08:30	Refreshments
08.30-09:30	Keynote Speaker: <b>Associate Professor Rob Duffield</b> : Member of the Sport & Exercise Science Group at the University of Technology Sydney in Australia and will discuss optimisation of athlete recovery.
09:30-10:30	<p>Oral Presentations</p> <p>11. <b>van Duijn T</b> Enhancing psychomotor efficiency: Analogy instructions versus explicit instructions?</p> <p>12. <b>Hoskens MCJ</b> Fatiguing working memory to cause implicit motor learning: A pilot study</p> <p>13. <b>Omuro S</b> Learning without errors: An application of error-reducing paradigm in speech motor learning</p> <p>14. <b>Uiga L</b> Investigating cognitive processes underlying performance of a 12K running race</p>
10:30-11:00	Morning tea
11:00-12:00	<p>Oral Presentations</p> <p>15. <b>Beaven CM</b> Passive heat maintenance combined with pre-cooling improves repeated sprint ability</p> <p>16. <b>Murray L</b> Intra- and inter-rater reliability of overground running measures from 2D video analyses</p> <p>17. <b>Prout J</b> The Effects of a Self-Regulated Heat Acclimation Regimen</p> <p>18. <b>Ramsey C</b> Running related injuries, does footwear make a difference? A systematic review of methods for assessing running shoes</p>
12:00-13:00	Keynote Speaker: <b>Associate Professor Chris Button</b> : University of Otago, will discuss the impact of a survival-skills education program upon aquatic competency of children.
13:00-13.45	Lunch and Poster Session II
13.45-15:15	<p><b>Invited Symposium: Dopey Kiwi! Doping in Sport and Exercise.</b></p> <p><b>Symposium Speakers:</b> Toby Mündel (Chair, Massey University), Peter Burt (University of Otago), Dave Gerrard (University of Otago), Mike Hamlin (Lincoln University), Elaine Hargreaves (University of Otago), Alison Heather (University of Otago), Bridget Leonard (Drug Free Sport NZ).</p>
15:15-15:30	Walk and Stretch
15:30-17:00	<p>Oral Presentations and Prizes</p> <p>19. <b>Jenkins M</b> Assessing the effectiveness of a mindfulness-based PA intervention to increase psychological flexibility, autonomous extrinsic motivation, and physical activity using a single case design</p> <p>20. <b>Ng JL</b> Assessing General Movement Competence in Primary School Children</p> <p>21. <b>Pichardo A</b> The Relationship Between Maturation and Athletic Motor Skills in Youth Males</p> <p>22. <b>Raj T</b> The effects of an 8-week yoga intervention on hamstring flexibility and sprint performance of rugby players.</p> <p>23. <b>Viviani F</b> Persuasion with deceit elicits the “Trojan Horse Effect” in tennis players</p> <p>24. <b>O'Brien W</b> Replacing sedentary time with active behaviour differentially predicts improved health markers dependent on ethnicity in overweight/obese women</p>

## Sponsors and Exhibitors

We are grateful to our sponsors, supporters and exhibitors who have contributed to the Sport and Exercise Science New Zealand conference in various ways.

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## SESNZ Member Benefit

SESNZ is working with GSI Direct, a New Zealand company that has been operating in the New Zealand commercial insurance industry since 2005.

GSI Direct are a Lloyd's cover holder and an Authorised Agent of certain underwriters at Lloyd's to arrange insurance on behalf of the insurer and coordinate the response when a claim is made.

- SESNZ members can purchase insurance cover directly through the following link <https://quotes.gsidirect.co.nz/quote/policies/2539>.
- Enter your details and purchase your policy online.
- A schedule, invoice and policy documentation will then be automatically emailed to you.
- For 2,000,000 PI cover, \$1 million public liability and \$1 million statutory liability the insurance premium would be **\$230 GST inclusive**.

GSI Direct specialise in providing small businesses, consultants and contractors with affordable liability insurance online in New Zealand. We encourage SESNZ members to investigate whether they can save on their premiums through this offering, or if they currently don't purchase any insurance, investigate whether it's something they should consider.



## Keynote Speakers

***Associate Professor Nic Gill, (B.Ph.Ed.(Hons), PhD) All Blacks Strengthening and Conditioning Coach and Assoc. Prof at Auckland University of Technology***



Nic Gill is a professional strength and conditioning coach and consultant with huge expertise in rugby and other sports. He is a staff wellness and fitness consultant for a number of international corporate organisations. He continues to study and research many areas of sports science at the Auckland University of Technology, constantly refining and evolving his philosophy for being fit and healthy and having the 'winning edge' in life and in competition. He is best

known for his work in rugby with 15 years working in the sport. For the last eight years Nic has been the strength and conditioning coach for the New Zealand All Blacks, a period of international success for the team which has included more than 100 rugby test wins and the World Cup title in 2011.

Nic's research primarily focuses on 1) improving sports performance through strength, power and conditioning methods, and 2) understanding physiological adaptations and recovery methods. Nic has published over 50 peer-reviewed journal articles and continues to apply all his research at the coalface with the All Blacks.

***Doctor John Hellemans, (PGDipSportsMed FRNZCGP), Sports Medicine Practitioner with High Performance Sport New Zealand and SportsMed Christchurch, Former National Triathlon Coach, The Netherlands***



Dr. John Hellemans is a sports medicine practitioner, coach, author and a six times New Zealand triathlon champion, a multiple age-group world champion and Hawaii ironman finisher. He has

been head coach for the New Zealand and Dutch high performance programs and over the years has guided 6 athletes to world champion titles. He has been involved with four Olympic campaigns as a coach. John has been a co-author of several scientific papers, especially related to altitude training. Besides running his sports medicine practice John is currently head coach for the Canterbury Triathlon Academy, working chiefly with development athletes.

***Associate Professor Rob Duffield, (PhD), Associate Professor in Sport and Exercise Science, Director of Research Students, Faculty of Health, University of Technology Sydney***



Associate Professor Rob Duffield works with the Sport & Exercise Science Group at the University of Technology Sydney in Australia. His research and teaching foci are related to sports physiology, exercise performance and health. Specific research areas include factors related to fatigue and recovery, training, adaptation and cooling in the heat, sleep and travel, and methods to

improve performance and recovery, particularly in team sport athletes. Additional areas relate to the use of a variety of exercise modes to improve glucose regulation and chronic systemic inflammation in sedentary populations. To date, he has over 120 scientific publications in sport, exercise and health science journals, along with over 80 national and international conference presentations. Further, he conducts research and collaborates with a range of professional and national sporting bodies including Tennis Australia, Football Federation Australia, Cricket Australia, the Australian and French Institutes of Sport and numerous football teams worldwide.

***Associate Professor Chris Button (BSc(Hons) PhD(MMU)), School of Physical Education, Sport & Exercise Sciences, University of Otago***



Associate Professor Chris Button is the Dean of the School of Physical Education, Sport and Exercise Sciences at the University of Otago. He gained his PhD at

Manchester Metropolitan University in 2000 and then worked at Edinburgh University for 3 years before moving to New Zealand. Chris' research interests concern an ecological dynamics approach to motor skill learning. In recent work he is applying these theoretical ideas to the acquisition of swimming survival skills in children. Dr Button has published research on a broad range of topics including individual differences, movement variability, perceptual skill, and interpersonal coordination.

## Keynote Presentations

### **The integration of sport science into the performance jigsaw.**

Associate Professor Nic Gill<sup>1</sup>

<sup>1</sup>*All Blacks and Auckland University of Technology*

Modern day competitive sport continues to change and grow at an incredibly rapid rate. The money invested, the resources available, and the technology development that is occurring are incredible. The amount of information at our fingertips is mind-blowing as we seek to measure anything and everything. All this information means there is no need to teach or coach or “listen to your gut”.

Collect numbers, loads of numbers, then come up with a formula to win! Easy.

If only it was this simple!

The integration of sport science into any performance environment is still an art. It is not as objective as it may seem. It is actually really easy to collect data and measure “stuff” but it requires far more skill and nous to collect the information that will actually make a difference. The sort of data you need is the data that will help you improve your decision making, that will help you ensure the individuals you are working with are given every chance of success on their important day.

There is strategy involved in what to collect, when to collect it, how to interpret it and more importantly what decisions to make from it. Many athletes and teams probably feel like they are experiments. No data or sport science will make up for poor relationships, lack of trust and poor connections through the team (athletes and staff included).

We will outline what we believe is useful information to collect and how we utilise the information within a day, week, year and cycle. Athletes advance, coaches change, schedules are different! We must expect how sport science fits into the performance jigsaw to evolve as well.

### **The sports scientist and the coach: working together. A coach's perspective.**

John Helleman

Sports science can make a significant contribution to a winning formula of a high performance sports campaign. A relationship of trust and respect between the scientist and coach, athletes and other members of the support team will maximise the impact of any sports science based contribution.

What is the role of the scientist within a high performance sports programme? Most coaches and scientists agree that gathering data and providing coaches and athletes with feedback and information is their first and foremost role. However, how this is executed is crucial to the desired outcome for the scientist, coach and athletes involved. The coach is the pivot in the process of sports science delivery. The scientist therefore requires the respect and trust of the coach.

Not infrequently the scientist has an ulterior motive for their work within a high performance sports programme in the form of a potential future publication with use of the data obtained. This needs to be made clear from the outset, including what that means for the data gathering and processing. Other times the scientists employ PhD students to assist with their field work. Coaches need to be given the opportunity to have a say in this and get the chance to meet the student first. Any field work undertaken by the scientist or student requires them to become a part of the team with duties extending beyond that of their role as the scientist. They need to have an understanding of the team culture and be prepared to contribute when and where required. This applies in particular to training camp situations or where it concerns centralised programmes.

The sports scientist is a source of general knowledge in the area of scientific aspects of training and performance. The coach and athletes can benefit from this knowledge if it is transferred in an understandable and practical way. Also, here the coach needs to be seen by the scientist as the pivot. The coach represents the human and intuitive side of the practical aspects of training and performance regarding the team and individual athletes. That is their area of expertise. This needs to be accepted and respected by the scientist.

### **Optimising Athlete Recovery**

Rob Duffield<sup>1</sup>

<sup>1</sup>*Sport & Exercise Discipline Group, University of Technology Sydney*

The prescription of high volume and quality of training load is fundamental to drive adaptation and ensuing performance optimisation. However, appropriate and sufficient recovery is also critical to optimise the ability to tolerate the training loads and ensure ongoing adaptation. Given the diversity of recovery interventions and options available to athletes, decisions on when and how to recover are seemingly more convoluted than ever. Accordingly, this presentation will initially discuss the role of some of the primary drivers of recovery, including sleep, load, and nutritional aspects. Further, the role of additional recovery interventions, such as water immersion and compression and circumstances potentially negating recovery, such as travel will also be outlined. Finally, alternate perspectives and viewpoints on the recovery process, types of recovery and thus interventions to aid recovery will also be discussed.

## Water Skills for Life: Assessing Aquatic Survival Skills of Children

Chris Button<sup>1</sup>, Jim Cotter<sup>1</sup>, Anne Marie Jackson<sup>1</sup>, Tim McGuire<sup>1</sup> and Ludovic Seifert<sup>2</sup>

<sup>1</sup>University of Otago, School of PE, Sport and Exercise Sciences, Dunedin, New Zealand

<sup>2</sup>University of Rouen, Faculty of Sport Sciences, Normandy, France.

Approximately 100 people drown in New Zealand (NZ) annually, which is one of the worst records per capita in the developed world. A recent review signalled a shared desire among NZ's water safety organisations to improve the teaching delivery of swimming and survival skills for children given that young people are particularly vulnerable. We aimed to (i) assess water skill competency in NZ primary school children (aged 6 -11 years), and (ii) monitor the impact of a 10-week survival skills-focussed education program. Participants were

48 children (25 male, 23 female). Survival skills competency was tested at a 25-m school swimming pool on three occasions; before and immediately after the program, and then 3 months afterward. Before the education program, the percentage of children achieving a high competency score at various survival skills was typically low (see Table 1). In general, competency had improved after 10 weeks of survival skills education (e.g., Quiz and Bouyancy) but these improvements were modest and not statistically significant for all tasks. This study reveals that NZ children lack a range of survival skills and that further attention to these skills by education providers is necessary. As reported previously, basic swimming competency was low; 62% were unable to swim for 5 minutes or 100 m continuously. However, there was some indication that education of survival skills can bring about improvements. Whilst such changes were modest and limited to certain skills, practitioners can build upon this evidence to better integrate survival skills teaching into their programs.

Table 1: Percentage of children achieving high competency grade (4-point scale) at different phases of the study. The seven competencies are adapted from NZ's Water Skills for Life campaign (<http://www.watersafety.org.nz>). \* denotes significant difference ( $p < 0.05$ ) from pre-test identified with Friedman's N related samples tests.

Phase	Water Safety Quiz	Entry/exit & bouyancy	Perception depth & distance	Submersion, underwater swim	Obstacle course (clothed)	Simulated rescue	Propulsion (up to 5 mins)
Pre	15	23	6	23	31	23	38
Post	33*	44*	6	23	40	35	44
Retention	8	40*	2	38	46	38	42

## Invited Presentations

### **Clustering movement patterns and game styles: applications in biomechanics and performance analysis**

Peter Lamb<sup>1</sup>

<sup>1</sup>*School of Physical Education, Sport and Exercise Sciences, University of Otago*

The analysis of human movement and performance is often complicated by the multivariate data that represent them. Analyses are further complicated by the potentially, non-linear relationships among many of the variables in the data sample. Self-organising maps (SOM), a machine learning approach, are useful for clustering and visualising multivariate data, while preserving non-linear relationships in the data distribution, which makes them attractive for studying human behaviour from many perspectives. My research groups have applied SOMs to many sub-disciplines within sport and exercise science – in particular biomechanics and performance analysis. We have used SOMs in biomechanics most recently as a method for classifying back pain, based on patients' movement patterns. The results have led to a more fine-grained distinction between pain groups than is achieved through conventional pain provocation tests. In rugby and netball performance analysis, we have clustered match data to represent 'game styles' for real-time assessment of the coupling between a team's game style and that of their opponent. Further applications of SOMs in other sub-disciplines of sport and exercise science are discussed.

### **Examination of the Validity and Efficacy of GPS Generated Metabolic Load Measures.**

Smith, T.B<sup>1,2</sup>, Tarrant, O.P<sup>3</sup>, McIntosh, N.<sup>1</sup>

<sup>1</sup>*Faculty of Health, Sport and Human Performance, University of Waikato, New Zealand*

<sup>2</sup>*Chiefs Rugby Club, New Zealand,*

<sup>3</sup>*Dept of Physical Education and Sport Sciences, University of Limerick, Ireland*

GPS determined speed and acceleration measures are common locomotion metrics in team sports. Rugby union typically consists of repeated high intensity sprints of 10-20m which isn't long enough to reach high speeds and the acceleration "count" metric doesn't accurately reflect workload as power output increase with acceleration duration. To measure the combined locomotion workload of acceleration, deceleration and velocity, some GPS companies include a high metabolic workload (HML) metric. We examined the relationship between HML from the STATSports Viper GPS (Courtney Hill, NI) and the time taken to complete common rugby specific intensive interval tests (rugbytests) for twenty participants. HML was set at  $\geq 25$  w/kg which is equivalent to  $\geq 5.5$  m/s and  $\geq \pm 2$  m/s/s. The validity of real-time HML was assessed during five matches and six training sessions. A near perfect relationship was generated in the comparison of HML against rugby tests. Real-time measurement error was large for matches and small for training. Traditional GPS measures of running distance above a specific intensive speed or the count of intensive accelerations doesn't adequately reflect running workload in rugby union. HML has the capacity to better monitor intensive running workload to help inform training interventions and monitor injury risk.

## Symposium Speakers

### Addicted to winning: the case of nicotine in sport

Mündel, T<sup>1</sup>

<sup>1</sup>Massey University

Nicotine use amongst athletes is high and increasing, especially in team sports. This presentation will describe the rationale behind its use, evidence of its effect on physical performance and considers important factors that should determine future research efforts. To date, studies have assessed muscular strength and power, sub- or maximal endurance and high-intensity exercise when nicotine (medication) or smokeless tobacco was used as an intervention. These studies have notable limitations and confounding factors that include participant tolerance to nicotine, inter-individual responses, the nicotine delivery system used and failure to adhere to rigorous experimental/scientific design. Further research will be outlined to address these limitations and determine the extent to which anti-doping and governing bodies should consider promoting, coordinating and monitoring any effort against nicotine and nicotine-containing substances in sports.

#### References

Mündel T. Nicotine: Sporting Friend or Foe? A Review of Athlete Use, Performance Consequences and Other Considerations. *Sports Med.* 2017. doi: 10.1007/s40279-017-0764-5.

### The physician and doping

Dr Peter Burt<sup>1</sup>

<sup>1</sup>University of Otago

What are some of the challenges that face a physician who practice medicine in the sporting environment that could influence them to participate in behaviour counter to their professional practice. What helps to guide a physician in this environment in terms of maintaining professional integrity. Does experience of working in this setting change physician/professional practice.

A reflection for sport scientists working with elite sports teams and athletes on some of the challenges in the sporting environment that have the potential to compromise or influence their performance.

### Prescribing banned drugs for athletes: what are the obligations?

Emeritus Professor David Gerrard OBE CNZM MB ChB FACSEP FSMNZ FFSEM (Hon)<sup>1</sup>

<sup>1</sup>University of Otago Medical School

The concept of a prohibited list of drugs for use in sport has been in force for over 30 years. The responsibility for this falls to a specialist group of physicians and pharmacologists under the aegis of the World Anti-Doping Agency (WADA). JSES | <https://doi.org/10.36905/jses.2017.01.01>

However, when an athlete requires medical treatment for legitimate clinical reasons there is provision within the WADA Code for banned drug use.

This presentation will explore the genesis of the process known as Therapeutic Use Exemption (TUE) and explain the obligations of those responsible. Recent adverse publicity suggesting that this process offers a loophole to circumvent doping control will also be refuted.

### Sports Supplements: The Trojan Horse of Doping

Heather, A.K.<sup>1</sup>

<sup>1</sup>School of Biomedical Sciences, Department of Physiology, University of Otago

Athletes of all ages, from recreational to professionals, use sports supplements. Athletes use these supplements because they hope that by consuming the supplement it will help them be more competitive and healthy. While many supplements contain ingredients that may have useful properties, there are supplements that are contaminated, or even adulterated, with substances that are banned for use in sport. In this presentation, the prevalence of banned substances for which no ingredient is included on the product label will be discussed. Emphasis will be placed on the New Zealand and Australian markets, with data from the Heather laboratory showing 6/112 over-the-counter sports supplements tested positive for androgens. The supplements included protein powders, pre-work out-, fat burning-, amino acid-, creatine-, herbal extract-, and carbohydrate- formulations. The study was conducted using in vitro cell-based bioassays. The findings highlight that sports supplements, taken without medical supervision, could expose or predispose consumers to the adverse consequences of androgen abuse. Moreover, for an athlete, it may result in a positive doping test. Together, these data reinforce the need to increase awareness of the dangers of sports supplements for the athlete as well as the general population.

### Erythropoietin- The Wonder Drug?

Hamlin, M.J.

Athletes and coaches are continuously looking for ways (both legal and illegal) to improve performance. Aerobic-based athletes rely heavily on a continuous supply of oxygen to the working muscles to generate ATP. Haemoglobin which is the blood's oxygen carrying pigment is situated on the red blood cell, and therefore many athletes attempt to enhance their haemoglobin mass by increasing their red cell volume. Most coaches and athletes use legal means to increase haemoglobin mass (e.g. altitude training) and thereby augment oxygen carriage and improve aerobic performance. However, some coaches and athletes use illegal methods to increase haemoglobin mass (blood reinfusion, recombinant human erythropoietin, continuous erythropoietin receptor activator,

hypoxia-inducible factor agents). Probably the most convenient, common and easily accessible method is the use of recombinant human erythropoietin (rHuEPO). In research studies, using either recreational or well-trained participants, injection of rHuEPO results in increases in haemoglobin mass (12-33%) and VO<sub>2</sub>max (6-7% ), but was not always associated with substantially improved performance and in some cases can lead to adverse effects such as increased risk of thromboembolic events. This presentation will outline what rHuEPO is, how it works, who uses it, and what dangers it poses to athletes.

#### References

Heuberger JA, Rotmans JI, Gal P, Stuurman FE, van't Westende J, Post TE, Daniels JM, Moerland M, van Veldhoven PL, and de Kam ML. (2017). Effects of erythropoietin on cycling performance of well trained cyclists: a double-blind, randomised, placebo-controlled trial. *The Lancet Haematology* 4,e374-e386.

Clark B, Woolford SM, Eastwood A, Sharpe K, Barnes PG, and Gore CJ. (2017). Temporal changes in physiology and haematology in response to high-and micro-doses of recombinant human erythropoietin. *Drug Testing and Analysis*.

#### **Psychological mechanisms underlying why athletes choose to dope: The role of motivation and morality**

Hargreaves, E. A.<sup>1</sup>

<sup>1</sup>*University of Otago*

To eliminate doping from sport requires an understanding of the social psychological factors that explain why athletes engage in this unethical, cheating behaviour. Two factors proposed to be important are motivation quality and morality. This presentation will discuss the rationale and evidence for the position that athletes who have controlled forms of motivation (participate to satisfy external or internal pressures) compared with autonomous forms (participate out of interest, enjoyment or for valued outcomes) are more likely to have positive attitudes toward doping and consequently be more susceptible to engage in doping. Moral disengagement is a set of processes through which athletes can transgress their moral standards and engage in doping without experiencing negative affect (e.g., self-censure, guilt). Higher levels of moral disengagement are

associated with positive attitudes towards doping and doping susceptibility. The relationships between motivation quality, moral disengagement and doping related outcomes will be discussed. The presentation will conclude with strategies that can be used to create a social environment that supports autonomous motivation and reduces moral disengagement to help diminish the likelihood that athletes will dope.

#### References

Hodge, K., Hargreaves, E. A., Gerrard, D., & Lonsdale, C. (2013). Psychological mechanisms underlying doping attitudes in sport: Motivation and moral disengagement. *Journal of sport and exercise psychology*, 35(4), 419-432.

#### **The Athlete Biological Passport – defining normal and detecting doping.**

Leonard, B<sup>1</sup>

<sup>1</sup>*Drug Free Sport New Zealand*

Many in this audience will be involved with athletes who are part of Drug Free Sport NZ's (DFSNZ) anti-doping testing programme. These athletes are required to provide blood and/or urine samples for the purpose of detecting the use of substances or methods prohibited under the World Anti-Doping Code.

As well as testing for the presence of a substance itself, anti-doping now includes the analysis of markers in blood and urine that may indicate use of a prohibited substance or method. This involves collating results of multiple tests from an athlete to establish a personal longitudinal profile or 'Athlete Biological Passport' (ABP). Significant variability in the profile may indicate doping.

International experience indicates athletes have modified their behaviours in response to the introduction of the ABP. For example, the shift to microdosing with erythropoietin. The change in behaviours along with acute and chronic physiological effects of training, residing at altitude, hydration status etc. can all make interpretation of the ABP increasingly complex.

DFSNZ's testing programme continues to evolve to meet both changing WADA requirements, evolving analytical science and changing behaviours of athletes. This talk provides an overview of the ABP and its role in detecting and deterring doping.



## Oral Presentations

### **Passive heat maintenance combined with pre-cooling improves repeated sprint ability**

Beaven, C.M.<sup>1</sup>, Kilduff, L.P.<sup>1</sup>, Cook, C.J.<sup>3,4</sup>

<sup>1</sup>University of Waikato

<sup>2</sup>Swansea University

<sup>3</sup>Bangor University

<sup>4</sup>University of Canberra

Pre-conditioning strategies that elevate muscle temperature are common when preparing for physical performance, while pre-cooling strategies are often adopted in thermally challenging environments. We investigated the individual and combined effects of a passive heat maintenance strategy and the ingestion of an ice-water slurry on repeated sprint performance. In a random cross-over design, 12 professional athletes performed 5x40 m maximal running sprints under one of four conditions following warm-up: 15-min passive rest (Control); wearing a lower-body survival garment (HEAT); consuming a 500 mL slushy (COLD); or wearing the garment and consuming the slushy (H+C). Measures of sprint speed, fatigue, and rectal temperature were collected. Compared to Control HEAT improved Sprint 1, but negatively impacted Sprints 4 & 5; COLD slowed Sprint 1, but improved Sprint 5; whereas H+C was faster for every sprint (ES: 0.26 to 0.52). Fatigue was greatest after the HEAT intervention with a large correlation between fatigue and rectal temperature ( $r = 0.66$ ;  $p = 0.02$ ). While there are undoubtedly peripheral effects of cooling and heating on various aspects of muscle function and fatigue, understanding the integration of psychophysiological feedback relating to combined warming and cooling may benefit sports in which repeat sprints are performed.

### **Biomechanics of successful versus unsuccessful placekicking in Rugby Union**

Beaven, C.M.<sup>1</sup>, Hébert-Losier, K.<sup>1</sup>

<sup>1</sup>University of Waikato, Faculty of Health, Sport, and Human Performance

Forty-five percent of points scored during international Rugby Union matches are from placekicks, with individual success rates varying from 36% to 93%<sup>1,2</sup>. Our aims were to explore which biomechanical metrics relate to successful placekicks in an ecologically valid environment. Three competitive male placekickers performed 10 kicks outdoors, 35 meters from the goalposts. Placekicker and ball 3D biomechanics, coach and player perceptions, and placekick outcomes were recorded to define the three best and three worst kicks for each placekicker. In the best kicks, centre of mass speed was slower at ball contact, but maintained better through contact; the kicking leg reached greater knee flexion during swing and was more flexed at the hip and knee at ball contact; and placekickers were better aligned with the kicking direction (i.e., trunk less rotated

outwards). A subset of variables consistently and meaningfully delineated the best from the worst placekicks. These key metrics can guide coaching of placekicking skills at a group level in absence of individual data. Controlling centre of mass speed, enhancing knee flexion in swing, and being on-top of the ball at contact appear important in promoting placekicking success.

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### **Menthol mouth rinsing evokes mixed responses in trained runners**

Best, R.<sup>1,2</sup>, Berger, N.<sup>2</sup>

<sup>1</sup>WINTEC

<sup>2</sup>Teesside University

Menthol is used to evoke pleasant feelings of coolness and freshness. Sports science has focused upon the topical or oral application of menthol to athletes, either directly on the skin or menthol soaked garments, and as a mouth rinse or in beverages. Interest has largely been in endurance activity, with increased time to exhaustion and time trial performance shown. Participants are also typically of limited or recreational fitness, therefore we recorded the perceptual responses to menthol mouth rinsing in trained runners, at typical training and racing intensities. Seven runners (5km PB: 15:24 ± 00:39) completed a modified running economy test in 15°C and 28°C, with (+M) and without menthol. Thirst, Thermal Comfort (TC) and Thermal Sensation (TS) were recorded. Unclear responses for TS were found within temperatures; a likely to most likely positive increase in TS was shown between 15°C and 28°C. Thirst and TC responses were unclear within temperatures, but thirst was elevated at higher speeds between temperatures. Finally, TC was improved at 16 and 18km/h in 15°C+M. These varied responses suggest either an individual tolerance to

menthol, or that trained athletes are less susceptible to the perceptual thermal challenges of exercise, than lesser trained populations.

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### Enhancing psychomotor efficiency: Analogy instructions versus explicit instructions?

van Duijn, T<sup>1</sup>, Hoskens, M<sup>1</sup>, Masters, R. S. W.<sup>1</sup>

<sup>1</sup>University of Waikato

With repetition, performance of a motor task generally becomes less taxing. Psychomotor efficiency is characterized by movement efficiency and cognitive efficiency (i.e., suppressed non-essential brain activity). Increased EEG alpha power in the left temporal lobe of the brain is thought to be a neural marker of psychomotor efficiency, distinguishing experts from novices.

Explicit instructions are often provided to learners to promote skill learning; however, the necessity to consciously process explicit instructions may disrupt psychomotor efficiency. Analogies are an alternative means of instruction that package movement instructions into a single, meaningful unit and thus reduce explicit information processing. The present experiment investigated whether teaching a movement by analogy promotes psychomotor efficiency compared to explicit instructions. Novices were instructed how to perform a hockey push-pass by analogy, by explicit instruction or by discovery (no instructions). Push-pass accuracy was identical in a delayed retention test following practice; however, significantly better performance during a memory-loading task (passing coupled with decision-making) suggested that cognitive processes were facilitated by the analogy instruction. Significant differences were also evident in left-temporal EEG alpha power. The findings indicate that psychomotor efficiency may be advanced by using an analogy instruction. Analogy instructions may be beneficial for the development of psychomotor efficiency.

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### Whey Protein Supplementation Improves Insulin-Mediated Microcirculation After 10 Weeks in Exercising Men with T2D

Gaffney, K<sup>1</sup>, Lucero, A<sup>1</sup>, Clapham, J<sup>2</sup>, Stoner, L<sup>3</sup>, Faulkner, J<sup>4</sup>, Macartney-Coxson, D<sup>2</sup>, Rowlands, D.<sup>1</sup>

<sup>1</sup>School of Sport, Exercise, and Nutrition, Massey University Wellington, New Zealand

<sup>2</sup>Biomarkers Team, Health Group, Institute of Environmental Science and Research, Wellington, New Zealand

<sup>3</sup>Department of Exercise and Sport Science, University of North Carolina at Chapel Hill, USA

<sup>4</sup>Department of Sport and Exercise, University of Winchester, Winchester, UK.

Type-2 diabetes (T2D) is characterised by vascular insulin resistance which impairs microcirculation after eating. Milk-protein supplementation and exercise have been shown to independently improve vascular insulin sensitivity; but the combined effect on microcirculation is unknown. In a double blind, randomized clinical trial, 24 middle-aged men with T2D consumed a peri-training whey-carbohydrate (20g-10g) supplement or carbohydrate control during 10-weeks of high-intensity mixed-mode training. Microvascular blood flow (mBF) and volume (mBV) were measured at the vastus lateralis muscle via near-infrared spectroscopy at rest and following insulin infusion; capillarity via light microscopy of biopsied muscle tissue; the angiogenic environment from mRNA expression of eNOS, VEGF and VEGFR2 (RT-PCR). Whey supplementation produced likely improvements in insulin-stimulated mBV of 17.5% (-3.7%, 43.5%) and mBF of 10.2% (0.3%, 21.1%) compared to a nil exercise effect. There were substantial increases in capillary to fibre ratio of 24.5% and 26.3% in the control and whey groups respectively, with no clear group difference. A substantial decrease in VEGF (-0.2%) and VEGFR2 (-0.4%) and an almost certain increase in eNOS expression (13%) was observed in the whey-control contrast. Adjunct therapy with whey protein ingestion may facilitate superior microvascular response to chronic intense exercise in T2D men.

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### Energy Drink Consumption Rates and Influences in Extreme Sport Enthusiasts

Goodhew, C<sup>1</sup>, Rehrer, N, Tracy, P.<sup>1</sup>

<sup>1</sup>University of Otago

Energy drink companies have embedded themselves in the extreme sport subculture through extensive advertising where there is limited data on energy drink consumption rates and the drivers influencing their consumption. The study aim was to quantify energy drink consumption and influences effecting consumption in extreme sport enthusiasts. Two hundred and forty-eight respondents (mean (SD) age 26.2 (8.2) y, 40.5% female) were analysed using an online survey. Of the respondents, 57.9% indicated that they consumed energy drinks, with 25.5% of respondents consuming at least one energy drink per week. Respondents were 3.1% less likely to consume energy drinks for every year ( $p>0.05$ ). Additionally, there was a 31% increase in the odds of consuming energy drinks for every weekly viewing of extreme sport ( $p<0.001$ ), however reported weekly viewing of energy drink advertising was not associated with increased consumption. Extreme sport enthusiasts appear to have a higher energy drink consumption, especially those with thrill-seeking tendencies. The consumption rates reported in this study may be influenced by the exposure of energy drink advertising towards those with an increased frequency of viewing extreme sports. Future research will be needed to confirm this finding, in a larger, more international sample.

### Fatiguing working memory to cause implicit motor learning: A pilot study

Hoskens, M.C.J.<sup>1</sup>, Boaz-Curry, K<sup>1</sup>, Buszard, T<sup>2</sup>, Masters, R.S.W.<sup>1</sup>

<sup>1</sup>University of Waikato

<sup>2</sup>Victoria University

Implicit motor learning refers to acquisition of skills with minimal accretion of task-relevant declarative knowledge. Implicit motor learning paradigms achieve this by preventing working memory (WM) from being used to process declarative knowledge about the task. This study investigated whether implicit motor learning can be caused by fatiguing WM immediately prior to practice. Participants practiced a golf putting task following after completion of a fatigue intervention (repeated n-back task) or a control condition (documentary viewing). Subjective and objective (neural) measures of cognitive fatigue were collected. Putting performance and the extent to which putting was learned implicitly were evaluated. The subjective and objective measures suggested that working memory was suppressed following the fatigue intervention but not the control condition. Putting performance improved in both conditions, but implicit motor learning was not clearly discernible. Our protocol caused cognitive fatigue in participants and appeared to suppress WM activity during motor

learning, but further work is required to establish whether such an approach causes implicit motor learning. This protocol is the first step in developing an implicit learning paradigm using suppression of WM, to prevent conscious accretion of task-relevant declarative knowledge during skill acquisition.

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### Assessing the effectiveness of a mindfulness-based PA intervention to increase psychological flexibility, autonomous extrinsic motivation, and physical activity using a single case design

Jenkins, M<sup>1</sup>, Hargreaves, E. A<sup>1</sup>, Hodge, K.<sup>1</sup>

<sup>1</sup>University of Otago

A lack of sufficient physical activity (PA) is the fourth leading cause of mortality worldwide (WHO, 2017), and has therefore been described as a global pandemic (Anderson, Mota, & Di Pietra, 2016). We developed an intervention that aimed to support PA by creating autonomous extrinsic motivation (that based on valued outcomes) through increasing individuals' psychological flexibility (the capacity to contact the present moment and change or persist in behaviour that results in valued outcomes). A multiple baseline, single case design (N = 3; M age = 46.5 years) was used to assess the effects of a four-session Acceptance and Commitment Therapy (ACT)-based PA intervention on psychological flexibility (represented by the proxies of cognitive acceptance and behavioural commitment), psychological need satisfaction (of autonomy, competence, and relatedness), autonomous extrinsic motivation for PA, and PA behaviour. Results showed that behavioural commitment, competence, and PA behaviour increased, but the remaining variables did not increase. It was also shown that engagement with the intervention material was predictive of intervention effectiveness. Further research is required before we can ascertain the effectiveness of ACT-based interventions in increasing value-based motivation and PA.

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## Effects of Resistance Exercise on Peripheral Artery Blood Flow

Kissling, L.<sup>1</sup>, Cotter, J.<sup>1</sup>, Akerman, A.<sup>1</sup>, van Rij, A.<sup>2</sup>, Thomas, K.<sup>2</sup>

<sup>1</sup>*School of Physical Education, Sport and Exercise Sciences, University of Otago, Dunedin*

<sup>2</sup>*Department of Surgical Sciences, Dunedin School of Medicine, University of Otago, Dunedin*

Resistance exercise may cause blood flow profiles that impair blood vessel function. Resistance exercise is considered to promote retrograde flow profiles and has been linked to impaired vascular function. The purpose of this study was to characterize the blood flow profiles in both the arm and the leg arteries during resistance exercise. Ten participants (5 male, 5 female) with resistance training backgrounds performed 3 sets of 10 reps of bicep curls or leg extensions on separate days. Along with continuous ultrasound measurements before, during and for 3 min following each set, we also measured muscle oxygenation, blood pressure, and heart rate. Preliminary results indicate the opposing leg has increases in both antegrade and retrograde shear rates in response to exercise. Systolic blood pressure increased by 36 20 mm Hg with lower-body exercise. Lower-body exercise reduced oxyhemoglobin within the active quadriceps by 78 30  $\mu\text{molcm}$ . Upper-body exercise increased oxyhemoglobin in the local muscle, by up to 242 9  $\mu\text{molcm}$ . Further Analysis to be presented. As expected, antegrade blood flow and shear rate increased in the active limb. For the inactive limb, from this preliminary analysis, it seems that retrograde shear rate is elevated after exercise for up to three minutes.

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## Intra- and inter-rater reliability of overground running measures from 2D video analyses

Murray, L.<sup>1</sup>, Sella, FS<sup>1</sup>, Beaven, CM<sup>1</sup>, Hébert-Losier, K<sup>1</sup>

<sup>1</sup>*University of Waikato, Faculty of Health Sport and Human Performance*

Two-dimensional analyses of running are common in research and practice, and reliable when conducted on a treadmill. Our aim was to determine the reliability of 2D analyses of overground running. Two raters evaluated 155 high-speed videos (240 Hz) of overground running on two occasions, 7 days apart. Foot-strike pattern (rearfoot, midfoot, and forefoot), foot-strike angle ( $^{\circ}$ ), and running speed (m/s) were extracted using Siliconcoach Pro. Reliability was assessed using

weighted kappa ( $\kappa$ ), percentage agreement, intra-class correlation coefficient (ICC), typical error (TE), and coefficient of variation (CV) statistics. Foot-strike pattern (agreement = 99.4%,  $\kappa = 0.963$ ) and running speed (ICC = 0.98, TE = 0.1 m/s, CV = 2%) demonstrated excellent relative and absolute reliability. Relative reliability of foot-strike angle was high (ICC = 0.88), but absolute reliability was suboptimal (TE = 2.50°, CV = 18%). Reliability of overground running parameters from two-dimensional analyses was high, except for foot-strike angles in absolute terms. The larger CV associated with this measure likely results from the limited range of possible values ( $\sim 45^{\circ}$ ). Two-dimensional analyses of overground running are reliable for quantifying foot-strike pattern, foot-strike angle, and running speed, although foot-strike angle errors of 2.5° are typical.

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## Assessing General Movement Competence in Primary School Children

Ng, J. L.<sup>1</sup>, Button, C<sup>1</sup>

<sup>1</sup>*University of Otago*

Movement competence is assessed by movement assessment batteries, primarily developed for clinical sub-populations. Increasingly, assessment batteries are being used amongst the general population of children which raises concerns about a lack of sensitivity at detecting higher movement competence levels (Logan et al., 2017). We adopt a theoretical model that illustrates how combinations of movement attributes emerge under constraint (Turvey, 1990). The model underpins the development of the General Movement Competence Assessment (GMCA). Movement competence of 83 children (36 boys and 47 girls), aged 8-10 years ( $9.1 \pm 0.8$  years) were measured using the GMCA. Five 'games' were custom designed based upon fundamental principles of movement science; 1) Balance, 2) Precision, 3) Control, 4) Swiftiness and 5) Interception. Internal reliability of the data extracted from the GMCA was good ( $\alpha = 0.5 - 0.9$ ) indicating that combinations of movement attributes were being measured in each game. Exploratory factor analysis extracted four overall movement constructs. To provide better sensitivity in assessing movement competence of children, an additional construct (dexterity), may need to be considered in addition to currently accepted movement constructs. The GMCA has considerable potential for practical use in schools where time, equipment and expertise are often constrained.

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### **Replacing sedentary time with active behaviour differentially predicts improved health markers dependent on ethnicity in overweight/obese women**

O'Brien, W. J.<sup>1</sup>, Walsh, D. C. I.<sup>1</sup>, Shultz, S. P.<sup>1</sup>, Fink, P. W.<sup>1</sup>, Breier, B. H.<sup>1</sup>, Kruger, R.<sup>1</sup>

<sup>1</sup>Massey University

Increased daily physical activity (PA) is recommended to improve long-term health. Since discretionary leisure-time is finite, identifying activities most beneficial to health is critical. This study aimed to predict changes in body composition and metabolic health markers associated with increased PA in women of different ethnicities.

Healthy overweight/obese women (n=175) aged 16-45y, were stratified by ethnicity (Māori, Pacific, European). Sedentary and PA were assessed using accelerometry. Fat and lean mass (total, regional) and metabolic blood markers were assessed. Isotemporal substitution analysis reallocated 30 min/d sedentary time to PA to predict changes in body composition and metabolic health markers.

Replacing sedentary with moderate PA predicted improvements in most body composition variables but few metabolic markers across all women. Sedentary time reallocated to moderate-to-vigorous PA predicted improved waist circumference (-10.0%), BF% (-16.2%), BMI (-15.3%) and android fat% (-12.5%) in Māori and waist-to-hip ratio (-5.3%) in Pacific, but not European women ( $p < 0.05$ ).

Substituting sedentary time with active behaviour predicted improved body composition and metabolic health markers in overweight/obese New Zealand women. In particular, Maori women might especially benefit from more physically active lifestyles. PA recommendations to improve long-term health should reflect the needs and current activity levels of specific population groups.

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### **Match-day napping on perceived energy and performance in elite female athletes**

O'Donnell, S.<sup>1,2</sup>, Beaven, C.<sup>1</sup>, Driller, M.<sup>1,3</sup>

<sup>1</sup>University of Waikato

<sup>2</sup>Waikato/BOP Magic Netball

<sup>3</sup>High Performance Sport New Zealand

The role of napping on the day of competition is yet to be evaluated in an elite athletic setting. Methods: 14 elite female netballers (mean  $\pm$  SD; age =  $23 \pm 6$  yr) participated in an observational study over two competitive seasons (26 matches). On each match day athletes provided information on their napping habits, perceived energy levels, and performed 3 countermovement jumps (CMJ) 4 hours prior to match commencement. One hour following the match, subjective player performance and coaching staff player performance ratings were obtained. Naps were characterized into 3 conditions for analysis; No Nap (NN),  $< 20$  min Nap (SHORT), and  $\geq 20$  min Nap (LONG). A significant difference in peak jump velocity was observed between the SHORT and the LONG condition in favor of the shorter nap ( $3.23 \pm 0.26$  vs  $3.12 \pm 0.29$  m.s<sup>-1</sup>,  $p < 0.05$ ). A significant difference was observed in the coach rating of performance between the SHORT and the No Nap condition ( $7.2 \pm 0.8$  &  $6.4 \pm 0.9$ ,  $p < 0.05$ ). The findings from the study would suggest that a short nap ( $< 20$  min) on the day of competition can enhance jump velocity and improve subjective performance as assessed by coaching staff.

### **Learning without errors: An application of error-reducing paradigm in speech motor learning**

Omuro, S.<sup>1</sup>, Ma, E.P.M.<sup>1</sup>, Masters, R.S.W.<sup>2</sup>

<sup>1</sup>University of Hong Kong

<sup>2</sup>University of Waikato

Errorless learning is defined as a learning procedure where individuals are limited from making mistakes as they learn a new skill during practice. Only handful of literatures available in the application of the errorless paradigm in speech motor learning. The purpose of the study was to examine the effects of errorless learning in the manipulation of speech volume control. Forty-nine vocally healthy participants were required to sustain a vowel sound in either an errorless learning condition or a errorful learning condition. Participants were required to match their speech intensity to a clinician-assigned reference line indicated on the computer screen. An immediate retention and transfer test was administered after the acquisition phase. In the immediate retention test, participants in the errorless learning condition were able to produce vowel significantly louder compared to those in the errorful learning condition. On the contrary, there was no significant difference in speech volume between the two learning conditions for the passage reading and conversation task. The errorless learning paradigm is more an effective learning paradigm in training speech volume, providing learners with a louder speech volume compared to the errorful learning group.

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subsequent performance. *Human Movement Science*, 24(3), 362-378.

### The Relationship Between Maturation and Athletic Motor Skills in Youth Males

Pichardo, A.<sup>1</sup>, Harrison, C.<sup>1</sup>, Oliver, J.<sup>1,2</sup>, Maulder, P.<sup>1,3</sup>, Cronin, J.<sup>1</sup>, Lloyd, R.<sup>1,2,3</sup>

<sup>1</sup>*Sport Performance Research Institute New Zealand (SPRINZ)*

<sup>2</sup>*Cardiff Metropolitan University*

<sup>3</sup>*Wintec*

The influence of maturation on talent identification and development is often overlooked. The purpose of this study was to examine the relationship between maturity offset and athletic motor skills and differences between pre-PHV, circa-PHV and post-PHV males. One hundred boys age 12.9 to 14.9 with a maturity offset of -1.96 to 2.27 performed a 10 meter sprint (10m), an isometric mid-thigh pull (IMTP), a bilateral (BHJ), right leg (RHJ) and left leg (LHJ) horizontal jump and a countermovement jump (CMJ). Relative values for horizontal jumps and IMTP were obtained by dividing by leg length and weight, respectively. Maturity had a significant but small relationship with 10m, BHJ, RHJ, LHJ and CMJ ( $r \approx 0.30$ ) and a large relationship with IMTP ( $r = 0.70$ ). Correlations between relative BHJ, RHJ, LHJ and IMTP were trivial ( $r < 0.10$ ). When comparing between groups, effect sizes ranged from 0.11 to 1.99 for absolute measures but only 0.24 to 0.37 for relative measures. Lower body neuromuscular strength has a stronger relationship to maturity status than measures of lower body power while maturational differences are reduced with relative scores. Relative scores will reduce the influence of maturation on performance.

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Atkinson, M., & Malina, R. M. (2016). Biological maturity-associated variance in peak power output and momentum in academy rugby union players. *European journal of sport science*, 16(8), 972-980.

### Using Global Positioning System Analysis to Quantify the Movement Characteristics of Sub Elite Rugby Union Players in Training and Match Performance

Pieters, T.<sup>1</sup>, Haggie, M.<sup>1</sup>, Onishi, T.<sup>2</sup>

<sup>1</sup>*Waikato Institute of Technology*

<sup>2</sup>*Teikyo University of Sport Science and Medicine*

Rugby Union(RU) involves various movement patterns(MP) which include walking, jogging and sprinting. Substantial physiological differences exist between backs and forwards. The diversity of physiological requirements of each positional group results in a range of physiological stress experienced by players. Game demands and training loads need to be quantified to maximise the physiological benefits of training and improve performance. Therefore, the aim of the present study was to incorporate GPS player tracking in sub-elite(SE) RU games and training sessions to evaluate the MP. 31 SE RU players participated in the study. Players were categorised as tight or loose forwards, scrumhalves, inside or outside backs. MP was evaluated over four weeks of training and games with 23 portable GPS player tracking devices. MP was categorized as walking, jogging, cruising, striding, high-intensity and sprinting. Total distance (m), total duration (min), relative distance (m/min), and distance (m) and duration (min) covered in each speed zone were compared between training and games. Results indicated that SE RU players are not trained sufficiently. Training loads fail to meet game demands, especially in high-intensity and sprint zones, which increase injury risks. Conditioning programmes should be adjusted so that training loads equal game demands.

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## The Effects of a Self-Regulated Heat Acclimation Regimen

Prout, J<sup>1</sup>, Cotter, J<sup>1</sup>, Hargreaves, E<sup>1</sup>, Lamberts, R<sup>1</sup>, Corbett, J<sup>2</sup>, Sims, S.<sup>3</sup>

<sup>1</sup>University of Otago

<sup>2</sup>University of Portsmouth

<sup>3</sup>University of Waikato

Humans adapt powerfully to heat. Repeated bouts of clamped- or controlled-hyperthermia are deemed the ‘gold-standard’ approach to heat acclimation, and are used in research, but athletes typically self-regulate their exposures. The purpose of this study was to determine the efficacy of self-regulated intensity of heat exposures during heat acclimation. Athletes underwent a self-regulated HA regimen, whereby they cycled in a heated laboratory, manipulating their workload based on how they felt. Nine highly-trained (NZ universities) rowers (19 ± 1 y; 5 female) completed 7 days of self-regulated HA (60 min-d<sup>-1</sup>; 41 ± 1°C; 48 ± 6% RH). On days 1 and 7, athletes cycled at 2.75 W·kg<sup>-1</sup> for the first 7 min of their HA session. HA substantially reduced resting core temperature (-0.6 ± 0.5 °C), modestly expanded plasma volume (+2 ± 2%), and reduced exercising heart rate (-8 ± 7 beats·min<sup>-1</sup>). These data indicate that self-regulated HA elicits beneficial thermoregulatory and cardiovascular adaptations in well-trained individuals. Now we are comparing self-regulated HA against controlled-hyperthermia HA, assessing each regimen’s effectiveness in eliciting thermoregulatory, cardiovascular, and behavioural adaptations.

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## The effects of an 8-week yoga intervention on hamstring flexibility and sprint performance of rugby players.

Raj, T<sup>1</sup>, Hamlin, M<sup>1</sup>, Elliot, C.<sup>1</sup>

<sup>1</sup>Lincoln University, Canterbury, New Zealand

Whether increased flexibility can improve sprint performance, among athletes is debatable. The purpose of this study was to evaluate the effect of an 8-week structured yoga intervention on flexibility and sprint performance of 18 male rugby union players, 19 ± 1.3 years old (mean ± SD). Players were assigned randomly to 2 groups; an experimental group (EG) that practiced yoga two times a week for 8 weeks and a control group (CG) that continued with their normal rugby training routine for the 8 weeks. Data were collected during pre-season and mid-season and included hamstring flexibility (sit and reach) and sprint performance (electronic timing). The EG had a small but non-significant increase in the sit and reach test of 3.0±11.9 cm (mean ± SD) compared to the CG. Additionally, compared to CG, the 5, 10, and 30 metre sprint time of EG showed a small but non-significant improvement of -0.08 ± 0.11 s in sprint time. The changes in the flexibility from pre- to - post-test was moderately correlated with change in sprint time (r=-0.25, p<.01). Results indicate that improved hamstring

flexibility may have a small to moderate beneficial effect on 5-30 metre sprint performance.

## Running related injuries, does footwear make a difference? A systematic review of methods for assessing running shoes

Ramsey, C<sup>1</sup>, Baxter, G.D<sup>1</sup>, Kaur, M<sup>1</sup>, Lamb, P<sup>2</sup>, Ribeiro, D.<sup>1</sup>

<sup>1</sup>University of Otago, Centre for Health, Activity and Rehabilitation Research, School of Physiotherapy

<sup>2</sup>University of Otago, School of Physical Education, Sport and Exercise Science

Footwear might be a risk factor for running-related injuries (RRI) [1, 2]. Several footwear assessment tools are available; however, most are designed to assess special footwear (i.e. diabetic shoes). Consequently, the methods to assess characteristics of running footwear used in studies of RRI are often unknown. This systematic review evaluated the methods of assessing footwear characteristics in studies of RRI. Five online databases were searched. The methodological quality of included articles was independently assessed by two raters using a modified checklist [3]. Data were extracted regarding study and participant characteristics, footwear assessment tools used, and footwear characteristics reported. Twenty-five articles were included for qualitative synthesis. Eleven studies presented low risk of bias. Twenty-one different footwear characteristics were assessed by 15 different methods reported in the included studies. Only three methods were previously described as valid and reliable. Current methods of reporting footwear characteristics in studies of RRI are inconsistent. This limits the evaluation of the characteristics that may play a role in RRI. Different methods were reported for assessing footwear characteristics. Studies should assess the validity of these methods prior to these being applied in clinical practice and research.

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## Does varying exercise intensity during the post-prandial period affect glucose regulation?

Shambrook, P<sup>1</sup>, Kingsley MI<sup>1</sup>, Wundersitz, DW<sup>1</sup>, Xanthos, PD<sup>1</sup>, Wyckelsma, VL<sup>2</sup>, Gordon, BA.<sup>1</sup>

<sup>1</sup>Discipline of Exercise Physiology, La Trobe Rural Health School, La Trobe University, Bendigo, Australia

<sup>2</sup>Institute of Sport, Exercise and Active Living (ISEAL), Victoria University, Melbourne, Australia

Exercise can reduce the risk of developing metabolic disorders associated with elevated glucose. This study aimed to identify the most efficacious exercise intensity for regulating glucose.

Ten insufficiently active males, (age  $37 \pm 7$  y, BMI  $29.3 \pm 6.5$  kg·m<sup>-2</sup>) completed separate 30 minute interventions of low-intensity (~35%  $\dot{V}O_2R$ ), moderate-intensity (~50%  $\dot{V}O_2R$ ) and high-intensity interval (10 x 1 min at ~80%  $\dot{V}O_2R$  with 2 min active recovery) cycling exercise, and a no-exercise control. Five minute average glucose concentrations from a continuous glucose monitor were evaluated from the completion of breakfast (30 minutes before exercise) to 120 minutes after exercise. There was a significant interaction between intervention and time for glucose throughout the evaluation period ( $p=0.02$ ). Glucose was lower ( $p<0.05$ ). Exercising 30 minutes after a meal minimises the time with elevated glucose, regardless of intensity, in people at risk of developing glucose regulation disorders. Independent of intensity, exercise effectively regulates glucose when completed 30 minutes after a meal.

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#### Myths and Methodologies: Scientific design for sex difference studies

Sims, S.T.<sup>1</sup>

<sup>1</sup>*University of Waikato*

In recent years, the increase of the scientific literature exploring sex differences has been beneficial to both the clinician and allied health science professional; women are still significantly under-represented in exercise science (1). One is the same reason that haunts many sex disparities in biological research — the menstrual cycle. Upon closer inspection of study designs and outcomes, there remains a significant gap in the understanding of controlling for the sex hormone perturbations across the natural and oral contraceptive controlled menstrual cycles. This body of research is weakened by inconsistencies in the definition and measurement of reproductive status and from poor methodological rigor. Oral contraceptives are often used as an experimental group in two ways; a) to examine the effects of downregulated oestrogen and progesterone levels on performance and, b) to investigate the effects of the exogenous synthetic component on performance (2). Moreover, different half-lives of the exogenous steroids and variable impact on the endogenous hormones, the withdrawal phase should be considered a transient hormonal phase. By highlighting specific

differences between phases with regards to hormone perturbations and the systems that are affected, methodological inconsistencies can be reduced; improving scientific design sex difference and women in sport science research.

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#### The effects of pre-exercise blood glucose on responses to short duration high intensity exercise

Swanwick, E<sup>1</sup>, Matthews Martyn J<sup>1</sup>

<sup>1</sup>*School of Health Sciences, University of Salford, Frederick Road, Salford M6 6PU, UK.*

To investigate the relationship between pre-exercise blood glucose levels and performance during a 7-point incremental swim test. Forty-two national -level swimmers undertook a 6 x 200 m discontinuous, incremental, training set on a 6:30 mins turnaround followed by an additional maximum effort swim. Subjects were asked to be one hour post-absorptive. Results were analysed in three groups based on pre-test blood glucose level; Low Blood Glucose (LBG) below 4.3; Euglycemic (EUG), 4.3 mmol/l to 6.0 mmol/l; High Blood Glucose (HBG) above 6.0 mmol/l. After each 200m-swim, blood glucose, blood lactate, and heart rate were taken. Additionally, swim speed stroke count and stroke rate were recorded for each swim. Values were plotted against the swim time of each swim. Significant differences were observed between responses for both LBG and HBG when compared to EUG for blood glucose, lactate and heart rate ( $P < 0.01$ ). Additionally, markers of swim efficiency and swim speeds were significantly affected by LBG ( $P < 0.01$ ). High blood glucose appeared to be beneficial to swimming efficiency against LBG and EUG ( $p < 0.01$ ). Blood glucose levels prior to swimming had a marked effect on performance. LBG resulted in a marked reduction in the blood glucose, lactate, heart rate, and swimming efficiency responses to swimming at a range of intensities, up to maximal effort.

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### Investigating cognitive processes underlying performance of a 12K running race

Uiga, L.<sup>1</sup>, Malhotra, N<sup>1</sup>, Capio, C.M<sup>1</sup>, van Duijn, T<sup>1</sup>, Masters, R.S.W.<sup>1</sup>

<sup>1</sup>University of Waikato

A high propensity to consciously process movements (i.e., movement-specific reinvestment) has been linked to performance breakdown under pressure. Mostly, discrete, fine motor skills have been examined; less is known about continuous skill sports that do not require technical precision, yet provide ample time for conscious movement processing. We investigated the cognitive processes underlying competitive running performance. Sixty-one runners (age=33.61±9.91 years) completed a 12K race. Prior to the race, participants completed the Movement-Specific Reinvestment Scale (MSRS), which comprises a conscious motor processing dimension and a movement self-consciousness dimension. Participants self-evaluated their anxiety, preparation satisfaction and self-confidence associated with the competition. Performance time was recorded. A stepwise regression analysis revealed that MSRS was the only significant predictor of running time ( $\Delta R^2=10.7\%$ ,  $p<.01$ ), with higher scores related to worse times. Further analysis revealed that only movement self-consciousness significantly accounted for running time ( $p<.01$ ), with higher scores related to worse times. Movement specific reinvestment, movement self-consciousness in particular, seems to play a role in the performance of a competitive long distance run. Endurance skills, which occur over long periods of time, may allow opportunity for self-focused attention and rumination about performance, which potentially disrupts physical performance and/or causes cognitive exhaustion.

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### Persuasion with deceit elicits the “Trojan Horse Effect” in tennis players

Viviani, F.<sup>1,2</sup>, Fenza, M.<sup>1</sup>

<sup>1</sup>Biomedicine Department, University of Padua

<sup>2</sup>FISPPA Department, University of Padua

When people have to make decisions and solve problems without complete information, heuristics are usually employed and this can lead to systematic errors or cognitive biases. Some of them are widely exploited by more or less occult persuaders. To reach insights on this topic, to 90 both sexes tennis players (TP), subdivided into three levels of performance, was asked to test two identical rackets having two similar strings, apart for the brand and the price. Half of the sample tested strings whose iconic and appearance characteristics were altered (PG). The other half was not deceived (NPG). ANOVA 2 (groups) x 3 (performance level) show that the average evaluations of the strings in the PG agreed to the suggestions offered, with an inverted proportion between the degree of evaluation and the level of performance. To the increase of the performance level corresponds a more factual evaluation. The NPG judged the strings in accordance with its own sensitivity. Our sample shows that persuasion with deceit generates a cognitive bias that could be defined as being the “Trojan Horse Effect” (THE). Further research is needed to verify that performance could be increased by using training methodologies eliciting the THE.

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## Poster Presentations

### Near-infrared light affect oxygen uptake during time trial performance

Beaven, C.M.<sup>1</sup>

<sup>1</sup>University of Waikato

Near-infrared light has the potential to have major physiological effects by impacting cellular respiration, and has been shown to enhance the oxidative capacity of muscle fibres in rats[1] and increase endurance and VO<sub>2</sub>MAX in athletes[2]. In a double-blinded, placebo controlled design, 10 ice hockey players were treated with 808 nm wavelength light at 13 points on the lower body immediately before performing a self-paced 4-min cycling time trial at their preferred cadence. Power output, oxygen uptake and heart rate were continuously monitored, while perceived exertion and lactate were assessed after exercise. There was no difference in average time trial power output between the intervention and placebo (334 vs 335W), post-lactate (11.69 vs 11.47mmol/L) or perceived exertion (17.6 vs 17.7). Interestingly, differences were observed in the metabolic data, with a greater total oxygen consumption over the exercise period ( $p < 0.001$ ) in the intervention group, which was driven by a greater uptake of oxygen in the first minute of exercise. Average heart rate across the exercise was elevated in the intervention group (160 vs 155 bpm). Near-infrared light has the potential to modulate oxygen kinetics during high-intensity exercise. These observations may have important implications for sport performance.

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### Food Choice Motives in Student Athletes in the North East of England

Best, R.<sup>1,2</sup>, Campbell, J.<sup>3</sup>, Berger, N.<sup>2</sup>, Harrison, C.<sup>2</sup>

<sup>1</sup>WINTeC

<sup>2</sup>Teesside University

<sup>3</sup>Jasmine Campbell Performance Nutrition

Athletes' food choices play an important part in fuelling and recovering from sport, and support health. Athletes' environments, social influences, personal beliefs, preferences and skills all contribute to food choices. These issues are not isolated to a particular sport or gender and are driven by sport specific demands. Given this complexity, and to underpin

nutritional support afforded to athletes we sought to understand food choice motives of 30 student athletes (22 male, 8 female), from team (n 20) and individual (n 10) sports. Athletes completed the Food Choice Questionnaire (FCQ). The FCQ assigns food choice motives into 9 sub-categories. Ratings for each sub-category were calculated and analysed using a customised spreadsheet; with gender and sport played (individual or team) analysed as covariates. Differences were reported using standardised mean differences (ES) with 90% Confidence Intervals and accompanying descriptors. Sport played demonstrated a greater influence on food choice motives (ES: Small to Large), than athletes' gender (ES: Trivial to Small). This suggests food choice occurs largely independent of gender, across team and individual sports. Large confidence intervals confirm that food choice is an individual and complex exercise.

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### Concurrent feedback fading in motor learning- future directions

Campbell, T.<sup>1</sup>, Masters, R.<sup>1</sup>

<sup>1</sup>University of Waikato

In order for motor learning to occur there must be some form of feedback about the success or failure of the movement. How we receive this feedback, influences the degree to which changes brought about by practice are retained as learned behaviours. The guidance hypothesis (Salmoni, Schmidt, & Walter, 1984) suggests that when a skill is first practiced regular feedback (or guidance) is associated with rapid acquisition, but as skill learning proceeds the need for feedback reduces. If feedback continues to be delivered, learners can become overly dependent on the feedback. Salient forms of feedback that are gradually faded as skill learning proceeds may facilitate retention of learned behaviours without risking over dependence on feedback. Although fading procedures have been used in the past to cause errorless discrimination learning (Terrace, 1963), less has been done in motor learning. Recent technological advancements make it possible to examine fading procedures using new modes of feedback delivery in virtual/augmented reality, and point light visualizations.

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### Ki-o-Rahi: Movement fun and fundamentals

Capio, C.M<sup>1,2</sup>, Uiga, L<sup>1</sup>, Eguia, K.F<sup>3</sup>, Masters R.S.W<sup>1,2</sup>

<sup>1</sup>*Faculty of Health, Sport and Human Performance, University of Waikato*

<sup>2</sup>*School of Public Health, University of Hong Kong*

<sup>3</sup>*Therabilities Inc.*

Ki-o-Rahi, a traditional Māori game, has seen a renaissance in some regions of New Zealand. It appears to involve transferable skills, and is presumably grounded on fundamental movement skills (FMS) that develop during childhood. Ki-o-Rahi movements have yet to be examined systematically; this study aimed to analyse the required movement skills. Video recordings (30fps) captured two training sessions and two matches of a Ki-o-Rahi team from a secondary school in Waikato. The videos were analysed frame-by-frame using time-motion and notation analysis principles. Six players who represented different roles were observed, and performance of FMS was coded to corresponding time stamps. Four locomotor (i.e., run, jump, slide, leap) and four object control skills (i.e., kick, catch, overhand throw, underhand throw) were observed. Observed advanced skills included dodge, dive, block, and two-handed throw. Player position, team role (i.e. kioma, taniwha), and playing field zone (i.e., te ao, te roto, pawero) determined the most important skill. This is the first systematic information on Ki-o-Rahi movements. The skills that players performed varied with positions, roles, and field zones. The findings offer the foundation for future work exploring Ki-o-Rahi as a context-based FMS training for children, and for coaching and training of Ki-o-Rahi players.

### Intra-day vs. Inter-day Concurrent training Intervention Study

Hedges, C<sup>1</sup>, McMaster, D, T<sup>1</sup>

<sup>1</sup>*University of Waikato*

CrossFit is a fitness regimen defined as, “increased work capacity across broad time and modal domains”. A sport, where it is vital to accurately measure and track improvements in

fitness. We aimed to assess the test-retest reliability of a physical testing battery in CrossFit athletes. Nineteen CrossFit athletes performed eight fitness tests on two occasions. The following fitness tests were deemed reliable (ICC = 0.95 – 0.99; CV = 1-6%; d = -0.24 to 0.16): one-repetition maximum (1RM) back squat, 1RM deadlift, 1RM power clean, 1RM shoulder press, vertical jump, 400 m sprint, and 2000 m row. Pull-up endurance was considered unreliable due to high variability between testing sessions (CV = 10%). Small significant between day differences were observed in the 1RM back squat ( $p = 0.0001$ ;  $d = -0.24$ ; CV = 6.2%) and 400m sprint times ( $p = 0.0034$ ;  $d = -0.20$ ; CV = 2.8%). The results indicate that 7 out of the 8 tests may be implemented to accurately assess fitness changes in CrossFit athletes. This information should be used to better inform strength, jump, aerobic, and anaerobic assessment and training practices for CrossFit athletes.

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### Predictors of Sprint Ability in Elite Women's Rugby Sevens Athletes

Daniel McMaster<sup>1</sup>, Francesco Sella<sup>1</sup>, Nicole Armstrong<sup>2</sup>, Brad Anderson<sup>2</sup>, Christopher Beaven<sup>1</sup>, Nicholas Gill<sup>2,3</sup>

<sup>1</sup>*Health, Sport and Human Performance, University of Waikato*

<sup>2</sup>*New Zealand Rugby Union*

<sup>3</sup>*SPRINZ, AUT University*

Rugby Sevens is a contact team sport characterised by periods of high-speed running, maximal effort sprinting, with multiple accelerations and decelerations. Sprint acceleration is a key attribute for success in Rugby Sevens. However, minimal research has been conducted on female rugby sevens athletes. We aimed to determine the best predictors of sprint acceleration ability in female rugby sevens athletes. Twelve elite female rugby sevens athletes performed 10 m sprints, and horizontal and vertical jump profiling over a 7-day period. Pearson-product moment correlations ( $r$ ) were used to identify potential predictors of sprint acceleration ability. Unilateral 3-hop distance ( $r = -0.50$ ;  $p = 0.047$ ), vertical jump height ( $r = -0.47$ ;  $p = 0.064$ ) and horizontal jump distance ( $r = -0.36$ ;  $p = 0.126$ ) were the best predictors of 10 m sprint acceleration ability.

Although, bilateral vertical jump and horizontal unilateral jump performance were *moderately* correlated with 10 m sprint times, these findings indicate a relatively low-shared variance ( $r^2 = 13 - 25\%$ ) with sprinting ability. Therefore, we suggest that sprint ability is an independent physical quality with specific training requirements. This information should be used to better inform strength, jump and sprint training practices for female rugby sevens athletes.

### The effect of functional movement training on sprint performance in youth males

Maulder, P.S.<sup>1,2</sup>, Pichardo, A.<sup>2</sup>

<sup>1</sup>Centre for Sport Science and Human Performance, Wintec, Hamilton, New Zealand

<sup>2</sup>Sport Performance Research Institute New Zealand (SPRINZ)

Understanding the role biological maturity plays in responsiveness to changes in speed post training may have implications for athlete development programmes. The purpose of this study was to identify the effect of functional movement training on sprint performance in youth males. High school males were categorised by maturation (pre, circa, or post peak height velocity (PHV)) and allocated to either a 6-week (2 sessions per week) functional movement training or control group. Forty-seven participants completed a 10m sprint assessment pre and post 6-week intervention period. Training consisted of body weight strength and sprint technique activities. Relative to the control group the training group netted small to moderate improvements in 10m sprint time post 6-weeks of training for pre-PHV (N=8; %change= -2.4,  $\pm 2.4\%$ ;  $d = -0.35$ ;  $p = 0.085$ ), circa-PHV (N=8; %change= -3.7,  $\pm 2.3\%$ ;  $d = -0.78$ ;  $p = 0.012$ ) and post-PHV individuals (N=8; %change= -1.8,  $\pm 1.1\%$ ;  $d = -0.25$ ;  $p = 0.014$ ). Within training group responses seem to be sensitive to the maturation status of the individuals. Specifically, training elicited small effects on 10m sprint performance for pre and circa-PHV individual's whereas post-PHV individual's responses were trivial. A 6-week functional movement training programme induces meaningful improvements in sprint performance for youth males circa-PHV.

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### Functional movement, maturation and physical performance in youth female netball athletes

Niao, S.<sup>1</sup>, Maulder, P.<sup>1</sup>

<sup>1</sup>Waikato Institute of Technology

The need to understand how maturation and functional movement relate to physical performance in female netballers is important to aid in the facilitation of their performance enhancement. The purpose of this study was to examine the relationship between movement competency, maturation and physical performance outcomes of youth female netball players. A cross sectional sample of 8 female senior high school Netball players (Age:  $16.4 \pm 0.6$  y; maturity offset  $3.9 \pm 0.5$  y) had their movement competency assessed utilising the Functional Movement Screen (FMS). Physical performance tests including speed, agility and both horizontal and vertical bilateral jumps were assessed utilising Netball New Zealand guidelines. FMS scores demonstrated a very large ( $r = 0.75$ ) and large ( $r = 0.56$ ) relationship with horizontal Jump and vertical jump respectively. FMS competency was moderately correlated with maturation ( $r = 0.41$ ) and locomotive tasks ( $r = -0.37$  to  $-0.45$ ). There were trivial to moderate relationships between maturation and physical performance test outcomes. A very large correlation between maturation and vertical jump height ( $r = 0.72$ ) was identified. The findings demonstrate that aspects of physical performance may be influenced by functional movement ability and maturation. Consideration of strategies that increase functional movement competency may be advantageous in improving physical performance in youth female netball players.

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## Does maturation influence functional performance in youth males?

Standing, R.<sup>1</sup>, Maulder, P.<sup>1</sup>

<sup>1</sup>Waikato Institute of Technology

Understanding the role biological maturity has on athletic motor skills may have implications for athlete development programmes. The purpose of this study was to identify the influence maturation has on functional performance in youth males. A cross sectional sample of 97 youth males (Age range 13.2 to 15.7 years old with a maturity offset of -1.0 to 2.6 years) were allocated into either pre, circa, or post PHV maturation groups. Participants performed 20m sprint, unilateral horizontal jump, and 10s bilateral tuck jump (TJ) assessments. Significant group differences ( $p < 0.01$ ) revealed increased maturation status positively influenced speed performances ( $ES = 0.64$  to  $1.03$ ) but not jump performances. Associations between speed performances and horizontal jump performances were large to very large ( $r = -0.67$  to  $-0.74$ ). Maturation status appears to influence speed especially over 10m and 20m but not initial acceleration or jump capability, despite the strong associations between speed and horizontal jump performances. It appears there is a need to consider biological maturity when determining speed characteristics in male youth.

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## Preliminary data on interoceptive sensibility in exercising, overweight and obese subjects.

Viviani, F.<sup>1</sup>

<sup>1</sup>University of Padua

Interoception (IC) is mostly self-awareness. IC is a little sense constantly monitoring how we feel inside. It can go awry, potentially distorting our body image. During time IC has been associated to a number of behaviours varying from eating disorders, chronic fatigue syndrome and, in exercising subjects, pacing. To reach preliminary insights on this elusive aspect, a data collection was carried out using the Heartbeat Perception Task (HPT) on three subsamples: sports practicing subjects (SP, or 17 sportsmen and 16 sportswomen aged  $23.6 \pm 8.5$  years); 10 overweight (OV,  $25.029,9$ ) males and 15 females (aged  $44.8 \pm 3,3$  years); 13 obese (OB,  $BMI > 30,0$ ) males and 12 females, aged  $30.4 \pm 6,5$ . For HBT test significant differences emerged among sub-groups. SP and OV did not show gender differences, while high scores ( $0.85 \pm 0.11$ ) and moderate scores ( $0.67 \pm 0.79$ ) were obtained by SP and OV, respectively. In OB significant gender differences and low scores ( $0.44 \pm 0.10$ ) were found and the latter in 96% of the subjects, mostly males. Results confirm relevant literature as high BMI values correspond to low HBT scores, with the lowest scores reserved solely for OB. SP show a better interoceptive capacity. To reprogram IC contemplative practices, yoga, thai chi, mindfulness training, and graded exercise therapy are suggested.

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